



Chapter 3

Mathematics

By the end of Grade 8, students will understand various numerical representations, including square roots, exponents, and scientific notation. Students will use and apply geometric properties of plane figures, including congruence and the Pythagorean Theorem. Symbolic algebra will be used to represent situations and solve problems that involve linear relationships, linear equations, and systems of linear equations or inequalities. Students will be able to use equations, tables, and graphs to analyze and interpret linear functions. Students will work with and understand set theory and simple counting techniques, and use those to determine the theoretical probability of simple events. Students will begin to make inferences from statistical data, particularly data that can be modeled by linear functions.

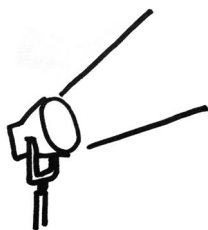
The Mathematics activities are focused on some of the concepts that are assessed on the Grade 8 CRCT Mathematics domains. These domains are as follows:

- 1 Number and Operations**
- 2 Geometry**
- 3 Algebra**
- 4 Data Analysis and Probability**

The *Mathematical Process Skills* are integrated throughout the domains. These are skills used to acquire and apply content knowledge.

Mathematical Process Skills refer to students' dexterity in applying concepts and skills in the context of authentic problems, and in understanding concepts rather than merely following a sequence of procedures. Process skills are used to acquire and apply content knowledge. Process skills include solving problems that arise in mathematics and other contexts; reasoning and evaluating mathematical arguments; communicating mathematically; making connections among mathematical ideas and to other content areas; and representing mathematical ideas in multiple ways.

Activities



1 Number and Operations

Georgia Performance Standard M8N1

Within the Number and Operations domain, students learn the different representations of numbers including square roots, exponents, and scientific notation. Students learn the square roots of perfect squares and use the perfect squares to estimate the square roots of other numbers. Students will see square roots in different ways, including as the length of a side of a square with a given area, and as points and lengths on a number line. They will learn that the square root of 0 is 0 and that every positive number has two square roots that are opposite in sign. Students will recognize and use the radical symbol to denote the positive square root of a positive number, as well as simplify, add, subtract, multiply, and divide expressions containing square roots. Students will distinguish between rational and irrational numbers. Students will use the laws of exponents to simplify expressions containing integer exponents. They will express numbers in scientific notation and use them in problem situations. Lastly, students will use appropriate technologies to solve problems involving square roots, exponents, and scientific notation.

The following activities develop skills in this domain:

- To practice finding square roots and using radicals, students will set up and solve simple radical equations involving the side lengths of squares in this problem:

In *The Perfect Square Gardens*, there are currently four gardens that are perfectly square. Garden A has an area of 81 square yards; Garden B has an area of 121 square yards; Garden C has an area of 225 square yards; and Garden D has an area of 324 square yards. The head gardener is going to make four new square gardens and he wants:

- The side length of Garden E to be twice the side length of Garden C
- The side length of Garden F to be the sum of the side lengths of Gardens A and B
- The side length of Garden G to be the difference of the side lengths of Gardens A and D
- The ratio of the side lengths of Garden H to Garden B to have the same ratio as the side lengths of Garden D to Garden A

Use $\sqrt{81}$, $\sqrt{121}$, $\sqrt{225}$, and $\sqrt{324}$ to set up and solve equations and proportions to find the side lengths of the four new perfectly square gardens.

After finishing the problem, students should describe in their own words the relationship between the radical sign, the square root of a number, and the side length of a square with a given area.

- To develop fluency with the laws of exponents, students will build exponential expressions that are equivalent to a given exponential expression. Each student will write a different simple exponential expression, such as a^6 , on three index cards. For their unique expression, the students should make five additional index cards according to these rules:

- The first index card should have an expression that reduces to the original exponential expression using the addition law of exponents. For example, for a^6 students might write $a^2 \times a^4$, $a^3 \times a^3$, or $a^5 \times a$.
- The second index card should have an expression that reduces to the original exponential expression using the multiplicative law of exponents. For example, for a^6 students might write $(a^3)^2$ or $(a^2)^3$.
- The third index card will have an expression that reduces to the original exponential expression using the division law of exponents. For example, for a^6 students might write $\frac{a^{12}}{a^6}$ or $\frac{a^{10}}{a^4}$.
- The fourth index card will have an expression that reduces to the original exponential expression using the addition and division law of exponents. For a^6 students might write $\frac{a^4 a^5}{a^3}$ or $\frac{a^2 a^6}{a^2}$.
- The fifth index card will have an expression that reduces to the original exponential expression using the multiplication and division law of exponents. For example, $\frac{(a^3)^3}{a^3}$.

