Common Core Algebra Regents Outline

TOPICS

1) Reason quantitatively and use units to solve problems.
2) Use properties of rational and irrational numbers.
3) Interpret the structure of expressions.
4) Write expressions in equivalent forms to solve problems.
5) Perform arithmetic operations on polynomials.
6) Understand the relationship between zeros and factors of polynomials.
7) Create equations that describe numbers or relationships.
8) Understand solving equations as a process of reasoning and explain the reasoning
9) Solve equations and inequalities in one variable.
10) Represent and solve equations and inequalities graphically.
11) Solve systems of equations.
12) Understand the concept of a function and use function notation.
13) Interpret functions that arise in application in terms of the context.
14) Analyzing functions using different representations.
15) Build a function that models a relationship between two quantities.
16) Build new functions from existing functions.
17) Construct and compare linear, quadratic and exponential models and solve problems.
18) Interpret expressions for functions in terms of the situation they model.
19) Interpret linear models.
20) Summarize, represent and interpret data on two categorical and quantitative variables.
21) Summarize, represent and interpret data on a single count or measurement variable.

<u>**TOPIC 1**</u>: Numbers and Quantities – Reason quantitatively and use units to solve problems.

<u>**Standard N-Q.1**</u>: Use units as a way to understand problems and to guide the solution of multi-step problems; choose and interpret units consistently in formulas; choose and interpret the scale and the origin in graphs and data displays.

1) You want to measure the heights of the players of your favorite basketball team. Which units would be the best to use?
   a) Meters
   b) Inches
   c) gallons
   d) millimeters

2) A cell phone can receive 120 messages per minute. At this rate, how many messages can the phone receive in 150 seconds?
   1) 48
   2) 75
   3) 300
   4) 18,000

3) A car uses one gallon of gasoline for every 20 miles it travels. If a gallon of gasoline costs $3.98, how much will the gas cost, to the *nearest dollar*, to travel 180 miles?
   1) 9
   2) 36
   3) 45
   4) 80

4) Dave is on vacation in Europe and needs to properly dress for the weather. It is currently 9 degrees Celcius. Using the formula: $F = \frac{9}{5}C + 32$, where C is the temperature in Celcius, to the nearest degree, what temperature in Fahrenheit should he expect?

5) A girl can ski down a hill five times as fast as she can climb up the same hill. If she can climb up the hill and ski down in a total of 9 minutes, how many minutes does it take her to climb up the hill?
   1) 1.8
   2) 4.5
   3) 7.2
   4) 7.5

6) A bicyclist leaves Bay Shore traveling at an average speed of 12 miles per hour. Three hours later, a car leaves Bay Shore, on the same route, traveling at an average speed of 30 miles per hour. How many hours after the car leaves Bay Shore will the car catch up to the cyclist?
   1) 8
   2) 2
   3) 5
   4) 4

7) A truck traveling at a constant rate of 45 miles per hour leaves Albany. One hour later a car traveling at a constant rate of 60 miles per hour also leaves Albany traveling in the same direction on the same highway. How long will it take for the car to catch up to the truck, if both vehicles continue in the same direction on the highway?

8) Which domain would be the most appropriate set to use for a function that predicts the number of household online-devices in terms of the number of people in the household?
   1) integers
   2) whole numbers
   3) irrational numbers
   4) rational numbers

9) Officials in a town use a function, *C*, to analyze traffic patterns. *C*(*n*) represents the rate of traffic through an intersection where *n* is the number of observed vehicles in a specified time interval. What would be the most appropriate domain for the function?

      1) {…-2, -1, 0, 1, 2, 3, …}   3) {0, ½, 1, 1½, 2, 2½}

      2) {-2, -1, 0, 1, 2, 3}   4) {0, 1, 2, 3, …}

10) Alex is a sprinter who can run the 40-yard dash in 4.5 seconds. He converts his speed into miles per hour, as

shown: $\dfrac{40\,yards}{4.5\,sec.} \bullet \dfrac{3\,ft.}{1\,yard} \bullet \dfrac{5280\,ft.}{1\,mi} \bullet \dfrac{60\,sec.}{1\,min.} \bullet \dfrac{60\,min}{1\,hr.}$

Which ratio is incorrectly written to convert his speed?

      a) 3 ft./1 yd.   c) 60 sec/1 min

      b) 5280 ft./1 mi.   d) 60 min/1 hr

Standard N-Q.2: Define appropriate quantities for the purpose of descriptive modeling.

