Correlation of Oklahoma Academic Standards for Mathematics to i-Ready Diagnostic

Grade K

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
K.N.1.1 Count . . . forward in sequence to 100 by . . . 10s.	Count by 10s to 100.
K.N.1.1 Count . . . forward in sequence to 100 by 1s . . .	Count by 1s to 100.
K.N.1.1 Count aloud forward in sequence to 100 by 1s and 10s.	Count forward by 1s from any number less than 100.*
K.N.1.2 Recognize that a number can be used to represent how many objects are in a set up to 10.	Count up to 20 objects arranged in a line, rectangular array, a circle, or a scattered configuration.*
K.N.1.3 Use ordinal numbers . . . in a sequence up to [6].	Use ordinal numbers through 6th.
K.N.1.3 Use ordinal numbers to represent the position of an object in a sequence up to 10.	Identify the number that is one more than a given number to ten.* Understand that each successive number name in the counting sequence refers to a quantity that is one larger.*
K.N.1.4 Recognize without counting (subitize) the quantity of a small group of objects in organized and random arrangements up to 10.	Count up to 20 objects arranged in a line, rectangular array, a circle, or a scattered configuration.* Compare two sets with up to 20 objects.*
K.N.1.5 Count . . . objects, . . . given [any] number up to 20.	Given a number from 1-20, make a set of up to 20 objects.
K.N.1.5 Count forward, with . . . objects, . . . any given number up to 20.	Count up to 20 objects arranged in a line, rectangular array, a circle, or a scattered configuration.
K.N.1.5 Count forward, with and without objects, from any given number up to 20.	Count forward by 1s from any number less than 100.*
K.N.1.6 . . . [R]epresent whole numbers from [1] to . . . 20. Representations may include . . . real-object . . . manipulatives.	Given a number from 1-20, make a set of up to 20 objects.

**This skill is related to the aligned standard*

Correlation of Oklahoma Academic Standards for Mathematics to i-Ready Diagnostic (continued)

Grade K (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
K.N.1.6 . . . [W]rite . . . and represent whole numbers from 0 to . . . 20. Representations may include numerals . . . [and] real-object . . . manipulatives.	Count up to 20 objects arranged in a line, rectangular array, a circle, or a scattered configuration.
K.N.1.6 Read . . . whole numbers from 0 to . . . [10]. . . .	Recognize numerals to 10.
K.N.1.7 Find a number that is . . . 1 less than a given number up to 10.	Identify the number that is one less than a given number to ten.
K.N.1.7 Find a number that is 1 more . . . than a given number up to 10.	Identify the number that is one more than a given number to ten.
K.N.1.7 Find a number that is 1 more or 1 less than a given number up to 10.	Understand that each successive number name in the counting sequence refers to a quantity that is one larger.*
K.N.1.8 Compare . . . whole numbers from [1] to 10 . . . without objects, using the vocabulary "more than," "less than," or "equal to."	Compare two written numerals from 1 to 10.
K.N.1.8 Compare . . . whole numbers from [1] to 10 with . . . objects, using the vocabulary "more than," "less than," or "equal to."	Compare two sets with up to 20 objects.
K.N.1.8 Compare and order whole numbers from 0 to 10 with and without objects, using the vocabulary "more than," "less than," or "equal to."	Count up to 20 objects arranged in a line, rectangular array, a circle, or a scattered configuration.* Identify the number that is one more than a given number to ten.* Identify the number that is one less than a given number to ten.*
K.N.2.1 . . . [D]ecompose numbers up to 10 . . .	Find different number pairs with the same sum for sums to 10.
K.N.2.1 Compose and decompose numbers up to 10 using objects and pictures.	Relate addition and subtraction to part-part-whole concepts.*

**This skill is related to the aligned standard*

Grade K (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Find combinations of 10 and identify missing addends.*
K.N.3.1 Distribute a set of objects into at least two smaller equal sets.	Compare two sets with up to 20 objects.* Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.*
K.A.1.1 Sort . . . objects into a set based upon characteristics . . .	Sort objects according to one or more attributes.
K.A.1.1 Sort . . . [shapes] into a set based upon characteristics such as . . . size, and shape. Explain . . . what the objects have in common.	Compare, contrast, and classify attributes of two-dimensional shapes (circle, square, rectangle, triangle, hexagon) and three-dimensional shapes (cube, cone, cylinder, sphere).
K.A.1.1 Sort and group up to 10 objects into a set based upon characteristics such as color, size, and shape. Explain verbally what the objects have in common.	Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.* Describe parts of two-dimensional shapes using informal language such as the number of sides and corners.*
K.GM.1.1 Recognize squares, circles, triangles, and rectangles.	Identify basic two-dimensional shapes (square, circle, rectangle, triangle), including two-dimensional shapes modeled by real-world objects.
K.GM.1.2 Sort two-dimensional objects using characteristics such as shape and size.	Sort objects according to one or more attributes.* Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.* Compare, contrast, and classify attributes of two-dimensional shapes (circle, square, rectangle, triangle, hexagon) and three-

Grade K (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	dimensional shapes (cube, cone, cylinder, sphere).* Describe parts of two-dimensional shapes using informal language such as the number of sides and corners.*
K.GM.1.3 Identify attributes of two-dimensional shapes using informal . . . geometric language . . . , such as the number of corners/vertices and the number of sides/ edges.	Describe parts of two-dimensional shapes using informal language such as the number of sides and corners.
K.GM.1.3 Identify attributes of two-dimensional shapes using informal and formal geometric language interchangeably, such as the number of corners/vertices and the number of sides/edges.	Compare, contrast, and classify attributes of two-dimensional shapes (circle, square, rectangle, triangle, hexagon) and three-dimensional shapes (cube, cone, cylinder, sphere).*
K.GM.1.6 Use basic shapes . . . to . . . [describe] objects in the real world.	Identify basic two-dimensional shapes (square, circle, rectangle, triangle), including two-dimensional shapes modeled by real-world objects. Identify basic three-dimensional shapes (cube, cone, cylinder, sphere), including three-dimensional shapes modeled by real-world objects.
K.GM.1.6 Use basic shapes and spatial reasoning to . . . [describe] objects in the real world.	Describe the relative positions of shapes and objects using terms such as *above*, *below*, *beside*, *in front of*, *behind*, and *next to*.
K.GM.2.1 Use words to compare objects . . .	Compare measures of familiar objects.
K.GM.2.1 Use words to compare objects according to . . . position . . .	Describe the relative positions of shapes and objects using terms such as *above*, *below*, *beside*, *in front of*, *behind*, and *next to*.

**This skill is related to the aligned standard*

Correlation of Oklahoma Academic Standards for Mathematics to i-Ready Diagnostic (continued)

Grade K (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
K.GM.2.1 Use words to compare objects according to . . . weight . . .	Directly compare the weight of two objects and describe the difference (heavier, lighter).
K.GM.2.1 Use words to compare objects according to length . . .	Directly compare the length of two objects and describe the difference (longer, taller, shorter, thicker).
K.GM.2.1 Use words to compare objects according to length, size, weight, position, and location.	Identify measurable attributes of objects using informal language (how long, wide, thick, deep, short or tall they are, or how much they weigh or hold).* Compare, contrast, and classify attributes of two-dimensional shapes (circle, square, rectangle, triangle, hexagon) and three-dimensional shapes (cube, cone, cylinder, sphere).*
K.GM.2.2 Order up to 6 objects using measurable attributes, such as length and weight.	Identify measurable attributes of objects using informal language (how long, wide, thick, deep, short or tall they are, or how much they weigh or hold).* Directly compare the length of two objects and describe the difference (longer, taller, shorter, thicker).* Directly compare the weight of two objects and describe the difference (heavier, lighter).*
K.GM.2.3 Identify . . . shared attribute[s] between objects, and sort objects into sets.	Sort objects according to one or more attributes.
K.GM.2.3 Identify more than one shared attribute between objects, and sort objects into sets.	Classify objects into given categories; count the numbers of objects in each category and sort the categories by count.*
K.GM.2.4 Compare the number of objects needed to fill two different containers.	Identify measurable attributes of objects using informal language (how long, wide,

**This skill is related to the aligned standard*

Grade K (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	thick, deep, short or tall they are, or how much they weigh or hold).*
K.GM.3.1 Develop an awareness of simple time concepts within daily life, using age-appropriate vocabulary . . .	Compare activities according to the length of time they take (shorter, longer).
K.D.1.1 Collect . . . information about objects . . . in the environment.	Describe the relative positions of shapes and objects using terms such as *above, below, beside, in front of, behind*, and *next to*. Identify basic two-dimensional shapes (square, circle, rectangle, triangle), including two-dimensional shapes modeled by real-world objects. Identify basic three-dimensional shapes (cube, cone, cylinder, sphere), including three-dimensional shapes modeled by real-world objects.

Grade 1

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
1.N.1.1 Recognize numbers to 20 without counting (subitize) the quantity of structured arrangements.	Recognize numerals up to 100.* Understand that the number 10 is composed of ten ones and the teen numbers 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.*
1.N.1.1 Recognize numbers to [10] . . .	Recognize numerals to 10.
1.N.1.2 . . . Know that . . . 100 is equivalent to 10 tens.	Identify the value of the digits in three-digit numbers.
1.N.1.2 . . . [D]escribe [decade] whole numbers between 10 and [90] in terms of tens and ones. . . .	Understand that the numbers 10, 20, 30, 40, 50, 60, 70, 80, 90 refer to one, two, three, four, five, six, seven, eight, or nine tens (and 0 ones).
1.N.1.2 Use . . . representations to describe whole numbers between 10 and [19] in terms of tens and ones. Know that 10 is equivalent to 10 ones . . .	Understand that the number 10 is composed of ten ones and the teen numbers 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
1.N.1.2 Use concrete representations to describe whole numbers between 10 and 100 in terms of tens . . . Know that . . . 100 is equivalent to 10 tens.	Group up to 100 objects in sets of 10.
1.N.1.2 Use concrete representations to describe whole numbers between 10 and [99] in terms of tens and ones. . . .	Use base-ten models to represent a two-digit number and identify the corresponding numeral.
1.N.1.3 . . . [R]epresent whole numbers [from 10] up to 100. Representations may include numerals . . . and manipulatives.	Use base-ten models to represent a two-digit number and identify the corresponding numeral.
1.N.1.3 Read, write, . . . and represent whole numbers up to 100. Representations may include numerals, words, [and] addition . . .	Read and write whole numbers through hundreds using number words, standard form, and expanded form.
1.N.1.3 Read, write, discuss, and represent whole numbers up to 100. Representations may include numerals, words, addition and	Recognize numerals up to 100.* Count forward from any number to 120.*

**This skill is related to the aligned standard*

Grade 1 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
subtraction, pictures, tally marks, number lines, and manipulatives.	Group up to 100 objects in sets of 10.* Understand that the number 10 is composed of ten ones and the teen numbers 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.*
1.N.1.4 Count forward, with objects, . . . up to 100 by . . . 5s . . .	Count by 5s to 100 using a chart or models.
1.N.1.4 Count forward, with objects, . . . up to [20] by . . . 2s . . .	Count by 2s to 20 using a chart or models.
1.N.1.4 Count forward, with objects, . . . up to [20] by 1s . . .	Count up to 20 objects arranged in a line, rectangular array, a circle, or a scattered configuration.
1.N.1.4 Count forward, with objects, from any given number up to 100 by 1s, 2s, 5s and 10s.	Count forward from any number to 120.* Find 10 more or 10 less than a given number within 100.*
1.N.1.5 Count forward, without objects, by . . . 10s, up to 100.	Count by 10s to 100.
1.N.1.5 Count forward, without objects, by . . . 1s . . . up to 100.	Count forward by 1s from any number less than 100.
1.N.1.5 Count forward, without objects, by . . . 1s . . . up to [120].	Count forward from any number to 120.
1.N.1.5 Count forward, without objects, by . . . 2s . . . up to [20].	Count by 2s to 20 using a chart or models.
1.N.1.5 Count forward, without objects, by . . . 5s . . . up to 100.	Count by 5s to 100 using a chart or models.
1.N.1.5 Count forward, without objects, by multiples of 1s, 2s, 5s, and 10s, up to 100.	Recognize numerals up to 100.*
1.N.1.6 Find a number that is . . . 10 less than a given number up to 100.	Subtract multiples of 10 from two-digit numbers, including multiples of 10.
1.N.1.6 Find a number that is 10 more or 10 less than a given number up to 100.	Find 10 more or 10 less than a given number within 100.

**This skill is related to the aligned standard*

Grade 1 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
1.N.1.7 Compare and order whole numbers from 0 to 100.	Compare two numbers to 100 using the symbols >, <, or =.*
1.N.1.7 Compare and order whole numbers from [10] to [99].	Compare and order two-digit numbers.
1.N.1.9 Use words such as "more than," "less than," and "equal to" to describe the relative value of numbers.	Compare two numbers to 100 using the symbols >, <, or =.*
1.N.2.1 . . . [S]olve . . . subtraction with . . . minuends of up to 10.	Count back to subtract 1, 2, or 3 from numbers up to 10.
1.N.2.1 . . . [S]olve problems using addition . . . with sums . . . of up to 10.	Solve addition problems by counting on with numbers to 10.
1.N.2.1 Represent and solve . . . addition and subtraction with sums and minuends of up to 10.	Add and subtract within 10.
1.N.2.1 Represent and solve problems using . . . subtraction . . .	Solve subtraction problems for separation or take away situations.
1.N.2.1 Represent and solve problems using . . . subtraction with . . . minuends of up to 10.	Use equations to solve take away problems with numbers to 10.
1.N.2.1 Represent and solve problems using addition . . .	Solve addition problems for combining, joining, or comparison situations.
1.N.2.1 Represent and solve problems using addition . . . with sums . . . of up to 10.	Use equations to solve joining problems with numbers to 10.
1.N.2.1 Represent and solve problems using addition and subtraction with sums and minuends of up to 10.	Identify and find sums for doubles addition facts.* Add within 20.* Subtract within 20.* Solve basic subtraction facts by counting back to subtract 1, 2, or 3.*

**This skill is related to the aligned standard*

Grade 1 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Solve basic subtraction facts by counting on.*
1.N.2.1 Solve . . . subtraction problems . . . in real-world . . . contexts. Represent and solve problems using . . . subtraction . . .	Build equations to represent real-world subtraction problems involving take from, take apart, or comparison situations.
1.N.2.1 Solve . . . subtraction problems with . . . minuends of up to 10 in real-world . . . contexts. Represent and solve problems using . . . subtraction with . . . minuends of up to 10.	Solve subtraction word problems within 10.
1.N.2.1 Solve addition . . . problems with sums . . . of up to 10 in real-world . . . contexts. Represent and solve problems using addition . . . with sums . . . of up to 10.	Solve addition word problems within 10.
1.N.2.2 Determine if equations involving addition and subtraction are true.	Demonstrate an understanding of the equal sign and determine if equations involving addition and subtraction are true or false.
1.N.2.3 Demonstrate . . . basic facts of . . . subtraction . . .	Solve basic subtraction facts by counting back to subtract 1, 2, or 3. Solve basic subtraction facts by counting on.
1.N.2.3 Demonstrate fluency with basic facts of addition and subtraction with sums and minuends of up to 10.	Solve addition problems by counting on with numbers to 10.* Identify and find sums for doubles addition facts.* Add within 20.* Subtract within 20.* Solve addition problems for combining, joining, or comparison situations.*

**This skill is related to the aligned standard*

Grade 1 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
1.N.2.3 Demonstrate fluency with basic facts of addition and subtraction with sums and minuends of up to [5].	Add and subtract within 5.
1.N.2.3 Solve addition and subtraction problems with sums and minuends of up to 10 in real-world and mathematical contexts. Demonstrate fluency with basic facts of addition and subtraction with sums and minuends of up to 10.	Build equations to represent real-world subtraction problems involving take from, take apart, or comparison situations. *
1.N.3.1 Partition a regular polygon using physical models and recognize when those parts are equal.	Partition circles and rectangles into halves and fourths, describe the shares using the words *halves*, *fourths*, and *quarters*, and use the phrases *half of*, *fourth of*, and *quarter of*.* Describe equal parts of circles, rectangles, and squares using terms such as *halves*, *fourths*, and *quarters*.*
1.N.3.2 Partition (fair share) sets of objects into two and three equal groups.	Group up to 100 objects in sets of 10.*
1.A.1.1 . . . [C]reate [and] complete . . . repeating . . . patterns . . . (e.g., quantity . . .).	Group up to 100 objects in sets of 10.
1.A.1.1 . . . [E]xtend . . . increasing . . . patterns . . . (e.g., . . . numbers . . .).	Count by 5s to 100 using a chart or models. Count forward by 1s from any number less than 100. Count by 10s to 100.
1.GM.1.4 Recognize three-dimensional shapes such as cubes, cones, cylinders, . . . and spheres.	Identify basic three-dimensional shapes (cube, cone, cylinder, sphere), including three-dimensional shapes modeled by real-world objects.
1.GM.1.4 Recognize three-dimensional shapes such as cubes, cones, cylinders,	Identify defining attributes of three-dimensional shapes.

**This skill is related to the aligned standard*

Grade 1 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
pyramids, and spheres [based on defining attributes].	
1.GM.2.1 Use . . . standard measuring tools to measure the length of objects.	Use a ruler to measure length in inches. Use a ruler to measure length in centimeters.
1.GM.2.1 Use nonstandard . . . measuring tools to measure the length of objects.	Express length using whole number non-standard units.
1.GM.2.2 Illustrate that the length of an object is the number of same-size units of length that, when laid end-to-end with no gaps or overlaps, reach from one end of the object to the other.	Express length using whole number non-standard units.
1.GM.2.3 . . . [D]escribe how and why the measurements [with units of two different lengths] differ.	Describe how the size of a unit of measurement relates to the number of units needed to equal the length of an object.
1.GM.2.4 Describe a length to the nearest whole unit using a number with . . . nonstandard units.	Express length using whole number non-standard units.
1.GM.3.1 Tell time to the hour and half-hour (analog and digital).	Tell time to the hour and half hour on an analog clock or a digital clock.
1.D.1.1 Collect, sort, and organize data in up to three categories using representations (e.g., tally marks, tables, Venn diagrams).	Organize, represent, and interpret several categories of data in a picture or bar graph with up to 3 categories.*
1.D.1.2 Use data to create pictographs and bar graphs that demonstrate one-to-one correspondence.	Organize, represent, and interpret several categories of data in a picture or bar graph with up to 3 categories.*
1.D.1.3 Draw conclusions from pictographs . . .	Create or interpret a picture graph with a single-unit scale to represent data that include multiple categories.
1.D.1.3 Draw conclusions from pictographs and bar graphs.	Organize, represent, and interpret several categories of data in a picture or bar graph with up to 3 categories.*

Grade 2

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
2.N.1.1 . . . [R]epresent whole numbers . . . Representations should include . . . number lines . . .	Represent whole numbers as lengths on a number line.
2.N.1.1 . . . [R]epresent whole numbers up to 1,000. . . .	Model three-digit numbers.
2.N.1.1 Read, write, . . . and represent whole numbers up to 1,000. Representations should include, but are not limited to, numerals [and] words . . .	Read and write whole numbers through hundreds using number words, standard form, and expanded form.
2.N.1.1 Read, write, discuss, and represent whole numbers up to 1,000. Representations should include, but are not limited to, numerals, words, pictures, tally marks, number lines, and manipulatives.	Count, read, write, and represent numbers from 1 to 120.*
2.N.1.2 Use knowledge of number relationships to locate the position of a given whole number . . . on an open number line.	Represent whole numbers as lengths on a number line.
2.N.1.3 Use place value to describe whole numbers . . . [up to] 1,000 in terms of hundreds, tens, and ones, including written, standard, and expanded forms. . . .	Read and write whole numbers through hundreds using number words, standard form, and expanded form.
2.N.1.3 Use place value to describe whole numbers between 10 and 1,000 in terms of hundreds, tens, and ones, including written, standard, and expanded forms. Know that 10 is equivalent to 10 ones and 100 is equivalent to 10 tens.	Model three-digit numbers.* Count, read, write, and represent numbers from 1 to 120.*
2.N.1.3 Use place value to describe whole numbers between 10 and [19] in terms of . . . tens, and ones . . . Know that 10 is equivalent to 10 ones . . .	Understand that the number 10 is composed of ten ones and the teen numbers 11 to 19 are composed of a ten and one, two, three, four, five, six, seven, eight, or nine ones.
2.N.1.3 Use place value to describe whole numbers between [100] and 1,000 in terms of hundreds, tens, and ones . . . Know that . . . 100 is equivalent to 10 tens.	Identify the value of the digits in three-digit numbers.

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
2.N.1.4 Find 10 more or 10 less than a given three-digit number [to 900]. Find 100 more or 100 less than a given three-digit number [to 900].	Mentally add 10 or 100 to a given number 100-900, and mentally subtract 10 or 100 from a given number 100-900.
2.N.1.5 . . . [D]etermine whether a number is even or odd [up to 20].	Identify odd and even numbers up to 20.
2.N.1.5 Use objects to determine whether a number is even or odd.	Demonstrate an understanding that a group of objects is an even number of objects if it can be divided into complete pairs and is odd if it cannot; express even numbers as doubles facts. Count and group by 2s, 5s, and 10s to 100.*
2.N.1.6 Use place value understanding to round numbers to the nearest ten and nearest hundred . . .	Round whole numbers to the nearest ten and hundred.
2.N.1.7 Use place value to compare and order whole numbers up to 1,000 using . . . numbers, and symbols (e.g., 425 > 276, 73 < 107 . . .).	Compare and order three-digit numbers.
2.N.1.7 Use place value to compare and order whole numbers up to 1,000 using comparative language, numbers, and symbols (e.g., 425 > 276, 73 < 107, page 351 comes after page 350, 753 is between 700 and 800).	Identify a number that is greater than or less than a given number.*
2.N.2.1 . . . [G]enerate basic facts with . . . minuends of up to 20.	Subtract within 20.
2.N.2.1 . . . [G]enerate basic facts with sums . . . of up to 20.	Add within 20.
2.N.2.1 Use the relationship between addition and subtraction . . . with sums and minuends of up to 20.	Solve subtraction problems for separation or take away situations and check the solution using addition.

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Use addition to check subtraction equations for part-part-whole situations.
2.N.2.1 Use the relationship between addition and subtraction to generate basic facts with sums and minuends . . .	Know addition/subtraction fact families.
2.N.2.1 Use the relationship between addition and subtraction to generate basic facts with sums and minuends of up to 20.	Solve subtraction problems for comparison situations.* Add a two-digit number and a one-digit number.* Explain why addition and subtraction strategies work using place value and the properties of operations. *
2.N.2.2 Demonstrate fluency with basic facts of . . . subtraction with . . . minuends of up to 20.	Subtract within 20.
2.N.2.2 Demonstrate fluency with basic facts of addition . . . with sums . . . of up to 20.	Add within 20.
2.N.2.2 Demonstrate fluency with basic facts of addition and subtraction . . .	Know addition/subtraction fact families.
2.N.2.2 Demonstrate fluency with basic facts of addition and subtraction with sums and minuends of up to 20.	Solve subtraction problems for separation or take away situations and check the solution using addition.* Use addition to check subtraction equations for part-part-whole situations.* Solve subtraction problems for comparison situations.*
2.N.2.4 Use strategies . . . based on knowledge of place value and equality to . . . subtract two-digit numbers [without regrouping].	Subtract two-digit numbers without regrouping.