Students then shuffle the cards, exchange them, find and match all the equivalent expressions, and label the index card with the law or laws that were used to reduce the expression on it.

- To apply converting to, and using numbers in, scientific notation, students will make a model of the universe and calculate the time it would take to travel to the different locations at the speed of light. On a large sheet of paper or poster board students should draw the sun, the eight planets, Alpha Centauri, Sirius, Deneb, and the Galactic Center. Students should label their distances from Earth in scientific notation, and should not be concerned with making the drawing to scale.

Location	Distance from earth in standard form (km)	Distance from earth in scientific notation (km)	Column 3/speed of light = number of seconds	Column 4/seconds per year = years to reach location
Sun	149,570,000			
Mercury	91,620,000			
Venus	41,460,000			
Mars	78,270,000			
Jupiter	628,570,000			
Saturn	1,277,430,000			
Uranus	2,720,730,000			
Neptune	4,350,330,000			
Alpha Centauri	40,396,400,000,000			
Sirius	81,738,800,000,000			
Deneb	13,263,600,000,000,000			
Galactic Center	262,151,000,000,000,000			



Students will then:

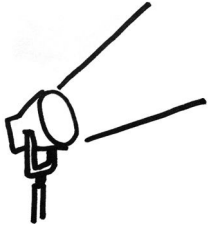
- 1** Divide the distances by the speed of light (3.0×10^8 km/s).
- 2** Divide the quotient from (1) by the number of seconds in a year (3.1556926×10^7 s) to determine the time it would take in years to reach Earth by traveling at the speed of light. This information should also be included on their drawings.

Further support can be found in the GPS Mathematics Framework:
Unit 2: *Exponents*.

The Mathematics Framework documents are available at
www.georgiastandards.org/mathframework.aspx



Activities



2 Geometry

Georgia Performance Standards M8G1 and M8G2

The Geometry domain addresses students' understanding of and ability to apply the properties of parallel and perpendicular lines as well as the meaning of congruence. Students will investigate characteristics of parallel and perpendicular lines both algebraically and geometrically, and apply properties of angle pairs formed by parallel lines cut by a transversal. Students will understand the properties of the ratio of segments of parallel lines cut by one or more transversals. Students will know the meaning of congruence, and understand that all corresponding angles are congruent and all corresponding sides are congruent. Students will understand and use the Pythagorean Theorem and other properties of right triangles. They will recognize and interpret the Pythagorean Theorem as a statement about areas of squares or sides of a right triangle.

The following activities develop skills in this domain:

- To experience the outcome when parallel lines are cut by a transversal, students will make and put together puzzles formed by parallel lines and transversals. Students place masking tape on paper to make two parallel lines, one transversal, and a second set of parallel lines that cross the first set. Students then separate the angles by cutting the piece of paper along the masking tape edge. Students will measure and label one angle formed by the single transversal and one angle formed by the parallel line crossings. They then switch pieces, put the puzzle back together, and label all the angles. After they finish, students should be able to explain the following:
 - Why they needed only one angle measurement from each set of line crossings
 - Why they couldn't have found the measures of all the angles if they had been given only one angle from a single transversal intersection
 - The rules they used to find the missing angle measures
- Students will strengthen their ability to use congruence by labeling corresponding angles and sides of congruent figures in different positions. First, students should cut out different triangles, quadrilaterals, and polygons from a piece of paper. On separate pieces of paper for each shape, students should choose a position for tracing the figure. Then, based on that position, students should do the following:
 - Trace the figure translated right two inches.
 - Trace the figure reflected horizontally and vertically.
 - Trace the figure rotated 90° and 270° .
 - Measure and label the angles and side lengths of the original figure.

Students then exchange tracings and use different colored markers to show congruent sides and angles. They will label the angle measures and side lengths, and briefly describe how they used the properties of congruence to find the measurements.