11) The current graduating class at Ridgemont High School is 512 students. The class of 2015 is approximately 10 percent larger than the class of 2014. Which of the following represent the number of students in the class of 2015?

      a) 461   c) 563.2

      b) 522   d) 563

12) You have to do spring clean up at your house. If you do the job alone, it will take you 4 hours. Your 3 friends come over to help and together you can complete the job in

      a) 4 hours   c) 1 hour

      b) 3 hours   d) 5 hours

13) You have a jar full of nickels. If you can fit 40 nickels into a standard roll, how many rolls would you have to fill to have $22?

      a) 440   c) 22

      b) 11   d) 44

Standard N-Q.3: Choose a level of accuracy appropriate to the limitations on measurement when reporting quantities.

14) An art studio has a list of information posted with each sculpture that is for sale. Each entry in the list could be classified as quantitative except for the

      a) cost   c) artist

      b) height   d) weight

15) A school cafeteria has five different lunch periods. The cafeteria staff wants to find out which items on the menu are most popular, so they give every student in the first lunch period a list of questions to answer in order to collect data to represent the school. Which type of study does this represent?

      a) observation   c) population survey

      b) controlled experiment   d) sample survey

16) Neil is running a marathon this Fall, and he's pretty intense! If a marathon is approximately 26.2 miles, ***about*** how many feet will he run?

      a) 26.2   c) 138000

      b) 138336   d) 138300

TOPIC 2: Use properties of rational and irrational numbers.

Standard N-RN.3: Explain why the sum or product of two rational numbers is rational; that the sum of a rational number and an irrational number is irrational; and that the product of a nonzero rational number and an irrational number is irrational.

1) Which statement is *not* always true?
   1) The product of two irrational numbers is irrational.
   2) The product of two rational numbers is rational.
   3) The sum of two rational numbers is rational.
   4) The sum of a rational number and an irrational number is irrational

2) What is $2\sqrt{45}$ expressed in simplest radical form?
   1) $3\sqrt{5}$
   2) $5\sqrt{5}$
   3) $6\sqrt{5}$
   4) $18\sqrt{5}$

3) When $5\sqrt{20}$ is written in simplest radical form, the result is $k\sqrt{5}$. What is the value of k?
   1) 20
   2) 10
   3) 7
   4) 4

4) What is $\dfrac{\sqrt{32}}{4}$ expressed in simplest radical form?
   1) $\sqrt{2}$
   2) $4\sqrt{2}$
   3) $\sqrt{8}$
   4) $\dfrac{\sqrt{8}}{2}$

5) Express $\left(\sqrt{17}\right)^2$ in simplest form.

6) Express $2\sqrt{5}+3\sqrt{5}$ in simplest radical form.

7) Nick determined that the correct length of the hypotenuse of the right triangle in the accompanying diagram is $\sqrt{20}$. Danielle found the length of the hypotenuse to be $2\sqrt{5}$. Is Danielle's answer also correct? Justify your answer.
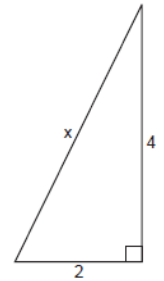
8) What is the sum of $\sqrt{50}$ and $\sqrt{8}$?
   1) $\sqrt{58}$ 2) $7\sqrt{2}$ 3) $9\sqrt{2}$ 4) $29\sqrt{2}$

9) What is $3\sqrt{2}+\sqrt{8}$ expressed in simplest radical form?
   1) $3\sqrt{10}$ 2) $3\sqrt{16}$ 3) $5\sqrt{2}$ 4) $7\sqrt{2}$

10) The expression $2\sqrt{50}-\sqrt{2}$ is equivalent to
   1) $2\sqrt{48}$ 2) 10 3) $9\sqrt{2}$ 4) $49\sqrt{2}$

11) Express $\dfrac{16\sqrt{21}}{2\sqrt{7}}-5\sqrt{12}$ in simplest radical form.

12) Express $\dfrac{3\sqrt{75}+\sqrt{27}}{3}$ in simplest radical form.

13) Expressed in simplest radical form, the product of $\sqrt{6} \cdot \sqrt{15}$ is
1) $\sqrt{90}$
2) $3\sqrt{10}$
3) $9\sqrt{10}$
4) $3\sqrt{15}$

14) Express the product of $3\sqrt{20}\,(2\sqrt{5} - 7)$ in simplest radical form.