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
2.N.2.4 Use strategies . . . based on knowledge of place value and equality to . . . subtract [one-digit numbers from] two-digit numbers.	Subtract a one-digit number from a two-digit number.
2.N.2.4 Use strategies and algorithms based on knowledge of place value and equality to . . . subtract two-digit numbers [with regrouping].	Subtract two-digit numbers with regrouping.
2.N.2.4 Use strategies and algorithms based on knowledge of place value and equality to add . . . two-digit numbers [with regrouping].	Add two-digit numbers with regrouping.
2.N.2.4 Use strategies and algorithms based on knowledge of place value and equality to add . . . [three or four] two-digit numbers.	Add three or four two-digit numbers with regrouping.
2.N.2.4 Use strategies and algorithms based on knowledge of place value and equality to add and subtract two-digit numbers.	Solve subtraction problems for separation or take away situations and check the solution using addition.* Use addition to check subtraction equations for part-part-whole situations.*
2.N.2.4 Use strategies and algorithms based on knowledge of place value [models] and equality to add . . . two-digit numbers [with regrouping].	Add two-digit numbers with regrouping using models.
2.N.2.5 Solve . . . subtraction problems involving whole numbers up to two digits [for comparison situations].	Solve subtraction problems for comparison situations.
2.N.2.5 Solve addition and subtraction problems involving whole numbers up to two digits.	Solve subtraction problems for separation or take away situations and check the solution using addition.* Solve subtraction problems by counting back 1, 2, or 3.*

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Represent and solve addition and subtraction word problems using equations with unknowns in all positions.* Use addition to check subtraction equations for part-part-whole situations.* Subtract two-digit numbers with regrouping.* Subtract two-digit numbers without regrouping.* Add three or four two-digit numbers with regrouping.*
2.N.3.1 Identify the parts of a set and area that represent fractions for halves, thirds, and fourths.	Partition circles and rectangles into two, three, or four equal shares and describe the shares or whole using words (*halves*, *thirds*, *fourths*, *two halves*, *three thirds*, *four fourths*.)*
2.N.3.2 Construct equal-sized portions through fair sharing (. . . area models for halves, thirds, and fourths).	Partition circles and rectangles into two, three, or four equal shares and describe the shares or whole using words (*halves*, *thirds*, *fourths*, *two halves*, *three thirds*, *four fourths*.)
2.N.3.2 Construct equal-sized portions through fair sharing (. . . area models for[, and using the terms,] halves, thirds, and fourths).	Identify equal parts of the same whole circle, rectangle, or square partitioned in different ways, using terms such as *halves*, *thirds*, and *fourths*.
2.N.3.2 Construct equal-sized portions through fair sharing (length, set, and area models for halves, thirds, and fourths).	Find the total number of square units in a rectangle divided into same-size squares.*
2.N.4.1 Determine the value of a collection of coins up to one dollar using the cent symbol.	Solve problems involving counting dollar bills and coins, and use the dollar symbol.*

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Identify and compare the values of coin combinations (pennies, nickels, dimes, quarters).*
2.N.4.2 Use a combination of coins to represent a given amount of money up to one dollar.	Solve problems involving counting dollar bills and coins, and use the dollar symbol.* Identify and compare the values of coin combinations (pennies, nickels, dimes, quarters).*
2.A.1.1 . . . [C]reate . . . [and] complete . . . increasing . . . patterns with quantity and numbers . . .	Count and group by 2s, 5s, and 10s to 100.
2.A.1.1 . . . [E]xtend increasing . . . patterns with . . . numbers [to 1,000] . . .	Count and skip-count by 5s, 10s, and 100s to 1,000.
2.A.2.1 Use . . . number lines to represent [addition and subtraction] . . .	Represent whole number addition and subtraction within 100 on a number line.
2.A.2.1 Use number sentences involving unknowns to represent and solve real-world . . . problems. Use objects . . . to represent number sentences.	Solve subtraction problems for comparison situations. Solve subtraction problems for separation or take away situations. Build equations to represent real-world subtraction problems involving take from, take apart, or comparison situations. Solve addition problems for combining, joining, or comparison situations.
2.A.2.1 Use number sentences involving unknowns to represent and solve real-world and mathematical problems. Use objects and number lines to represent number sentences.	Represent and solve addition and subtraction word problems using equations with unknowns in all positions.*
2.A.2.1 Use objects and number lines to represent number sentences.	Represent whole numbers as lengths on a number line.*

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
2.A.2.2 Generate . . . [number sentences] to represent [situations] . . .	Solve subtraction problems for comparison situations.
2.A.2.2 Generate models and situations to represent number sentences and vice versa.	Solve subtraction problems for separation or take away situations and check the solution using addition.*
2.A.2.2 Use number sentences involving unknowns to represent and solve real-world . . . problems. Generate models and [number sentences] . . . to represent [situations] . . .	Add and subtract within 100 to solve word problems involving lengths that are given in the same units, including using equations with a symbol for the unknown number.
2.A.2.2 Use number sentences involving unknowns to represent and solve real-world . . . problems. Generate [number sentences] . . . to represent [situations] . . .	Represent and solve addition and subtraction word problems using equations with unknowns in all positions.
2.A.2.3 Apply . . . number sense to find values for unknowns that make . . . subtraction number sentences true . . .	Solve subtraction problems for comparison situations.
2.A.2.3 Apply the commutative property, identity property, and number sense to find values for unknowns that make addition and subtraction number sentences true or false.	Solve subtraction problems for separation or take away situations and check the solution using addition.*
2.A.2.3 Use number sentences involving unknowns to represent and solve real-world . . . problems. Apply . . . number sense to find values for unknowns that make addition and subtraction number sentences true . . .	Represent and solve addition and subtraction word problems using equations with unknowns in all positions. Add and subtract within 100 to solve word problems involving lengths that are given in the same units, including using equations with a symbol for the unknown number.
2.GM.1.1 Recognize regular and irregular trapezoids and hexagons.	Use attributes, including vertices, angles, and sides, to identify, describe, sort, and classify two-dimensional shapes.*
2.GM.1.2 Describe, compare, and classify two-dimensional figures according to their geometric attributes.	Use attributes, including vertices, angles, and sides, to identify, describe, sort, and classify two-dimensional shapes.

**This skill is related to the aligned standard*

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
2.GM.1.3 Compose and decompose two-dimensional shapes using triangles, squares, hexagons, trapezoids, and rhombi.	Combine and separate two-dimensional shapes to create other two-dimensional shapes and predict the results.*
2.GM.1.4 Sort three-dimensional shapes based on attributes such as number of faces, vertices, and edges.	Compare and contrast attributes of solid figures including numbers of vertices, faces, and edges.*
2.GM.2.1 Explain the relationship between the size of the unit of measurement and the number of units needed to measure the length of an object.	Describe how the size of a unit of measurement relates to the number of units needed to equal the length of an object.
2.GM.2.2 . . . [Use] a ruler to measure lengths to the nearest whole unit.	Use a ruler to measure length in inches. Use a ruler to measure length in centimeters.
2.GM.3.1 Distinguish between a.m. and p.m.	Tell time to the nearest five minutes.*
2.GM.3.2 Read and write time to the quarter hour on an analog and digital clock.	Tell time to the nearest five minutes.*
2.GM.3.2 Read and write time to the [half] hour on an analog and digital clock.	Tell time to the hour and half hour on an analog clock or a digital clock.
2.D.1.1 Explain that . . . the number of objects in a pictograph represents the number of data points for a given category.	Create or interpret a picture graph with a single-unit scale to represent data that include multiple categories.
2.D.1.1 Explain that the length of a bar in a bar graph and the number of objects in a pictograph represents the number of data points for a given category.	Construct a bar graph with a single-unit scale to represent data that includes multiple categories, and solve simple joining, separating, and comparing problems based on the data displayed.*
2.D.1.2 Organize a collection of data with up to four categories using pictographs . . . in intervals of 1s . . .	Create or interpret a picture graph with a single-unit scale to represent data that include multiple categories.
2.D.1.2 Organize a collection of data with up to four categories using pictographs and bar graphs in intervals of 1s, 2s, 5s or 10s.	Construct a bar graph with a single-unit scale to represent data that includes multiple categories, and solve simple joining,

Grade 2 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	separating, and comparing problems based on the data displayed.*
2.D.1.3 Write and solve one-step word problems involving addition or subtraction using data represented within pictographs and bar graphs with intervals of one.	Construct a bar graph with a single-unit scale to represent data that includes multiple categories, and solve simple joining, separating, and comparing problems based on the data displayed.*
2.D.1.4 Draw conclusions . . . from information in a pictograph . . .	Create or interpret a picture graph with a single-unit scale to represent data that include multiple categories.
2.D.1.4 Draw conclusions and make predictions from information in a pictograph and bar graph.	Construct a bar graph with a single-unit scale to represent data that includes multiple categories, and solve simple joining, separating, and comparing problems based on the data displayed.*

Grade 3

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
3.N.1.1 Read, write, . . . and represent whole numbers up to [10,000]. Representations should include but are not limited to numerals [and] words . . .	Read and write whole numbers through thousands in expanded form and standard form and identify the value of the digits.
3.N.1.1 Read, write, discuss, and represent whole numbers up to 100,000. Representations should include but are not limited to numerals, words, pictures, number lines, and manipulatives (e.g., 350 = 3 hundreds, 5 tens = 35 tens = 3 hundreds, 4 tens, 10 ones).	Represent a whole number on a number line as a point between two consecutive multiples of 10; 100; 1,000; or 10,000, and use words to describe the relative size of the whole number in order to round it.*
3.N.1.2 Use place value to describe whole numbers between 1,000 and 100,000 in terms of ten thousands, thousands, hundreds, tens and ones, including written, standard, and expanded forms.	Represent a whole number on a number line as a point between two consecutive multiples of 10; 100; 1,000; or 10,000, and use words to describe the relative size of the whole number in order to round it.*
3.N.1.2 Use place value to describe whole numbers between 1,000 and [10,0000] in terms of . . . thousands, hundreds, tens and ones, including . . . standard, and expanded forms.	Read and write whole numbers through thousands in expanded form and standard form and identify the value of the digits.
3.N.1.3 Applying knowledge of place values, use mental strategies (no written computations) to find 100 more or 100 less than a given number [100-900] . . .	Mentally add 10 or 100 to a given number 100-900, and mentally subtract 10 or 100 from a given number 100-900.
3.N.1.4 . . . [C]ompare . . . whole numbers . . . using comparative language . . .	Identify a number that is greater than or less than a given number.
3.N.1.4 . . . [C]ompare and order whole numbers, up to [1,000], using . . . numbers, and symbols.	Compare and order three-digit numbers.
3.N.1.5 Use place value understanding to round numbers . . .	Round whole numbers to the nearest ten and hundred.
3.N.1.5 Use place value understanding to round numbers to the nearest thousand, ten-thousand and hundred thousand.	Represent a whole number on a number line as a point between two consecutive multiples of 10; 100; 1,000; or 10,000, and

**This skill is related to the aligned standard*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	use words to describe the relative size of the whole number in order to round it.*
3.N.2.1 Represent multiplication facts by modeling . . . approaches (e.g., . . . equal-sized groups . . .).	Interpret products of whole numbers, for example, interpret 6 × 8 as the total number of objects in 6 groups of 8 objects each.
3.N.2.1 Represent multiplication facts by modeling a variety of approaches (e.g., . . . arrays . . .).	Write a multiplication sentence to represent objects in a rectangular array, recognizing that the order of factors does not affect the product.
3.N.2.1 Represent multiplication facts by modeling a variety of approaches (e.g., . . . repeated addition, . . . area models . . .).	Measure the area of a rectangle by covering it with unit squares and counting them, and show that the area is the same as would be found by multiplying the side lengths.
3.N.2.1 Represent multiplication facts by modeling a variety of approaches (e.g., . . . repeated addition, equal-sized groups . . .).	Write multiplication sentences to represent equal groups and repeated addition.
3.N.2.1 Represent multiplication facts by modeling a variety of approaches (e.g., manipulatives, repeated addition, equal-sized groups, arrays, area models, equal jumps on a number line, skip counting).	Solve one- and two-step problems involving multiplication and division within 100, using drawings, arrays, strip diagrams, and equations.* Model, create, and describe multiplication and division situations.*
3.N.2.1 Solve real-world and mathematical problems using . . . multiplication . . . Represent multiplication facts by modeling . . . approaches (e.g., . . . area models . . .).	Multiply side lengths to find areas of rectangles with whole-number side lengths to solve real-world and mathematical problems.
3.N.2.2 Demonstrate fluency with multiplication facts using factors up to 10.	Know multiplication/division fact families.*
3.N.2.2 Demonstrate fluency with multiplication facts using factors up to [12].	Know multiplication facts through 12 times 12.
3.N.2.3 Solve . . . problems using addition [and] subtraction . . . Use strategies and algorithms based on knowledge of place	Solve one- and two-step problems involving addition and subtraction within 1,000, using strategies based on place value, properties

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
value and equality to . . . add and subtract [within 1,000] . . .	of operations, and the relationship between addition and subtraction.
3.N.2.3 Use strategies and algorithms based on knowledge of place value and equality to fluently . . . subtract . . . [three]-digit numbers [with regrouping] . . .	Subtract three-digit numbers with regrouping.
3.N.2.3 Use strategies and algorithms based on knowledge of place value and equality to fluently add . . . [three]-digit numbers [with regrouping] . . .	Add three-digit numbers with regrouping.
3.N.2.4 . . . [R]ound numbers . . . to the nearest . . . hundred, and ten.	Round whole numbers to the nearest ten and hundred.
3.N.2.4 . . . [R]ound numbers and apply understanding to estimate sums and differences to the nearest . . . hundred, and ten.	Use rounding (to the nearest 10 or 100) or compatible numbers to estimate solutions to addition and subtraction problems.
3.N.2.4 Recognize when to round numbers and apply understanding to estimate sums and differences to the nearest ten thousand, thousand, hundred, and ten.	Write and solve two-step real-world problems using addition, subtraction, multiplication, and division.* Represent a whole number on a number line as a point between two consecutive multiples of 10; 100; 1,000; or 10,000, and use words to describe the relative size of the whole number in order to round it.*
3.N.2.5 Use . . . subtraction . . . involving whole numbers [with regrouping]. . . .	Subtract three-digit numbers with regrouping.
3.N.2.5 Use addition . . . involving whole numbers [with regrouping]. . . .	Add three-digit numbers with regrouping.
3.N.2.5 Use addition and subtraction to solve problems involving whole numbers [to 1,000]. Use various strategies . . .	Represent one- and two-step problems involving addition and subtraction of whole numbers to 1,000 using pictorial models, number lines, and equations.

**This skill is related to the aligned standard*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
3.N.2.5 Use addition and subtraction to solve problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction and the context of the problem to assess the reasonableness of results.	Write and solve two-step real-world problems using addition, subtraction, multiplication, and division.* Determine the operation(s) needed to solve one- and two-step word problems involving all four operations with whole numbers and represent these problems using equations with a letter standing for the unknown quantity.* Use rounding (to the nearest 10 or 100) or compatible numbers to estimate solutions to addition and subtraction problems.*
3.N.2.5 Use addition and subtraction [within 1,000] to solve problems involving whole numbers. Use various strategies, including the relationship between addition and subtraction . . .	Solve one- and two-step problems involving addition and subtraction within 1,000, using strategies based on place value, properties of operations, and the relationship between addition and subtraction.
3.N.2.6 Represent division facts . . . by modeling a variety of approaches (e.g., . . . equal sharing . . .) . . .	Interpret whole-number quotients of whole numbers, for example, interpret 72 ÷ 9 as the number of objects in each share when 72 objects are partitioned equally into 9 shares, or as a number of shares when 72 objects are partitioned into equal shares of 9 objects each.
3.N.2.6 Represent division facts and divisibility by modeling a variety of approaches (e.g., repeated subtraction, equal sharing, forming equal groups) to show the relationship between multiplication and division.	Solve one- and two-step problems involving multiplication and division within 100, using drawings, arrays, strip diagrams, and equations.* Model, create, and describe multiplication and division situations.* Know multiplication/division fact families.*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Know division facts through 144 divided by 12.*
3.N.2.6 Solve . . . problems using . . . division. Represent division facts . . . by modeling . . . approaches (e.g., . . . forming equal groups) . . .	Solve problems involving sharing equal groups, including identifying the remainder.
3.N.2.6 Solve . . . problems using . . . multiplication, and division. Represent division facts . . . to show the relationship between multiplication and division.	Solve a division problem by rewriting it as an unknown factor problem.
3.N.2.6 Solve real-world . . . problems using . . . division. Represent division facts . . . by modeling . . . approaches (e.g., . . . forming equal groups) . . .	Solve problems involving partitioning in equal groups, including identifying the remainder.
3.N.2.6 Solve real-world . . . problems using . . . division. Represent division facts . . . by modeling a variety of approaches (e.g., . . . forming equal groups) . . .	Solve one- and two-step real-world problems involving division of a two-digit number by a one-digit number.
3.N.2.7 . . . [Know] the relationship between multiplication and division to . . . solve problems . . .	Know multiplication/division fact families.
3.N.2.7 Apply the relationship between multiplication and division to represent and solve problems.	Solve a division problem by rewriting it as an unknown factor problem. Solve one- and two-step real-world problems involving division of a two-digit number by a one-digit number.*
3.N.2.8 . . . [M]ultiply a two-digit factor by a one-digit factor.	Multiply two-digit numbers by one-digit numbers.
3.N.2.8 Use . . . properties of . . . multiplication to multiply . . .	Apply the properties of multiplication (zero, identity, commutative, associative, and distributive).
3.N.2.8 Use . . . strategies . . . based on knowledge of . . . properties of . . .	Know multiplication facts through 12 times 12.

**This skill is related to the aligned standard*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
multiplication to multiply a two-digit factor [through 12] by a . . . factor [through 12].	
3.N.2.8 Use various strategies (e.g., base ten blocks, area models, arrays, repeated addition, algorithms) based on knowledge of place value, equality, and properties of addition and multiplication to multiply a two-digit factor by a one-digit factor.	Solve one- and two-step problems involving multiplication and division within 100, using drawings, arrays, strip diagrams, and equations.* Model, create, and describe multiplication and division situations.* Know multiplication/division fact families.*
3.N.2.8 Use various strategies . . . based on knowledge of place value, equality, and properties of . . . multiplication to multiply a two-digit factor [multiple of 10] by a one-digit factor.	Multiply 10 or a multiple of 10 by a one-digit number.
3.N.3.1 Read and write fractions with words and symbols using appropriate terminology (i.e., numerator and denominator).	Identify fractions that name part of a whole (denominators of 2, 3, 4, 6, 8, 10, 12).* Partition objects into equal parts and identify the parts using the terms *halves*, *fourths*, and *eighths*. Identify non-examples of objects partitioned into halves, fourths, and eighths.* Identify fractions that name part of a set (denominators of 2, 3, 4, 6, 8, 10, 12).* Identify fractions shown on a number line.* Represent unit fractions (1/*b*) on number lines by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts.*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Represent fractions of halves, thirds, fourths, sixths, and eighths as distances from zero on a number line.*
3.N.3.2 Model fractions using length . . . for halves, thirds, fourths, sixths, and eighths.	Represent fractions of halves, thirds, fourths, sixths, and eighths as distances from zero on a number line.
3.N.3.2 Model fractions using length, set, and area for halves, thirds, fourths, sixths, and eighths.	Partition shapes into 2, 3, 4, 6 or 8 parts with equal area.*
3.N.3.2 Model [unit] fractions using . . . area . . .	Describe areas of equal parts of a shape using unit fractions.
3.N.3.2 Model [unit] fractions using length . . .	Represent unit fractions (1/*b*) on number lines by defining the interval from 0 to 1 as the whole and partitioning it into *b* equal parts.
3.N.3.2 Use and justify fractional representations in . . . problems. Model fractions using . . . set, and area . . .	Solve problems involving partitioning an object or a set of objects among two or more recipients using pictorial representations of fractions.
3.N.3.3 Apply understanding of unit fractions and use this understanding to compose and decompose fractions related to the same whole.	Compose and decompose a fraction with a numerator greater than zero and less than or equal to the denominator as the sum of unit fractions. Solve problems involving partitioning an object or a set of objects among two or more recipients using pictorial representations of fractions.* Partition objects into equal parts and identify the parts using the terms *halves*, *fourths*, and *eighths*. Identify non-examples of objects partitioned into halves, fourths, and eighths.*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Partition shapes into 2, 3, 4, 6 or 8 parts with equal area.*
3.N.3.4 Use models . . . to . . . compare fractions . . .	Compare two fractions with the same numerator or the same denominator using a visual fraction model.
3.N.4.1 Use addition and subtraction to determine the value of a collection of coins up to one dollar using the cent symbol and in monetary transactions.	Solve problems with dollar bills and coins and use dollar and cent symbols.*
3.N.4.2 Add and subtract a collection of bills up to twenty dollars using whole dollars in monetary transactions.	Solve problems with dollar bills and coins and use dollar and cent symbols.*
3.A.1.1 Create, describe, and extend patterns involving addition, subtraction, or multiplication to solve problems in a variety of contexts.	Find and explain arithmetic patterns, including patterns in the addition table and multiplication table, and explain the patterns using the properties of operations.*
3.A.1.2 Describe the rule (limited to a single operation) for a pattern . . . involving addition . . . or multiplication.	Find and explain arithmetic patterns, including patterns in the addition table and multiplication table, and explain the patterns using the properties of operations.
3.A.2.1 Use number sense with . . . addition [and] subtraction . . . to find unknowns (represented by symbols) in one-step equations. . . .	Represent and solve addition and subtraction word problems using equations with unknowns in all positions.
3.A.2.1 Use number sense with . . . subtraction . . . to find unknowns . . . in one-step equations. . . .	Solve subtraction problems for comparison situations.
3.A.2.1 Use number sense with the properties of addition, subtraction, and multiplication, to find unknowns (represented by symbols) in one-step equations. Generate real-world situations to represent number sentences.	Write and solve two-step real-world problems using addition, subtraction, multiplication, and division.* Determine the operation(s) needed to solve one- and two-step word problems involving all four operations with whole numbers and represent these problems using equations

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	with a letter standing for the unknown quantity.* Represent one- and two-step problems involving addition and subtraction of whole numbers to 1,000 using pictorial models, number lines, and equations.* Solve one- and two-step problems involving addition and subtraction within 1,000, using strategies based on place value, properties of operations, and the relationship between addition and subtraction.* Use rounding (to the nearest 10 or 100) or compatible numbers to estimate solutions to addition and subtraction problems.* Solve one- and two-step problems involving multiplication and division within 100, using drawings, arrays, strip diagrams, and equations.* Model, create, and describe multiplication and division situations.* Determine the unknown whole number in a multiplication or division equation relating three whole numbers.* Select the proper operation to solve real-world and mathematical problems.*
3.A.2.2 . . . [A]pply the number properties . . . to solve [addition] . . .	Add three-digit numbers with regrouping.
3.A.2.2 . . . [A]pply the number properties . . . to solve [division] . . .	Know division facts through 144 divided by 12.

