

Grade 8 Math Performance Level Descriptors

8th Grade Mathematics

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Cluster: 8.NS.A

Know that there are numbers that are not rational, and approximate them by rational numbers.

Standards:

- 8.NS.1 - Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.
- 8.NS.2 - Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (e.g. π^2). For example, for the approximation of $\sqrt{68}$, show that $\sqrt{68}$ is between 8 and 9 and closer to 8.

Standard: 8.NS.1

Know that numbers that are not rational are called irrational. Understand informally that every number has a decimal expansion; for rational numbers show that the decimal expansion repeats eventually, and convert a decimal expansion which repeats eventually into a rational number.

Evidence Statements			
1. The student classifies real numbers as rational or irrational. 2. The student converts between fractions and decimals.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to differentiate among terminating decimals, repeating decimals, and non-repeating decimals.• Students should be able to convert terminating decimals to the hundredths place to fractions.	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to classify numbers as rational or irrational.• Students should be able to understand that every rational number has a decimal expansion that terminates or repeats.• Students should be able to convert terminating decimals and repeating decimals with a single repeating digit to fractions.	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to classify numbers as rational or irrational and generate examples of irrational numbers.• Students should be able to convert repeating decimals to fractions.	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to use conversion between fractions and decimals in real-world situations.

Standard: 8.NS.2

Use rational approximations of irrational numbers to compare the size of irrational numbers, locate them approximately on a number line diagram, and estimate the value of expressions (*e.g.* π^2). For example, for the approximation of $\sqrt{68}$, show that $\sqrt{68}$ is between 8 and 9 and closer to 8.

Evidence Statements			
<ol style="list-style-type: none"> 1. The student writes approximations of irrational numbers as rational numbers. 2. The student compares irrational numbers by using rational approximations of irrational numbers. 3. The student approximates the locations of irrational numbers on a number line by using rational approximations of irrational numbers. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to recognize that irrational square roots can be compared and ordered using the radicands. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use rational approximations to compare rational and irrational numbers. • Students should be able to identify approximate locations of irrational numbers between two perfect squares on a number line. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use rational approximations to compare rational and irrational numbers to solve a problem. • Students should be able to use rational approximations of irrational numbers to estimate their locations on a number line. • Students should be able to use approximations of irrational numbers to estimate the value of expressions. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to explore and explain whether a radical’s placement between two whole numbers is proportional to the radicand’s placement between two perfect squares. • Students should be able to use approximations of irrational numbers to solve problems.

Cluster: 8.EE.A

Work with radicals and integer exponents.

Standards:

- 8.EE.1 - Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of whole number perfect squares with solutions between 0 and 15 and cube roots of whole number perfect cubes with solutions between 0 and 5. Know that $\sqrt{2}$ is irrational.
- 8.EE.2 - Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9 , and determine that the world population is more than 20 times larger.*
- 8.EE.3 - Read and write numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (*e.g. use millimeters per year for seafloor spreading*). Interpret scientific notation that has been generated by technology.

Standard: 8.EE.1

Use square root and cube root symbols to represent solutions to equations of the form $x^2 = p$ and $x^3 = p$, where p is a positive rational number. Evaluate square roots of whole number perfect squares with solutions between 0 and 15 and cube roots of whole number perfect cubes with solutions between 0 and 5. Know that $\sqrt{2}$ is irrational.

Evidence Statements			
<ol style="list-style-type: none">1. The student solves equations of the form $x^2 = p$ by representing solutions using a square root symbol or by evaluating the square root of whole-number perfect squares with solutions between 0 and 15.2. The student solves equations of the form $x^3 = p$ by representing solutions using a cube root symbol or by evaluating the cube root of whole-number perfect cubes with solutions between 0 and 5.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to solve equations of the form $x^2 = p$ by evaluating the square root of whole-number perfect squares with solutions between 0 and 5.	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to solve equations of the form $x^2 = p$ by representing solutions using a square root symbol or by evaluating the square root of whole-number perfect squares with solutions between 0 and 10.• Students should be able to recognize when solutions found this way are irrational numbers.	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to solve equations of the form $x^2 = p$ by representing solutions using a square root symbol or by evaluating the square root of a whole-number perfect square with a solution between 0 and 15.• Students should be able to solve equations of the form $x^3 = p$ by representing solutions using a cube root symbol or by evaluating the cube root of whole-number	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to solve equations of the form $x^2 = p$ by representing solutions using a square root symbol or by evaluating the square root of whole-number perfect squares with solutions between 0 and 25.• Students should be able to solve equations of the form $x^3 = p$ by representing solutions using a cube root symbol or by evaluating the cube root of whole-number