15) Express in simplest form: $\sqrt{48} - 5\sqrt{27} + 2\sqrt{75}$

16) Simplify: $8\sqrt{12} \times 3\sqrt{24}$

17) The expression $\sqrt{90} \cdot \sqrt{40} - \sqrt{8} \cdot \sqrt{18}$ simplifies to
1) 22.9
2) 48
3) 864
4) 3,456

18) The expression $\dfrac{6\sqrt{20}}{3\sqrt{5}}$ is equivalent to
1) $3\sqrt{15}$
2) $2\sqrt{15}$
3) 8
4) 4

19) If $(\sqrt{128} - \sqrt{72})$ is divided by $\sqrt{8}$, the result is
1) 1
2) $8\sqrt{2} - 3$
3) $\sqrt{7}$
4) $4 - 6\sqrt{2}$

20) Simplify: $\dfrac{\sqrt{45}}{\sqrt{80}}$

21) Given:
L = $\sqrt{2}$
M = $3\sqrt{3}$
N = $\sqrt{16}$
P = $\sqrt{9}$
Which expression results in a rational number?
1) L+M   3) N+P
2) M+N   4) P+L

22) Mr. Izzo asked his class "Is the sum of 4.2 and π rational or irrational?" Travis answered that the sum would be irrational.
State whether Travis is correct or incorrect. Justify your reasoning.

TOPIC 3: Interpret the structure of expressions

Standard A.SSE.1: Interpret expressions that represent a quantity in terms of its context
(translating mathematical expressions).

1) The owner of a small computer repair business has one employee, who is paid an hourly rate of $22. The owner estimates his weekly profit using the function $P(x) = 8600 - 22x$. In this function, x represents the number of
1) computers repaired per week
2) hours worked per week
3) customers served per week
4) days worked per week

2) Miriam and Jessica are growing bacteria in a laboratory. Miriam uses the growth function $f(t)=n^{2t}$ while Jessica uses the function $g(t)=n^{4t}$, where *n* represents the initial number of bacteria and *t* is the time, in hours. If Miriam starts with 16 bacteria, how many bacteria should Jessica start with to achieve the same growth over time?
1) 32   3) 8
2) 16   4) 4

3) Which algebraic expression represents 15 less than *x* divided by 9?
1) $\frac{x}{9} - 15$

2) $9x - 15$
3) $15 - \frac{x}{9}$

4) $15 - 9x$

4) A correct translation of "six less than twice the value of *x*" is
1) $2x < 6$
2) $2x - 6$
3) $6 < 2x$
4) $6 - 2x$

5) Julie has three children whose ages are consecutive odd integers. If *x* represents the youngest child's age, which expression represents the sum of her children's ages?
1) 3x + 3   3) 3x + 5
2) 3x + 4   4) 3x + 6

6) Which expression represents the number of hours in *w* weeks and *d* days?
1) $7w + 12d$
2) $84w + 24d$
3) $168w + 24d$
4) $168w + 60d$

7) If Angelina's weekly allowance is *d* dollars, which expression represents her allowance, in dollars, for *x* weeks?
1) dx
2) $7dx$
3) $x + 7d$
4) $\frac{d}{x}$

8) What is the perimeter of a regular pentagon with a side whose length is $x + 4$?

9) The length of a rectangular room is 7 less than three times the width, *w*, of the room. Find an expression that represents the area of the room?

10) A hockey team played *n* games, losing four of them and winning the rest. Find the ratio of games won to games lost.

11) Mr. Cash bought *d* dollars worth of stock. During the first year, the value of the stock tripled. The next year, the value of the stock decreased by $1200.
(a) Write an expression in terms of *d* to represent the value of the stock after two years.
(b) If an initial investment is $1,000, determine its value at the end of 2 years.

12) An example of an equation is
1) $2x^2 - 4x + 12$
2) $|x - 6|$
3) $4(x + 6)(x - 2)$
4) $2x = x^2 + 3$

For numbers 13-15, translate the following expressions.