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
3.A.2.2 . . . [A]pply the number properties . . . to solve [multiplication] . . .	Know multiplication facts through 12 times 12. Multiply 10 or a multiple of 10 by a one-digit number.
3.A.2.2 . . . [A]pply the number properties . . . to solve [subtraction] . . .	Subtract three-digit numbers with regrouping.
3.A.2.2 Identify, represent, and apply the number properties (commutative, identity, and associative properties of addition and multiplication) using models and manipulatives to solve problems.	Know multiplication/division fact families.* Apply the properties of multiplication (zero, identity, commutative, associative, and distributive).* Solve one- and two-step problems involving addition and subtraction within 1,000, using strategies based on place value, properties of operations, and the relationship between addition and subtraction.*
3.A.2.2 Use number sentences . . . unknowns to represent and solve real-world . . . problems. . . . [Use] models . . . to solve [division] problems.	Solve one- and two-step real-world problems involving division of a two-digit number by a one-digit number.
3.GM 1.1 Sort three-dimensional shapes based on attributes.	Sort and classify three-dimensional shapes according to attributes, such as vertices, faces, and edges.*
3.GM.2.1 Find the perimeter of a polygon, given whole number lengths of the sides, using a variety of models.	Use side lengths to solve problems involving perimeter.
3.GM.2.2 Analyze why length and width are multiplied to find the area of a rectangle by decomposing the rectangle into one unit by one unit squares and viewing these as rows and columns to determine the area.	Measure the area of a rectangle by covering it with unit squares and counting them, and show that the area is the same as would be found by multiplying the side lengths.
3.GM.2.4 Find the area of two-dimensional figures by counting the total number of	Solve area problems by decomposing figures into non-overlapping rectangles and adding the areas of the rectangles.*

**This skill is related to the aligned standard*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
same-size unit squares that fill the shape without gaps or overlaps.	
3.GM.2.4 Find the area of two-dimensional figures [rectangles] by counting the total number of same-size unit squares that fill the shape without gaps or overlaps.	Measure the area of a rectangle by covering it with unit squares and counting them, and show that the area is the same as would be found by multiplying the side lengths.
3.GM.2.5 Choose an appropriate measurement instrument and measure the length of objects to the nearest whole centimeter or whole meter.	Choose millimeters, centimeters, meters, or kilometers to measure length or distance.*
3.GM.2.5 Choose an appropriate measurement [unit to] . . . measure the length of objects[:] . . . centimeter or . . . meter.	Choose the best unit to measure length: centimeters or meters.
3.GM.2.6 . . . [Use] an appropriate instrument [ruler] to measure the length of objects to the . . . inch.	Use a ruler to measure length in inches.
3.GM.2.6 Choose an appropriate measurement instrument and measure the length of objects to the nearest whole yard, whole foot, or half inch.	Use a ruler to measure length to 1/4 inch.* Choose inches, feet, yards, or miles to measure length.*
3.GM.2.6 Choose an appropriate measurement [unit to] . . . measure the length of objects[:] . . . yard, . . . foot, or . . . inch.	Choose the best unit to measure length: inches, feet, or yards.
3.GM.3.1 Read and write time to the nearest five-minute interval (analog and digital).	Tell time to the nearest five minutes. Tell time to the minute and measure time intervals in minutes.*
3.GM.3.2 Determine the solutions to problems involving addition and subtraction of time in intervals of . . . minutes, up to one hour, using . . . number line diagrams . . .	Solve word problems involving addition and subtraction of time intervals in minutes involving elapsed time less than 60 minutes.
3.GM.3.2 Determine the solutions to problems involving addition and subtraction	Tell time to the minute and measure time intervals in minutes.*

Grade 3 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
of time in intervals of five minutes, up to one hour, using pictorial models, number line diagrams, or other tools.	
3.D.1.1 . . . [O]rganize a data set . . . using a . . . line plot . . . with scaled intervals.	Given lengths measured to wholes, halves, and fourths inches, display the data in a line plot.
3.D.1.1 Collect and organize a data set with multiple categories using a frequency table, line plot, pictograph, or bar graph with scaled intervals.	Solve one- and two-step problems using categorical data in a frequency table and line plot.* Construct and interpret scaled bar graphs and scaled picture graphs.* Solve one- and two-step problems using categorical data in picture graphs and bar graphs with scaled intervals.*
3.D.1.2 Solve one- and two-step problems using categorical data represented with a . . . pictograph, or bar graph with scaled intervals.	Solve one- and two-step problems using categorical data in picture graphs and bar graphs with scaled intervals.
3.D.1.2 Solve one- and two-step problems using categorical data represented with a frequency table, pictograph, or bar graph with scaled intervals.	Construct and interpret scaled bar graphs and scaled picture graphs.* Solve one- and two-step problems using categorical data in a frequency table and line plot.*

Grade 4

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
4.N.1.1 Read, write, discuss, and represent whole numbers up to 1,000,000. Representations may include numerals, words, pictures, number lines, and manipulatives.	Read and write whole numbers through hundred millions in expanded form and standard form and identify the value of the digits.* Read and write whole numbers through hundred thousands in expanded form and standard form and identify the value of the digits.* Compare and order numbers through hundred thousands.*
4.N.1.2 Use place value to describe whole numbers . . . [up to] 1,000,000 in terms of . . . hundred thousands, ten thousands, thousands, hundreds, tens, and ones with written, standard, and expanded forms.	Read and write whole numbers through hundred thousands in expanded form and standard form and identify the value of the digits.
4.N.1.2 Use place value to describe whole numbers between 1,000 and 1,000,000 in terms of millions, hundred thousands, ten thousands, thousands, hundreds, tens, and ones with written, standard, and expanded forms.	Read and write whole numbers through hundred millions in expanded form and standard form and identify the value of the digits.* Compare and order numbers through hundred thousands.* Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.*
4.N.1.3 Applying knowledge of place value . . . to multiply . . . a number by 10, 100 and 1,000.	Multiply a whole number by a power of 10 or a multiple of 10.
4.N.1.3 Applying knowledge of place value, use mental strategies (no written computations) to multiply or divide a number by 10, 100 and 1,000.	Multiply two-digit numbers by one-digit numbers.*

**This skill is related to the aligned standard*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Recognize that in a multi-digit whole number, a digit in one place represents ten times what it represents in the place to its right.*
4.N.1.4 Use place value to compare and order whole numbers up to 1,000,000, using . . . numbers, and symbols.	Compare and order numbers through hundred thousands.
4.N.1.4 Use place value to compare and order whole numbers up to 1,000,000, using comparative language, numbers, and symbols.	Read and write whole numbers through hundred millions in expanded form and standard form and identify the value of the digits.* Read and write whole numbers through hundred thousands in expanded form and standard form and identify the value of the digits.*
4.N.2.1 Demonstrate . . . multiplication and division facts with factors up to [10].	Identify factor pairs of whole numbers up to 100. Identify multiples of whole numbers with products to 100.
4.N.2.1 Demonstrate fluency with . . . division facts with factors up to 12.	Know division facts through 144 divided by 12.
4.N.2.1 Demonstrate fluency with multiplication . . . facts with factors up to 12.	Know multiplication facts through 12 times 12.
4.N.2.1 Demonstrate fluency with multiplication and division facts with factors up to [10].	Know multiplication/division fact families.
4.N.2.2 Multiply . . . 2-digit by 2-digit whole numbers . . .	Multiply two-digit whole numbers by two-digit whole numbers.
4.N.2.2 Multiply . . . 2-digit by 2-digit whole numbers, using various strategies . . .	Use arrays, area models, and equations to represent the product of two two-digit numbers.

**This skill is related to the aligned standard*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
4.N.2.2 Multiply 3-digit by 1-digit . . . whole numbers . . .	Multiply three-digit numbers by one-digit numbers.
4.N.2.2 Multiply 3-digit by 1-digit and 2-digit by 2-digit whole numbers, using various strategies, including but not limited to standard algorithms.	Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.*
4.N.2.3 Estimate products of 3-digit by 1-digit and 2-digit by 2-digit whole number factors using a variety of strategies (e.g., rounding, front end estimation, adjusting, compatible numbers) to assess the reasonableness of results. Explore larger numbers using technology to investigate patterns.	Multiply three-digit numbers by one-digit numbers.* Multiply two-digit whole numbers by two-digit whole numbers.* Multiply a whole number of up to four digits by a one-digit whole number using strategies based on place value and the properties of operations.* Use arrays, area models, and equations to represent the product of two two-digit numbers.* Estimate and assess the reasonableness of answers to word problems involving whole numbers and the four operations.* Round whole numbers to the nearest ten, hundred, thousand, ten thousand, and hundred thousand.*
4.N.2.4 Apply and analyze models to solve multi-step problems requiring the use of addition, subtraction, and multiplication of multi-digit whole numbers. Use various strategies, including the relationship between operations, the use of appropriate technology, and the context of the problem to assess the reasonableness of results.	Write and solve equations with variables to determine the answers to multi-step real-world problems using the four operations and whole numbers.* Estimate and assess the reasonableness of answers to word problems involving whole numbers and the four operations.*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
4.N.2.5 Use strategies and algorithms (e.g., mental strategies, standard algorithms, partial quotients, repeated subtraction, the commutative, associative, and distributive properties) based on knowledge of place value, equality, and properties of operations to divide a 3-digit dividend by a 1-digit whole number divisor, with and without remainders.	Identify the remainder in a problem involving division of a two-digit number by a one-digit number.* Divide up to four-digit whole numbers by one-digit whole numbers.* Represent the quotient of up to a four-digit whole number divided by a one-digit whole number using arrays, area models, or equations.*
4.N.3.1 Represent and rename equivalent fractions using fraction models (e.g., parts of a set, area models, fraction strips, number lines).	Recognize and generate equivalent fractions. Use models to find equivalent fractions.
4.N.3.2 . . . [L]ocate . . . fractions . . . on a number line.	Identify fractions shown on a number line.
4.N.3.2 . . . [L]ocate . . . fractions with denominators up to [eighths] on a number line.	Represent fractions of halves, thirds, fourths, sixths, and eighths as distances from zero on a number line.
4.N.3.3 . . . [C]ompare . . . fractions . . .	Compare two fractions with unlike denominators.
4.N.3.3 . . . [O]rder and compare whole numbers . . . using comparative . . . symbols.	Compare and order numbers through hundred thousands.
4.N.3.3 Use models to . . . compare . . . fractions . . . using comparative . . . symbols.	Compare two fractions with different numerators and different denominators using a visual fraction model.
4.N.3.3 Use models to order and compare whole numbers and fractions less than and greater than one, using comparative language and symbols.	Read and write whole numbers through hundred millions in expanded form and standard form and identify the value of the digits.* Read and write whole numbers through hundred thousands in expanded form and

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	standard form and identify the value of the digits.*
4.N.3.4 Decompose a fraction into a sum of fractions with the same denominator in more than one way, . . . recording results with numerical representations (e.g., 3/4 = 1/4 + 1/4 + 1/4 and 3/4 = 2/4 + 1/4).	Decompose a fraction into a sum of fractions with like denominators. Understand a fraction *a*/*b* as a sum of unit fractions 1/*b*.
4.N.3.5 . . . [A]dd and subtract fractions with like denominators.	Add and subtract fractions with like denominators.
4.N.3.5 Represent . . . fractions . . . real-world . . . situations; . . . . . [A]dd and subtract fractions with like denominators.	Solve word problems by adding and subtracting fractions with like denominators that refer to the same whole.
4.N.3.6 Represent tenths and hundredths . . . , making connections between fractions and decimals.	Express fractions with denominators of 10 or 100 as decimals.
4.N.3.6 Represent tenths and hundredths with . . . pictorial models [number lines], making connections between fractions and decimals.	Locate decimals through hundredths on a number line.
4.N.3.7 Read and write decimals in standard, word, and expanded form up to . . . [thousandths] place . . .	Read and write decimals to thousandths in standard form, word form, and expanded form.
4.N.3.7 Read and write decimals in standard, word, and expanded form up to at least the hundredths place in a variety of contexts, including money.	Compare two decimals to hundredths, including amounts of money.*
4.N.3.8 Compare . . . decimals . . .	Compare two decimals to hundredths, including amounts of money.
4.N.3.8 Compare and order . . . whole numbers . . .	Compare and order numbers through hundred thousands.
4.N.3.8 Compare and order decimals . . .	Compare and order decimals through hundredths.
4.N.3.8 Compare and order decimals and whole numbers using place value and	Read and write whole numbers through hundred millions in expanded form and

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
various models including but not limited to grids, number lines, and base 10 blocks.	standard form and identify the value of the digits.* Read and write whole numbers through hundred thousands in expanded form and standard form and identify the value of the digits.*
4.N.3.9 Compare and order benchmark fractions (0, 1/4, 1/3, 1/2, 2/3, 3/4, 1) and decimals (0, 0.25, 0.50, 0.75, 1.00) in a variety of representations.	Compare two fractions with different numerators and different denominators using a visual fraction model.* Compare two fractions with unlike denominators.* Compare and order decimals through hundredths.* Compare two decimals to hundredths, including amounts of money.*
4.N.4.1 Select the fewest number of coins for a given amount of money up to one dollar.	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals and problems that require expressing measurements given in a larger unit in terms of a smaller unit. *
4.N.4.2 Given a total cost (dollars and coins up to twenty dollars) and amount paid (dollars and coins up to twenty dollars), find the change required in a variety of ways.	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals and problems that require expressing measurements given in a larger unit in terms of a smaller unit. *
4.A.1.1 Create an input/output chart or table to represent or extend a numerical pattern.	Generate a number or shape pattern that follows a given rule, and identify and explain features of the pattern that were not explicit in the rule.*

**This skill is related to the aligned standard*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
4.A.1.2 Describe the single operation rule for a pattern from . . . [a] table . . . involving . . . operation of a whole number.	Find and explain arithmetic patterns, including patterns in the addition table and multiplication table, and explain the patterns using the properties of operations.
4.A.1.2 Describe the single operation rule for a pattern from an input/output table or function machine involving any operation of a whole number.	Generate a number or shape pattern that follows a given rule, and identify and explain features of the pattern that were not explicit in the rule.*
4.A.1.3 Construct models to show growth patterns involving geometric shapes and define the single operation rule of the pattern.	Generate a number or shape pattern that follows a given rule, and identify and explain features of the pattern that were not explicit in the rule.*
4.A.2.1 Use multiplication and division with variables to create number sentences representing a given mathematical situation. Use . . . multiplication and division . . . to solve problems and find values for variables that make number sentences true.	Multiply or divide whole numbers to solve real-world problems involving multiplicative comparisons.
4.A.2.1 Use the relationships between multiplication and division with the properties of multiplication to solve problems and find values for variables that make number sentences true.	Write and solve equations with variables to determine the answers to multi-step real-world problems using the four operations and whole numbers.* Interpret the remainder in a real-world problem involving division of up to a three-digit number by a one-digit number.* Divide up to four-digit whole numbers by one-digit whole numbers.*
4.A.2.2 Solve for a variable in an equation involving addition, subtraction, multiplication, or division with whole numbers. . . . [R]epresent number sentences	Write and solve equations with variables to determine the answers to multi-step real-world problems using the four operations and whole numbers.
4.A.2.2 Solve for a variable in an equation involving addition, subtraction, multiplication, or division with whole	Interpret the remainder in a real-world problem involving division of up to a three-digit number by a one-digit number.*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
numbers. Analyze models to represent number sentences and vice versa.	Estimate and assess the reasonableness of answers to word problems involving whole numbers and the four operations.*
4.A.2.2 Use multiplication and division with variables to create number sentences representing a given mathematical situation. Solve for a variable in an equation involving . . . multiplication, or division with whole numbers . . .	Multiply or divide whole numbers to solve real-world problems involving multiplicative comparisons.
4.GM.1.1 Identify . . . angles [acute, obtuse, right, and straight], . . . and parallel and perpendicular lines . . .	Identify acute, obtuse, right, and straight angles and perpendicular and parallel lines.
4.GM.1.1 Identify points, lines, line segments, rays, angles, endpoints, and parallel and perpendicular lines in various models.	Identify points, lines, line segments, rays, and planes in two-dimensional figures.*
4.GM.1.2 Describe [and] classify . . . quadrilaterals, including squares, rectangles, trapezoids, rhombuses, [and] parallelograms . . . Recognize quadrilaterals . . .	Identify squares, rectangles, parallelograms, rhombuses, and trapezoids, and recognize them as examples of quadrilaterals. Identify quadrilaterals that do not belong to any of these subcategories.
4.GM.1.2 Describe, classify, and construct quadrilaterals, including squares, rectangles, trapezoids, rhombuses, parallelograms, and kites. Recognize quadrilaterals in various models.	Classify two-dimensional figures based on their parallel and perpendicular lines, angle measures, or side lengths.*
4.GM.1.3 Given two three-dimensional shapes, . . . [analyze] each shape. Compare and contrast their similarities and differences based on their attributes.	Compare and contrast attributes of solid figures including numbers of vertices, faces, and edges.
4.GM.2.1 Measure angles . . . with a protractor . . .	Measure angles using a virtual protractor.
4.GM.2.1 Measure angles in geometric figures and real-world objects with a protractor or angle ruler.	Understand that an angle is measured with reference to a circle with its center at the vertex of the angle, by considering the

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	portion of the circle that the angle turns through. An angle that turns through 1/360 of the circle has a measure of 1 degree, and an angle that turns through n/360 of a circle has a measure of n degrees.*
4.GM.2.2 Find the area of polygons by determining if they can be decomposed into rectangles.	Solve area problems by decomposing figures into non-overlapping rectangles and adding the areas of the rectangles.
4.GM.2.3 . . . [Use] the concept that the volume of rectangular prisms with whole-number edge lengths can be found by counting the total number of same-sized unit cubes that fill a shape without gaps or overlaps. Use . . . models to determine the volume using appropriate measurements (e.g., cm^3).	Use unit cubes to find the volume of right rectangular prisms.
4.GM.2.3 Develop the concept that the volume of rectangular prisms with whole-number edge lengths can be found by counting the total number of same-sized unit cubes that fill a shape without gaps or overlaps. . . .	Recognize a unit cube as a cube with side length one unit and volume one cubic unit, and recognize that a three-dimensional figure that can be fully packed with *n* unit cubes has a volume of *n* cubic units.
4.GM.2.4 . . . [Use] an appropriate instrument [ruler] to measure the length of an object to the nearest . . . quarter inch.	Use a ruler to measure length to 1/4 inch.
4.GM.2.5 Recognize and use the relationship between inches, feet, and yards to measure and compare objects.	Convert and compare customary units of length (inches, feet, yards, miles).*
4.GM.2.6 Recognize and use the relationship between millimeters, centimeters, and meters to measure and compare objects.	Convert and compare metric units of length (millimeters, centimeters, meters, kilometers).* Know relative sizes of measurement units within the customary or metric systems, including km, m, cm; kg, g; lb., oz.; l, ml; hr, min, sec.*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Choose millimeters, centimeters, meters, or kilometers to measure length.* Within the same system of measurement, convert measurements in a larger unit to a smaller unit, including km, m, cm; kg, g; lb., oz.; l, ml; hr, min, sec, and record measurement equivalents in a table.*
4.GM.2.7 Determine . . . the best use of . . . metric measurements in . . . situations (. . . length).	Choose millimeters, centimeters, meters, or kilometers to measure length.
4.GM.2.7 Determine . . . the best use of . . . metric measurements in . . . situations (. . . mass . . .).	Choose grams or kilograms to measure mass.
4.GM.2.7 Determine . . . the best use of . . . metric measurements in . . . situations (liquid volumes . . .).	Choose milliliters or liters to measure liquid volume.
4.GM.2.7 Determine . . . the best use of customary . . . measurements in . . . situations (. . . length).	Choose inches, feet, yards, or miles to measure length.
4.GM.2.7 Determine . . . the best use of customary . . . measurements in . . . situations (. . . weight . . .).	Choose ounces, pounds, or tons to measure weight.
4.GM.2.7 Determine . . . the best use of customary . . . measurements in . . . situations (liquid volumes . . .).	Choose fluid ounces, cups, quarts, or gallons to measure capacity.
4.GM.2.7 Determine and justify the best use of customary and metric measurements in a variety of situations (liquid volumes, mass vs. weight, temperatures above 0 (zero) degrees, and length).	Know relative sizes of measurement units within the customary or metric systems, including km, m, cm; kg, g; lb., oz.; l, ml; hr, min, sec.*
4.GM.3.1 Determine elapsed time.	Solve real-world problems involving elapsed time.

**This skill is related to the aligned standard*

Grade 4 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Use the four operations to solve word problems involving distances, intervals of time, liquid volumes, masses of objects, and money, including problems involving simple fractions or decimals and problems that require expressing measurements given in a larger unit in terms of a smaller unit. *
4.GM.3.2 Convert one measure of time to another including seconds to minutes, minutes to hours, hours to days, and vice versa, using various models.	Within the same system of measurement, convert measurements in a larger unit to a smaller unit, including km, m, cm; kg, g; lb., oz.; l, ml; hr, min, sec, and record measurement equivalents in a table.* Know relative sizes of measurement units within the customary or metric systems, including km, m, cm; kg, g; lb., oz.; l, ml; hr, min, sec.*
4.D.1.1 Create and organize data on a . . . line plot marked with whole numbers . . . using appropriate . . . units.	Show data on a line plot with a scale that includes whole-number units.
4.D.1.1 Create and organize data on a . . . line plot marked with whole numbers and fractions using appropriate . . . units.	Given lengths measured to wholes, halves, and fourths inches, display the data in a line plot.
4.D.1.1 Create and organize data on a frequency table or line plot marked with whole numbers and fractions using appropriate titles, labels, and units.	Construct line plots using data in fractional units of 1/2, 1/4, and 1/8, and solve problems involving addition and subtraction of fractions by using the information in the line plots.*
4.D.1.3 Solve one- and two-step problems by analyzing data in whole number . . . form . . . in a frequency table and line plot.	Solve one- and two-step problems using categorical data in a frequency table and line plot.
4.D.1.3 Solve one- and two-step problems by analyzing data in whole number, decimal, or fraction form in a frequency table and line plot.	Construct line plots using data in fractional units of 1/2, 1/4, and 1/8, and solve problems involving addition and subtraction of fractions by using the information in the line plots.*

**This skill is related to the aligned standard*

Grade 5

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
5.N.1.1 Represent decimal fractions (e.g., 1/10, 1/100) . . . and show the . . . relationships among fractions [and] decimals . . .	Express fractions with denominators of 10 or 100 as decimals.
5.N.1.1 Represent decimal fractions (e.g., 1/10, 1/100) using a variety of models (e.g., 10 by 10 grids, base-ten blocks, meter stick) and show the rational number relationships among fractions, decimals and whole numbers.	Demonstrate an understanding of place value in base-ten by showing how the places increase by powers of 10 from right to left.* Multiply and divide multi-digit decimals by positive powers of 10 and demonstrate an understanding of the patterns involved in multiplying and dividing by powers of 10 by identifying and explaining the patterns.* Read and write decimals to thousandths in standard form, word form, and expanded form.*
5.N.1.2 Read, write, and represent decimals using place value to describe decimal numbers including fractional numbers as small as thousandths and whole numbers . . .	Read and write decimals to thousandths in standard form, word form, and expanded form.
5.N.1.3 . . . [L]ocate [decimals] on a number line.	Locate decimals through hundredths on a number line.
5.N.1.3 Compare . . . decimals . . .	Compare two decimals through thousandths.
5.N.1.3 Compare . . . fractions [with different numerators and denominators] . . .	Compare two fractions with different numerators and different denominators using a visual fraction model.
5.N.1.3 Compare . . . fractions [with unlike denominators] . . .	Compare two fractions with unlike denominators.
5.N.1.4 . . . [G]enerate equivalent . . . mixed numbers, and fractions . . .	Express fractions greater than 1 as mixed numbers and mixed numbers as fractions greater than 1.

**This skill is related to the aligned standard*

Grade 5 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
5.N.1.4 . . . [G]enerate equivalent terminating decimals [from] fractions [with denominators 10 or 100] . . .	Express fractions with denominators of 10 or 100 as decimals.
5.N.1.4 Recognize . . . terminating decimals . . . in . . . models [number lines].	Locate decimals through hundredths on a number line.
5.N.1.4 Recognize and generate equivalent . . . fractions . . . in various models.	Recognize and generate equivalent fractions.
5.N.1.4 Recognize and generate equivalent terminating decimals, fractions, mixed numbers, and fractions in various models.	Add and subtract fractions and mixed numbers with unlike denominators.*
5.N.2.1 Estimate solutions to division problems to assess the reasonableness of results.	Divide four-digit numbers by two-digit numbers using models.*
5.N.2.2 Divide multi-digit numbers, by . . . two-digit divisors, based on knowledge of place value, including but not limited to standard algorithms.	Divide multi-digit whole numbers.
5.N.2.2 Divide multi-digit numbers, by one- and two-digit divisors, based on knowledge of place value, including but not limited to standard algorithms.	Divide four-digit numbers by two-digit numbers using models.*
5.N.2.2 Divide [up to four]-digit numbers, by one- . . . digit divisors, based on knowledge of place value . . .	Divide up to four-digit whole numbers by one-digit whole numbers.
5.N.2.3 Divide multi-digit numbers and solve real-world and mathematical problems using [division]. Recognize that remainders can be represented in a variety of ways, including a . . . fraction . . . Determine [and interpret] the . . . remainder based on the context of the problem.	Interpret a fraction as the division of the numerator by the denominator in a mathematical or real-world context.
5.N.2.3 Divide [three]-digit numbers and solve real-world . . . problems using	Interpret the remainder in a real-world problem involving division of up to a three-digit number by a one-digit number.

**This skill is related to the aligned standard*

Grade 5 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
[division]. . . . [Interpret] the . . . remainder based on the context of the problem.	
5.N.2.4 . . . [Estimate solutions to] multi-digit whole number problems requiring addition, subtraction, multiplication, and division using . . . the context of the problem to assess the reasonableness of results.	Estimate and assess the reasonableness of answers to word problems involving whole numbers and the four operations.
5.N.2.4 . . . [S]olve multi-digit whole number . . . addition . . .	Add multi-digit numbers.
5.N.2.4 . . . [S]olve multi-digit whole number . . . subtraction . . .	Subtract multi-digit numbers.
5.N.2.4 . . . [S]olve multi-digit [by two-digit] whole number . . . multiplication . . .	Multiply multi-digit numbers by two-digit numbers.
5.N.2.4 Construct models to solve multi-digit whole number . . . division [four-digit by two-digit] using various representations, including the inverse relationships between operations . . .	Divide four-digit numbers by two-digit numbers using models.
5.N.3.1 Add and subtract fractions with like and unlike denominators . . . to solve real-world . . . problems. Estimate sums and differences of fractions with like and unlike denominators . . . to assess the reasonableness of the results.	Solve word problems involving the addition and subtraction of fractions with like and unlike denominators using fraction models or equations, and use benchmark fractions to assess the reasonableness of the solution.
5.N.3.1 Estimate sums and differences of fractions with like and unlike denominators, mixed numbers, and decimals to assess the reasonableness of the results.	Add and subtract fractions and mixed numbers with unlike denominators.* Solve one- and two-step real-world problems involving addition, subtraction, and multiplication of decimals.* Add and subtract decimals through hundredths.*
5.N.3.2 Add and subtract fractions . . . to solve . . . mathematical problems. Illustrate	Construct line plots using data in fractional units of 1/2, 1/4, and 1/8, and solve

Grade 5 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
addition and subtraction of fractions . . . using . . . mathematical models (e.g., . . . number lines . . .).	problems involving addition and subtraction of fractions by using the information in the line plots.
5.N.3.2 Add and subtract fractions with like and unlike denominators, mixed numbers, and decimals to solve real-world and mathematical problems. Illustrate addition and subtraction of fractions with like and unlike denominators, mixed numbers, and decimals using a variety of mathematical models (e.g., fraction strips, area models, number lines, fraction rods).	Construct and interpret a line plot using data in fractional units.*
5.N.3.2 Illustrate addition and subtraction of fractions with like and unlike denominators, mixed numbers, and decimals using a variety of mathematical models (e.g., fraction strips, area models, number lines, fraction rods).	Add and subtract fractions and mixed numbers with unlike denominators.* Solve word problems involving the addition and subtraction of fractions with like and unlike denominators using fraction models or equations, and use benchmark fractions to assess the reasonableness of the solution. * Solve one- and two-step real-world problems involving addition, subtraction, and multiplication of decimals.*
5.N.3.3 Add and subtract . . . decimals [through hundredths] . . .	Add and subtract decimals through hundredths.
5.N.3.3 Add and subtract fractions . . . to solve . . . mathematical problems. Add and subtract fractions . . . , involving . . . data. Use . . . models . . .	Construct line plots using data in fractional units of 1/2, 1/4, and 1/8, and solve problems involving addition and subtraction of fractions by using the information in the line plots.
5.N.3.3 Add and subtract fractions with . . . unlike denominators [and] mixed numbers . . . Use . . . efficient strategies, including . . . standard algorithms.	Add and subtract fractions and mixed numbers with unlike denominators.