- Students will apply the Pythagorean Theorem to construct lines with lengths that are irrational numbers. The square root of any positive integer that is not a perfect square is an irrational number. Students should first draw four right triangles with the following leg lengths:
 - 1 inch and 1 inch
 - 1 inch and 2 inches
 - 2 inches and 3 inches
 - 4 inches and 4 inches

Students will then find the lengths of the hypotenuses, leaving them in radical form. Students should then answer the following questions:

- 1** Which lines have lengths that are irrational?
 - 2** How did you find the lengths?
 - 3** Could you have measured these lengths accurately using a standard ruler?
 - 4** How were you able to use the Pythagorean Theorem to create and measure the lengths accurately?
- To make a connection between the algebraic equation and geometric meaning of the Pythagorean Theorem, students will find the square of the hypotenuse of a right triangle using the squares of its legs. Students will cut out one-inch squares from two 8.5 x 11 pieces of paper.
 - 1** First, students should draw a right triangle with leg lengths 3 inches and 4 inches. They will then use the one-inch square papers to build a 3 x 3 square and a 4 x 4 square along the respective legs. They then will use those one-inch square papers to build a square along the hypotenuse and write what happened in their own words.
 - 2** Second, students should draw an acute triangle that has side lengths 3 inches and 4 inches. Students should predict and verify whether the third side length will be less than or greater than 5 inches. They then will build 3 x 3 and 4 x 4 squares along the 3- and 4-inch sides using inch squares. Students will then try to build a square along the third side and write what happens.
 - 3** Finally, students should draw an obtuse triangle with side lengths 3 inches and 4 inches. They should predict and verify whether the third side length will be less than or greater than 10 inches. They then build the 3 x 3 and 4 x 4 squares on the 3 and 4 inch sides with the 1-inch paper squares. Students will then try to build a square of 1-inch paper squares along the third side and write what happens.
 - 4** Students then repeat steps 1–3 using leg lengths and side lengths of 6 inches and 8 inches, and 5 inches and 12 inches.



After finishing the activity, students will answer these questions:

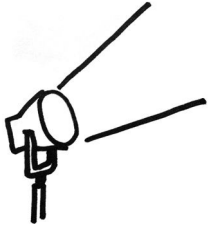
- 1** What does the Pythagorean Theorem say about the areas of the squares formed on the legs and hypotenuse of a right triangle?
- 2** Was the third side of the acute triangle shorter or longer than the hypotenuse of the right triangle? How did this affect the relationship between the area of the squares formed on the 3- and 4-inch sides and the area of the square formed on the third side?
- 3** Was the third side of the obtuse triangle shorter or longer than the hypotenuse of the right triangle? How did this affect the relationship between the area of the squares formed on the 3- and 4-inch sides and the area of the square formed on the third side?
- 4** Why didn't the Pythagorean Theorem work for the acute and obtuse triangles?

Further support can also be found in the GPS Math Framework: Unit 6: *Parallel Lines & Congruence*.

The Mathematics Framework documents are available at
www.georgiastandards.org/mathframework.aspx



Activities



3 Algebra

Georgia Performance Standards M8A1, M8A2, M8A3, M8A4 and M8A5

The Algebra domain addresses students' ability to use algebra to represent, analyze, and solve problems. Students will learn to represent a given situation using algebraic expressions or equations in one variable as well as how to simplify and evaluate them. Students will solve different forms of algebraic equations in one variable, including those with absolute values, and interpret solutions in context. Students will solve equations involving several variables for one variable in terms of the others. Students will understand and graph inequalities in one variable. They will represent a given situation using an inequality in one variable, use the properties of inequality to solve, graph solutions on a number line, and interpret solutions in problem contexts. Students will understand relations and linear functions. They will recognize a relation as a correspondence between varying quantities, and recognize a function as a correspondence between inputs and outputs, where the output for each input must be unique. They will distinguish between relations that are functions and those that are not, and recognize functions in a variety of representations and contexts. Students will use tables to describe sequences recursively and with a formula in closed form. They will understand and recognize arithmetic sequences as linear functions with whole number input values, and interpret the constant difference in an arithmetic sequence as the slope of the associated linear function. Students will identify relations and functions as linear or nonlinear, and translate among verbal, tabular, graphic, and algebraic representations of them. Students will graph and analyze graphs of linear equations and inequalities, including interpreting slope as a rate of change; determining the meaning of the slope and y-intercept in a given situation; graphing equations of the form $y = mx + b$ and $ax + by = c$; graphing the solution set of a linear inequality; and identifying whether the solution set is an open or a closed half-plane. Given a graph, students will determine the equation of a line, numerical information that defines the line, or a context involving a linear relationship. They will solve problems involving linear relationships, including systems of linear equations and inequalities. Given a problem in context, students will be able to write a system of linear equations or inequalities to represent it, solve these systems graphically or algebraically (using technology as appropriate) and interpret the solutions in context.