13) $10 + 25/x$

14) $7x - 5 = 33$

15) $\frac{1}{2}x - 7 = 15$

16) Mrs. Smith wrote "Eight less than three times a number is greater than fifteen" on the board. If x represents the number, which inequality is a correct translation of this statement?
1) $3x - 8 > 15$
2) $3x - 8 < 15$
3) $8 - 3x > 15$
4) $8 - 3x < 15$

17) Roger is having a picnic for 78 guests. He plans to serve each guest at least one hot dog. If each package, p, contains eight hot dogs, which inequality could be used to determine how many packages of hot dogs Roger will need to buy?
1) $p \geq 78$
2) $8p \geq 78$
3) $8 + p \geq 78$
4) $78 - p \geq 8$

18) The ninth grade class at a local high school needs to purchase a park permit for $250.00 for their upcoming class picnic. Each ninth grader attending the picnic pays $0.75. Each guest pays $1.25. If 200 ninth graders attend the picnic, which inequality can be used to determine the number of guests, x, needed to cover the cost of the permit?
1) $0.75x - (1.25)(200) \geq 250.00$
2) $0.75x + (1.25)(200) \geq 250.00$
3) $(0.75)(200) - 1.25x \geq 250.00$
4) $(0.75)(200) + 1.25x \geq 250.00$

19) Students in a ninth grade class measured their heights, h, in centimeters. The height of the shortest student was 155 cm, and the height of the tallest student was 190 cm. Which inequality represents the range of heights?
1) $155 < h < 190$
2) $155 \leq h \leq 190$
3) $h \geq 155$ or $h \leq 190$
4) $h > 155$ or $h < 190$

20) The length of a rectangle is 15 and its width is w. The perimeter of the rectangle is, *at most*, 50. Which inequality can be used to find the longest possible width?
1) $30 + 2w < 50$
2) $30 + 2w \leq 50$
3) $30 + 2w > 50$
4) $30 + 2w \geq 50$

TOPIC 3: Interpret the structure of expressions

Standard A.SSE.2: Use the structure of an expression to identify ways to rewrite it. For example, see x⁴ – y⁴ as (x²)² – (y²)², thus recognizing it as a difference of squares that can be factored as (x² – y²)(x² + y²). <u>AKA</u>: FACTORING

1) Factor the expression $x^4 + 6x - 7$ completely.

2) When factored completely, the expression
$p^4 - 81$ is equivalent to
1) $(p^2 + 9)(p^2 - 9)$
2) $(p^2 - 9)(p^2 - 9)$
3) $(p^2 + 9)(p + 3)(p - 3)$
4) $(p + 3)(p - 3)(p + 3)(p - 3)$

3) Which expression is equivalent to $x^4 - 12x^2 + 36$?
1) $(x^2 - 6)(x^2 - 6)$
2) $(x^2 + 6)(x^2 + 6)$
3) $(6 - x^2)(6 + x^2)$
4) $(x^2 + 6)(x^2 - 6)$

4) Factored completely, the expression
$3x^3 - 33x^2 + 90x$ is equivalent to
1) $3x(x^2 - 33x + 90)$
2) $3x(x^2 - 11x + 30)$
3) $3x(x + 5)(x + 6)$
4) $3x(x - 5)(x - 6)$

5) If $3x$ is one factor of $3x^2 - 9x$, what is the other factor?

6) If one factor of $56x^4y^3 - 42x^2y^6$ is $14x^2y^3$, what is the other factor?

7) If $x + 2$ is a factor of $x^2 + bx + 10$, what is the value of b?

8) The expression $x^2 - 16$ is equivalent to
1) $(x + 2)(x - 8)$
2) $(x - 2)(x + 8)$
3) $(x + 4)(x - 4)$
4) $(x + 8)(x - 8)$

9) Which expression is equivalent to $64 - x^2$?
1) $(8 - x)(8 - x)$
2) $(8 - x)(8 + x)$
3) $(x - 8)(x - 8)$
4) $(x - 8)(x + 8)$

10) If Ann correctly factors an expression that is the difference of two perfect squares, her factors could be
1) $(2x + y)(x - 2y)$
2) $(2x + 3y)(2x - 3y)$
3) $(x - 4)(x - 4)$
4) $(2y - 5)(y - 5)$

11) Factor completely: $3x^2 - 27$
1) $3(x - 3)^2$
2) $3(x^2 - 27)$
3) $3(x + 3)(x - 3)$
4) $(3x + 3)(x - 9)$

12) One of the factors of $4x^2 - 9$ is
1) $(x + 3)$
2) $(2x + 3)$
3) $(4x - 3)$
4) $(x - 3)$

7

13) One factor of the expression $x^2y^2 - 16$ is
   1) $xy - 4$
   2) $xy - 8$
   3) $x^2 - 4$
   4) $x^2 + 8$

14) What is a common factor of $x^2 - 9$ and
   $x^2 - 5x + 6$?
   1) $x + 3$
   2) $x - 3$
   3) $x - 2$
   4) x^2

15) The greatest common factor of $3m^2n + 12mn^2$ is?
   1) $3n$
   2) $3m$
   3) $3mn$
   4) $3mn^2$

16) Factor the quadratic: $3x^2 + x - 2$

17) Factor the quadratic: $6x^2 + 13x - 5$

18) Factor the quadratic: $4x^2 + 4x - 3$

19) Factor the quadratic: $6 + x - x^2$

20) Factor the quadratic: $3x^2 - 6x - 105$

21) In the equation $x^2 + 10x + 24 = (x+a)(x+b)$, b is an integer. Find algebraically all possible values of b.