		<p>perfect cubes with solutions between 0 and 5.</p> <ul style="list-style-type: none"> • Students should be able to explain why some solutions are irrational numbers and what that means about those solutions. 	<p>perfect cubes with solutions between 0 and 20.</p> <ul style="list-style-type: none"> • Students should be able to use place value and multiplicative reasoning to find square roots of decimal perfect squares that are related to known whole-number perfect squares (e.g., $\sqrt{0.16} = 0.4$) and decimal perfect cubes that are related to known whole-number perfect cubes (e.g., $\sqrt[3]{0.027} = 0.3$).
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Standard: 8.EE.2

Use numbers expressed in the form of a single digit times an integer power of 10 to estimate very large or very small quantities, and to express how many times as much one is than the other. *For example, estimate the population of the United States as 3×10^8 and the population of the world as 7×10^9 , and determine that the world population is more than 20 times larger.*

Evidence Statements			
<ol style="list-style-type: none">1. The student uses scientific notation to represent very large or very small numbers.2. The student states how many times larger or smaller a number, written in scientific notation, is than another number.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to represent very large numbers in the form of a single digit times a positive power of 10.	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to represent very large or very small numbers in the form of a single digit times an integer power of 10.• Students should be able to make multiplicative comparisons of whole numbers given in the form of a single digit times an integer power of 10.	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to make multiplicative comparisons of rational numbers given in the form of a single digit times an integer power of 10.	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to interpret real-world problems using multiplicative comparisons of numbers given in the form of a single digit times an integer power of 10.

Standard: 8.EE.3

Read and write numbers expressed in scientific notation, including problems where both decimal and scientific notation are used. Use scientific notation and choose units of appropriate size for measurements of very large or very small quantities (*e.g. use millimeters per year for seafloor spreading*). Interpret scientific notation that has been generated by technology.

Evidence Statements			
<ol style="list-style-type: none"> 1. The student uses scientific notation to represent very large or very small numbers. 2. The student states how many times larger or smaller a number, written in scientific notation, is than another number. 3. The student converts between standard form and scientific notation. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to convert numbers given in scientific notation, with a one-digit whole number times a whole-number power of 10, to standard form. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to convert numbers from standard form to scientific notation, with a one-digit whole number times a whole-number power of 10. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to convert numbers between standard form and scientific notation, including values generated by technology. • Students should be able to use scientific notation and choose units of appropriate size for realistic measurements. • Students should be able to estimate quantities to express how many times larger or smaller one quantity is than another, using scientific notation. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to convert a value or rate given in one unit to an equivalent value or rate in another unit. • Students should be able to explain why one unit of measurement is not appropriate and choose a more appropriate unit.

Cluster: 8.EE.B

Understand the connections between proportional relationships, lines, and linear equations

Standards:

- 8.EE.4 - Graph proportional relationships, interpreting its unit rate as the slope (m) of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*
- 8.EE.5 - Use similar triangles to explain why the slope (m) is the same between any two distinct points on a nonvertical line in the coordinate plane and extend to include the use of the slope formula ($m = (y_2 - y_1) / (x_2 - x_1)$) when given two coordinate points (x_1, y_1) and (x_2, y_2) . Generate the equation $y = mx$ for a line through the origin (proportional) and the equation $y = mx + b$ for a line with slope m intercepting the vertical axis at y -intercept b (not proportional when $b \neq 0$).
- 8.EE.6 - Describe the relationship between the proportional relationship expressed in $y = mx$ and the nonproportional linear relationship $y = mx + b$ as a result of a vertical translation. *Note: be clear with students that all linear relationships have a constant rate of change (slope), but only the special case of proportional relationships (line that goes through the origin) continue to have a **constant of proportionality**.*

Standard: 8.EE.4

Graph proportional relationships, interpreting its unit rate as the slope (m) of the graph. Compare two different proportional relationships represented in different ways. *For example, compare a distance-time graph to a distance-time equation to determine which of two moving objects has greater speed.*

Evidence Statements			
<ol style="list-style-type: none">1. The student graphs proportional relationships.2. The student interprets the unit rate as the slope of the graph of a proportional relationship.3. The student compares two different proportional relationships.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to compare two different proportional relationships represented in the same way.	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to use a graph of a proportional relationship on the coordinate plane to identify the slope and y-intercept.	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to graph a proportional relationship on a coordinate plane and interpret the slope and unit rate.	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to compare three or more different proportional relationships given in two different ways.

Standard: 8.EE.5

Use similar triangles to explain why the slope (m) is the same between any two distinct points on a nonvertical line in the coordinate plane and extend to include the use of the slope formula ($m = (y_2 - y_1)/(x_2 - x_1)$) when given two coordinate points (x_1, y_1) and (x_2, y_2)). Generate the equation $y = mx$ for a line through the origin (proportional) and the equation $y = mx + b$ for a line with slope m intercepting the vertical axis at y -intercept b (not proportional when $b \neq 0$).