The following activities develop skills in this domain:

- Extending sequences and writing equations to represent them may be used as students make fictional train schedules for the Atlanta-Athens commuter rail. Students will make the schedule for the Atlanta-bound trains by assuming the following information:
 - 1 The first train leaves at 6:30 A.M.
 - 2 A train leaves every 42 minutes.
 - 3 For trains that leave before 9:00 A.M. there are exactly 13 minutes between each stop.
 - 4 For trains that leave after 9:00 A.M. there are exactly 16 minutes between stops.

Atlanta-bound

Athens	6:30
Bogart	
Winder	
Cedars Road	
Lawrenceville	
Reagan Pkway	
Lilburn	
Tucker	
Emory	
Atlantic Station	
Atlanta	

Students will then write out and number the terms of the following:

- The sequence that gives the times trains leave Athens
- The sequence that gives the times of station stops for the 3rd train to leave Athens
- The sequence that gives the times of station stops for the 7th train to leave Athens

Students will make equations that represent the time it takes to get to a stop on the Atlanta-bound and the Athens-bound trains. Equations will be of the form $T = bS$, where S is the stop number, b is the time between each stop, and T is time. They then use the equation to find the time it takes to get from Athens to Cedars Road, Athens to Tucker, and Athens to Atlanta. Students also verify their equations using the schedules they've created.

- To determine the difference between solution sets of systems with open inequalities and those with closed inequalities, students will test the points that lie on the boundary. On two separate coordinate planes students will draw the solution sets to the following:

$y \leq x + 5$	$y \leq x + 5$	$y < x + 5$	$y < x + 5$
$y \geq 10 - 4x$	$y > 10 - 4x$	$y \geq 10 - 4x$	$y > 10 - 4x$

Students will test the points (1, 7), (2, 6), (3, 7), (2, 7), and (3, -2) for each system. Then they will then answer the following questions:

- 1** What is the only difference between the systems of inequalities?
- 2** Which points satisfy all four systems? How can you see this on the graphs?
- 3** Which of the points satisfy none of the systems? How can you see this on the graphs?



- 4** For the other points, which systems do they satisfy? How is this issue related to the system having closed or open inequalities?
- 5** In general, if a point lies on the boundary line of the solution set of a system of inequalities, when will it be part of the solution set? When will it not?

Students will graph and label equations of the form $y = mx + b$ to learn about the slopes of parallel and perpendicular lines. To study parallel lines, students will graph and label the pairs of lines given below on separate graphs. After graphing the equations, students will describe in their own words what lines with the same slope look like geometrically.

- | | | |
|-------------------------------|---------------------------------|--------------------------------|
| 1 slope = 4, y-int = 1 | 3 slope = -2, y-int = -3 | 5 slope = 1, y-int = 0 |
| 2 slope = 4, y-int = 3 | 4 slope = -2, y-int = 1 | 6 slope = 1, y-int = -2 |

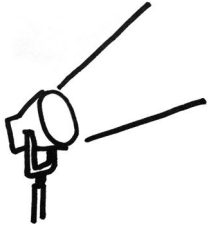
To study perpendicular lines, students will graph and label the pairs of lines given below on separate graphs. After graphing the equations, students will describe in their own words what lines with the same slope look like geometrically.

- | | | |
|----------------------------------|-----------------------------------|---------------------------------|
| 7 slope = 2, y-int = 2 | 9 slope = 3, y-int = 4 | 11 slope = 1, y-int = 0 |
| 8 slope = -1/2, y-int = 3 | 10 slope = -1/3, y-int = 2 | 12 slope = -1, y-int = 0 |

Further support can be found in the GPS Mathematics Framework: Unit 3: *Linear Equations*; Unit 4: *Functions and Relations*; Unit 5: *Linear Equations and Inequalities*; and Unit 7: *Systems of Equations and Inequalities*.

The Mathematics Framework documents are available at
www.georgiastandards.org/mathframework.aspx

Activities



4 Data Analysis and Probability

Georgia Performance Standards M8D1, M8D2, M8D3 and M8D4

The Data Analysis and Probability domain addresses students' ability to apply basic concepts of set theory. Students will demonstrate relationships among sets through use of Venn diagrams; determine subsets, complements, intersection, and union of sets; and use set notation to denote elements of a set. Students will determine the number of outcomes related to a given event using tree diagrams, or with the addition and multiplication principles of counting. Students will use the basic laws of probability to find the probabilities of simple and compound independent events. Students will learn to organize, interpret, and make inferences from statistical data. They will gather data that can be modeled with a linear function, and use it to estimate and determine a line of best fit on a scatterplot.