TOPIC 4: Write expressions in equivalent forms to solve problems.
Standard A-SSE.3 – Choose and produce an equivalent form of an expression to reveal and explain properties of the quantity represented by the expression.

1) Keith determines the zeros of the function $f(x)$ to be -6 and 5. What could be Keith's function?
   1) $f(x) = (x+5)(x+6)$
   2) $f(x) = (x+5)(x–6)$
   3) $f(x) = (x–5)(x+6)$
   4) $f(x) = (x–5)(x–6)$

2) A student was given the equation $x^2 + 6x – 13 = 0$ to solve by completing the square. The first step that was written is shown below.
$$x^2 + 6x + c = 13 + c$$
State the value of **c** that creates a perfect square trinomial. Explain how the value of **c** is determined.

3) The solution to the equation $x^2 – 6x = 0$ is
   1) 0, only
   2) 6, only
   3) 0 and 6
   4) $\pm\sqrt{6}$

4) The solutions of $x^2 = 16x – 28$ are
   1) −2 and −14
   2) 2 and 14
   3) −4 and −7
   4) 4 and 7

5) Solve for x: $x^2 + 3x – 28 = 0$

6) Solve: $(x – 3)(x + 3) = 6x – 14$

7) Brian correctly used a method of completing the square to solve the equation $x^2 + 7x – 11 = 0$. Brian's first step was to rewrite the equation as $x^2 + 7x = 11$. He then added a number to both sides of the equation. Which number did he add?
   1) $\dfrac{7}{2}$ 3) $\dfrac{49}{2}$
   2) $\dfrac{49}{4}$ 4) 49

8) If $x^2 + 2 = 6x$ is solved by completing the square, an intermediate step would be
   1) $(x + 3)^2 = 7$ 3) $(x – 3)^2 = 11$
   2) $(x – 3)^2 = 7$ 4) $(x – 6)^2 = 34$

9) Solve $2x^2 – 12x + 4 = 0$ by completing the square, expressing the result in simplest radical form.

10) The quadratic equation $y = (x – 1)^2 – 16$ has a vertex of
   1) (-1, -16)
   2) (1, -16)
   3) (-1, 16)
   4) (1, 16)

11) The quadratic equation $y = 2(x – 4)^2 – 8$ has a vertex of
   1) (2, -4)
   2) (-4, 8)
   3) (2, 4)
   4) (4, -8)

12) Complete the square to find the vertex of
$$y = x^2 – 6x + 4$$

9

TOPIC 5: Perform arithmetic operations on polynomials.

Standard A-APR.1 – Understand that polynomials form a system analogous to the integers, namely, they are closed under the operations of addition, subtraction, and multiplication; add, subtract, and multiply polynomials.

Let $A = x^2 - 2x - 15$
Let $B = x + 3$

1) Find $A + B$

2) Find $A - B$

3) Find $B - A$

4) Find AB

5) Find A/B

6) A company produces x units of a product per month, where $C(x)$ represents the total cost and $R(x)$ represents the total revenue for the month. The functions are modeled by $C(x) = 300x + 250$ and $R(x) = -0.5x^2 + 800x - 100$. The profit is the difference between revenue and cost where $P(x) = R(x) - C(x)$. What is the total profit, $P(x)$, for the month?

7) Express the product of $2x^2 + 7x - 10$ and $x + 5$ in standard form.

8) Tom is given a rectangular piece of paper. If the length of Tom's piece of paper is represented by $2x - 6$ and the width is represented by $3x - 5$, then the paper has a total area represented by
1) $5x - 11$
2) $6x^2 - 28x + 30$
3) $10x - 22$
4) $6x^2 - 6x - 11$

9) When $3x^2 - 8x$ is subtracted from $2x^2 + 3x$, the difference is
1) $-x^2 + 11x$
2) $x^2 - 11x$
3) $-x^2 - 5x$
4) $x^2 - 5x$

10) The expression $(x - 6)^2$ is equivalent to
1) $x^2 - 36$
2) $x^2 + 36$
3) $x^2 - 12x + 36$
4) $x^2 + 12x + 36$

11) The expression $\left(a^2 + b^2\right)^2$ is equivalent to
1) $a^4 + b^4$
2) $a^4 + a^2b^2 + b^4$
3) $a^4 + 2a^2b^2 + b^4$
4) $a^4 + 4a^2b^2 + b^4$

12) The expression $(2x + 1)^2 - 2(2x^2 - 1)$ is equivalent to

13) Find the area of a square whose side measures
x – 3 inches.