Evidence Statements			
<ol style="list-style-type: none"> 1. The student uses similar triangles to determine the slope m and explain why it is the same between any two distinct points on a non-vertical line in the coordinate plane. 2. The student calculates the slope of a line when given two coordinate points. 3. The student generates the equation $y = mx$ or $y = mx + b$ for a line. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to generate the equation $y = mx$ for a proportional relationship shown in a graph. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to generate the equation $y = mx$ or $y = mx + b$ for a line, given a graph. • Students should be able to recognize that any two pairs of points on a line can be used to draw similar right triangles, where the segment between the points is the hypotenuse. • Students should be able to determine the slope and y-intercept of a graphed line. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Student should be able to generate the equation $y = mx$ or $y = mx + b$ for a line, represented in a variety of ways. • Students should be able to recognize that any two pairs of points on a line can be used to draw similar right triangles, and explain why the slope is constant. • Students should be able to use any two coordinate points to calculate the slope of a line. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to generate an equation in the form $y = mx + b$ (where $b \neq 0$) to represent a line, given one coordinate point and the slope of the line.

Standard: 8.EE.6

Describe the relationship between the proportional relationship expressed in $y = mx$ and the nonproportional linear relationship $y = mx + b$ as a result of a vertical translation. *Note: be clear with students that all linear relationships have a constant rate of change (slope), but only the special case of proportional relationships (line that goes through the origin) continue to have a constant of proportionality.*

Evidence Statement			
1. The student identifies and describes the relationship between the proportional relationship $y = mx$ and the non-proportional linear relationship $y = mx + b$.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to identify a vertical translation of $y = mx$ as an equation in the form $y = mx + b$, given a graph that shows both lines. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to identify a vertical translation of $y = mx$ as an equation in the form $y = mx + b$, given a graph of one line and a verbal description of the translation. Students should be able to recognize that equations of the form $y = mx$ and $y = mx + b$ have the same slope if m is equal, despite going through different coordinates. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to identify a vertical translation of $y = mx$ as an equation in the form $y = mx + b$, given a verbal description of the translation. Students should be able to explain that equations of the form $y = mx$ and $y = mx + b$ have the same slope if m is equal, but that only the $y = mx$ relationship has a constant of proportionality that relates its x- and y-values. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to interpret and generate real-world situations that can be represented using the vertical translation between $y = mx$ and $y = mx + b$. Students should be able to identify a vertical translation of $y = mx$ as an equation in the form $y = mx + b$, given pairs of coordinates for each.

Cluster: 8.EE.C

Analyze and solve linear equations and inequalities.

Standards:

8.EE.7 - Fluently (efficiently, accurately, and flexibly) solve one-step, two-step, and multi-step linear equations and inequalities in one variable, including situations with the same variable appearing on both sides of the equal sign.

8.EE.7a - Give examples of linear equations in one variable with one solution ($x = a$), infinitely many solutions ($a = a$), or no solutions ($a = b$). Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

8.EE.7b - Solve linear equations and inequalities with rational number coefficients, including equations/inequalities whose solutions require expanding and/or factoring expressions using the distributive property and collecting like terms.

Standard: 8.EE.7

Fluently (efficiently, accurately, and flexibly) solve one-step, two-step, and multi-step linear equations and inequalities in one variable, including situations with the same variable appearing on both sides of the equal sign.

8.EE.7a - Give examples of linear equations in one variable with one solution ($x = a$), infinitely many solutions ($a = a$), or no solutions ($a = b$). Show which of these possibilities is the case by successively transforming the given equation into simpler forms, until an equivalent equation of the form $x = a$, $a = a$, or $a = b$ results (where a and b are different numbers).

8.EE.7b - Solve linear equations and inequalities with rational number coefficients, including equations/inequalities whose solutions require expanding and/or factoring expressions using the distributive property and collecting like terms.

Evidence Statements			
<ol style="list-style-type: none"> 1. The student identifies and writes examples of linear equations in one variable with one solution, infinitely many solutions, or no solutions. 2. The student solves linear equations and inequalities in one variable with rational-number coefficients, including equations whose solutions require expanding and factoring expressions. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve one- and two-step linear equations in one variable with integer coefficients, with the variable appearing on one side of the equal sign. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve multistep linear equations in one variable with rational-number coefficients, with the variable appearing on one side of the equal sign. • Students should be able to identify linear equations that have one solution, infinitely 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve and produce examples of multistep linear equations in one variable, with the variable appearing on both sides of the equal sign, including situations that have one solution, infinitely many solutions, or no solutions. • Students should be able to solve and produce examples 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve and produce examples of linear inequalities in one variable, with the variable appearing on both sides of the inequality sign. • Students should be able to solve and produce examples of multistep linear inequalities in one variable, with rational coefficients, with

	<p>many solutions, or no solutions.</p> <ul style="list-style-type: none">• Students should be able to solve one- and two-step linear inequalities in one variable with integer coefficients, with the variable appearing on one side of the inequality sign.	<p>of multistep linear inequalities in one variable, with rational coefficients, with the variable appearing on one side of the inequality sign.</p>	<p>the variable appearing on both sides of the inequality sign.</p>
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Cluster: 8.F.A

Define, evaluate, and compare functions.