The following activities develop skills in this domain:

- To practice working with and using set notation, students will divide 24 of Shakespeare's plays into different groups. Students will find the subsets listed below, and then find various unions and intersections as listed.

<i>The Comedy of Errors</i> : Comedy, 1590	<i>Othello</i> : Tragedy, 1604
<i>King Lear</i> : Tragedy, 1605	<i>Macbeth</i> : Tragedy, 1605
<i>Julius Caesar</i> : Tragedy, 1599	<i>Taming of the Shrew</i> : Comedy, 1593
<i>Much Ado about Nothing</i> : Comedy, 1598	<i>Romeo and Juliet</i> : Tragedy, 1594
<i>All's Well that Ends Well</i> : Comedy, 1602	<i>Coriolanus</i> : Tragedy, 1607
<i>Two Gentlemen of Verona</i> : Comedy, 1594	<i>Love's Labour's Lost</i> : Comedy, 1594
<i>As You Like It</i> : Comedy, 1599	<i>Hamlet</i> : Tragedy, 1600
<i>Measure for Measure</i> : Comedy, 1604	<i>Merchant of Venice</i> : Comedy, 1596
<i>Midsummer Night's Dream</i> : Comedy, 1595	<i>Twelfth Night</i> : Comedy, 1599
<i>Winter's Tale</i> : Comedy, 1610	<i>Timon of Athens</i> : Tragedy, 1607
<i>The Tempest</i> : Comedy, 1611	<i>Troilus and Cressida</i> : Tragedy, 1601
<i>Antony and Cleopatra</i> : Tragedy, 1606	<i>Titus Andronicus</i> : Tragedy, 1593

List the names of the plays that fall into each of the following subsets:

- A = the subset of Shakespeare's plays that are comedies
- B = the complement of A (the plays that are not in set A ; tragedies, not comedies)
- C = the subset of Shakespeare's plays that were written before 1600
- D = the complement of C (the plays that are not in set C ; plays not written before 1600)
- E = $A \cup C$ (the plays that are in sets A **or** C ; the plays that are comedies **or** the plays written before 1600)
- F = $A \cap C$ (the plays that are in sets A **and** C ; the plays that are comedies **and** the plays written before 1600)
- H = $B \cup D$ (the plays that are in sets B **or** D ; the plays that are not comedies **or** the plays that were not written before 1600)



- $I = B \cap D$ (the plays that are in sets B **and** D; the plays that are not comedies **and** the plays that were not written before 1600)
- $J = C \cap D$ (the plays that are in sets C **and** D; the plays that were written before 1600 **and** the plays that were not written before 1600)

Students should explain:

- 1 How they determined the plays that fall in sets B , D , and E through J
 - 2 The difference between the union and the intersection of sets
 - 3 Whether they think the union of two sets always has more elements (is bigger) than the intersection
 - 4 Why it makes sense that J does not have any plays in it
- Students will develop the connection between tree diagrams and the multiplication principle by building trees and filling in blanks.

You are ordering a breakfast combo, and have two choices to make:

- You get a bagel with either butter or cream cheese.
- You get either juice or tea.

Make a tree diagram to show the different breakfast combinations you can choose and then fill in the blanks to finish the following sentence:

There were _____ drink options for each of _____ bagel options, which gave a total of _____ options.

You order juice and have two choices to make:

- You can have orange, apple, or tomato juice.
- You can have small, medium, or large.

Make a tree diagram to show the different choices you can make for size and kind of juice. Then fill in the blanks to finish the following sentence:

There were _____ juice options and _____ size options, which gave a total of _____ options.

At lunch you order a sandwich and have three choices to make:

- You can have either ham or turkey.
- You can have either cheddar cheese or Swiss cheese.
- You can have either mustard or mayonnaise.

Make a tree diagram to show the different combinations you can choose. Then fill in the blanks to finish the following sentence:

There were _____ meat options, _____ cheese options, and _____ condiment options, which gave a total of _____ options.



At dinner you order the daily special and have three choices to make:

- You can have corn, steamed spinach, or carrots.
- You can have French fries, mashed potatoes, or a baked potato.
- You can have chicken, steak, or ham.

Make a tree diagram to show the different dinner combinations you have to choose from and then fill in the blanks to finish the following sentence:

There were _____ vegetable options, _____ potato options, and _____ meat options, which gave a total of _____ options.