14) Find the perimeter of a square whose side
measures x – 3 inches.

15) Find the volume of a cube whose side measures
x – 3 inches.

16) Given a rectangle with an area of $x^2 - 2x - 35$
inches and a width of x – 7 inches, find the
length.

17) When $16x^3 - 12x^2 + 4x$ is divided by $4x$, the
quotient is
1) $12x^2 - 8x$
2) $12x^2 - 8x + 1$
3) $4x^2 - 3x$
4) $4x^2 - 3x + 1$

18) If $x \neq 0$, the expression $\frac{x^2 + 2x}{x}$ is equivalent to
1) $x + 2$
2) 2
3) $3x$
4) 4

19) Which polynomial is the quotient of
$$\frac{6x^3 + 9x^2 + 3x}{3x}?$$
1) $2x^2 + 3x + 1$
2) $2x^2 + 3x$
3) $2x + 3$
4) $6x^2 + 9x$

20) What is the average (arithmetic mean) of
$3(5x^2 + 2)$ and $7(5x^2 + 2)$?

a) $10x^2 + 20$
b) $x^2 + 8$
c) $25x^2 + 10$
d) $40x^2 + 16$
e) $50x^2 + 20$

11

<u>TOPIC 6</u>: Understand the relationship between zeros and factors of polynomials.
<u>Standard A-APR.3</u> – Identify zeros of polynomials when suitable factorizations are available, and use the zeros to construct a rough graph of the function defined by the polynomial.

1) The zeros of the function $f(x) = (x + 2)^2 - 25$ are
   1) -2 and 5   3) -5 and 2
   2) -3 and 7   4) -7 and 3

2) Would you expect the function $f(x) = -x^2 + x + 6$ to open upward or downward? Explain why.

3) Find the x-intercepts of the function $f(x) = x^3 - x^2 - 6x$.

4) Using the x-intercepts and behavior of a cubic function, sketch the function $f(x) = x^3 - x^2 - 6x$.
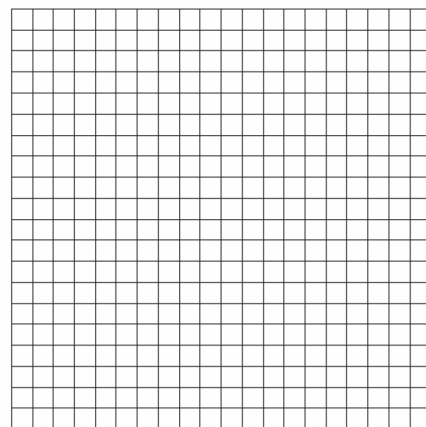
5) Find all x-intercepts of the polynomial $x^3 - 16x$.

6) Find the roots of the function $f(x) = x^3 - x^2$

8) Which of the following is the equation of a parabola that does *not* pass through the origin?
   a) $y = 4x^2$
   b) $y = 3x^2 - 2x$
   c) $y = -x^2 + 5x$
   d) $y = \frac{1}{2}x^2 + x$
   e) $y = x^2 + x - 6$

9) Which parabola intersects the x-axis in two distinct points?
   a) $y = x^2 - 10x - 25$
   b) $y = x^2 + 14x + 49$
   c) $y = x^2 + 4$
   d) $y = x^2 - 36$
   e) $y = (x + 1)^2$

10) Which is an equation of the parabola shown in the accompanying diagram?
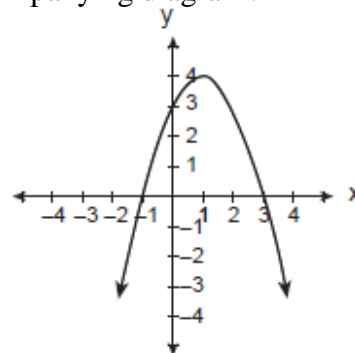
   1) $y = -x^2 + 2x + 3$
   2) $y = -x^2 - 2x + 3$
   3) $y = x^2 + 2x + 3$
   4) $y = x^2 - 2x + 3$

12

TOPIC 7: Create equations that describe numbers or relationships.
Standard A-CED.1 - Create equations and inequalities in one variable and use them to solve problems.
Include equations arising from linear and quadratic functions, and simple rational and exponential functions.