Standards:

- 8.F.1 - Explain that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (*Function notation is not required in Grade 8.*)
- 8.F.2 - Compare properties of two linear functions represented in a variety of ways (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change, the greater y-intercept, or the point of intersection.*
- 8.F.3 - Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1,1), (2,4) and (3,9), which are not on a straight line.*

Standard: 8.F.1

Explain that a function is a rule that assigns to each input exactly one output. The graph of a function is the set of ordered pairs consisting of an input and the corresponding output. (*Function notation is not required in Grade 8.*)

Evidence Statements			
1. The student recognizes that a function is a rule that assigns to each input exactly one output.			
2. The student identifies or produces input and output pairs for given functions.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:
<ul style="list-style-type: none">• Students should be able to identify whether a relationship represented graphically is a function.	<ul style="list-style-type: none">• Students should be able to identify whether a relationship represented graphically or numerically in a table is a function.• Students should be able to identify whether an input-output pair satisfies a function.	<ul style="list-style-type: none">• Students should be able to identify whether a relationship represented algebraically, graphically, or numerically in a table is a function, which is a rule that assigns exactly one output to each input.• Students should be able to identify whether an input-output pair satisfies a function and produce input-output pairs for a given function.	<ul style="list-style-type: none">• Students should be able to distinguish function or non-function relationships in real-world contexts (e.g., that one output per input means that there can only be one total price for a purchase of x items, one total distance traveled in x minutes, and so on); students should understand that allowing more than one output per input for these concepts would not work in the real world.

Standard: 8.F.2

Compare properties of two linear functions represented in a variety of ways (algebraically, graphically, numerically in tables, or by verbal descriptions). *For example, given a linear function represented by a table of values and a linear function represented by an algebraic expression, determine which function has the greater rate of change, the greater y-intercept, or the point of intersection.*

Evidence Statements			
<ol style="list-style-type: none"> 1. The student recognizes the same linear function represented in different ways (algebraically, graphically, numerically in tables, or by verbal descriptions). 2. The student compares properties of two linear functions represented in a variety of ways (algebraically, graphically, numerically in tables, or by verbal descriptions). 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to recognize the same linear function represented numerically by two sets of input and output values in a table. • Students should be able to compare the y-intercepts of two different linear functions presented numerically in tables. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to recognize the same linear function represented numerically in a table and graphically. • Students should be able to compare the slopes and y-intercepts of two different linear functions presented in the same way (numerically in tables or graphically). 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to compare the slopes and y-intercepts of two different linear functions presented in a variety of ways (algebraically, graphically, numerically in tables, or by verbal descriptions), as well as finding the point of intersection of the two lines. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to analyze real-world scenarios involving linear relationships, and create or describe the equation of a new linear function based on its comparison to a given function.

Standard: 8.F.3

Interpret the equation $y = mx + b$ as defining a linear function, whose graph is a straight line; give examples of functions that are not linear. *For example, the function $A = s^2$ giving the area of a square as a function of its side length is not linear because its graph contains the points (1, 1), (2, 4) and (3, 9), which are not on a straight line.*

Evidence Statements			
1. The student interprets the equation $y = mx + b$ as defining a linear function with a graph that is a straight line.			
2. The student recognizes and gives examples of functions that are not linear.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to determine whether a function is linear by its graph.	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to recognize that $y = mx + b$ defines a linear function, whose graph is always a straight line.• Students should be able to classify linear and nonlinear functions by their graphs.	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to explain that $y = mx + b$ defines a linear function, whose graph is always a straight line.• Students should be able to classify functions as linear or nonlinear when represented in a variety of ways.	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to analyze functions and justify why they are linear or nonlinear.

Cluster: 8.F.B

Use functions to model relationships between quantities.

Standards:

8.F.4 - Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

8.F.5 - Describe qualitatively the functional relationship between two quantities by analyzing a graph (*e.g. where the function is increasing or decreasing, linear or nonlinear*). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Standard: 8.F.4

Construct a function to model a linear relationship between two quantities. Determine the rate of change and initial value of the function from a description of a relationship or from two (x, y) values, including reading these from a table or from a graph. Interpret the rate of change and initial value of a linear function in terms of the situation it models, and in terms of its graph or a table of values.

Evidence Statements			
<ol style="list-style-type: none"> 1. The student constructs a function to model a linear relationship between two quantities. 2. The student determines the rate of change and initial value (y-intercept) of a function from a description of a relationship or from two (x, y) values. 3. The student interprets features of a linear function, such as rate of change and initial value, in terms of the situation it models, its graph, or a table of values. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to identify a graphical or tabular model that represents a linear relationship between two quantities. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to identify a function that represents a linear relationship between two quantities from a graph, a verbal description of the relationship, or two (x, y) values. • Students should be able to determine the rate of change and initial value of a graphed linear function. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to construct a function that represents a linear relationship between two quantities from a graph, a verbal description of the relationship, or two (x, y) values. • Students should be able to determine the rate of change and initial value of a linear function from a graph, a verbal description of the relationship, or two (x, y) values. • Students should be able to analyze a graph of a linear function to 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to compare two or more rates of change for two or more linear functions that represent relationships within the same context (e.g., the distance of two or more racers from the finish line).