Grade 5 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
5.N.3.3 Add and subtract fractions with like . . . denominators . . .	Add and subtract fractions with like denominators.
5.N.3.3 Add and subtract fractions with like and unlike denominators, mixed numbers, and decimals, involving money, measurement, geometry, and data. Use various models and efficient strategies, including but not limited to standard algorithms.	Solve word problems involving the addition and subtraction of fractions with like and unlike denominators using fraction models or equations, and use benchmark fractions to assess the reasonableness of the solution. * Solve one- and two-step real-world problems involving addition, subtraction, and multiplication of decimals.* Solve multi-step, real-world problems involving conversion among measurement units within a system.*
5.N.3.4 Apply mental math and knowledge of place value (no written computations) to find 0.1 more or 0.1 less than a number, 0.01 more or 0.01 less than a number, and 0.001 more or 0.001 less than a number.	Solve one- and two-step real-world problems involving addition, subtraction, and multiplication of decimals.* Add and subtract decimals through hundredths.*
5.A.1.1 Use tables and rules with up to two operations to describe patterns of change and make predictions and generalizations about various mathematical situations.	Generate two numerical patterns using two given rules, identify relationships between corresponding terms, and form and graph ordered pairs using corresponding terms.* Generate and analyze an additive or multiplicative numerical pattern from its equation, table, or graph.*
5.A.1.2 Use a rule or table to represent ordered pairs of whole numbers and graph these ordered pairs on a coordinate plane, identifying the origin and axes in relation to the coordinates.	Generate two numerical patterns using two given rules, identify relationships between corresponding terms, and form and graph ordered pairs using corresponding terms.*

Grade 5 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Generate and analyze an additive or multiplicative numerical pattern from its equation, table, or graph.* Identify the origin and axes in the coordinate system, locate and plot ordered pairs on a coordinate grid, and find the distance between two points with the same *x*- or *y*-coordinate.*
5.A.2.1 Generate equivalent numerical expressions . . . using number sense involving whole numbers by applying the . . . order of operations (excluding exponents).	Write and evaluate expressions with grouping symbols.
5.A.2.1 Generate equivalent numerical expressions and solve problems using number sense involving whole numbers by applying the commutative property, associative property, distributive property, and order of operations (excluding exponents).	Use formulas to find the volume of cubes and rectangular prisms.*
5.A.2.2 Determine whether an . . . inequality involving a variable is true or false for a given value of the variable.	Use substitution to determine whether a solution to an inequality is true.
5.A.2.2 Determine whether an equation . . . involving a variable is true or false for a given value of the variable.	Use substitution to determine whether a solution to an equation is true.
5.A.2.3 Evaluate expressions involving variables when values for the variables are given.	Evaluate expressions for given values of the variables.
5.GM.1.1 . . . [C]lassify . . . triangles . . . by their attributes . . .	Sort and classify triangles according to their side lengths and angle measures.
5.GM.1.2 . . . [C]lassify three-dimensional figures . . . [based on] their attributes (. . . edges, faces, vertices . . .) . . .	Sort and classify three-dimensional shapes according to attributes, such as vertices, faces, and edges.

Grade 5 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
5.GM.1.3 Recognize . . . a net for a three-dimensional figure . . .	Identify two-dimensional nets that form three-dimensional figures.
5.GM.2.1 Determine the volume of rectangular prisms . . . by the product of the dimensions of the prism . . .	Use formulas to find the volume of cubes and rectangular prisms.
5.GM.2.1 Determine the volume of rectangular prisms by the number of unit cubes (n) used to construct the shape . . .	Use unit cubes to find the volume of right rectangular prisms.
5.GM.3.1 Measure . . . angles . . . using . . . tools [protractor].	Measure angles using a virtual protractor.
5.GM.3.3 Apply the relationship between inches, feet, and yards to measure, convert, and compare objects to solve problems.	Solve multi-step, real-world problems involving conversion among measurement units within a system.*
5.GM.3.4 Apply the relationship between millimeters, centimeters, and meters to measure, convert, and compare objects to solve problems.	Solve multi-step, real-world problems involving conversion among measurement units within a system.*
5.D.1.2 Create and analyze line . . . graphs with increments of . . . fractions . . .	Construct and interpret a line plot using data in fractional units.

**This skill is related to the aligned standard*

Grade 6

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
6.N.1.1 Use . . . models (e.g., number lines) to determine positive and negative numbers . . . [and] identify opposites . . .	Understand that opposite signs indicate locations on opposite sides of the number line and that the opposite of the opposite of a number is the number itself.
6.N.1.1 Use . . . positive and negative numbers and their contexts, identify opposites, and explain the meaning of 0 (zero) in a variety of situations.	Use positive and negative numbers to represent quantities having opposite directions or values in real-world contexts, explaining the meaning of 0 in each situation.
6.N.1.1 Use manipulatives and models (e.g., number lines) to determine positive and negative numbers and their contexts, identify opposites, and explain the meaning of 0 (zero) in a variety of situations.	Represent and compare positive and negative rational numbers as points on the number line.* Locate pairs of rational numbers and plot points with rational number coordinates in all four quadrants on a coordinate plane. *
6.N.1.2 . . . [O]rder . . . [positive] rational numbers . . .	Order rational numbers in real-world contexts.
6.N.1.2 Compare . . . positive rational numbers, represented in various forms [decimals] . . . using the symbols "<", ">", and "=".	Compare two decimals through thousandths.
6.N.1.2 Compare and order positive rational numbers, represented in various forms, or integers using the symbols "<", ">", and "=".	Represent and compare positive and negative rational numbers as points on the number line.*
6.N.1.3 Explain that a percent represents parts "out of 100" and ratios "to 100."	Solve problems involving percent of a number. Solve problems involving finding the whole, given a part and the percent.*
6.N.1.4 Determine equivalencies among . . . decimals, and percents.	Express decimals as percents and percents as decimals.
6.N.1.4 Determine equivalencies among fractions . . . and percents.	Express fractions as percents and percents as fractions.

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
6.N.1.4 Determine equivalencies among fractions and mixed numbers . . .	Express fractions greater than 1 as mixed numbers and mixed numbers as fractions greater than 1.
6.N.1.4 Determine equivalencies among fractions, mixed numbers, decimals, and percents.	Solve problems involving percent of a number.* Solve problems involving finding the whole, given a part and the percent.*
6.N.2.4 . . . [R]epresent . . . whole-number exponents . . . Evaluate powers with whole-number bases and exponents.	Write and evaluate numerical expressions with whole-number exponents.
6.N.2.4 Identify and represent patterns with whole-number exponents and perfect squares. Evaluate powers with whole-number bases and exponents.	Simplify numerical expressions, including those involving whole number exponents or prime factorizations, using the order of operations.*
6.N.2.5 Factor whole numbers and express prime and composite numbers as a product of prime factors with exponents.	Find the least common multiple of two whole numbers through 12.* Find the greatest common factor of two whole numbers through 100.* Use the distributive property to write a sum of two numbers as a product of the greatest common factor of the two numbers and a sum of two different numbers.* Write and evaluate numerical expressions with whole-number exponents.* Simplify numerical expressions, including those involving whole number exponents or prime factorizations, using the order of operations.*
6.N.2.5 Factor whole numbers [up to 100] . . .	Identify factor pairs of whole numbers up to 100.

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
6.N.2.6 . . . Use common . . . multiples to calculate with fractions [and] find equivalent fractions . . .	Add and subtract fractions and mixed numbers with unlike denominators.
6.N.2.6 . . . [E]xpress the sum of two-digit numbers with a common factor using the distributive property.	Use the distributive property to write a sum of two numbers as a product of the greatest common factor of the two numbers and a sum of two different numbers.
6.N.2.6 Determine the . . . least common multiples [through 12]. . . .	Find the least common multiple of two whole numbers through 12.
6.N.2.6 Determine the greatest common factors [through 100] . . .	Find the greatest common factor of two whole numbers through 100.
6.N.3.1 Identify and use ratios to . . . relate quantities in multiple ways. . . .	Write a ratio to describe the relationship between two quantities using the forms *a:b* and *a/b*.
6.N.3.1 Identify and use ratios to compare and relate quantities in multiple ways. Recognize that multiplicative comparison and additive comparison are different.	Find equivalent ratios and complete equivalent ratio tables.*
6.N.3.2 Determine the unit rate for ratios.	Solve problems involving unit rate.*
6.N.3.3 Apply the relationship between ratios [and] equivalent fractions . . .	Find equivalent ratios and complete equivalent ratio tables.
6.N.3.3 Apply the relationship between ratios, equivalent fractions, . . . and percents to solve problems . . .	Solve problems involving percent of a number. Solve problems involving finding the whole, given a part and the percent.
6.N.3.3 Apply the relationship between ratios. . . [and] unit rates . . . to solve problems in various contexts.	Solve problems involving unit rate.
6.N.4.1 Estimate solutions to problems with whole numbers, decimals, fractions, and mixed numbers, and use the estimates to assess the reasonableness of results in the context of the problem.	Multiply multi-digit decimals.* Solve word problems involving division of fractions by fractions, for example, by using visual fraction models and equations to represent the problem.*

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Divide multi-digit whole numbers.* Divide multi-digit decimals.* Divide fractions.*
6.N.4.2 . . . [D]ivide . . . fractions . . . ; solve real-world . . . problems . . . Illustrate . . . division of fractions . . .	Solve word problems involving division of fractions by fractions, for example, by using visual fraction models and equations to represent the problem.
6.N.4.2 Illustrate multiplication and division of fractions and decimals to show connections to fractions, whole number multiplication, and inverse relationships.	Divide fractions.* Multiply multi-digit decimals.* Divide multi-digit decimals.*
6.N.4.2 Multiply . . . fractions, and mixed numbers; solve real-world . . . problems . . . Illustrate multiplication . . . of fractions . . .	Solve real-world problems involving multiplication of fractions and mixed numbers.
6.N.4.3 . . . [D]ivide . . . fractions . . . ; solve real-world . . . problems . . . . . [D]ivide fractions . . . using efficient and generalizable procedures.	Solve word problems involving division of fractions by fractions, for example, by using visual fraction models and equations to represent the problem.
6.N.4.3 . . . [D]ivide fractions . . . using efficient and generalizable procedures.	Divide fractions.
6.N.4.3 Multiply . . . decimals using efficient and generalizable procedures.	Multiply multi-digit decimals.
6.N.4.3 Multiply . . . fractions . . . using efficient and generalizable procedures.	Multiply fractions.
6.N.4.3 Multiply . . . fractions, and mixed numbers; solve real-world . . . problems . . . Multiply . . . fractions . . . using efficient and generalizable procedures.	Solve real-world problems involving multiplication of fractions and mixed numbers.
6.N.4.3 [D]ivide . . . decimals using efficient and generalizable procedures.	Divide multi-digit decimals.

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
6.N.4.4 Multiply . . . fractions, and mixed numbers; solve real-world . . . problems . . . Use mathematical modeling to solve . . . problems including . . . requiring [multiplication] with . . . fractions and mixed numbers.	Solve real-world problems involving multiplication of fractions and mixed numbers.
6.N.4.4 Use mathematical modeling to solve and interpret problems . . . requiring [division] with . . . fractions . . .	Solve word problems involving division of fractions by fractions, for example, by using visual fraction models and equations to represent the problem.
6.N.4.4 Use mathematical modeling to solve and interpret problems including . . . data requiring arithmetic with . . . fractions . . .	Construct and interpret a line plot using data in fractional units.
6.N.4.4 Use mathematical modeling to solve and interpret problems including money, measurement, geometry, and data requiring arithmetic with decimals, fractions and mixed numbers.	Divide fractions.* Use a formula to find the volume of right rectangular prisms with fractional edge lengths.*
6.A.1.1 . . . [R]ecognize the reflective relationships among coordinates that differ only by their signs.	Understand signs of numbers in ordered pairs as indicating locations in quadrants of the coordinate plane, and recognize that when two ordered pairs differ only by signs, the locations of the points are related by reflections across one or both axes.
6.A.1.1 Plot integer- and rational-valued (limited to halves and fourths) ordered-pairs as coordinates in all four quadrants and recognize the reflective relationships among coordinates that differ only by their signs.	Represent and compare positive and negative rational numbers as points on the number line.* Locate and plot points in all four quadrants of the coordinate plane and use the points to find horizontal and vertical distances.*
6.A.1.1 Plot integer- and rational-valued . . . ordered-pairs as coordinates in all four quadrants . . .	Locate pairs of rational numbers and plot points with rational number coordinates in all four quadrants on a coordinate plane.

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
6.A.1.2 Represent relationships between two varying . . . quantities involving no more than two operations with rules . . .	Write an equation in two variables for a real-world problem in which a dependent and independent variable change in relationship to one another.
6.A.1.2 Represent relationships between two varying . . . quantities involving no more than two operations with rules, graphs, and tables; . . .	Show the relationship between an independent and dependent variable with graphs, tables, and equations.
6.A.1.3 . . . [E]valuate variables in . . . equations, . . . , including determining when or if, for a given value of the variable, an equation . . . involving a variable is true or false.	Use substitution to determine whether a solution to an equation is true.
6.A.1.3 . . . [E]valuate variables in . . . inequalities . . . , including determining when or if, for a given value of the variable, an . . . inequality involving a variable is true or false.	Use substitution to determine whether a solution to an inequality is true.
6.A.1.3 Use . . . variables in . . . equations . . . that arise from various contexts . . .	Write a one-variable, one-step equation to represent a real-world or mathematical problem, or represent a one-variable, one-step equation with a corresponding real-world problem. Write an equation in two variables for a real-world problem in which a dependent and independent variable change in relationship to one another.
6.A.1.3 Use . . . variables in . . . inequalities that arise from various contexts, . . .	Write an inequality of the form $x > c$ or $x < c$ to represent a real-world or mathematical problem.
6.A.1.3 Use . . . variables in expressions . . . that arise from various contexts, . . .	Write a variable expression to represent a real-world or mathematical problem.
6.A.1.3 Use and . . . [solve for] variables in . . . equations . . . that arise from various contexts . . .	Solve real-world and mathematical problems by writing and solving equations

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	of the form $x + p = q$ and $px = q$, where p, q, and x are all nonnegative rational numbers. Use models of one-step equations to represent real-world problems, including geometric concepts.
6.A.1.3 Use and evaluate variables in expressions, equations, and inequalities that arise from various contexts, including determining when or if, for a given value of the variable, an equation or inequality involving a variable is true or false.	Read, write, and identify variable expressions or parts of expressions, using mathematical terms (sum, term, product, factor, quotient, coefficient).* Represent inequalities in the form $x > c$ or $x < c$ on number lines.* Show the relationship between an independent and dependent variable with graphs, tables, and equations.*
6.A.2.1 Generate . . . and evaluate expressions involving . . . numbers . . .	Write and evaluate numerical expressions with whole-number exponents.
6.A.2.1 Generate . . . and evaluate expressions involving . . . numbers by applying the . . . order of operations . . .	Write and evaluate expressions with grouping symbols.
6.A.2.1 Generate equivalent expressions and evaluate expressions involving . . . numbers by applying the . . . order of operations . . .	Simplify numerical expressions, including those involving whole number exponents or prime factorizations, using the order of operations.
6.A.2.1 Generate equivalent expressions and evaluate expressions involving positive rational numbers by applying the commutative, associative, and distributive properties and order of operations to model and solve mathematical problems.	Use Order of Operations rules, including applications with formulas.* Evaluate expressions for given values of the variables.*
6.A.2.1 Generate equivalent expressions involving . . . numbers by applying . . . properties [of operations] . . .	Use properties of operations to write and identify equivalent expressions.

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
6.A.3.1 Model mathematical situations using . . . equations . . . involving variables and [nonnegative] rational numbers.	Write a one-variable, one-step equation to represent a real-world or mathematical problem, or represent a one-variable, one-step equation with a corresponding real-world problem.
6.A.3.1 Model mathematical situations using . . . inequalities involving variables and . . . numbers.	Write an inequality of the form $x > c$ or $x < c$ to represent a real-world or mathematical problem.
6.A.3.1 Model mathematical situations using expressions . . . involving variables and . . . numbers.	Write a variable expression to represent a real-world or mathematical problem.
6.A.3.1 Model mathematical situations using expressions, equations and inequalities involving variables and rational numbers.	Read, write, and identify variable expressions or parts of expressions, using mathematical terms (sum, term, product, factor, quotient, coefficient).* Represent inequalities in the form $x > c$ or $x < c$ on number lines.*
6.A.3.1 Use equations . . . to model and solve mathematical problems and use the idea of maintaining equality to solve equations. . . . Model mathematical situations using . . . equations . . . involving variables and [nonnegative] rational numbers.	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$, where p, q, and x are all nonnegative rational numbers. Use models of one-step equations to represent real-world problems, including geometric concepts.
6.A.3.2 . . . [M]odel . . . mathematical problems involving equations in the form x + p = q and px = q, where p and q are nonnegative rational numbers. . . .	Write a one-variable, one-step equation to represent a real-world or mathematical problem, or represent a one-variable, one-step equation with a corresponding real-world problem.
6.A.3.2 . . . [M]odel and solve mathematical problems involving equations in the form x + p = q and px = q, where p and q are nonnegative rational numbers. . . .	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$, where p, q, and x are all nonnegative rational numbers.

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Use models of one-step equations to represent real-world problems, including geometric concepts.
6.GM.1.2 Recognize that translations, reflections, and rotations preserve congruence and use them to show that two figures are congruent.	Describe a single rotation, reflection, or translation, or a sequence of two of these transformations that is used to create a pair of congruent figures. [When presented on a coordinate plane, rotations are about the origin, reflections are over an axis, and translations are by whole number units.]
6.GM.1.3 Identify . . . the line(s) of symmetry in two-dimensional shapes.	Identify one or more lines of symmetry in two-dimensional figures.
6.GM.2.1 Develop and use formulas for the area of squares and parallelograms using a variety of methods including but not limited to the standard algorithms and finding unknown measures.	Solve problems involving composing and decomposing polygons into rectangles and triangles to find area.*
6.GM.2.2 Develop and use formulas to determine the area of triangles and find unknown measures.	Solve problems involving composing and decomposing polygons into rectangles and triangles to find area.*
6.GM.2.3 Find the area of . . . polygons that can be decomposed into triangles and other shapes.	Solve problems involving composing and decomposing polygons into rectangles and triangles to find area.
6.GM.4.2 Solve problems that require the conversion of lengths within the same measurement systems using appropriate units.	Solve multi-step, real-world problems involving conversion among measurement units within a system. Use ratio reasoning to convert measurement units.*
6.D.1.1 Interpret the mean, median, and mode for a set of data.	Find, use, and interpret mean, median, mode, range, and maximum and minimum.* Use mean, median, mode, range, and maximum and minimum to describe and compare data sets.*

**This skill is related to the aligned standard*

Grade 6 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Display numerical data in histograms, draw inferences from the data, and describe patterns in the data.* Display numerical data in box plots, draw inferences from the data, and describe patterns in the data.* Find, use, and interpret mean, median, mode, range, and maximum and minimum using data in box plots.*
6.D.2.1 Represent possible outcomes using a probability continuum from impossible to certain.	Express the likelihood of the occurrence of an event as a number between 0 and 1.
6.D.2.2 Determine the sample space for a given experiment . . . Sample space may be determined by the use of tree diagrams [or] tables . . .	Develop a probability model (which may not be uniform) from observed frequencies and use it to determine probabilities of simple and compound events.
6.D.2.3 Demonstrate simple experiments in which the probabilities are known and compare the resulting relative frequencies with the known probabilities . . .	Develop a probability model (which may not be uniform) from observed frequencies and use it to determine probabilities of simple and compound events.

Grade 7

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
7.N.1.1 . . . [O]rder rational numbers . . .	Order rational numbers in real-world contexts.
7.N.1.2 . . . [G]enerate equivalent representations of rational numbers . . .	Express decimals as percents and percents as decimals. Express fractions as percents and percents as fractions.
7.N.1.2 Recognize and generate equivalent representations of rational numbers, including equivalent fractions.	Use division to convert a rational number to a decimal and understand that the decimal form of a rational number either repeats or terminates in 0.*
7.N.1.3 Explain the relationship between the absolute value of a rational number and . . . distance . . . on a number line. Use the symbol for absolute value. Apply the concept of absolute value to model . . . problems.	Interpret rational number values on a number line, including addition expressions, and interpret sums of rational numbers in real-world contexts. Interpret rational number values on a number line, including subtraction expressions, and apply this principle in real-world contexts.
7.N.1.3 Explain the relationship between the absolute value of a rational number and the distance of that number from zero on a number line. Use the symbol for absolute value. Apply the concept of absolute value to model . . . problems.	Understand absolute value and interpret it in the context of a real-world situation.
7.N.1.3 Explain the relationship between the absolute value of a rational number and the distance of that number from zero on a number line. Use the symbol for absolute value. Apply the concept of absolute value to model and solve problems.	Add positive and negative rational numbers.* Subtract positive and negative rational numbers.*
7.N.2.1 Calculate with rational numbers, with and without positive integer exponents, to model and solve mathematical problems. Estimate solutions to multiplication and	Solve multi-step problems involving all forms of rational numbers.*

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
division of integers in order to assess the reasonableness of results.	Perform multi-step computations using all operations with both positive and negative rational numbers.*
7.N.2.1 Estimate solutions to multiplication and division of integers in order to assess the reasonableness of results.	Multiply positive and negative rational numbers and interpret products in real-world contexts.* Divide positive and negative rational numbers and interpret quotients in real-world contexts.*
7.N.2.2 Calculate with rational numbers, with and without positive integer exponents, to model and solve mathematical problems. Illustrate multiplication and division of integers using a variety of representations.	Multiply positive and negative rational numbers and interpret products in real-world contexts.* Divide positive and negative rational numbers and interpret quotients in real-world contexts.*
7.N.2.3 Calculate with rational numbers, with and without positive integer exponents, to model and solve mathematical problems. Multiply and divide integers in a variety of situations; use efficient and generalizable procedures, including standard algorithms.	Multiply positive and negative rational numbers and interpret products in real-world contexts.* Divide positive and negative rational numbers and interpret quotients in real-world contexts.* Solve multi-step problems involving all forms of rational numbers.* Perform multi-step computations using all operations with both positive and negative rational numbers.*
7.N.2.4 Raise . . . numbers . . . to positive integer exponents.	Write and evaluate numerical expressions with whole-number exponents.
7.N.2.5 . . . [S]olve problems using rational numbers involving addition, subtraction, multiplication, [and] division . . .	Solve mathematical problems involving the four operations with both positive

**This skill is related to the aligned standard*

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	and negative rational numbers, including complex fractions.
7.N.2.5 Model and solve problems using rational numbers involving addition, subtraction, multiplication, division, and positive integer exponents.	Add positive and negative rational numbers.* Subtract positive and negative rational numbers.* Multiply positive and negative rational numbers and interpret products in real-world contexts.* Divide positive and negative rational numbers and interpret quotients in real-world contexts.* Perform multi-step computations using all operations with both positive and negative rational numbers.*
7.A.1.1 Identify a relationship between two varying quantities, x and y, as proportional . . . ; distinguish proportional relationships from non-proportional relationships.	Distinguish between proportional and non-proportional situations.
7.A.1.1 Identify a relationship between two varying quantities, x and y, as proportional if it can be expressed in the form y/x = k or y = kx; . . .	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
7.A.1.1 Identify a relationship between two varying quantities, x and y, as proportional if it can be expressed in the form y/x = k or y = kx; distinguish proportional relationships from non-proportional relationships.	Use an equation to represent a proportional relationship and interpret the meaning of a point on the graph of the equation.*
7.A.1.2 Recognize that the graph of a proportional relationship is a line through the origin and the coordinate (1, r), where	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams,

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
r is the slope and the unit rate (constant of proportionality, k).	and verbal descriptions of proportional relationships.* Distinguish between proportional and non-proportional situations.* Use an equation to represent a proportional relationship and interpret the meaning of a point on the graph of the equation.*
7.A.2.1 . . . Determine . . . the unit rate (constant of proportionality, slope, or rate of change) . . .	Compute unit rates associated with ratios of fractions.
7.A.2.1 . . . Determine . . . the unit rate (constant of proportionality, slope, or rate of change) given any of these representations [tables, verbal descriptions, symbols, and graphs].	Identify the constant of proportionality (unit rate) in tables, graphs, equations, diagrams, and verbal descriptions of proportional relationships.
7.A.2.1 Represent proportional relationships with . . . graphs; . . . Determine . . . the unit rate (constant of proportionality, slope, or rate of change) . . .	Graph proportional relationships, interpreting the unit rate as the slope of the graph.
7.A.2.1 Represent proportional relationships with . . . symbols . . .	Use an equation to represent a proportional relationship and interpret the meaning of a point on the graph of the equation.
7.A.2.1 Represent proportional relationships with tables, verbal descriptions, symbols, and graphs; translate from one representation to another. Determine and compare the unit rate (constant of proportionality, slope, or rate of change) given any of these representations.	Distinguish between proportional and non-proportional situations.*
7.A.2.2 Solve multi-step problems with proportional relationships (e.g., distance-time, percent increase or decrease, discounts, tips, unit pricing, mixtures and concentrations, similar figures, other mathematical situations).	Solve multi-step ratio and percent problems. Use proportions to solve real-world and mathematical problems.