1) Sam and Jeremy have ages that are consecutive odd integers. The product of their ages is 783. Which equation could be used to find Jeremy's age, j, if he is the younger man?

   1) $j^2 + 2 = 783$ 3) $j^2 + 2j = 783$

   2) $j^2 - 2 = 783$ 4) $j^2 - 2j = 783$

2) During the 2010 season, football player McGee's earnings, m, were 0.005 million dollars more than those of his teammate Fitzpatrick's earnings, f. The two players earned a total of 3.95 million dollars. Which system of equations could be used to determine the amount each player earned, in millions of dollars?

   1)   m+f = 3.95   3) f − 3.95 = m
          m+0.005 = f   m+0.005 = f

   2)   m − 3.95 = f   4) m+f = 3.95
          f + 0.005 = m   f + 0.005 = m

3) A school is building a rectangular soccer field that has an area of 6000 square yards. The soccer field must be 40 yards longer than its width. Determine algebraically the dimensions of the soccer field, in yards.

4) A total of 69 students and coaches went to a track meet. If only mini-busses that seat 12 are available, which of the following shows the minimum number of busses needed?

   1) $\dfrac{69}{b} \le 12$ 3) $\dfrac{69}{b} \ge 12$

   2) $\dfrac{b}{69} \le 12$ 4) $\dfrac{12}{b} \le 69$

5) When ordering lunch, there were twice as many plain pizzas as there were with toppings. If there were 8 pizzas with toppings, how many pizzas were there in total?

   5)   8   3) 24

   6)   16   4) It cannot be determined.

6) Attendance at the track meet was 20% higher than it was last year. If the same growth occurs every year, how many years will it take before the attendance more than double? Use the equation, $A = (1 \pm r)^t$, where A is the total attendance, r is the rate of growth and t is time in years.

7) Upon returning to your school, all items must be returned to the storage shed. This shed of 2400 cubic feet has depth twice its height and a width 2 feet more than its height.
   a) Write an equation in terms of 1 variable (height) that can be used to find all dimensions.
   b) Find all dimensions.

8) A triangle has an area of 3x + 5. If the height is x + 3, write the algebraic expression that represents the base of the triangle.

9) Connor wants to attend the town carnival. The price of admission to the carnival is $4.50, and each ride costs an additional 79 cents. If he can spend at most $16.00 at the carnival, which inequality can be used to solve for r, the number of rides Connor can go on, and what is the maximum number of rides he can go on?

    1) $0.79 + 4.50r \leq 16.00$; 3 rides   3) $4.50 + 0.79r \leq 16.00$; 14 rides

    2) $0.79 + 4.50r \leq 16.00$; 4 rides   4) $4.50 + 0.79r \leq 16.00$; 15 rides

10) In 2013, the United States Postal Service charged $0.46 to mail a letter weighing up to 1 oz. and $0.20 per ounce for each additional ounce. Which function would determine the cost, in dollars, c(z), of mailing a letter weighing z ounces where z is an integer greater than 1?

    1) $c(z) = 0.46z + 0.20$ 3) $c(z) = 0.46(z - 1) + 0.20$

    2) $c(z) = 0.20z + 0.46$ 4) $c(z) = 0.20(z - 1) + 0.46$

11) A gardener is planting two types of trees:

    Type A is three feet tall and grows at a rate of 15 inches per year.

    Type B is four feet tall and grows at a rate of 10 inches per year.

Algebraically determine exactly how many years it will take for these trees to be the same height.

12) New Clarendon Park is undergoing renovations to its gardens. One garden that was originally a square is being adjusted so that one side is doubled in length, while the other side is decreased by three meters.

The new rectangular garden will have an area that is 25% more than the original square garden. Write an equation that could be used to determine the length of a side of the original square garden.

Explain how your equation models the situation.

Determine the area, in square meters, of the new rectangular garden.

TOPIC 7: Create equations that describe numbers or relationships.
Standard A-CED.2 - Create equations in two or more variables to represent relationships between quantities; graph equations on coordinate axes with labels and scales.

1) The ratio of the length of a rectangle to its width is 4:1. Find the percent of the perimeter to the length.

2) Racing fuel leaks out of a barrel at the rate **g** gallons per **h** hours. If racing fuel costs $10 per gallon, which expression could be used to calculate how much money in fuel is lost in **x** hours.