		<p>qualitatively describe it.</p> <ul style="list-style-type: none">• Students should be able to interpret the rate of change and initial value of a linear function, in terms of the situation it models and in terms of its graph or a table of values.	
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Standard: 8.F.5

Describe qualitatively the functional relationship between two quantities by analyzing a graph (*e.g. where the function is increasing or decreasing, linear or nonlinear*). Sketch a graph that exhibits the qualitative features of a function that has been described verbally.

Evidence Statements			
1. The student qualitatively describes the functional relationship between two quantities by analyzing a graph.			
2. The student identifies a graph that exhibits the qualitative features of a function that has been described verbally.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:
<ul style="list-style-type: none">• Students should be able to identify the graph of a linear function that has been described verbally.	<ul style="list-style-type: none">• Students should be able to identify the functional relationship between two quantities, related linearly, by analyzing a graph.	<ul style="list-style-type: none">• Students should be able to describe qualitatively the functional relationship between two quantities by analyzing a graph.• Students should be able to sketch a graph that exhibits the qualitative features of a function that has been described verbally.	<ul style="list-style-type: none">• Students should be able to compare the graph of a linear function and a nonlinear function by qualitatively describing the relationships they show.

Cluster: 8.G.A

Geometric measurement: understand concepts of angle and measure angles.

Standards:

- 8.G.1 - Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:
- 8.G.1a - An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the **circular arc** between the points where the two rays intersect the circle. An angle that turns through $1/360$ of a circle is called a “one-degree angle,” and can be used to measure angles.
 - 8.G.1b - An angle that turns through n one-degree angles is said to have an angle measure of n degrees.
- 8.G.2 - Measure angles in whole-number degrees using a protractor. Draw angles of specified measure using a protractor and straight edge.
- 8.G.3 - Recognize angle measure as additive. When an angle is **decomposed** into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, *e.g. by using an equation with a symbol for the unknown angle measure*.
- 8.G.4 - Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure.
- 8.G.5 - Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*
- 8.G.6 - Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on drawing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Standard: 8.G.1

Recognize angles as geometric shapes that are formed wherever two rays share a common endpoint, and understand concepts of angle measurement:

8.G.1a - An angle is measured with reference to a circle with its center at the common endpoint of the rays, by considering the fraction of the **circular arc** between the points where the two rays intersect the circle. An angle that turns through $1/360$ of a circle is called a “one-degree angle,” and can be used to measure angles.

8.G.1b - An angle that turns through n one-degree angles is said to have an angle measure of n degrees.

Evidence Statement			
1. The student relates the concept of an angle to the fraction of a circular arc between two points on a circle.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to recognize that an angle is formed by two rays with a common endpoint.• Students should be able to recognize that an angle that turns through $1/360$ of a circle is called a “one-degree angle.”	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to relate angle measurement to a circle with its center at the common endpoint of the rays; this measurement is determined by the fraction of the circular arc between the points where the two rays intersect the circle.	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to recognize that an angle that turns through n one-degree angles has an angle measure of n degrees.	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to explain how an angle is measured with reference to a circle with its center at the common endpoint of the rays, and how the angle measure is the same as the fraction of the circular arc between the points where the two rays intersect the circle.

Standard: 8.G.2

Measure angles in whole-number degrees using a protractor. Draw angles of specified measure using a protractor and straight edge.

Evidence Statement			
1. The student uses a protractor to measure angles and construct angles to whole-number degrees.			
Performance Level Descriptors (PLDs)			
Level 1 Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:	Level 2 Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:	Level 3 Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:	Level 4 Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:
<ul style="list-style-type: none">Students should be able to measure 90- and 180-degree angles using a protractor aligned with a horizontal ray.	<ul style="list-style-type: none">Students should be able to measure angles in whole-number degrees, from 0 to 90, using a protractor aligned with a horizontal ray.	<ul style="list-style-type: none">Students should be able to measure angles in whole-number degrees, from 0 to 180, using a protractor.Students should be able to draw angles of specified measures using a protractor and straight edge, where one ray of the angle is horizontal.	<ul style="list-style-type: none">Students should be able to draw angles that do not have a horizontal ray.Students should be able to solve real-world problems involving angle measurement.Students should be able to devise a strategy to use a protractor to measure angles between 180 and 360 degrees.