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Solve problems involving unit rate. Use scale drawings to solve problems, including finding actual lengths and areas and creating different scales. Compute unit rates associated with ratios of fractions.*
7.A.2.3 Use proportional reasoning to solve problems involving ratios.	Solve multi-step ratio and percent problems. Use proportions to solve real-world and mathematical problems. Compute unit rates associated with ratios of fractions.*
7.A.3.1 . . . [S]olve . . . linear equations with one variable in the form px + q = r and p(x + q) = r, where p, q, and r are rational numbers.	Solve equations of the form $px + q = r$ or $p(x + q) = r$ where p, q, and r are rational numbers.
7.A.3.1 Write and solve problems leading to linear equations with one variable . . .	Use variables to write equations for real-world problems and solve by reasoning about the quantities.
7.A.3.1 Write and solve problems leading to linear equations with one variable in the form px + q = r and p(x + q) = r, where p, q, and r are rational numbers.	Solve word problems by writing equations of the form $px + q = r$ and $p(x + q) = r$, where p, q, and r are specific rational numbers, and solving the equations algebraically.
7.A.3.2 Represent, write, solve, and graph problems leading to linear inequalities with one variable in the form x + p > q and x + p < q, where p, and q are nonnegative rational numbers.	Solve and graph the solutions of inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are rational numbers.*
7.A.3.2 Represent, write, [and] solve . . . linear inequalities with one variable . . .	Use variables to write inequalities for real-world and mathematical problems and solve by reasoning about the quantities.

**This skill is related to the aligned standard*

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
7.A.4.1 . . . [G]enerate equivalent numerical . . . expressions containing . . . whole number exponents.	Write and evaluate numerical expressions with whole-number exponents. Simplify numerical expressions, including those involving whole number exponents or prime factorizations, using the order of operations.
7.A.4.1 Use properties of operations (associative, commutative, and distributive) to generate equivalent . . . algebraic expressions containing rational numbers [and] grouping symbols . . .	Use properties to write equivalent linear expressions.
7.A.4.1 Use properties of operations (associative, commutative, and distributive) to generate equivalent numerical and algebraic expressions containing rational numbers, grouping symbols and whole number exponents.	Write equivalent expressions in different forms to show relationships.*
7.A.4.2 Evaluate numerical expressions using . . . grouping symbols.	Write and evaluate expressions with grouping symbols.
7.GM.1.1 Recognize that the surface area of a rectangular prism can be found by finding the area of each component of the net of that figure. Know that rectangular prisms of different dimensions can have the same surface area.	Use formulas to solve problems involving finding the area of two-dimensional figures composed of triangles, quadrilaterals, and polygons.* Use formulas to find the surface area of three-dimensional figures composed of triangles, quadrilaterals, polygons, cubes, and right prisms.*
7.GM.1.2 Using a variety of tools and strategies, develop the concept that surface area of a rectangular prism can be found by wrapping the figure with same-sized square units without gaps or overlap. Use appropriate measurements (e.g., cm^2).	Use formulas to solve problems involving finding the area of two-dimensional figures composed of triangles, quadrilaterals, and polygons.* Use formulas to find the surface area of three-dimensional figures composed of

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	triangles, quadrilaterals, polygons, cubes, and right prisms.*
7.GM.1.3 . . . [D]evelop the concept that the volume of rectangular prisms can be found by counting the total number of same-sized unit cubes that fill a shape without gaps or overlaps. . . .	Use unit cubes to find the volume of right rectangular prisms.
7.GM.2.1 Develop and use the formula to determine the area of a trapezoid.	Use formulas to solve problems involving finding the area of two-dimensional figures composed of triangles, quadrilaterals, and polygons.*
7.GM.2.2 Find the area . . . of composite figures.	Use formulas to solve problems involving finding the area of two-dimensional figures composed of triangles, quadrilaterals, and polygons.
7.GM.3.2 Demonstrate an understanding of the proportional relationship between the diameter and circumference of a circle and that the unit rate (constant of proportionality) is pi (#) and can be approximated by rational numbers such as 22/7 and 3.14.	Know the formulas for the area and circumference of a circle and use them to solve problems.* Use formulas to find the area and circumference of circles.*
7.GM.3.3 Calculate the circumference and area of circles to solve problems in various contexts . . .	Know the formulas for the area and circumference of a circle and use them to solve problems. Use formulas to find the area and circumference of circles.
7.GM.4.1 Analyze the effect of translations, reflections, rotations, and dilations on the attributes of two-dimensional figures on and off the coordinate plane. Describe the properties of similarity [and] compare geometric figures for similarity . . . resulting from dilations.	Describe a single dilation or a sequence of a dilation and a rotation, reflection, or translation that is used to create a pair of similar figures. [When presented on a coordinate plane, dilations are centered at the origin, reflections are over an axis, and translations are by whole number units.]

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
7.GM.4.1 Describe the properties of similarity, compare geometric figures for similarity, and determine scale factors resulting from dilations.	Use scale drawings to solve problems, including finding actual lengths and areas and creating different scales.*
7.GM.4.2 Apply proportions, ratios, and scale factors to solve problems involving scale drawings and to determine side lengths and areas of similar triangles and rectangles.	Use scale drawings to solve problems, including finding actual lengths and areas and creating different scales.*
7.GM.4.3 . . . [D]escribe translations . . . , reflections across the x- and y-axes, and rotations in 90° increments about the origin of figures on a coordinate plane . . .	Describe the results of rotations, reflections, and translations as they relate to points, line segments, and angles of two-dimensional figures. [When presented on a coordinate plane, rotations are about the origin, reflections are over an axis, and translations are by whole number units.]
7.GM.4.3 . . . [D]escribe translations . . . , reflections across the x- and y-axes, and rotations in 90Â° increments about the origin of figures on a coordinate plane . . .	Describe a single rotation, reflection, or translation, or a sequence of two of these transformations that is used to create a pair of congruent figures. [When presented on a coordinate plane, rotations are about the origin, reflections are over an axis, and translations are by whole number units.]
7.D.1.1 . . . [C]alculate measures of center (mean, median, and mode) and spread (range . . .). Use these quantities to draw conclusions about the data . . .	Find, use, and interpret mean, median, mode, range, and maximum and minimum. Find, use, and interpret mean, median, mode, range, and maximum and minimum using data in box plots.
7.D.1.1 . . . [Use] measures of center . . . and spread . . . Use these quantities to draw conclusions about the data . . .	Make inferences about a population given information drawn from a random sample of that population. Compare inferences made from numerical data for two populations using measures of center and variability.

**This skill is related to the aligned standard*

Grade 7 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
7.D.1.2 Use reasoning . . . to display and interpret data . . .	Display numerical data in dot plots, draw inferences from the data, and describe patterns in the data. Display numerical data in box plots, draw inferences from the data, and describe patterns in the data.
7.D.1.2 Use reasoning . . . to display and interpret data in . . . histograms.	Display numerical data in histograms, draw inferences from the data, and describe patterns in the data.
7.D.1.3 . . . [C]reate and analyze box plots.	Display numerical data in box plots, draw inferences from the data, and describe patterns in the data.
7.D.2.1 . . . [R]epresent probabilities as . . . fractions . . . between 0 and 1.	Express the likelihood of the occurrence of an event as a number between 0 and 1.
7.D.2.1 Determine the theoretical probability of an event using the ratio between the size of the event and the size of the sample space; represent probabilities as percents, fractions and decimals between 0 and 1.	Develop and use a probability model with equal outcomes to determine probabilities of simple and compound events.*
7.D.2.2 . . . Express probabilities as . . . fractions.	Express the likelihood of the occurrence of an event as a number between 0 and 1.
7.D.2.2 Calculate probability as a fraction of sample space . . . Express probabilities as . . . fractions.	Find probabilities of compound events using organized lists, tables, tree diagrams, and simulation.
7.D.2.2 Calculate probability as a fraction of sample space or as a fraction of area. Express probabilities as percents, decimals and fractions.	Develop and use a probability model with equal outcomes to determine probabilities of simple and compound events.*
7.D.2.3 Use proportional reasoning to draw conclusions about and predict relative frequencies of outcomes based on theoretical probabilities.	Develop a probability model (which may not be uniform) from observed frequencies and use it to determine probabilities of simple and compound events.

**This skill is related to the aligned standard*

Grade 8

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PA.N.1.1 . . . [A]pply the properties of integer exponents . . . to generate equivalent numerical . . . expressions.	Use properties of integer exponents to simplify and evaluate expressions.
PA.N.1.2 Express . . . approximations of [and represent] very large and very small numbers using scientific notation.	Express very small numbers, where the coefficient has two or more significant digits and the exponent is negative, and very large numbers, where the coefficient has two or more significant digits and the exponent is positive, in scientific notation.
PA.N.1.2 Express and compare . . . very large and very small numbers using scientific notation.	Express numbers as a single digit times an integer power of 10 and compare them.
PA.N.1.3 . . . [Compute with] numbers expressed in scientific notation . . .	Compute with numbers expressed in scientific notation, including expressions with decimals.
PA.N.1.3 Multiply and divide numbers expressed in scientific notation . . .	Compute with numbers expressed as a single digit times an integer power of 10.
PA.N.1.4 Compare . . . real numbers; . . .	Use rational numbers to approximate and compare irrational numbers.
PA.N.1.4 Compare and order real numbers; locate real numbers on a number line. Identify the square roots of perfect squares to 400 or, if it is not a perfect square root, locate it as an irrational number between two consecutive positive integers.	Solve equations with squares and cubes, $x2 = p$ and $x3 = p$, and find square and cube roots of perfect squares and cubes.*
PA.A.1.1 Recognize that a function is a relationship between an independent variable and a dependent variable in which the value of the independent variable determines the value of the dependent variable.	Understand and identify functions as one-to-one and many-to-one relationships.*
PA.A.1.2 Use linear functions to represent and model mathematical situations.	Model a linear relationship with a function.

**This skill is related to the aligned standard*

Grade 8 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PA.A.1.3 Identify a function as linear if it can be expressed in the form y = mx + b or if its graph is a non-vertical straight line.	Use and understand the equation $y = mx + b$; identify a function as linear or not linear.
PA.A.2.1 Represent linear functions with . . . symbols . . .	Model a linear relationship with a function.
PA.A.2.1 Represent linear functions with . . . verbal descriptions . . . and graphs; translate from one representation to another.	Describe a function shown in a graph; sketch a graph for a description of a function.
PA.A.2.1 Represent linear functions with tables, verbal descriptions, symbols, and graphs; translate from one representation to another.	Find the rate of change and initial value of a function from a description or from a set of x and y values shown in a table or graph.* Interpret the rate of change and initial value of a linear function modeled in a graph or a table of values.*
PA.A.2.2 . . . [D]escribe, and analyze linear relationships between two variables.	Find the rate of change and initial value of a function from a description or from a set of x and y values shown in a table or graph. Interpret the rate of change and initial value of a linear function modeled in a graph or a table of values.
PA.A.2.2 Identify . . . linear relationships between two variables.	Understand and identify functions as one-to-one and many-to-one relationships.
PA.A.2.2 Identify, describe, and analyze linear relationships between two variables.	Use and understand the equation $y = mx + b$; identify a function as linear or not linear.* Describe a function shown in a graph; sketch a graph for a description of a function.*
PA.A.2.3 Identify . . . properties of linear functions, including slope and intercepts. . . .	Find the slope and y-intercept of a line and relate these to an equation in the form $y = mx + b$.

**This skill is related to the aligned standard*

Grade 8 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PA.A.2.3 Identify graphical properties of linear functions, including slope and intercepts. Know that the slope equals the rate of change . . .	Find the rate of change and initial value of a function from a description or from a set of *x* and *y* values shown in a table or graph.
PA.A.2.3 Identify graphical properties of linear functions, including slope and intercepts. Know that the slope equals the rate of change, and that the y-intercept is zero when the function represents a proportional relationship.	Model a linear relationship with a function.* Interpret the rate of change and initial value of a linear function modeled in a graph or a table of values.* Describe a function shown in a graph; sketch a graph for a description of a function.* Explain why the slope of a non-vertical line in the coordinate plane is the same between any two points on the line and use this understanding to derive the slope-intercept form of an equation $y = mx + b$.*
PA.A.2.4 Predict the effect on the graph of a linear function when the slope or y-intercept changes. Use appropriate tools to examine these effects.	Find the rate of change and initial value of a function from a description or from a set of *x* and *y* values shown in a table or graph.* Interpret the rate of change and initial value of a linear function modeled in a graph or a table of values.*
PA.A.2.5 . . . [I]nterpret [linear functions] . . . in the original context.	Interpret the rate of change and initial value of a linear function modeled in a graph or a table of values.
PA.A.2.5 Solve problems involving linear functions and interpret results in the original context.	Model a linear relationship with a function.* Find the rate of change and initial value of a function from a description or from a set of *x* and *y* values shown in a table or graph.*

**This skill is related to the aligned standard*

Grade 8 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PA.A.3.1 Use substitution to simplify and evaluate algebraic expressions.	Evaluate expressions for given values of the variables.
PA.A.3.2 . . . [Generate] equivalent expressions by combining like terms and using order of operations (to include grouping symbols). . . . [Use] the properties of operations (associative, commutative, and distributive).	Use properties to write equivalent linear expressions.
PA.A.3.2 Justify steps in generating equivalent expressions by combining like terms and using order of operations (to include grouping symbols). Identify the properties used, including the properties of operations (associative, commutative, and distributive).	Solve linear equations with positive and negative rational coefficients by expanding expressions and collecting like terms.*
PA.A.4.1 . . . Represent situations using linear equations . . .	Write a one-variable, one-step equation to represent a real-world or mathematical problem, or represent a one-variable, one-step equation with a corresponding real-world problem.
PA.A.4.1 Solve . . . linear equations with one variable where there could be one, infinitely many, or no solutions. . . .	Solve linear equations in one variable with one solution, infinitely many solutions, or no solutions.
PA.A.4.1 Solve mathematical problems using linear equations with one variable . . . Represent situations using linear equations . . .	Solve real-world and mathematical problems by writing and solving equations of the form $x + p = q$ and $px = q$, where p, q, and x are all nonnegative rational numbers.
PA.A.4.2 Represent [and] write . . . linear inequalities with one variable . . .	Use variables to write inequalities for real-world and mathematical problems and solve by reasoning about the quantities.
PA.A.4.2 Represent, write, solve, and graph problems leading to linear inequalities with one variable in the form $px + q > r$ and $px + q < r$, where p, q, and r are rational numbers.	Solve and graph the solutions of inequalities of the form $px + q > r$ or $px + q < r$, where p, q, and r are rational numbers.

**This skill is related to the aligned standard*

Grade 8 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PA.A.4.3 Represent real-world situations using . . . inequalities involving one variable.	Write an inequality of the form $x > c$ or $x < c$ to represent a real-world or mathematical problem.
PA.A.4.3 Represent real-world situations using equations . . . involving one variable.	Write a one-variable, one-step equation to represent a real-world or mathematical problem, or represent a one-variable, one-step equation with a corresponding real-world problem.
PA.A.4.3 Represent real-world situations using equations and inequalities involving one variable.	Use variables to write equations for real-world problems and solve by reasoning about the quantities.*
PA.GM.1.1 . . . [Use] the Pythagorean theorem . . . to solve problems in two dimensions involving right triangles.	Use the Pythagorean theorem to solve problems involving right triangles.
PA.GM.1.1 Justify the Pythagorean theorem using measurements, diagrams, or dynamic software to solve problems in two dimensions involving right triangles.	Explain the steps of a proof of the Pythagorean Theorem and its converse.*
PA.GM.1.2 Use the Pythagorean theorem to find the distance between any two points in a coordinate plane.	Apply the Pythagorean theorem to calculate the distance between two points on a coordinate grid.
PA.GM.2.1 Calculate the surface area of a rectangular prism using . . . nets. . . .	Find the surface area of three-dimensional figures using nets.
PA.GM.2.4 Develop and use the formulas V = #r²h and V = Bh to determine the volume of right cylinders, in terms of # and using approximations for pi (#). Justify why base area (B) and height (h) are multiplied to find the volume of a right cylinder. Use appropriate units (e.g., cm³).	Use formulas to find the volume of cones, cylinders, and spheres.*
PA.D.1.1 Display and interpret data in a variety of ways, including using scatter plots and approximate lines of best fit. Use the line of best fit and average rate of change to make predictions and draw conclusions about data. Describe the impact	Construct and describe patterns in scatter plots, such as clustering, outliers, positive or negative association, and linear or non-linear association.*

Grade 8 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
that inserting or deleting a data point has on the mean and the median of a data set. Create data displays using technology to examine this impact.	
PA.D.1.2 Explain how outliers affect measures of center and spread.	Construct and describe patterns in scatter plots, such as clustering, outliers, positive or negative association, and linear or non-linear association.*
PA.D.1.3 . . . Use the shape of the scatter plot to find the informal line of best fit [and] make statements about the . . . original data set.	Identify a line of fit to model and analyze a relationship between two quantitative variables.
PA.D.1.3 . . . [D]isplay, and interpret data using scatter plots. . . .	Construct and describe patterns in scatter plots, such as clustering, outliers, positive or negative association, and linear or non-linear association.
PA.D.1.3 Collect, display, and interpret data using scatter plots. Use the shape of the scatter plot to find the informal line of best fit, make statements about the average rate of change, and make predictions about values not in the original data set. Use appropriate titles, labels, and units.	Solve problems by interpreting the slope and intercept in equations of linear models for data with two quantitative variables.*
PA.D.2.1 . . . [R]epresent [probabilities] as . . . fractions . . . between 0 and 1. . . .	Express the likelihood of the occurrence of an event as a number between 0 and 1.
PA.D.2.1 Calculate experimental probabilities and represent them as . . . fractions . . . between 0 and 1. Use experimental probabilities to predict relative frequencies when actual probabilities are unknown.	Develop a probability model (which may not be uniform) from observed frequencies and use it to determine probabilities of simple and compound events.
PA.D.2.2 . . . [Understand] how samples are chosen (randomness) to draw and support conclusions about generalizing a sample to a population . . .	Understand that random sampling tends to produce representative samples and identify samples that are representative of a population.

**This skill is related to the aligned standard*

Grade 8 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PA.D.2.2 Determine how samples are chosen (randomness) to draw and support conclusions about generalizing a sample to a population . . .	Identify methods for gathering valid representative samples of a population.

Grades 9 - 10

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A1.N.1.1 Write square roots and cube roots of constants and monomial algebraic expressions in simplest radical form.	Simplify expressions involving radicals and rational exponents using the properties of exponents.* Solve simple radical and rational equations, including those with extraneous solutions and justify reasoning.*
A1.N.1.2 Add, subtract, multiply, divide, and simplify square roots of constants, rationalizing the denominator when necessary.	Simplify expressions involving radicals and rational exponents using the properties of exponents.*
A1.A.1.1 Use knowledge of solving equations with rational values to represent, use and apply mathematical models (e.g., . . . geometric formulas . . .) . . .	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems. • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system. Demonstrate an understanding of volume formulas and use them to solve problems involving • Cylinders • Cones • Spheres • Pyramids
A1.A.1.1 Use knowledge of solving equations with rational values to represent, use and apply mathematical models	Analyze data on a scatter plot and determine a good model.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
(e.g., . . . statistics) and interpret the solutions in the original context.	• Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
A1.A.1.1 Use knowledge of solving equations with rational values to represent, use and apply mathematical models (e.g., angle measures, geometric formulas, dimensional analysis, Pythagorean theorem, science, statistics) and interpret the solutions in the original context.	Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Solve systems of linear equations using graphing and linear combination. * • Show that linear combination results in one solution, infinitely many solutions or no solution that is shared by both lines.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Solve systems of linear equations algebraically and graphically. Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other. Analyze and interpret linear models in the context of measurement and data.* • Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference. Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.
A1.A.1.2 Solve absolute value equations and interpret the solutions in the original context.	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]*
A1.A.1.3 Analyze, use and apply mathematical models to solve . . . systems of linear equations with a maximum of two variables by graphing . . . and elimination. . . .	Solve systems of linear equations using graphing and linear combination. • Show that linear combination results in one solution, infinitely many solutions or no solution that is shared by both lines. • Solve systems of linear equations algebraically and graphically.
A1.A.1.3 Analyze, use and apply mathematical models to solve problems involving systems of linear equations with a maximum of two variables by graphing, substitution, and elimination. Graphing calculators or other appropriate technology may be utilized. Interpret the solutions in the original context.	Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Represent and solve linear, quadratic, and simple exponential equations graphically. * • Demonstrate an understanding that the graph of an equation in two variables is the set of all the ordered pairs in the coordinate plane that are solutions to the equation. • Recognize that when the graphs of two functions intersect, the x-value of the point of intersection produces the same y-value in both functions such that f(x)=g(x); estimate these intersections by graphing, creating tables of x- and y- values, or finding successive approximations. [Functions are limited to linear and linear, exponential and exponential, linear and exponential.] • Graph half-planes to represent linear inequalities in two variables; graph the solution set to a system of linear inequalities in two variables as the intersection of half-planes.
A1.A.2.1 Represent relationships using mathematical models with linear inequalities; solve the resulting inequalities, graph on a coordinate plane, and interpret the solutions.	Represent and solve linear, quadratic, and simple exponential equations graphically. • Demonstrate an understanding that the graph of an equation in two variables is the set of all the ordered pairs in the coordinate plane that are solutions to the equation. • Recognize that when the graphs of two functions intersect, the x-value of the point of intersection produces the same y-value in both functions

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	such that f(x)=g(x); estimate these intersections by graphing, creating tables of x- and y- values, or finding successive approximations. [Functions are limited to linear and linear, exponential and exponential, linear and exponential.] • Graph half-planes to represent linear inequalities in two variables; graph the solution set to a system of linear inequalities in two variables as the intersection of half-planes. Solve systems of linear equations using graphing and linear combination. * • Show that linear combination results in one solution, infinitely many solutions or no solution that is shared by both lines. • Solve systems of linear equations algebraically and graphically. Solve linear and literal equations and inequalities for one variable.*
A1.A.2.1 Represent [constraints] using mathematical models with linear inequalities; solve the resulting inequalities, graph on a coordinate plane, and interpret the solutions.	Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
A1.A.2.2 Represent relationships using mathematical models with . . . absolute value inequalities and solve the resulting inequalities by graphing . . .	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]
A1.A.2.2 Represent relationships using mathematical models with compound and absolute value inequalities and solve the resulting inequalities by graphing and interpreting the solutions on a number line.	Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Represent and solve linear, quadratic, and simple exponential equations graphically. * • Demonstrate an understanding that the graph of an equation in two variables is the set of all the ordered pairs in the

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	coordinate plane that are solutions to the equation. • Recognize that when the graphs of two functions intersect, the x-value of the point of intersection produces the same y-value in both functions such that f(x)=g(x); estimate these intersections by graphing, creating tables of x- and y- values, or finding successive approximations. [Functions are limited to linear and linear, exponential and exponential, linear and exponential.] • Graph half-planes to represent linear inequalities in two variables; graph the solution set to a system of linear inequalities in two variables as the intersection of half-planes.
A1.A.3.1 Solve equations involving several variables for one variable in terms of the others.	Solve literal formulas for a specific variable. Solve linear and literal equations and inequalities for one variable.* Represent all kinds of relationships, including simple root functions, as algebraic equations to solve mathematical and real-world problems. * • Create equations and inequalities in one variable that may include simple rational, exponential, and root functions and use them to solve problems • Create equations in two or more variables that model complex situations and graph them on the coordinate plane. • Solve systems of equations and inequalities that model complex situations, and interpret the results. • Solve literal functions that model complex situations for a specific