Students should then explain in their own words how to find the total number of combinations available without making a tree diagram. They should also explain how the multiplication rule is related to tree diagrams.

- Calculating probabilities of independent events may be used in observing different kinds of weather for tomorrow based on this forecast:

We have a 60% chance of sunshine, 20% chance of clouds, and a 20% chance of rain. The temperature should be in the low 80s, with a 10% chance of being between 75 and 79 degrees, an 80% chance of being between 80 and 84 degrees, and a 10% chance of being between 85 and 90 degrees.

Students will assume that the temperature probabilities and the probabilities of sun/cloud/rain are independent, and use them to find the probability that tomorrow's weather will be:

- 1** 77 degrees and sunny
- 2** 87 degrees and rainy
- 3** 81 degrees and cloudy

Finally, students choose three weather conditions (a combination of temperature and sun, cloud, rain) that they think will have different probabilities of occurring than those above. Students should use the individual probabilities to explain why they think the compound probability will be different. Then they should find the actual probability.

- Students will practice making inferences from statistics by gathering price data for cereals, making a scatterplot, and creating a line of best fit to model it. Students will go to the grocery store and record the prices and weights of 15 different cereals. Students will then plot the values with the weights on the x-axis and the prices on the y-axis. Students will draw a line of best fit and explain in their own words what they think is the relationship between the amount of cereal purchased and the purchase price.

Further support can be found in the GPS Math Framework Unit 1: *Probability*.

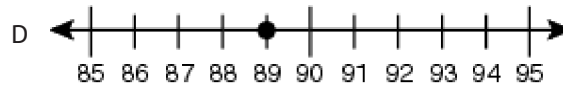
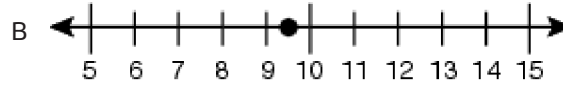
The Mathematics Framework documents are available at
www.georgiastandards.org/mathframework.aspx



Practice Quiz



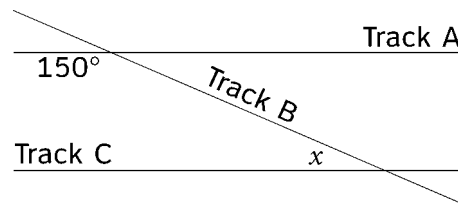
- 1 Lisa found the value of $\sqrt{89}$ and plotted it on a number line. Which number line shows the value that is closest to $\sqrt{89}$?



- 2 What is the value of $3^6 \times 3^{-2} \times 3$?

- A 9
- B 27
- C 81
- D 243

- 3 At a train station, Track B crosses Track A and Track C, which are parallel to each other. Track A and Track B intersect at an angle of 150° as shown.



What is the measure of the angle, x , formed by the intersection of Track B and Track C?

- A 30°
 - B 50°
 - C 150°
 - D 180°
- 4 Tammy is 2 years older than twice the age of her brother. The sum of their ages is 17. If x represents the age of her brother, which equation represents this situation?
- A $2x + 2 = 17$
 - B $2(x + 2) = 17$
 - C $x + 2(x + 2) = 17$
 - D $x + (2x + 2) = 17$

- 5 **Eva transports camping tents across a lake using a boat that can hold a maximum of 1,000 pounds. Eva weighs 100 pounds, and each tent weighs 50 pounds. The inequality below can be used to find the number of tents, t , the boat can hold while Eva is onboard.**

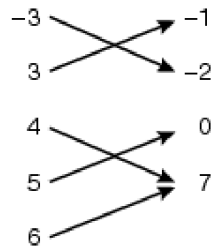
$$50t + 100 \leq 1,000$$

What is the maximum number of tents the boat can hold with Eva onboard?