Standard: 8.G.3

Recognize angle measure as additive. When an angle is decomposed into non-overlapping parts, the angle measure of the whole is the sum of the angle measures of the parts. Solve addition and subtraction problems to find unknown angles on a diagram in real world and mathematical problems, *e.g. by using an equation with a symbol for the unknown angle measure.*

Evidence Statements			
<ol style="list-style-type: none"> 1. The student decomposes an angle into smaller, non-overlapping parts and adds the measures of these smaller parts to calculate the measure of the whole angle. 2. The student determines the measure of an unknown angle on a diagram in real-world and mathematical problems. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve addition problems to find unknown angles on a diagram in mathematical problems, by recognizing angle measurement as additive when an angle is decomposed into non-overlapping parts. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve addition problems to find unknown angles on a diagram in mathematical and real-world problems, by recognizing angle measurement as additive when an angle is decomposed into non-overlapping parts. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve addition and subtraction problems to find unknown angles on a diagram in real-world and mathematical problems, by recognizing angle measurement as additive when an angle is decomposed into non-overlapping parts. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to create addition and subtraction word problems, in mathematical and real-world contexts, for angles represented on a diagram.

Standard: 8.G.4

Use facts about supplementary, complementary, vertical, and adjacent angles in a multi-step problem to write and use them to solve simple equations for an unknown angle in a figure.

Evidence Statement			
1. The student identifies and solves multistep problems involving supplementary, complementary, vertical, and adjacent angles.			
Performance Level Descriptors (PLDs)			
Level 1 Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:	Level 2 Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:	Level 3 Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:	Level 4 Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:
<ul style="list-style-type: none">Students should be able to identify supplementary, complementary, vertical, and adjacent angles in a diagram.	<ul style="list-style-type: none">Students should be able to use facts about supplementary, complementary, vertical, and adjacent angles to solve one-step equations for an unknown angle in a figure.	<ul style="list-style-type: none">Students should be able to use facts about supplementary, complementary, vertical, and adjacent angles in a multistep problem to solve simple equations for an unknown angle in a figure.	<ul style="list-style-type: none">Students should be able to use facts about supplementary, complementary, vertical, and adjacent angles in multistep problems to write and solve simple equations for an unknown angle in a figure, and explain the solution.

Standard: 8.G.5

Use informal arguments to establish facts about the angle sum and exterior angle of triangles, about the angles created when parallel lines are cut by a transversal, and the angle-angle criterion for similarity of triangles. *For example, arrange three copies of the same triangle so that the sum of the three angles appears to form a line, and give an argument in terms of transversals why this is so.*

Evidence Statement			
1. The student draws, constructs, and describes geometric shapes given certain conditions.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to recognize that the sum of the interior angles of a triangle equals 180. • Students should be able to identify angle pairs when parallel lines are cut by a transversal. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to find unknown angle measures in a triangle and unknown angle measures for angle pairs when parallel lines are cut by a transversal. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to explain why corresponding angles are congruent when parallel lines are cut by a transversal, and which other angles are congruent or supplementary, and use them to solve problems. • Students should be able to use visual arguments to explain why the angle-angle criterion can be used to prove similar triangles. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to give an informal argument that a triangle can only have one 90-degree angle. • Students should be able to give an informal argument for the pairs of angles that are supplementary when parallel lines are cut by a transversal.

Standard: 8.G.6

Draw (freehand, with ruler and protractor, and with technology) geometric shapes with given conditions. Focus on drawing triangles from three measures of angles or sides, noticing when the conditions determine a unique triangle, more than one triangle, or no triangle.

Evidence Statement			
1. The student draws, constructs, and describes geometric shapes given certain conditions.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to, when given three side measurements, notice if the conditions determine a unique triangle or not.	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to describe triangles given three angle measures and determine when the conditions are met for a unique triangle, more than one triangle, or no triangle.	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to draw and describe triangles given angle and side measures, determining when the conditions are met for a unique triangle, more than one triangle, or no triangle.	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to draw and describe quadrilaterals with given angle and side measures.

Cluster: 8.G.B

Understand and apply the Pythagorean Theorem.

Standards:

8.G.7 - Explain a proof of the Pythagorean Theorem and its converse.

8.G.8 - Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. *For example: Finding the slant height of pyramids and cones.*

8.G.9 - Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Standard: 8.G.7

Explain a proof of the Pythagorean Theorem and its converse.

Evidence Statement			
1. The student constructs the Pythagorean Theorem proof and its converse.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to describe the Pythagorean Theorem and how it is used to solve problems with triangles.	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to identify an appropriate reason behind a step in the proof of the Pythagorean Theorem and its converse.• Students should be able to test the Pythagorean Theorem to confirm if a triangle is a right triangle.	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to describe an appropriate reason behind each step in the proof of the Pythagorean Theorem and its converse, and order each step in the proof.	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to identify an error in a step of a proof of the Pythagorean Theorem and its converse, explain why the step has an error, and correct the error with the correct step and reason behind the step.