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	variable, including formulas involving simple roots.
A1.A.3.2 Simplify polynomial expressions by adding, subtracting, or multiplying.	Add, subtract, and multiply polynomials.
A1.A.3.2 Simplify polynomial expressions [of degree 3 or greater] by adding, subtracting, or multiplying.	Add, subtract, and multiply polynomials of degree 3 or greater.
A1.A.3.3 . . . [F]actor quadratic expressions . . .	Analyze, perform operations, and solve quadratic expressions and equations. • Factor quadratic expressions. • Determine the maximum or minimum of a quadratic function by completing the square.
A1.A.3.3 Factor common monomial factors from polynomial expressions and factor quadratic expressions with a leading coefficient of 1.	Determine the zeros of polynomials and use them in graphing. * • Demonstrate an understanding of the Remainder and Factor theorems and use them in polynomial division problems • Find the zeros of polynomials of degree three or greater by factoring • Sketch graphs of polynomial functions using zeros Use inspection and completing the square to solve quadratic equations.* Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing,

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.
A1.A.3.4 Evaluate . . . rational . . . expressions. . . .	Rewrite rational expressions with linear and quadratic denominators. • Determine the quotient of simple rational expressions that have linear or quadratic denominators. For example, write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using factoring, synthetic division, or long division • Add, subtract, multiply, and divide rational expressions with linear or quadratic denominators
A1.A.3.4 Evaluate linear, absolute value, rational, and radical expressions. Include applying a nonstandard operation such as x # y = 2x + y.	Demonstrate an understanding of rational exponents and use them in representations of radicals; convert between algebraic representations that use radicals or rational exponents.* Simplify expressions involving radicals and rational exponents using the properties of exponents.*

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A1.A.4.1 Analyze, use and apply mathematical models and other data sets (e.g., . . . a set of data points) to . . . interpret slope and the . . . y-intercepts of a line.	Analyze and interpret linear models in the context of measurement and data. • Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference.
A1.A.4.1 Analyze, use and apply mathematical models and other data sets (e.g., graphs, equations, two points, a set of data points) to calculate and interpret slope and the x- and y-intercepts of a line.	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system. Analyze, compare, and contrast representations of linear, exponential and quadratic functions. * • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way. Analyze data on a scatter plot and determine a good model. * • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data. Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	interpret solutions as viable or nonviable options in a modeling context. Analyze, compare, and contrast linear and exponential models in real-world and mathematical situations. * • Show that linear functions have a constant rate of change regardless of intervals, and that for exponential functions, the rate of change over one interval is a factor or multiple of the rate of change over another interval. • Identify situations in which one quantity changes at a constant rate over one interval, but at a different rate of change over another interval. • Identify situations that have a constant percent growth or decay rate. • Demonstrate using different representations of functions that exponential graphs grow more quickly than linear, quadratic, or polynomial functions. Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph.
A1.A.4.2 Analyze and interpret mathematical models involving lines that are parallel [and] perpendicular . . .	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems. • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.
A1.A.4.3 Write the equation of the line given its slope and y-intercept, slope and one point, two points, x- and y-intercepts, or a set of data points.	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system. Construct new representations of functions from algebraic, graphic, numerical,

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other. Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
A1.A.4.3 Write the equation of the line [or curve of best fit] given . . . a set of data points.	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
A1.A.4.4 Express linear equations in slope-intercept, point-slope, and standard forms. Convert between these forms.	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system. Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	convert from one representation to the other. Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
A1.A.4.5 Analyze and interpret associations between graphical representations and written scenarios.	Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context. Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	or table, or estimate the rate of change using a graph.
A1.F.1.1 Distinguish between relations and functions.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence.
A1.F.1.2 Identify the . . . domain and range given a [radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational] function . . . or graph. . . .	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval.
A1.F.1.2 Identify the dependent variable, independent variable, domain and range given a function, equation, or graph. Identify restrictions on the domain and range in mathematical models.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence. Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing,

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.
A1.F.1.3 Write linear functions, using function notation, to represent mathematical models.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence. Construct new representations of functions from algebraic, graphic, numerical,

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other.
A1.F.1.4 Read and interpret the linear piecewise function, given a graph modeling a situation.	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. * • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A1.F.1.5 Interpret graphs as being discrete or continuous.	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. *

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A1.F.2.1 Distinguish between linear and nonlinear (including exponential) functions. Understand that linear functions grow by equal intervals (arithmetic) and that exponential functions grow by equal factors over equal intervals (geometric).	Analyze, compare, and contrast linear and exponential models in real-world and mathematical situations. • Show that linear functions have a constant rate of change regardless of intervals, and that for exponential functions, the rate of change over one interval is a factor or multiple of the rate of change over another interval. • Identify situations in which one quantity changes at a constant rate over one interval, but at a different rate of change over another interval. • Identify situations that have a constant percent growth or decay rate. • Demonstrate using different representations of functions that exponential graphs grow more quickly than linear, quadratic, or polynomial functions.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Compare and analyze the growth of exponential functions using tables or graphs to other functions. * • Compare to linear functions. • Compare to other exponential functions. • Compare to quadratic functions. • Compare to simple polynomial functions of degree 3 or higher. • Compare to power functions.
A1.F.2.2 Recognize the parent functions f(x) = x and f(x) = |x|. Predict the effects of vertical and horizontal transformations f(x + c) and f(x) + c, algebraically and graphically.	Analyze transformations of linear functions, quadratic functions, and exponential functions. * • Determine the impact on the graph of F(x) when F(x) is replaced by F(kx), kF(x), F(x+k) or F(x)+k, and determine what values of k will result in a new graph. • Use technology to represent and explain the impact of these changes on the graphs. • Determine whether a function is even or odd based on its algebraic or graphical representation. Analyze transformations of exponential, simple radical, and rational functions * • Determine the impact on a graph by replacing F(x) by F(x+k), F(x)+k,k(f(x)) or F(x) by F(kx), and determine what values of k will result in a new graph • Use technology to represent and explain the impact of these changes on the graphs • Determine whether a function is even or odd based on its algebraic or graphical representation

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A1.F.3.1 Identify and generate equivalent representations of linear functions, graphs, tables, and real-world situations.	Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other. Analyze, compare, and contrast representations of linear, exponential and quadratic functions. * • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way. Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph.
A1.F.3.2 Use function notation; evaluate a function, including nonlinear, at a given point in its domain algebraically . . . Interpret the results in terms of the original context.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence.
A1.F.3.2 Use function notation; evaluate a function, including nonlinear, at a given point in its domain algebraically and graphically. Interpret the results in terms of the original context.	Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.

**This skill is related to the aligned standard*

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. * • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	or rational function from a graph over a specified interval.
A1.F.3.3 Add, subtract, and multiply functions using function notation.	Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other. Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations. • Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions, absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A1.D.1.1 Display, describe, and compare data sets using summary statistics (central tendency and spread (range)). . . .	Model, describe, and interpret representations of data in one variable. • Create box plots and histograms. • Compare the measures of central tendency and the distribution of two or more sets of data. • Explain the statistical differences in the context of the data sets; state why there is a difference in shape, center, or spread.
A1.D.1.2 . . . [U]se scatter plots to analyze patterns and describe linear [or] exponential, . . . relationships between two variables.	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
A1.D.1.3 Make predictions based upon the linear regression, and use the correlation coefficient to assess the reliability of those predictions using graphing technology.	Analyze and interpret linear models in the context of measurement and data.* • Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A1.D.1.3 Make predictions based upon the linear [or exponential] regression, and . . . assess the reliability . . .	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
A1.D.2.1 Apply simple counting procedures (factorials, permutations, combinations, and tree diagrams) to determine sample size, sample space, and calculate probabilities.	Demonstrate an understanding of conditional probability and use conditional probability in real-world situations.* • Determine the conditional probability of A given B when A and B are dependent events. Identify that A and B are independent events if P(B) is not conditional upon the occurrence of A. • Represent bivariate data in two-way frequency tables and interpret the relative frequencies to determine conditional probabilities and whether events are independent or not. • Relate real world situations to conceptual understandings of conditional probability and independence. Use introductory probability techniques and counting rules to evaluate outcomes and determine probabilities.* • Use the formula P(B|A) = P(AnB)/P(A) to determine the conditional probability

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	of A given B and interpret the answers in real world situations. • Use the Addition Rule for dependent and independent events, and interpret the answers in real world situations. Demonstrate an understanding of sample spaces and independent events.* • Use set notation and set vocabulary, such as union, intersection, and complement to describe sample spaces. • Identify independent events A and B as events such that the probability of A and B occurring is determined by multiplying the Probability of A by the Probability of B.
A1.D.2.2 . . . [D]etermine the probability of the union of events, the intersection of events, and the complement of an event. Understand the relationships between these concepts and the words "AND," "OR," and "NOT."	Demonstrate an understanding of sample spaces and independent events. • Use set notation and set vocabulary, such as union, intersection, and complement to describe sample spaces. • Identify independent events A and B as events such that the probability of A and B occurring is determined by multiplying the Probability of A by the Probability of B.
A1.D.2.2 Given a Venn diagram, determine the probability of the union of events, the intersection of events, and the complement of an event. Understand the relationships between these concepts and the words "AND," "OR," and "NOT."	Demonstrate an understanding of conditional probability and use conditional probability in real-world situations.* • Determine the conditional probability of A given B when A and B are dependent events. Identify that A and B are independent events if P(B) is not conditional upon the occurrence of A. • Represent bivariate data in two-way frequency tables and interpret the relative frequencies to determine

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	conditional probabilities and whether events are independent or not. • Relate real world situations to conceptual understandings of conditional probability and independence. Use introductory probability techniques and counting rules to evaluate outcomes and determine probabilities.* • Use the formula P(B|A) = P(AnB)/P(A) to determine the conditional probability of A given B and interpret the answers in real world situations. • Use the Addition Rule for dependent and independent events, and interpret the answers in real world situations.
A1.D.2.3 Use simulations and experiments to calculate experimental probabilities.	Determine and analyze expected values to solve problems.* • Determine values for the events in a sample space associated with a random variable; graph the resulting probability distribution. • Determine and interpret the expected value of a random variable. • Use theoretical probabilities to develop a probability distribution and find the expected value. • Use experimental probabilities to develop a probability distribution and find the expected value.
A1.D.2.4 Apply probability concepts to real-world situations to make informed decisions.	Use probability techniques to evaluate outcomes of decisions for real-world situations. • Distinguish between probability events that are fair and unfair and random or not.

Grades 9 - 10 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• For unfair probability events, describe how to make a given outcome fair using probabilities. • Analyze real-world decisions and strategies using probability concepts.

Grades 10 - 11

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
G.RL.1.1 Use . . . definitions . . .	Demonstrate an understanding of geometric terms and how they are used to create precise definitions of Euclidean geometry figures, such as line segment, angle, and circle. • Angle - two rays that share the same endpoint; • Circle - the set of all points equidistant from another point, called the center. • Perpendicular lines - lines that intersect at a right angle. • Parallel lines - lines that are in the same plane, but never intersect. • Line segment - a portion of a line that has two endpoints. • Line segment Distance - the distance along the line from endpoint to endpoint of the segment.
G.RL.1.1 Use . . . definitions [and] postulates . . . in logical arguments . . .	Demonstrate a fundamental understanding of congruence as it relates to transformations of rigid motions, including those involving triangles. • Describe translations, rotations, and reflections using geometric terms, and predict the impact of these transformations on figures. Use the definition of congruence in terms of rigid motions to decide if two figures are congruent. • Show that two triangles are congruent if and only if the corresponding sides and angles are congruent using the definition of congruence in terms of rigid motions. • Using congruence in terms of rigid motions, show how the congruence criteria for triangles (ASA, SAS, and SSS) follows.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
G.RL.1.1 Use . . . definitions, postulates, and theorems in logical arguments . . .	Demonstrate an understanding of similarity in terms of transformations. • Show that a dilation takes a line not passing through the center of the dilation to a parallel line. • Show that a dilation leaves a line passing through the center of the dilation unchanged. • Show that the dilation of a line segment creates a new line segment in the ratio of the scale factor of the dilation. • Represent the image of a given non-rigid motion transformation, given the pre-image and the horizontal/vertical stretch or dilation. Determine a sequence of transformations with a stretch or dilation that will carry the pre-image of a figure onto its image. • Show that transformations will result in similar figures by preserving the measure of corresponding angles and creating corresponding sides with proportional lengths. • Associate a rule describing a non-rigid motion transformation with a horizontal/vertical stretch or a dilation centered at the origin. • Prove the AA criterion for similarity using transformations.
G.RL.1.1 Use . . . definitions, postulates, and theorems in logical arguments/proofs.	Prove simple theorems about lines and angles. • Prove vertical angles are congruent. • Prove that when a transversal crosses parallel lines, alternate interior angles are congruent. • Prove that when a transversal crosses parallel lines, corresponding angles are congruent.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Prove that any point on a perpendicular bisector of a line segment is equidistant from the line segment's endpoints. Prove simple theorems about triangles and parallelograms in the Euclidean plane • Prove the measures of interior angles of a triangle sum to 180°. • Prove the base angles of isosceles triangles are congruent. • Prove the segment joining midpoints of two sides of a triangle is parallel to the third side. • Prove the segment joining midpoints of two sides of a triangle is half the length of the third side. • Prove the medians of a triangle meet at a point. • Prove opposite sides of a parallelogram are congruent. • Prove opposite angles of a parallelogram are congruent. • Prove the diagonals of a parallelogram bisect each other. • Prove that parallelograms with congruent diagonals are rectangles. Demonstrate an understanding of the similarity of circles and describe relationships of segments in circles and use them to solve problems. • Use transformations to prove that any two circles are similar. • Identify and describe relationships among angles, chords, and tangents; including central, inscribed, and circumscribed angles. • Recognize that an inscribed angle on a diameter is right.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Recognize that the radius of a circle is perpendicular to a tangent of the circle where the radius intersects the circle. • Recognize and prove that the opposite angles of a quadrilateral inscribed in a circle are supplementary. • Construct an inscribed or circumscribed circle of a triangle, using a virtual compass and straight edge. Use coordinate geometry to prove simple theorems, including simple theorems about circles algebraically.
G.RL.1.1 Use undefined terms, definitions, postulates, and theorems in logical arguments . . .	Represent, describe, and model transformations in the plane. • Represent and describe transformations in the plane as functions. Contrast transformations that are rigid motions to transformations that contain dilations. • Associate a rule with a rigid motion transformation. • Identify and describe transformations that carry quadrilaterals and regular polygons onto themselves. • Develop definitions of the rigid motion transformations using the geometric terms of parallel lines, perpendicular lines, angles, and circles. • Represent the image of a given rigid motion transformation given the pre-image and the specific rotation, translation, or reflection. Determine what sequence of rigid transformations will carry the pre-image of a figure onto its image.
G.RL.1.1 Use undefined terms, definitions, postulates, and theorems in logical arguments/proofs.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems. Solve problems and prove relationships about triangles using congruence and similarity.* • Solve problems using congruence criteria for triangles. • Solve problems using similarity criteria for triangles. • Prove that a line parallel to one side of a triangle divides the other two proportionally and the converse. • Prove the Pythagorean Theorem using similar triangles. Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.
G.RL.1.2 Analyze and draw conclusions based on a set of conditions using inductive and deductive reasoning. . . .	Demonstrate an understanding of similarity in terms of transformations. • Show that a dilation takes a line not passing through the center of the dilation to a parallel line. • Show that a dilation leaves a line passing through the center of the dilation unchanged. • Show that the dilation of a line segment creates a new line segment in the ratio of the scale factor of the dilation. • Represent the image of a given non-rigid motion transformation, given the pre-image and the horizontal/vertical stretch or dilation. Determine a sequence of transformations with a stretch or dilation that will carry the pre-image of a figure onto its image. • Show that transformations will result in similar figures by preserving the measure of corresponding angles and creating corresponding sides with proportional lengths. • Associate a rule describing a non-rigid motion transformation with a horizontal/vertical stretch or a dilation centered at the origin. • Prove the AA criterion for similarity using transformations. Prove simple theorems about triangles and parallelograms in the Euclidean plane • Prove the measures of interior angles of a triangle sum to 180°. • Prove the base angles of isosceles triangles are congruent.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Prove the segment joining midpoints of two sides of a triangle is parallel to the third side. • Prove the segment joining midpoints of two sides of a triangle is half the length of the third side. • Prove the medians of a triangle meet at a point. • Prove opposite sides of a parallelogram are congruent. • Prove opposite angles of a parallelogram are congruent. • Prove the diagonals of a parallelogram bisect each other. • Prove that parallelograms with congruent diagonals are rectangles.
G.RL.1.2 Analyze and draw conclusions based on a set of conditions using inductive and deductive reasoning. Recognize the logical relationships between a conditional statement and its inverse, converse, and contrapositive.	Demonstrate a fundamental understanding of congruence as it relates to transformations of rigid motions, including those involving triangles. • Describe translations, rotations, and reflections using geometric terms, and predict the impact of these transformations on figures. Use the definition of congruence in terms of rigid motions to decide if two figures are congruent. • Show that two triangles are congruent if and only if the corresponding sides and angles are congruent using the definition of congruence in terms of rigid motions. • Using congruence in terms of rigid motions, show how the congruence criteria for triangles (ASA, SAS, and SSS) follows. Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.*

**This skill is related to the aligned standard*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems. Solve problems and prove relationships about triangles using congruence and similarity.* • Solve problems using congruence criteria for triangles. • Solve problems using similarity criteria for triangles. • Prove that a line parallel to one side of a triangle divides the other two proportionally and the converse. • Prove the Pythagorean Theorem using similar triangles. Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.
G.RL.1.3 Assess the validity of a logical argument and give counterexamples to disprove a statement.	Demonstrate a fundamental understanding of congruence as it relates to transformations of rigid motions, including those involving triangles.* • Describe translations, rotations, and reflections using geometric terms, and predict the impact of these transformations on figures. Use the definition of congruence in terms of rigid motions to decide if two figures are congruent. • Show that two triangles are congruent if and only if the corresponding sides and angles are congruent using the definition of congruence in terms of rigid motions. • Using congruence in terms of rigid motions, show how the congruence criteria for triangles (ASA, SAS, and SSS) follows.
G.2D.1.1 Use properties of parallel lines cut by a transversal to determine angle relationships and solve problems.	Prove simple theorems about lines and angles.* • Prove vertical angles are congruent. • Prove that when a transversal crosses parallel lines, alternate interior angles are congruent. • Prove that when a transversal crosses parallel lines, corresponding angles are congruent. • Prove that any point on a perpendicular bisector of a line segment is equidistant from the line segment's endpoints.
G.2D.1.2 Use the angle relationships formed by lines cut by a transversal to determine if the lines are parallel and verify, using algebraic and deductive proofs.	Prove simple theorems about lines and angles.* • Prove vertical angles are congruent.

**This skill is related to the aligned standard*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Prove that when a transversal crosses parallel lines, alternate interior angles are congruent. • Prove that when a transversal crosses parallel lines, corresponding angles are congruent. • Prove that any point on a perpendicular bisector of a line segment is equidistant from the line segment's endpoints. Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.
G.2D.1.3 Apply the properties of angles (corresponding, exterior, interior, vertical, complementary, supplementary) to solve problems using mathematical models, algebraic reasoning, and proofs.	Prove simple theorems about lines and angles.* • Prove vertical angles are congruent. • Prove that when a transversal crosses parallel lines, alternate interior angles are congruent. • Prove that when a transversal crosses parallel lines, corresponding angles are congruent. • Prove that any point on a perpendicular bisector of a line segment is equidistant from the line segment's endpoints.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
G.2D.1.4 Apply theorems involving the interior and exterior angle sums of polygons to solve problems using mathematical models, algebraic reasoning, and proofs.	Prove simple theorems about triangles and parallelograms in the Euclidean plane* • Prove the measures of interior angles of a triangle sum to 180°. • Prove the base angles of isosceles triangles are congruent. • Prove the segment joining midpoints of two sides of a triangle is parallel to the third side. • Prove the segment joining midpoints of two sides of a triangle is half the length of the third side. • Prove the medians of a triangle meet at a point. • Prove opposite sides of a parallelogram are congruent. • Prove opposite angles of a parallelogram are congruent. • Prove the diagonals of a parallelogram bisect each other. • Prove that parallelograms with congruent diagonals are rectangles.
G.2D.1.5 Apply the properties of special quadrilaterals (square, rectangle, trapezoid, isosceles trapezoid, rhombus, kite, parallelogram) to solve problems involving angle measures and segment lengths using mathematical models, algebraic reasoning, and proofs.	Prove simple theorems about triangles and parallelograms in the Euclidean plane* • Prove the measures of interior angles of a triangle sum to 180°. • Prove the base angles of isosceles triangles are congruent. • Prove the segment joining midpoints of two sides of a triangle is parallel to the third side. • Prove the segment joining midpoints of two sides of a triangle is half the length of the third side. • Prove the medians of a triangle meet at a point. • Prove opposite sides of a parallelogram are congruent.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Prove opposite angles of a parallelogram are congruent. • Prove the diagonals of a parallelogram bisect each other. • Prove that parallelograms with congruent diagonals are rectangles. Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system. Demonstrate an understanding of the similarity of circles and describe relationships of segments in circles and use them to solve problems.* • Use transformations to prove that any two circles are similar. • Identify and describe relationships among angles, chords, and tangents; including central, inscribed, and circumscribed angles. • Recognize that an inscribed angle on a diameter is right. • Recognize that the radius of a circle is perpendicular to a tangent of the circle where the radius intersects the circle.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Recognize and prove that the opposite angles of a quadrilateral inscribed in a circle are supplementary. • Construct an inscribed or circumscribed circle of a triangle, using a virtual compass and straight edge.
G.2D.1.6 Use . . . algebraic reasoning to represent and analyze line segments and [triangles], including determining lengths . . .	Solve problems and prove relationships about triangles using congruence and similarity. • Solve problems using congruence criteria for triangles. • Solve problems using similarity criteria for triangles. • Prove that a line parallel to one side of a triangle divides the other two proportionally and the converse. • Prove the Pythagorean Theorem using similar triangles.
G.2D.1.6 Use coordinate geometry and algebraic reasoning to represent and analyze line segments and polygons, including determining lengths . . . and slopes of line segments.	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems. • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.
G.2D.1.6 Use coordinate geometry and algebraic reasoning to represent and analyze line segments and polygons, including determining lengths, midpoints, and slopes of line segments.	Use coordinate geometry to prove simple theorems, including simple theorems about circles algebraically.*

**This skill is related to the aligned standard*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Use the unit circle to determine the lengths of the sides of special right triangles and to explain periodicity. * • Use the unit circles and special right triangles to compute the values of the trigonometric ratios for angles with reference angles equal to 30, 45, 60, and 90 degrees • Explain periodicity using the unit circle • Explain even and odd symmetry using the unit circle Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.
G.2D.1.7 Apply the properties of polygons, and use them to represent and apply mathematical models involving perimeter and area (e.g., triangles, special quadrilaterals, regular polygons up to 12 sides, composite figures).	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.
G.2D.1.8 Apply the properties of . . . similar polygons . . . using mathematical models and algebraic and logical reasoning.	Demonstrate an understanding of similarity in terms of transformations. • Show that a dilation takes a line not passing through the center of the dilation to a parallel line. • Show that a dilation leaves a line passing through the center of the dilation unchanged. • Show that the dilation of a line segment creates a new line segment in the ratio of the scale factor of the dilation. • Represent the image of a given non-rigid motion transformation, given the pre-image and the horizontal/vertical stretch or dilation. Determine a sequence of transformations with a stretch or dilation that will carry the pre-image of a figure onto its image. • Show that transformations will result in similar figures by preserving the measure of corresponding angles and creating corresponding sides with proportional lengths. • Associate a rule describing a non-rigid motion transformation with a horizontal/vertical stretch or a dilation centered at the origin. • Prove the AA criterion for similarity using transformations.
G.2D.1.8 Apply the properties of congruent . . . polygons . . . using . . . algebraic and logical reasoning.	Demonstrate a fundamental understanding of congruence as it relates to transformations of rigid motions, including those involving triangles. • Describe translations, rotations, and reflections using geometric terms, and predict the impact of these