- A 17
 B 18
 C 19
 D 22
- 6 **Which relation does NOT represent a function?**

A $\{(3, 2), (-3, 2), (2, 3)\}$

B **Input** **Output**



C $x = -2$

D

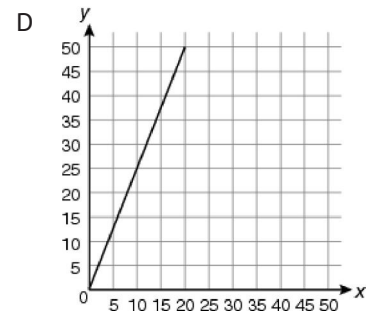
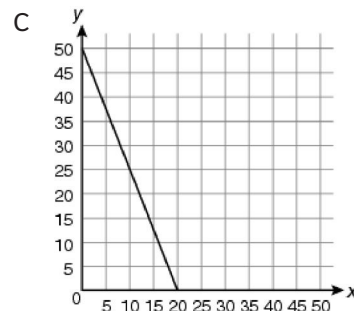
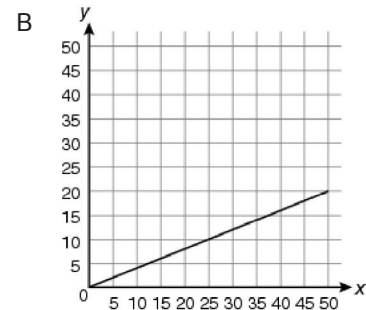
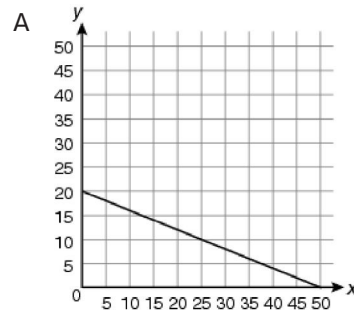
x	y
3	4
5	7
7	10
9	13



- 7 On a 100-point test, each multiple-choice question is worth 2 points, and each short-answer question is worth 5 points. The equation below shows the number of multiple-choice questions, x , and the number of short-answer questions, y , possible on the test.

$$2x + 5y = 100$$

Which graph represents this equation?



- 8 John gets price quotes from two different lawn-mowing services for the cost of mowing the field next to his house. Company A charges \$8 plus an additional \$5 per hour. Company B charges \$2 plus an additional \$6 per hour. The price quote for each company is the same amount. How many hours do the companies estimate it will take to mow the field?
- A 6
B 10
C 21
D 38
- 9 If $T = \{\text{the factors of } 30\}$ and $F = \{\text{the factors of } 40\}$, then what is $T \cap F$?
- A $\{1, 2, 4, 5, 8, 10, 20, 40\}$
B $\{1, 2, 3, 5, 6, 10, 15, 30\}$
C $\{1, 2, 3, 4, 5, 6, 8, 10, 15, 20, 30, 40\}$
D $\{1, 2, 5, 10\}$



-
- 10 **A bakery sells chocolate, vanilla, and strawberry cakes. All of the cakes are filled with either fruit or cream AND topped with either glaze or powdered sugar. How many different types of cakes does the bakery sell?**
- A 7
 - B 9
 - C 12
 - D 24



Solutions

Number	Correct Answer	Explanation
1	B	<p><i>Recognize square roots as points and as lengths on a number line. (M8N1c)</i></p> <p>The correct answer is Choice (B). Because 89 is between 81 and 100, its square root will be between $\sqrt{81} = 9$ and $\sqrt{100} = 10$. Choice (A) is incorrect because it is between 8 and 9, possibly a calculation error. Choice (C) is incorrect and is half of 89. Choice (D) is incorrect and is 89 itself.</p>
2	D	<p><i>Simplify expressions containing integer exponents. (M8N1i)</i></p> <p>The correct answer is Choice (D) 243. When multiplying powers with the same base, the exponents 6, -2, and 1 are added to give an exponent of 5: $3^5 = 243$. Choice (A) is incorrect and may result from dividing 6 by 2 and then subtracting the unlabeled exponent of 1 to get $3^2 = 9$. Choice (B) is incorrect and may result from dividing 6 by 2 and then ignoring the unlabeled exponent of 1 on top of 3 to get $3^3 = 27$. Choice (C) is incorrect and may result from mistakenly dividing 6 by 2 and then adding 1 to get $3^4 = 81$.</p>
3	A	<p><i>Apply properties of angle pairs formed by parallel lines cut by a transversal. (M8G1b)</i></p> <p>The correct answer is Choice (A) 30°. Angle x is congruent to either of the acute angles formed by the intersection of Track A and Track B. When one of the acute angles is added to the 150° angle, the result is a line forming a straight angle of 180°. Subtracting 150° from 180° gives an acute angle measuring 30°. Angle x is congruent to these acute angles and has the same angle measure, 30°. Choice (B) is incorrect and may result from calculation error when solving $x + 150 = 180$. Choice (C) is incorrect and may result from thinking that angles inside the parallel lines on the same side of the transversal should be equal. Choice (D) is incorrect because 180° represents the sum of 150° and 30°.</p>