Standard: 8.G.8

Apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. *For example: Finding the slant height of pyramids and cones.*

Evidence Statement			
1. The student solves real-world and mathematical problems involving right triangles in two and three dimensions by knowing and applying the Pythagorean Theorem and its converse.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to apply the Pythagorean Theorem to determine the hypotenuse of right triangles in mathematical problems in two dimensions. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two dimensions. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to apply the Pythagorean Theorem to determine unknown side lengths in right triangles in real-world and mathematical problems in two and three dimensions. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to apply the Pythagorean Theorem to solve multistep problems that involve finding unknown side lengths in right triangles from composite shapes, in real-world and mathematical problems in two and three dimensions.

Standard: 8.G.9

Apply the Pythagorean Theorem to find the distance between two points in a coordinate system.

Evidence Statement			
1. The student calculates the distance between two points in a coordinate system by knowing and applying the Pythagorean Theorem.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to apply the Pythagorean Theorem to find the whole-number length of the hypotenuse of a right triangle in Quadrant I of the coordinate plane.	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to apply the Pythagorean Theorem to find the length of any side of a right triangle in Quadrant I of the coordinate plane.	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to apply the Pythagorean Theorem to find the length of any side of a right triangle in any quadrant of the coordinate plane• Students should be able to find the distance between any two points on the coordinate plane using the Pythagorean Theorem.	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none">• Students should be able to use the Pythagorean Theorem to generate a triangle on the coordinate plane, given the length of each side and two points.• Students should be able to apply the Pythagorean Theorem when given all vertices of a triangle to determine if the triangle is a right triangle.

Cluster: 8.G.C

Solve real-world and mathematical problems involving measurement.

Standards:

8.G.10 - Use the formulas or informal reasoning to find the arc length, areas of sectors, surface areas and volumes of pyramids, cones, and spheres. *For example, given a circle with a 60° central angle, students identify the arc length as $\frac{1}{6}$ of the total circumference ($\frac{1}{6} = \frac{60}{360}$).*

8.G.11 - Investigate the relationship between the formulas of three dimensional geometric shapes;

8.G.11.a - Generalize the volume formula for pyramids and cones ($V = \frac{1}{3} Bh$).

8.G.11.b - Generalize surface area formula of pyramids and cones ($SA = B + \frac{1}{2} Pl$).

8.G.12 - Solve real-world and mathematical problems involving arc length, area of two-dimensional shapes including sectors, volume and surface area of three-dimensional objects including pyramids, cones and spheres.

Standard: 8.G.10

Use the formulas or informal reasoning to find the arc length, areas of sectors, surface areas and volumes of pyramids, cones, and spheres. *For example, given a circle with a 60° central angle, students identify the arc length as 1/6 of the total circumference ($1/6 = 60/360$).*

Evidence Statements			
<ol style="list-style-type: none"> 1. The student solves real-world and mathematical problems involving arc length and area of sectors. 2. The student solves real-world and mathematical problems by applying the volume formulas for pyramids, cones, and spheres. 3. The student solves real-world and mathematical problems by applying the surface area formulas for pyramids, cones, and spheres. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use formulas to find the arc length of sectors in mathematical problems. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use formulas or informal reasoning to find the arc length and area of sectors in mathematical problems. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use formulas or informal reasoning to find the arc length and area of sectors in real-world problems. • Students should be able to find the surface area of pyramids, cones, and spheres. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use formulas or informal reasoning to find the arc length of sectors, area of sectors, and surface area and volume of pyramids, cones, and spheres.

Standard: 8.G.11

Investigate the relationship between the formulas of three dimensional geometric shapes;

8.G.11.a - Generalize the volume formula for pyramids and cones ($V = 1/3 Bh$).

8.G.11.b - Generalize surface area formula of pyramids and cones ($SA = B + 1/2 Pl$).

Evidence Statements			
<ol style="list-style-type: none"> 1. The student solves real-world and mathematical problems by applying the volume formulas for pyramids, cones, and spheres. 2. The student solves real-world and mathematical problems by applying the surface-area formulas for pyramids, cones, and spheres. 			
Performance Level Descriptors (PLDs)			
<p style="text-align: center;">Level 1</p> <p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use the volume formula for pyramids and cones ($V = 1/3Bh$) to find the volume given the area of the base and the height. 	<p style="text-align: center;">Level 2</p> <p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to use the volume formula for pyramids and cones ($V = 1/3Bh$) to find the volume given the height and the dimensions to find the area of the base. • Students should be able to use the surface area formula for pyramids and cones ($S.A. = B + 1/2Pl$) to find the surface area given the dimensions of the base, the perimeter of the base, and the slant height. 	<p style="text-align: center;">Level 3</p> <p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to generalize the volume formula for pyramids and cones by connecting them to the concept of prisms and cylinders. • Students should be able to generalize the surface area formula for pyramids and cones by connecting them to the concept of prisms and cylinders. • Students should be able to use the formulas to find the area of the base, the height, or 	<p style="text-align: center;">Level 4</p> <p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to explain how $V = 1/3Bh$ applies because a pyramid or cone occupies 1/3 the space of a prism or cylinder with the same base and height (regardless of base shape). • Students should be able to explain how $S.A. = B + 1/2Pl$ captures the concept that the lateral surface area is calculated based on the base perimeter and slant height, even though the way it unfolds differs between pyramids and cones.

		the volume of pyramids and cones.	
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Standard: 8.G.12

Solve real-world and mathematical problems involving arc length, area of two-dimensional shapes including sectors, volume and surface area of three-dimensional objects including pyramids, cones and spheres.