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	transformations on figures. Use the definition of congruence in terms of rigid motions to decide if two figures are congruent. • Show that two triangles are congruent if and only if the corresponding sides and angles are congruent using the definition of congruence in terms of rigid motions. • Using congruence in terms of rigid motions, show how the congruence criteria for triangles (ASA, SAS, and SSS) follows.
G.2D.1.8 Apply the properties of congruent . . . polygons . . . using mathematical models . . . and logical reasoning.	Represent, describe, and model transformations in the plane. • Represent and describe transformations in the plane as functions. Contrast transformations that are rigid motions to transformations that contain dilations. • Associate a rule with a rigid motion transformation. • Identify and describe transformations that carry quadrilaterals and regular polygons onto themselves. • Develop definitions of the rigid motion transformations using the geometric terms of parallel lines, perpendicular lines, angles, and circles. • Represent the image of a given rigid motion transformation given the pre-image and the specific rotation, translation, or reflection. Determine what sequence of rigid transformations will carry the pre-image of a figure onto its image.
G.2D.1.8 Apply the properties of congruent or similar polygons to solve problems using mathematical models and algebraic and logical reasoning.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.
G.2D.1.8 Apply the properties of congruent or similar [triangles] to solve problems using . . . algebraic and logical reasoning.	Solve problems and prove relationships about triangles using congruence and similarity. • Solve problems using congruence criteria for triangles. • Solve problems using similarity criteria for triangles. • Prove that a line parallel to one side of a triangle divides the other two proportionally and the converse. • Prove the Pythagorean Theorem using similar triangles.
G.2D.1.9 . . . [Explain] triangle congruence (SSS, SAS, [and] ASA . . .) [using transformations].	Represent, describe, and model transformations in the plane. • Represent and describe transformations in the plane as functions. Contrast transformations that are rigid motions to transformations that contain dilations. • Associate a rule with a rigid motion transformation. • Identify and describe transformations that carry quadrilaterals and regular polygons onto themselves. • Develop definitions of the rigid motion transformations using the geometric terms of parallel lines, perpendicular lines, angles, and circles. • Represent the image of a given rigid motion transformation given the pre-image and the specific rotation,

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	translation, or reflection. Determine what sequence of rigid transformations will carry the pre-image of a figure onto its image.
G.2D.1.9 Construct logical arguments to prove triangle congruence (SSS, SAS, ASA, AAS and HL).	Demonstrate a fundamental understanding of congruence as it relates to transformations of rigid motions, including those involving triangles.* • Describe translations, rotations, and reflections using geometric terms, and predict the impact of these transformations on figures. Use the definition of congruence in terms of rigid motions to decide if two figures are congruent. • Show that two triangles are congruent if and only if the corresponding sides and angles are congruent using the definition of congruence in terms of rigid motions. • Using congruence in terms of rigid motions, show how the congruence criteria for triangles (ASA, SAS, and SSS) follows. Solve problems and prove relationships about triangles using congruence and similarity.* • Solve problems using congruence criteria for triangles. • Solve problems using similarity criteria for triangles. • Prove that a line parallel to one side of a triangle divides the other two proportionally and the converse. • Prove the Pythagorean Theorem using similar triangles.
G.2D.1.10 . . . [P]rove triangle similarity (AA . . .) [using transformations].	Demonstrate an understanding of similarity in terms of transformations.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Show that a dilation takes a line not passing through the center of the dilation to a parallel line. • Show that a dilation leaves a line passing through the center of the dilation unchanged. • Show that the dilation of a line segment creates a new line segment in the ratio of the scale factor of the dilation. • Represent the image of a given non-rigid motion transformation, given the pre-image and the horizontal/vertical stretch or dilation. Determine a sequence of transformations with a stretch or dilation that will carry the pre-image of a figure onto its image. • Show that transformations will result in similar figures by preserving the measure of corresponding angles and creating corresponding sides with proportional lengths. • Associate a rule describing a non-rigid motion transformation with a horizontal/vertical stretch or a dilation centered at the origin. • Prove the AA criterion for similarity using transformations.
G.2D.1.10 Construct logical arguments to prove triangle similarity (AA, SSS, SAS).	Solve problems and prove relationships about triangles using congruence and similarity.* • Solve problems using congruence criteria for triangles. • Solve problems using similarity criteria for triangles. • Prove that a line parallel to one side of a triangle divides the other two proportionally and the converse. • Prove the Pythagorean Theorem using similar triangles.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
G.2D.1.11 Use . . . graphic . . . representations of transformations in two dimensions (e.g., . . . dilations . . .) . . . involving figures on a coordinate plane . . .	Demonstrate an understanding of similarity in terms of transformations. • Show that a dilation takes a line not passing through the center of the dilation to a parallel line. • Show that a dilation leaves a line passing through the center of the dilation unchanged. • Show that the dilation of a line segment creates a new line segment in the ratio of the scale factor of the dilation. • Represent the image of a given non-rigid motion transformation, given the pre-image and the horizontal/vertical stretch or dilation. Determine a sequence of transformations with a stretch or dilation that will carry the pre-image of a figure onto its image. • Show that transformations will result in similar figures by preserving the measure of corresponding angles and creating corresponding sides with proportional lengths. • Associate a rule describing a non-rigid motion transformation with a horizontal/vertical stretch or a dilation centered at the origin. • Prove the AA criterion for similarity using transformations.
G.2D.1.11 Use . . . graphic . . . representations of transformations in two dimensions (e.g., reflections, translations, . . . rotations about the origin by multiples of 90°) . . . involving figures on a coordinate plane . . .	Represent, describe, and model transformations in the plane. • Represent and describe transformations in the plane as functions. Contrast transformations that are rigid motions to transformations that contain dilations. • Associate a rule with a rigid motion transformation.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Identify and describe transformations that carry quadrilaterals and regular polygons onto themselves. • Develop definitions of the rigid motion transformations using the geometric terms of parallel lines, perpendicular lines, angles, and circles. • Represent the image of a given rigid motion transformation given the pre-image and the specific rotation, translation, or reflection. Determine what sequence of rigid transformations will carry the pre-image of a figure onto its image.
G.2D.1.11 Use . . . representations of transformations in two dimensions (e.g., reflections, translations, dilations, rotations about the origin by multiples of 90°) . . . involving figures . . .	Demonstrate a fundamental understanding of congruence as it relates to transformations of rigid motions, including those involving triangles. • Describe translations, rotations, and reflections using geometric terms, and predict the impact of these transformations on figures. Use the definition of congruence in terms of rigid motions to decide if two figures are congruent. • Show that two triangles are congruent if and only if the corresponding sides and angles are congruent using the definition of congruence in terms of rigid motions. • Using congruence in terms of rigid motions, show how the congruence criteria for triangles (ASA, SAS, and SSS) follows.
G.2D.1.11 Use numeric, graphic, and algebraic representations of transformations in two dimensions (e.g., . . . translations, dilations . . .) . . . involving figures on a coordinate plane . . .	Analyze transformations of linear functions, quadratic functions, and exponential functions. • Determine the impact on the graph of F(x) when F(x) is replaced by F(kx), kF(x), F(x+k) or F(x)+k, and determine

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	what values of k will result in a new graph. • Use technology to represent and explain the impact of these changes on the graphs. • Determine whether a function is even or odd based on its algebraic or graphical representation. Analyze transformations of exponential, simple radical, and rational functions • Determine the impact on a graph by replacing F(x) by F(x+k), F(x)+k,k(f(x)) or F(x) by F(kx), and determine what values of k will result in a new graph • Use technology to represent and explain the impact of these changes on the graphs • Determine whether a function is even or odd based on its algebraic or graphical representation
G.3D.1.1 . . . [U]se, and apply mathematical . . . tools (e.g., . . . formulas) to solve problems involving . . . volume of three-dimensional figures (. . . cylinders, pyramids, cones, spheres . . .).	Demonstrate an understanding of volume formulas and use them to solve problems involving • Cylinders • Cones • Spheres • Pyramids
G.3D.1.2 Use ratios derived from similar three-dimensional figures to make conjectures, generalize, and to solve for unknown values such as angles, side lengths, perimeter, and circumference of a face, area of a face, and volume.	Demonstrate an understanding of similarity in terms of transformations. * • Show that a dilation takes a line not passing through the center of the dilation to a parallel line. • Show that a dilation leaves a line passing through the center of the dilation unchanged.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Show that the dilation of a line segment creates a new line segment in the ratio of the scale factor of the dilation. • Represent the image of a given non-rigid motion transformation, given the pre-image and the horizontal/vertical stretch or dilation. Determine a sequence of transformations with a stretch or dilation that will carry the pre-image of a figure onto its image. • Show that transformations will result in similar figures by preserving the measure of corresponding angles and creating corresponding sides with proportional lengths. • Associate a rule describing a non-rigid motion transformation with a horizontal/vertical stretch or a dilation centered at the origin. • Prove the AA criterion for similarity using transformations. Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system.

**This skill is related to the aligned standard*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Demonstrate an understanding of volume formulas and use them to solve problems involving* • Cylinders • Cones • Spheres • Pyramids
G.C.1.1 Apply the properties of circles to solve problems involving circumference and area, using approximate values and in terms of pi, using algebraic and logical reasoning.	Demonstrate an understanding of volume formulas and use them to solve problems involving* • Cylinders • Cones • Spheres • Pyramids
G.C.1.2 . . . [R]ecognize and write the radius r, center (h, k), and . . . equation of a circle $(x - h)^2 + (y - k)^2 = r^2$ . . .	Derive equations of simple conic sections: parabolas and circles. • Use the Pythagorean theorem to derive the equation of a circle. • Find the center and radius of a circle given by completing the square. • Given the focus and directrix, derive the equation of a parabola.
G.C.1.3 Apply the properties of circles and relationships among angles; . . . and distances in a circle among radii, chords, . . . and tangents . . . using algebraic and logical reasoning.	Demonstrate an understanding of the similarity of circles and describe relationships of segments in circles and use them to solve problems. • Use transformations to prove that any two circles are similar. • Identify and describe relationships among angles, chords, and tangents; including central, inscribed, and circumscribed angles. • Recognize that an inscribed angle on a diameter is right. • Recognize that the radius of a circle is perpendicular to a tangent of the circle where the radius intersects the circle.

**This skill is related to the aligned standard*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Recognize and prove that the opposite angles of a quadrilateral inscribed in a circle are supplementary. • Construct an inscribed or circumscribed circle of a triangle, using a virtual compass and straight edge.
G.C.1.3 Apply the properties of circles and relationships among angles; arcs; and distances in a circle among radii, chords, secants, and tangents to solve problems using algebraic and logical reasoning.	Demonstrate an understanding of the unit circle and how it relates to trigonometric functions. * • Demonstrate a conceptual understanding of radian measure as arc length • Demonstrate a conceptual understanding between angle measures represented in degrees or radians in all four quadrants of the unit circle Demonstrate an understanding of the properties of a sector of a circle and apply them to solve problems.* • Convert between radian measure and angle measure. • Recognize and show that #r is the length of the arc intercepted by an angle. • Recognize and show that (#r^2)/2 is the formula for the area of a sector of a circle. Use the unit circle to determine the lengths of the sides of special right triangles and to explain periodicity. * • Use the unit circles and special right triangles to compute the values of the trigonometric ratios for angles with reference angles equal to 30, 45, 60, and 90 degrees • Explain periodicity using the unit circle • Explain even and odd symmetry using the unit circle

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
G.RT.1.1 Apply the distance formula, the Pythagorean theorem, and the Pythagorean theorem converse (approximate and exact values, including Pythagorean triples) to solve problems, using algebraic and logical reasoning and mathematical models.	Use coordinate geometry to prove geometric theorems and to solve real-world and mathematical problems.* • Prove simple geometric theorems using the rectangular coordinate system. • Prove that lines with the same slope are either the same line or parallel lines; Prove that lines are perpendicular if and only if the slopes have a product of -1. Find the equation of a line parallel or perpendicular to a given line through a specified point. • Find the perimeters of polygons and areas of triangles and rectangles using the rectangular coordinate system. Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.
G.RT.1.2 Verify and apply properties of right triangles, including properties of 45-45-90 and 30-60-90 triangles, to solve problems using algebraic and logical reasoning.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure.

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems. Use the unit circle to determine the lengths of the sides of special right triangles and to explain periodicity. * • Use the unit circles and special right triangles to compute the values of the trigonometric ratios for angles with reference angles equal to 30, 45, 60, and 90 degrees • Explain periodicity using the unit circle • Explain even and odd symmetry using the unit circle
G.RT.1.3 Use the definition of the trigonometric functions to determine the sine, cosine, and tangent ratio of an acute angle in a right triangle. . . .	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems. • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.
G.RT.1.3 Use the definition of the trigonometric functions to determine the sine, cosine, and tangent ratio of an acute angle in a right triangle. Apply the inverse	Use trigonometric functions to model periodic situations given the amplitude, frequency and midline*

Grades 10 - 11 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
trigonometric functions to find the measure of an acute angle in right triangles.	
G.RT.1.4 Apply the trigonometric functions as ratios (sine, cosine, tangent) to find side lengths in right triangles in mathematical models, including the coordinate plane.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems. • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.

Grades 11 - 12

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A2.N.1.1 Find the value of i# for any whole number n.	Demonstrate a deep understanding of complex numbers by using them in polynomial theorems and identities. * • Use complex numbers in rewriting algebraic expressions. • Determine the number of roots for a polynomial of any degree. • Prove that all quadratic polynomials have two roots. Find and use conjugates of complex numbers * • Find the conjugate of a complex number • Find the moduli of complex numbers • Find quotients of complex numbers
A2.N.1.2 Simplify, add, subtract, multiply, and divide complex numbers.	Find and use conjugates of complex numbers * • Find the conjugate of a complex number • Find the moduli of complex numbers • Find quotients of complex numbers
A2.N.1.3 Understand and apply the relationship between rational exponents to integer exponents and radicals . . .	Demonstrate an understanding of rational exponents and use them in representations of radicals; convert between algebraic representations that use radicals or rational exponents. Simplify expressions involving radicals and rational exponents using the properties of exponents.
A2.A.1.1 . . . [S]olve [quadratic relationships] using . . . completing the square . . . and various methods [inspection] . . .	Use inspection and completing the square to solve quadratic equations.
A2.A.1.1 . . . [S]olve [quadratic relationships] using factoring [and] completing the square . . .	Analyze, perform operations, and solve quadratic expressions and equations. • Factor quadratic expressions.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine the maximum or minimum of a quadratic function by completing the square.
A2.A.1.1 Use mathematical models to represent quadratic relationships and solve using factoring, completing the square, the quadratic formula, and various methods (including graphing calculator or other appropriate technology). Find non-real roots when they exist.	Demonstrate a deep understanding of complex numbers by using them in polynomial theorems and identities. * • Use complex numbers in rewriting algebraic expressions. • Determine the number of roots for a polynomial of any degree. • Prove that all quadratic polynomials have two roots. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A2.A.1.2 Use mathematical models to represent exponential relationships . . . Solve these equations . . . graphically . . .	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]
A2.A.1.2 Use mathematical models to represent exponential relationships, such as compound interest, depreciation, and population growth. Solve these equations algebraically or graphically (including graphing calculator or other appropriate technology).	Simplify expressions involving radicals and rational exponents using the properties of exponents.* Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other. Analyze, compare, and contrast linear and exponential models in real-world and mathematical situations. * • Show that linear functions have a constant rate of change regardless of intervals, and that for exponential functions, the rate of change over one interval is a factor or multiple of the rate of change over another interval.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Identify situations in which one quantity changes at a constant rate over one interval, but at a different rate of change over another interval. • Identify situations that have a constant percent growth or decay rate. • Demonstrate using different representations of functions that exponential graphs grow more quickly than linear, quadratic, or polynomial functions. Compare and analyze the growth of exponential functions using tables or graphs to other functions. * • Compare to linear functions. • Compare to other exponential functions. • Compare to quadratic functions. • Compare to simple polynomial functions of degree 3 or higher. • Compare to power functions. Analyze, compare, and contrast representations of linear, exponential and quadratic functions. * • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way. Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. *

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.A.1.3 Solve one-variable rational equations and check for extraneous solutions.	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]* Solve simple radical and rational equations, including those with extraneous solutions and justify reasoning.*
A2.A.1.4 Solve polynomial equations with real roots using various methods (e.g., polynomial division, synthetic division, using graphing calculators or other appropriate technology).	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	and exponential equations. Linear and exponential are used in conjunction with one of the other types.] Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. * • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior. Determine the zeros of polynomials and use them in graphing. * • Demonstrate an understanding of the Remainder and Factor theorems and use them in polynomial division problems • Find the zeros of polynomials of degree three or greater by factoring • Sketch graphs of polynomial functions using zeros
A2.A.1.4 Solve polynomial [expressions] with real roots using various methods	Rewrite rational expressions with linear and quadratic denominators.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
(e.g., polynomial division, synthetic division . . .).	• Determine the quotient of simple rational expressions that have linear or quadratic denominators. For example, write a(x)/b(x) in the form q(x) + r(x)/ b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using factoring, synthetic division, or long division • Add, subtract, multiply, and divide rational expressions with linear or quadratic denominators
A2.A.1.5 Solve square and cube root equations with one variable, and check for extraneous solutions.	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]* Solve simple radical and rational equations, including those with extraneous solutions and justify reasoning.*
A2.A.1.6 Solve common and natural logarithmic equations using the properties of logarithms.	Demonstrate an understanding of the connection between exponential and logarithmic relationships. * • Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. • Translate between logarithmic equations of base 2, 10 or e, and their exponential forms. • Translate between equivalent forms of logarithmic equations.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]* Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. * • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.A.1.7 Represent and evaluate mathematical models using systems of linear equations with a maximum of three variables. Graphing calculators or other appropriate technology may be used.	Represent linear, quadratic, and simple exponential relationships as algebraic equations and inequalities to solve mathematical and real-world problems. * • Create linear, quadratic, and simple exponential equations and inequalities

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	in one variable and use them to solve problems. • Create linear, quadratic, and simple exponential equations in two or more variables to represent relationships between quantities; graph linear, quadratic, and simple exponential equations on coordinate axes with labels and scales. • Represent constraints by linear equations or inequalities, and by systems of linear equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.
A2.A.1.7 Represent and evaluate mathematical models using systems of linear equations with a maximum of [two] variables. . . .	Solve systems of linear equations using graphing and linear combination. • Show that linear combination results in one solution, infinitely many solutions or no solution that is shared by both lines. • Solve systems of linear equations algebraically and graphically.
A2.A.1.8 . . . [Graphically] solve systems of equations containing one linear equation and one quadratic equation . . .	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]
A2.A.1.8 Use tools to solve systems of equations containing one linear equation and one quadratic equation. Graphing calculators or other appropriate technology may be used.	Represent all kinds of relationships, including simple root functions, as algebraic equations to solve mathematical and real-world problems. * • Create equations and inequalities in one variable that may include simple rational, exponential, and root functions and use them to solve problems

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Create equations in two or more variables that model complex situations and graph them on the coordinate plane. • Solve systems of equations and inequalities that model complex situations, and interpret the results. • Solve literal functions that model complex situations for a specific variable, including formulas involving simple roots.
A2.A.1.9 Solve systems of linear inequalities in two variables . . . ; graph . . . the solutions on a coordinate plane. . . .	Represent and solve linear, quadratic, and simple exponential equations graphically. • Demonstrate an understanding that the graph of an equation in two variables is the set of all the ordered pairs in the coordinate plane that are solutions to the equation. • Recognize that when the graphs of two functions intersect, the x-value of the point of intersection produces the same y-value in both functions such that f(x)=g(x); estimate these intersections by graphing, creating tables of x- and y- values, or finding successive approximations. [Functions are limited to linear and linear, exponential and exponential, linear and exponential.] • Graph half-planes to represent linear inequalities in two variables; graph the solution set to a system of linear inequalities in two variables as the intersection of half-planes.
A2.A.2.1 Factor polynomial expressions including, but not limited to, trinomials, differences of squares, sum and difference of cubes, and factoring by grouping, using a variety of tools and strategies.	Demonstrate a deep understanding of complex numbers by using them in polynomial theorems and identities. * • Use complex numbers in rewriting algebraic expressions. • Determine the number of roots for a polynomial of any degree.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Prove that all quadratic polynomials have two roots. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph. Determine the zeros of polynomials and use them in graphing. * • Demonstrate an understanding of the Remainder and Factor theorems and use them in polynomial division problems • Find the zeros of polynomials of degree three or greater by factoring • Sketch graphs of polynomial functions using zeros

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A2.A.2.1 Factor polynomial [quadratic] expressions including . . . trinomials, . . . using a variety of . . . strategies.	Analyze, perform operations, and solve quadratic expressions and equations. • Factor quadratic expressions. • Determine the maximum or minimum of a quadratic function by completing the square. Use inspection and completing the square to solve quadratic equations.
A2.A.2.2 Add, subtract, multiply, . . . and simplify polynomial expressions [of degree 3 or greater].	Add, subtract, and multiply polynomials of degree 3 or greater.
A2.A.2.2 Add, subtract, multiply, . . . and simplify polynomial expressions.	Add, subtract, and multiply polynomials.
A2.A.2.2 Add, subtract, multiply, divide, and simplify polynomial expressions.	Determine the zeros of polynomials and use them in graphing. * • Demonstrate an understanding of the Remainder and Factor theorems and use them in polynomial division problems • Find the zeros of polynomials of degree three or greater by factoring • Sketch graphs of polynomial functions using zeros Rewrite rational expressions with linear and quadratic denominators. * • Determine the quotient of simple rational expressions that have linear or quadratic denominators. For example, write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using factoring, synthetic division, or long division • Add, subtract, multiply, and divide rational expressions with linear or quadratic denominators

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Solve simple radical and rational equations, including those with extraneous solutions and justify reasoning.*
A2.A.2.3 Add, subtract, multiply, divide, and simplify rational expressions [with linear and quadratic denominators].	Rewrite rational expressions with linear and quadratic denominators. • Determine the quotient of simple rational expressions that have linear or quadratic denominators. For example, write a(x)/b(x) in the form q(x) + r(x)/b(x), where a(x), b(x), q(x), and r(x) are polynomials with the degree of r(x) less than the degree of b(x), using factoring, synthetic division, or long division • Add, subtract, multiply, and divide rational expressions with linear or quadratic denominators
A2.A.2.4 Recognize that a quadratic function has different equivalent representations [$f(x) = ax^2 + bx + c$, $f(x) = a(x - h)^2 + k$, and $f(x) = a(x - p)(x - q)$]. Identify and use the mathematical model that is most appropriate to solve problems.	Analyze, perform operations, and solve quadratic expressions and equations. • Factor quadratic expressions. • Determine the maximum or minimum of a quadratic function by completing the square. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph. Use inspection and completing the square to solve quadratic equations.*
A2.A.2.5 Rewrite algebraic expressions involving radicals and rational exponents using the properties of exponents.	Demonstrate an understanding of rational exponents and use them in representations of radicals; convert between algebraic representations that use radicals or rational exponents. Simplify expressions involving radicals and rational exponents using the properties of exponents.
A2.A.3.1 Recognize that arithmetic sequences are linear using equations, tables, graphs, and verbal descriptions. Using the pattern, find the next term.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence. Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other.
A2.A.3.2 Recognize that geometric sequences are exponential using equations, tables, graphs, and verbal descriptions. Given the formula f(x) = a(r)#, find the next term and define the meaning of a and r within the context of the problem.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence. Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other.
A2.A.3.3 Solve problems that can be modeled using arithmetic sequences or series given the nth terms and sum formulas. Graphing calculators or other appropriate technology may be used.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	relationship between terms in a recursive sequence. Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other.
A2.A.3.4 Solve problems that can be modeled using finite geometric . . . series given the nth terms and sum formulas. . . .	Understand the formula Sn=a(1-r^n)/(1-r) for the sum of a finite geometric series (when the common ratio is not 1) and solve problems involving finite geometric series.
A2.A.3.4 Solve problems that can be modeled using finite geometric sequences and series given the nth terms and sum formulas. Graphing calculators or other appropriate technology may be used.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence. Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. * • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other.
A2.F.1.1 . . . [S]pecify the domain and range of various types of functions [radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational] . . .	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	(degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval.
A2.F.1.1 Use algebraic, interval, and set notations to specify the domain and range of various types of functions, and evaluate a function at a given point in its domain.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence. Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.
A2.F.1.2 . . . [Analyze] exponential [and] radical (square root and cube root only) . . . functions. Predict the effects of transformations [f(x + c), f(x) + c, f(cx), and cf(x)] algebraically and graphically.	Analyze transformations of exponential, simple radical, and rational functions • Determine the impact on a graph by replacing F(x) by F(x+k), F(x)+k,k(f(x)) or F(x) by F(kx), and determine what values of k will result in a new graph • Use technology to represent and explain the impact of these changes on the graphs • Determine whether a function is even or odd based on its algebraic or graphical representation
A2.F.1.2 Identify the parent forms of exponential, radical (square root and cube root only), quadratic, and logarithmic functions. Predict the effects of transformations [f(x + c), f(x) + c, f(cx), and cf(x)] algebraically and graphically.	Analyze transformations of linear functions, quadratic functions, and exponential functions. * • Determine the impact on the graph of F(x) when F(x) is replaced by F(kx), kF(x), F(x+k) or F(x)+k, and determine what values of k will result in a new graph. • Use technology to represent and explain the impact of these changes on the graphs. • Determine whether a function is even or odd based on its algebraic or graphical representation.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A2.F.1.3 Graph a quadratic function. Identify the . . . x- and y-intercepts [and] maximum or minimum value . . .	Analyze, compare, and contrast representations of linear, exponential and quadratic functions. • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way.
A2.F.1.3 Graph a quadratic function. Identify the domain, range, x- and y-intercepts, maximum or minimum value, axis of symmetry, and vertex using various methods and tools that may include a graphing calculator or appropriate technology.	Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Analyze, perform operations, and solve quadratic expressions and equations. * • Factor quadratic expressions. • Determine the maximum or minimum of a quadratic function by completing the square.
A2.F.1.4 Graph exponential and logarithmic functions. Identify the . . . x- and y-intercepts . . .	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]
A2.F.1.4 Graph exponential and logarithmic functions. Identify the domain, range, asymptotes, and x- and y-intercepts . . .	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
A2.F.1.4 Graph exponential and logarithmic functions. Identify the domain, range, asymptotes, and x- and y-intercepts using various methods and tools that may include calculators or other appropriate technology. Recognize exponential decay and growth graphically and algebraically.	Analyze, compare, and contrast linear and exponential models in real-world and mathematical situations. * • Show that linear functions have a constant rate of change regardless of intervals, and that for exponential functions, the rate of change over one interval is a factor or multiple of the rate of change over another interval. • Identify situations in which one quantity changes at a constant rate over one interval, but at a different rate of change over another interval. • Identify situations that have a constant percent growth or decay rate. • Demonstrate using different representations of functions that exponential graphs grow more quickly than linear, quadratic, or polynomial functions. Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph. Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates).