Number	Correct Answer	Explanation
4	D	<p><i>Represent a given situation using algebraic expressions or equations in one variable. (M8A1a)</i></p> <p>The correct answer is Choice (D) $x + (2x + 2) = 17$. If x is the age of Tammy's brother, then Tammy is twice her brother's age ($2x$) plus two years, or $(2x + 2)$. The sum of their ages is 17, which is represented as $x + (2x + 2) = 17$. Choice (A) is incorrect because $2x + 2$ represents only Tammy's age rather than the sum of Tammy's age and her brother's age. Choices (B) and (C) are incorrect because $2(x + 2)$ suggests a misapplication of the distributive property (placing 2 outside the parentheses) when attempting to represent Tammy's age as "2 years older than twice the age of her brother." Choice (B) also fails to represent the sum of their ages.</p>
5	B	<p><i>Use the properties of inequality to solve inequalities. (M8A2b)</i></p> <p>The correct answer is Choice (B) 18. By subtracting 100 from both sides of the inequality it becomes $50t \leq 900$, which reduces to $t \leq 18$. Choice (A) is incorrect and results from subtracting the constant and the coefficient of t from both sides of the equation before dividing by 50 or by misreading the inequality symbol as <i>less than</i> rather than <i>less than or equal to</i>. Choice (C) is incorrect and results from mistakenly subtracting the coefficient of t, 50. Choice (D) is incorrect and results from mistakenly adding 100 to both sides of the inequality before dividing by 50.</p>
6	C	<p><i>Recognize functions in a variety of representations and a variety of contexts. (M8A3d)</i></p> <p>The correct answer is Choice (C) $x = -2$. $x = -2$ is a vertical line, which means there is more than one y value that corresponds to the x value of -2. Choice (A) is incorrect and could represent a function because we don't see any repeated values in the input positions of the coordinate pair. Choice (B) is incorrect. It represents a function because every input has only one arrow coming from it, and therefore has only one output. Choice (D) is incorrect and represents a function because we don't see different y outputs for a repeated x input.</p>

Number	Correct Answer	Explanation
7	A	<p><i>Graph equations of the form $ax + by = c$. (M8A4d)</i></p> <p>The correct answer is Choice (A). The y-intercept of the equation is 20 and the x-intercept is 50. The only graph with a line with those intercepts is the graph in Choice (A). Choice (B) is incorrect and results from using the x- and y-intercepts as the x and y values of a point on the line. Choice (C) is incorrect and results from making the x-intercept 20 and the y-intercept 50. Choice (D) is incorrect and results from using the x-intercept as the y value and the y-intercept as the x value of a point on the line.</p>
8	A	<p><i>Solve systems of equations graphically and algebraically, using technology as appropriate. (M8A5b)</i></p> <p>The correct answer is Choice (A) 6. If $h =$ hours, the expression for the price quote from Company A is $8 + 5h$, and the expression for the price quote from Company B is $2 + 6h$. Because the two price quotes are equal, the two expressions should be written as an equality: $8 + 5h = 2 + 6h$. Simplifying the equation (by subtracting $5h$ from both sides and subtracting 2 from both sides) to isolate the variable, the result is $h = 6$. Choice (B) is incorrect and may result from incorrectly adding 2 to both sides instead of subtracting. Choice (C) is incorrect and results from simply adding all the given numbers: $8 + 5 + 2 + 6 = 21$. Choice (D) is incorrect and results from finding the dollar amount of the price quotes from either company.</p>
9	D	<p><i>Determine subsets, complements, intersection, and union of sets. (M8D1b)</i></p> <p>The correct answer is Choice (D) {1, 2, 5, 10}. The intersection of two sets includes all the elements the sets have in common, which in this case is the common factors of 30 and 40. Choice (A) is incorrect and represents the elements of set F. Choice (B) is incorrect and represents the elements of set T. Choice (C) is incorrect and is the union of T and F.</p>

Number	Correct Answer	Explanation
10	C	<i>Apply the addition and multiplication principles of counting. (M8D2b)</i> The correct answer is Choice (C) 12 . Multiplication can be used to find the total number of combinations. Since there are three cake options, two filling options, and two topping options, the total number of combinations is $3 \times 2 \times 2 = 12$. Choice (A) is incorrect and results from adding the number of options together instead of multiplying them. Choices (B) and (D) are incorrect and may result from calculation error.