Evidence Statements			
<ol style="list-style-type: none"> 1. The student solves real-world and mathematical problems by applying the volume formulas for pyramids, cones, and spheres. 2. The student solves real-world and mathematical problems by applying the surface area formulas for pyramids, cones, and spheres. 			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve mathematical problems that involve arc length and area of two-dimensional shapes, including sectors. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve mathematical problems that involve arc length; area of two-dimensional shapes, including sectors; and volume of pyramids and cones. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to solve real-world and mathematical problems that involve arc length; area of two-dimensional shapes, including sectors; and volume and surface area of three-dimensional shapes, including pyramids, cones, and spheres. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> • Students should be able to identify and correct errors in sample student work that aims to solve multistep real-world and mathematical problems that involve arc length; area of two-dimensional shapes, including sectors; and volume and surface area of three-dimensional shapes, including pyramids, cones, and spheres.

Cluster: 8.SP.A

Investigate patterns of association in bivariate data.

Standards:

- 8.SP.1 - Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.
- 8.SP.2 - Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.
- 8.SP.3 - Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

Standard: 8.SP.1

Construct and interpret scatter plots for bivariate measurement data to investigate patterns of association between two quantities. Describe patterns such as clustering, outliers, positive or negative association, linear association, and nonlinear association.

Evidence Statement			
1. The student describes and interprets patterns of association between two quantities in a scatter plot.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to identify the type of association (positive, negative, no association) on a given scatter plot for bivariate measurement data.	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to construct scatter plots for bivariate measurement data.• Students should be able to describe patterns in bivariate data, such as clustering and outliers.	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to construct and interpret scatter plots for bivariate measurement data.• Students should be able to describe patterns in bivariate data, including clustering, outliers, and associations.	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as: <ul style="list-style-type: none">• Students should be able to explain how the patterns in a scatter plot might relate to the real-world context of the data.• Students should be able to use their understanding to make predictions about future data points based on observed trends.

Standard: 8.SP.2

Know that straight lines are widely used to model relationships between two quantitative variables. For scatter plots that suggest a linear association, informally fit a straight line, and informally assess the model fit by judging the closeness of the data points to the line.

Evidence Statement			
1. The student determines an approximate linear equation that models the relationship between two quantitative variables.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
<p>Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to recognize that a straight line is used to model relationships between two quantitative variables. 	<p>Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to explain why a straight line is used to model relationships between two quantitative variables. Students should be able to recognize an appropriate fit for a straight line on a scatter plot that suggests a linear association. 	<p>Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to informally fit a straight line on a scatter plot that suggests a linear association, and informally assess the model fit by judging the closeness of the data points to the line. 	<p>Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:</p> <ul style="list-style-type: none"> Students should be able to informally fit a straight line on a scatter plot that suggests a linear association and draw meaningful insights by using the straight line and its relationship to the data. Students should be able to connect the model fit to the strength of the association observed in the scatter plot.

Standard: 8.SP.3

Use the equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and intercept. *For example, in a linear model for a biology experiment, interpret a slope of 1.5 cm/hr as meaning that an additional hour of sunlight each day is associated with an additional 1.5 cm in mature plant height.*

Evidence Statement			
1. The student identifies and interprets the slope (rate of change) and y-intercept (initial value) of a linear model in the context of bivariate measurement data.			
Performance Level Descriptors (PLDs)			
Level 1	Level 2	Level 3	Level 4
Students at level 1 show a <i>limited</i> ability to demonstrate their knowledge and skills such as:	Students at level 2 show a <i>basic</i> ability to demonstrate their knowledge and skills such as:	Students at level 3 show a <i>proficient</i> ability to demonstrate their knowledge and skills such as:	Students at level 4 show an <i>advanced</i> ability to demonstrate their knowledge and skills such as:
<ul style="list-style-type: none">Students should be able to identify the parts of a given equation of a linear model in the context of bivariate measurement data.	<ul style="list-style-type: none">Students should be able to use a given equation of a linear model to solve problems in the context of bivariate measurement data, interpreting the slope and y-intercept.	<ul style="list-style-type: none">Students should be able to determine the equation of a linear model when given a graph of the line and use it to solve problems in the context of bivariate measurement data, interpreting the slope and y-intercept.	<ul style="list-style-type: none">Students should be able to compare two sets of bivariate measurement data using linear modeling and interpretation of slope and intercepts.