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence.
A2.F.1.5 . . . [G]raph . . . a polynomial function by identifying the . . . zeros . . .	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.] Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.F.1.5 Analyze the graph of a polynomial function by identifying the domain, range, intercepts, zeros, relative maxima, relative minima, and intervals of increase and decrease.	Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph. Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence.
A2.F.1.6 Graph a rational function and identify the . . . x- and y-intercepts [and] vertical and horizontal asymptotes, using various methods . . .	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	[Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]
A2.F.1.6 Graph a rational function and identify the domain (including holes), range, x- and y-intercepts, vertical and horizontal asymptotes, using various methods and tools that may include a graphing calculator or other appropriate technology (excluding slant or oblique asymptotes).	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. * • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval.
A2.F.1.6 Graph a rational function and identify [parts of] the domain (including holes), . . . x- and y-intercepts, [and] vertical and horizontal asymptotes, using various methods . . .	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.F.1.7 Graph a radical function (square root and cube root only). . . .	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.F.1.7 Graph a radical function (square root and cube root only). Identify the domain, range, and x- and y-intercepts using various methods and tools that may include a graphing calculator or other appropriate technology.	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. * • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval.
A2.F.1.8 Graph piecewise functions . . .	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.F.1.9 Recognize whether a discrete or continuous graphical representation is	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. *

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
appropriate to create a graph based upon a mathematical model.	• Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
A2.F.2.1 Add, subtract, multiply, and divide functions using function notation . . .	Construct new representations of functions from algebraic, graphic, numerical, or verbal representations of linear and exponential functions. • Determine an algebraic expression or steps for calculation of a linear or exponential function that model real world situations. • Create new functions by using arithmetic operations on functions. • Write an algebraic expression or steps for calculation to determine terms in arithmetic and geometric sequences and convert from one representation to the other. Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions, absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically.
A2.F.2.2 Combine functions by composition . . .	Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations. • Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions, absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically.
A2.F.2.2 Combine functions by composition and recognize that g(x) = f#¹(x), the inverse function of f(x), if and only if f(g(x)) = g(f(x)) = x.	Determine whether a linear or quadratic function has an inverse that is also a function, and if so, write the inverse function.*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	Determine whether an exponential, simple radical, absolute value, polynomial (degree 3 or greater), rational, or logarithmic function has an inverse that is also a function, and if so, write an expression or equation for the inverse.* Demonstrate an understanding of the connection between exponential and logarithmic relationships. * • Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. • Translate between logarithmic equations of base 2, 10 or e, and their exponential forms. • Translate between equivalent forms of logarithmic equations.
A2.F.2.3 Find . . . the inverse of a [linear [or] quadratic] function, if it exists . . .	Determine whether a linear or quadratic function has an inverse that is also a function, and if so, write the inverse function.
A2.F.2.3 Find . . . the inverse of a [simple exponential, radical, absolute value, polynomial (degree 3 or greater), rational or logarithmic] function, if it exists . . .	Determine whether an exponential, simple radical, absolute value, polynomial (degree 3 or greater), rational, or logarithmic function has an inverse that is also a function, and if so, write an expression or equation for the inverse.
A2.F.2.4 Apply the inverse relationship between exponential and logarithmic functions to convert from one form to another.	Demonstrate an understanding of the connection between exponential and logarithmic relationships. • Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Translate between logarithmic equations of base 2, 10 or e, and their exponential forms. • Translate between equivalent forms of logarithmic equations.
A2.D.1.2 . . . [U]se scatter plots to analyze patterns and describe linear . . . relationships between two variables.	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
A2.D.1.3 Make predictions based upon the regression equation (linear . . .), and use the correlation coefficient to assess the reliability of those predictions using graphing technology.	Analyze and interpret linear models in the context of measurement and data. • Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference.
A2.D.1.3 Make predictions based upon the regression equation (linear [or] exponential . . .) . . .	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
A2.D.2.3 Differentiate between correlation and causation when describing the relationship between two variables.	Analyze and interpret linear models in the context of measurement and data. • Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference.
PC.F.1.1 Interpret characteristics of a function defined by an expression in the context of the situation.	Demonstrate an understanding of functions, apply functional notation, and evaluate functions. * • Understand the definition of a function in terms of its domain and range; Understand that f(x) denotes the graph of the ordered pairs of the output (the y-coordinates) corresponding to the input (the x-coordinates). • Use function notation to interpret linear and exponential functions and parts of these functions in real-world contexts. Evaluate linear and exponential functions given inputs from their domains. • Recognize that geometric and arithmetic sequences are functions that are defined

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	by determining the next number in the sequence (i.e., recursively). Describe the relationship between terms in a recursive sequence.
PC.F.1.2 Sketch the graph of a function that models a relationship between two quantities, identifying key features.	Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.
PC.F.1.2 Sketch the graph of a [linear, quadratic, or exponential] function that models a relationship between two quantities, identifying key features.	Analyze, compare, and contrast representations of linear, exponential and quadratic functions. • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way.
PC.F.1.2 Sketch the graph of a [radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational] function that models a relationship between two quantities, identifying key features.	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	(degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval.
PC.F.1.2 Sketch the graph of a [square root, cube root, piece-wise-defined, step-, absolute-value, polynomial functions of degree 3 or greater, logarithmic, trigonometric, and rational] function that models a relationship between two quantities, identifying key features.	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
PC.F.1.3 Interpret characteristics of graphs and tables for a function that models a relationship between two quantities in terms of the quantities.	Interpret linear and exponential functions in real-world and mathematical situations. * • For a linear or exponential function, interpret key features of graphs and tables in terms of the intercepts and the intervals on which the function is increasing or decreasing. • Sketch graphs of functions given the intercepts, the intervals on which the function is increasing or decreasing, and the end behavior. • Determine an appropriate domain of a function and describe its effect on the graph. • Determine the average rate of change of a linear or exponential function over a specified interval using an equation or table, or estimate the rate of change using a graph. Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing,

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.
PC.F.1.3 Interpret characteristics of graphs and tables for a [radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational] function that models a relationship between two quantities in terms of the quantities.	Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Determine an appropriate domain of a function and relate it to its graph. Use only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval.
PC.F.1.4 Describe end behavior, asymptotic behavior, and points of discontinuity.	Graphically solve systems of equations or inequalities, using linear, polynomial, rational, radical, absolute value, exponential and/or logarithmic equations or inequalities. [Systems do not include linear and linear; exponential and exponential; or linear and exponential equations. Linear and exponential are used in conjunction with one of the other types.]* Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. * • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior. Interpret a variety of functions, including radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, in real-world and mathematical situations. * • For radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions, interpret models represented as graphs and tables in terms of intercepts; intervals on which the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; and end behavior. • Sketch graphs of radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions using the intercepts; intervals on which the function is increasing or decreasing; intervals on which the function is positive or negative; symmetry; end behavior; and any maximums or minimums of the graphs. • Determine an appropriate domain of a function and relate it to its graph. Use

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	only functions that could be modeled by radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational functions. • Determine and interpret the average rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function presented in an equation or table over a specified interval. • Estimate the rate of change of a radical, piece-wise defined, step, absolute value, polynomial (degree 3 or higher), and/or rational function from a graph over a specified interval. Analyze, compare, and contrast representations of linear, exponential and quadratic functions. * • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way.
PC.F.1.5 Determine if a function has an inverse. Algebraically and graphically find the inverse or define any restrictions on the domain that meet the requirement for invertibility, and find the inverse on the restricted domain.	Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations. * • Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions,

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically. Demonstrate an understanding of the connection between exponential and logarithmic relationships. * • Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. • Translate between logarithmic equations of base 2, 10 or e, and their exponential forms. • Translate between equivalent forms of logarithmic equations.
PC.F.1.5 Determine if a [linear or quadratic] function has an inverse. Algebraically . . . find the inverse . . .	Determine whether a linear or quadratic function has an inverse that is also a function, and if so, write the inverse function.
PC.F.1.5 Determine if a [simple exponential, radical, absolute value, polynomial (degree 3 or greater), rational or logarithmic] function has an inverse. Algebraically . . . find the inverse . . .	Determine whether an exponential, simple radical, absolute value, polynomial (degree 3 or greater), rational, or logarithmic function has an inverse that is also a function, and if so, write an expression or equation for the inverse.
PC.F.2.1 Model relationships through composition . . .	Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations. • Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions, absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically.
PC.F.2.2 Rewrite a function as a composition of functions.	Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations. • Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions, absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically.
PC.F.2.4 Verify by analytical methods that one function is the inverse of another.	Construct new representations of a variety of functions from algebraic, graphical, numerical, or verbal representations. * • Create new functions using arithmetic operations by combining standard functions, such as linear functions, exponential functions, quadratic functions, square and cube root functions, polynomial functions, rational functions, logarithmic functions,

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	absolute value functions, piece-wise defined functions, step functions, etc. • Demonstrate an understanding of composition of functions; state the domain and range for newly composed functions and represent functions that are compositions of functions algebraically.
PC.F.3.1 Predict solutions involving functions that are quadratic, polynomial of higher order, rational, exponential, and logarithmic.	Interpret quadratic functions in real-world and mathematical situations. * • For quadratic functions, interpret models represented as graphs and tables in terms of the intercepts, maxima, minima, and intervals where the function is increasing and decreasing. • Sketch graphs of functions given the intercepts, intervals on which the function is increasing or decreasing, symmetry, end behavior, and a maximum or a minimum of the graph. • Determine an appropriate domain of a function for its graph, using only functions that could be modeled by quadratic functions or exponential functions with rational exponents. • Determine the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using an equation or table. • Estimate the average rate of change over a specified interval of a quadratic or exponential function with rational exponents using a graph.
PC.F.3.2 Graphically verify solutions involving functions that are quadratic, polynomial of higher order, rational, exponential, and logarithmic.	Analyze representations of quadratic, exponential, radical, piece-wise defined, step, absolute value, polynomial (degree 3 or greater) and/or rational functions. *

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Translate between algebraic representations of functions to highlight the properties of the functions. • Compare and contrast two functions that are represented in different ways. Analyze, compare, and contrast representations of linear, exponential and quadratic functions. * • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way. Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. * • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
PC.F.3.3 Algebraically verify solutions involving functions that are quadratic, polynomial of higher order, rational, exponential, and logarithmic.	Demonstrate an understanding of the connection between exponential and logarithmic relationships. * • Understand the inverse relationship between exponents and logarithms and use this relationship to solve problems involving logarithms and exponents. • Translate between logarithmic equations of base 2, 10 or e, and their exponential forms. • Translate between equivalent forms of logarithmic equations. Analyze representations of quadratic, exponential, radical, piece-wise defined, step, absolute value, polynomial (degree 3 or greater) and/or rational functions. * • Translate between algebraic representations of functions to highlight the properties of the functions. • Compare and contrast two functions that are represented in different ways. Analyze, compare, and contrast representations of linear, exponential and quadratic functions. * • Graph linear functions and specify intercepts. • Graph exponential functions, specify intercepts and explain end behavior. • Graph quadratic functions and specify intercepts. • Compare and contrast two linear, simple exponential, and/or quadratic functions, each represented in a different way.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PC.CS.1.2 Identify key features of conic sections (foci, directrix, radii, axes, asymptotes, center) graphically and algebraically.	Derive equations of simple conic sections: parabolas and circles.* • Use the Pythagorean theorem to derive the equation of a circle. • Find the center and radius of a circle given by completing the square. • Given the focus and directrix, derive the equation of a parabola.
PC.CS.1.4 Write the equation of a conic section [parabolas and circles] given its key features.	Derive equations of simple conic sections: parabolas and circles. • Use the Pythagorean theorem to derive the equation of a circle. • Find the center and radius of a circle given by completing the square. • Given the focus and directrix, derive the equation of a parabola.
PC.CS.1.5 Given the equation $ax^2 + by^2 + cx + dy + e = 0$, determine if the equation represents a circle, ellipse, parabola, or hyperbola.	Derive equations of simple conic sections: parabolas and circles.* • Use the Pythagorean theorem to derive the equation of a circle. • Find the center and radius of a circle given by completing the square. • Given the focus and directrix, derive the equation of a parabola.
PC.T.1.1 . . . [R]ecognize angles in standard position using radian measure . . .	Demonstrate an understanding of the unit circle and how it relates to trigonometric functions. • Demonstrate a conceptual understanding of radian measure as arc length • Demonstrate a conceptual understanding between angle measures represented in degrees or radians in all four quadrants of the unit circle
PC.T.1.2 Convert radian measure to degree measure and vice-versa.	Demonstrate an understanding of the unit circle and how it relates to trigonometric functions. *

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Demonstrate a conceptual understanding of radian measure as arc length • Demonstrate a conceptual understanding between angle measures represented in degrees or radians in all four quadrants of the unit circle Demonstrate an understanding of the properties of a sector of a circle and apply them to solve problems.* • Convert between radian measure and angle measure. • Recognize and show that #r is the length of the arc intercepted by an angle. • Recognize and show that (#r^2)/2 is the formula for the area of a sector of a circle.
PC.T.1.3 Find the length of an arc and the area of a sector on a circle.	Demonstrate an understanding of the properties of a sector of a circle and apply them to solve problems. • Convert between radian measure and angle measure. • Recognize and show that #r is the length of the arc intercepted by an angle. • Recognize and show that (#r^2)/2 is the formula for the area of a sector of a circle.
PC.T.1.4 Use special triangles to determine geometrically the values of sine, cosine, tangent for #/3, #/4 and #/6, and use the unit circle to express the values of sine, cosine, and tangent for # - x, # + x, and 2# - x in terms of their values for x, where x is any real number.	Use the unit circle to determine the lengths of the sides of special right triangles and to explain periodicity. • Use the unit circles and special right triangles to compute the values of the trigonometric ratios for angles with reference angles equal to 30, 45, 60, and 90 degrees • Explain periodicity using the unit circle • Explain even and odd symmetry using the unit circle

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PC.T.1.5 Use reference angles to determine the terminal point P(x, y) on the unit circle for a given angle.	Demonstrate an understanding of the unit circle and how it relates to trigonometric functions. * • Demonstrate a conceptual understanding of radian measure as arc length • Demonstrate a conceptual understanding between angle measures represented in degrees or radians in all four quadrants of the unit circle
PC.T.1.6 Estimate trigonometric values of any angle.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems. Use the unit circle to determine the lengths of the sides of special right triangles and to explain periodicity. * • Use the unit circles and special right triangles to compute the values of the trigonometric ratios for angles with reference angles equal to 30, 45, 60, and 90 degrees • Explain periodicity using the unit circle • Explain even and odd symmetry using the unit circle
PC.T.1.7 Apply the properties of a unit circle to explain symmetry (odd and even) and periodicity of trigonometric functions.	Use the unit circle to determine the lengths of the sides of special right triangles and to explain periodicity.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Use the unit circles and special right triangles to compute the values of the trigonometric ratios for angles with reference angles equal to 30, 45, 60, and 90 degrees • Explain periodicity using the unit circle • Explain even and odd symmetry using the unit circle
PC.T.1.8 Graph . . . trigonometric functions, identifying key features.	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior.
PC.T.1.9 Describe and analyze the relationships of the properties of a unit circle.	Demonstrate an understanding of the unit circle and how it relates to trigonometric functions. • Demonstrate a conceptual understanding of radian measure as arc length • Demonstrate a conceptual understanding between angle measures represented in degrees or radians in all four quadrants of the unit circle

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PC.T.2.1 Create models for situations involving trigonometry.	Use trigonometric functions to model periodic situations given the amplitude, frequency and midline
PC.T.2.4 Use inverse functions to solve trigonometric equations; evaluate the solution and interpret them in terms of context.	Use trigonometric functions to model periodic situations given the amplitude, frequency and midline*
PC.T.3.1 Algebraically manipulate the structure of a trigonometric expression to identify ways to rewrite it.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.
PC.T.3.2 Choose and produce an equivalent form of an expression to explain the properties of the quantity represented by the expression.	Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PC.T.3.3 Graphically and algebraically verify solutions to trigonometric equations.	Graph square root, cube root, piece-wise-defined, step-, absolute-value, logarithmic, trigonometric, and rational functions. * • Graph a variety of functions including square root, cube root, piece-wise-defined, step, and absolute value functions. • Graph polynomial functions of degree 3 or greater; identify the intercepts and describe end-behavior. • Graph logarithmic functions; identify and interpret intercepts, asymptotes, and end-behavior. • Graph trigonometric functions; identify and interpret midline, periodicity, amplitude, phase shift, and intercepts. • Determine an appropriate domain and range of a logarithmic or trigonometric function and relate them to its graph. • Graph rational functions; identify points of discontinuity, asymptotes, and end-behavior. Demonstrate an understanding of trigonometric ratios and use them to solve real-world and mathematical problems.* • Understand that sine, cosine, and tangent are ratios of sides in a right triangle and the ratios remain constant for each angle measure. • Demonstrate that sin x = cos (90-x), and use this fact to solve problems in right triangles. • Use first quadrant sine, cosine, and tangent ratios along with the Pythagorean Theorem to solve real world problems.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
PC.T.4.1 Use the relation $i^2 = -1$ and the mathematical properties to add, subtract, and multiply complex numbers.	Find and use conjugates of complex numbers * • Find the conjugate of a complex number • Find the moduli of complex numbers • Find quotients of complex numbers
PC.T.4.2 Find the conjugate of a complex number in rectangular forms and quotients of complex numbers.	Find and use conjugates of complex numbers * • Find the conjugate of a complex number • Find the moduli of complex numbers • Find quotients of complex numbers
PC.T.4.3 Solve quadratic equations in one variable that have complex solutions.	Demonstrate a deep understanding of complex numbers by using them in polynomial theorems and identities. * • Use complex numbers in rewriting algebraic expressions. • Determine the number of roots for a polynomial of any degree. • Prove that all quadratic polynomials have two roots. Use inspection and completing the square to solve quadratic equations.*
S.DA.1.1 Summarize and represent the distribution for univariate quantitative data by describing and analyzing the shape of the distribution, the measures of center for the distribution, the patterns in variability for the distribution, and any outliers, gaps, or other unusual features in the distribution.	Model, describe, and interpret representations of data in one variable. • Create box plots and histograms. • Compare the measures of central tendency and the distribution of two or more sets of data. • Explain the statistical differences in the context of the data sets; state why there is a difference in shape, center, or spread.
S.DA.1.2 . . . [C]reate an appropriate display (e.g., dot plots, histograms, box plots) for univariate data.	Model, describe, and interpret representations of data in one variable. • Create box plots and histograms.

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Compare the measures of central tendency and the distribution of two or more sets of data. • Explain the statistical differences in the context of the data sets; state why there is a difference in shape, center, or spread.
S.DA.1.3 Use statistics appropriate to the shape of the data distribution to compare center and variability of two or more different data sets.	Model, describe, and interpret representations of data in one variable.* • Create box plots and histograms. • Compare the measures of central tendency and the distribution of two or more sets of data. • Explain the statistical differences in the context of the data sets; state why there is a difference in shape, center, or spread.
S.DA.1.4 Describe and analyze the distribution of univariate categorical data.	Model, describe, and interpret representations of data in one variable.* • Create box plots and histograms. • Compare the measures of central tendency and the distribution of two or more sets of data. • Explain the statistical differences in the context of the data sets; state why there is a difference in shape, center, or spread.
S.DA.4.1 Create two-way tables for bivariate categorical data and analyze for possible associations between the two categories using marginal, joint, and conditional [relative] frequencies.	Analyze, describe and summarize categorical data represented in two-way frequency tables. • Analyze and interpret joint, marginal, and conditional relative frequencies in context. • Determine possible trends or associations in the data.
S.DA.4.2 . . . [D]raw conclusions from regression models (linear . . .) from two-variable quantitative data.	Analyze and interpret linear models in the context of measurement and data.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	• Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference.
S.DA.4.2 Make predictions and draw conclusions from regression models (linear [or] exponential . . .) from two-variable quantitative data.	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
S.DA.4.3 Analyze scatter plots for patterns, linearity, outliers, and influential points.	Analyze data on a scatter plot and determine a good model. • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	exponential model is a good fit for the data.
S.DA.4.4 Using technology, compute and interpret the correlation coefficient.	Analyze and interpret linear models in the context of measurement and data. • Analyze and interpret the slope and intercepts of a linear model. • Use technology to determine the correlation coefficient of a linear fit and use the correlation coefficient to describe how well the model fits the data. • Identify associations of data that are based on correlation versus causation and explain the difference.
S.DA.4.5 Understand the implications of extrapolating data to make predictions.	Analyze data on a scatter plot and determine a good model. * • Determine if a linear or exponential model is a good fit from a scatterplot of the data. • Determine a linear function that best fits data in a scatterplot that suggests a linear model or an exponential function that best fits data in a scatterplot that suggests an exponential model, and use the functions to estimate future trends. • Determine from a plot of the residuals of a scatterplot whether a linear model or exponential model is a good fit for the data.
S.P.1.1 Describe events as subsets of a sample space.	Demonstrate an understanding of sample spaces and independent events. • Use set notation and set vocabulary, such as union, intersection, and complement to describe sample spaces. • Identify independent events A and B as events such that the probability of A and B occurring is determined by

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
	multiplying the Probability of A by the Probability of B.
S.P.1.3 Use counting techniques . . . to solve mathematical and real-world problems, including determining probabilities of compound events.	Use introductory probability techniques and counting rules to evaluate outcomes and determine probabilities. • Use the formula P(B|A) = P(AnB)/P(A) to determine the conditional probability of A given B and interpret the answers in real world situations. • Use the Addition Rule for dependent and independent events, and interpret the answers in real world situations.
S.P.2.1 Understand that two events, A and B, are independent if the probability of A and B occurring together is the product of their probabilities, and use this characterization to determine if two events are independent.	Demonstrate an understanding of sample spaces and independent events. • Use set notation and set vocabulary, such as union, intersection, and complement to describe sample spaces. • Identify independent events A and B as events such that the probability of A and B occurring is determined by multiplying the Probability of A by the Probability of B.
S.P.2.2 Understand and calculate the conditional probability of A given B as P(A and B)/P(B).	Demonstrate an understanding of conditional probability and use conditional probability in real-world situations.* • Determine the conditional probability of A given B when A and B are dependent events. Identify that A and B are independent events if P(B) is not conditional upon the occurrence of A. • Represent bivariate data in two-way frequency tables and interpret the relative frequencies to determine conditional probabilities and whether events are independent or not. • Relate real world situations to conceptual understandings of conditional probability and independence.

**This skill is related to the aligned standard*

Grades 11 - 12 (continued)

Oklahoma Academic Standards for Mathematics	Aligned Diagnostic Skills
S.P.2.3 Interpret independence of A and B as saying that the conditional probability of A, given B, is the same as the probability of A.	Demonstrate an understanding of conditional probability and use conditional probability in real-world situations.* • Determine the conditional probability of A given B when A and B are dependent events. Identify that A and B are independent events if P(B) is not conditional upon the occurrence of A. • Represent bivariate data in two-way frequency tables and interpret the relative frequencies to determine conditional probabilities and whether events are independent or not. • Relate real world situations to conceptual understandings of conditional probability and independence.
S.P.3.1 Analyze decisions and strategies using . . . expected values.	Calculate expected values and use them to evaluate real-world decisions. • Find the expected profit or loss given a probability distribution in a context of a game of chance. • Make, evaluate, and compare high-level strategic and financial decisions based on expected values.
S.P.3.1 Analyze decisions and strategies using probability concepts . . .	Use probability techniques to evaluate outcomes of decisions for real-world situations. • Distinguish between probability events that are fair and unfair and random or not. • For unfair probability events, describe how to make a given outcome fair using probabilities. • Analyze real-world decisions and strategies using probability concepts.

**This skill is related to the aligned standard*