   1) $\dfrac{10gx}{h}$

   2) $\dfrac{h}{10gx}$

   3) $\dfrac{10x}{gh}$

   4) $\dfrac{10gh}{x}$

3) If the student-teacher ratio is 25:1 in Ridgemont High, which relation could be used to represent the population of this High School? Use **s** for students and **t** for teachers.

   1) $\dfrac{t}{s} = 25$

   2) $\dfrac{s}{t} = 25$

   3) $st = 25$

   4) $\dfrac{s}{t} = \dfrac{1}{25}$

4) Which of the following describes the line x = 2.
   1) A horizontal line thorough the point (2, 2).
   2) A vertical line thorough the point (2, 2).
   3) A straight line with a slope of 2.
   4) A straight line with a y-intercept of 2.

5) Which of the following best represents the equation y = 3x – 1?
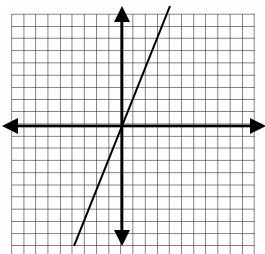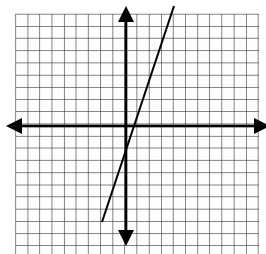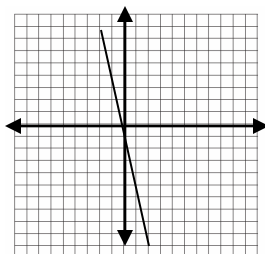
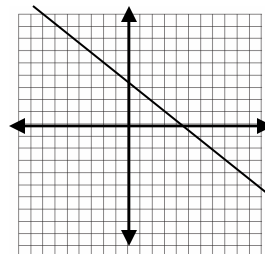   1)   2)   3)   4)

6) The current graduating class at Ridgemont High School is 512 students. If the ratio of boys to girls is 3 to 5, find the number of each.

15

TOPIC 7: Create equations that describe numbers or relationships.

Standard A-CED.3 – Represent constraints by equations or inequalities, and by systems of equations and/or inequalities, and interpret solutions as viable or nonviable options in a modeling context.

You just received a $50 coupon for Overcharge Wireless. The standard monthly charge is $30 and each text costs 20 cents.

1) Write an equation that can be used to calculate your monthly bill.

2) What is your bill if you send 20 texts per day in a 31-day month?

3) If you plotted cost versus number of texts on a graph, which of the following would be the best use of the graph space?
   1) It doesn't matter as long as the x & y axes are in the middle of the plot.
   2) Every dollar & text.
   3) Every 10 dollars & 25 texts.
   4) It cannot be graphed.

4) On the following plane, graph cost vs. number of texts and identify the break-even point between your monthly bill and the $50 coupon you received.
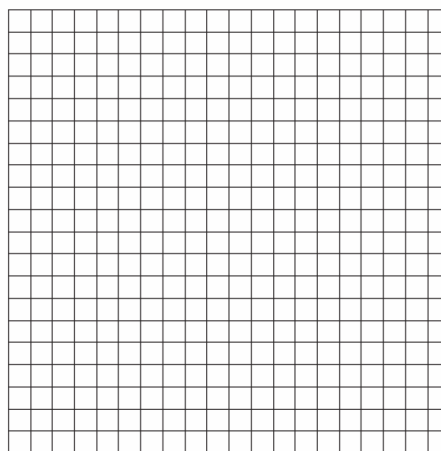
5) John is in a car at the top of a roller-coaster ride. The distance in feet, d, of the car from the ground as the car descends is determined by the equation $h(t) = (12t)(12 - 3t)$, where t is the number of seconds it takes the car to travel down to each point on the ride. How many seconds will it take John to reach the ground?

6) John was told the highest roller-coaster was over 150 feet high. Was the roller-coaster in problem #5 the highest at this amusement park? Explain your reasoning.

7) The Common-Core Algebra Regents has a total of 37 questions and 86 points. If you take out the 1 6-point question, there are only 4 and 4 point questions. Find the number of each question type.

8) 3 out of every 4 two point questions on Common-Core Algebra Regents is a multiple choice question. Find the total number of multiple choice questions.

9) Edith babysits for x hours a week after school at a job that pays $4 an hour. She has accepted a job that pays $8 an hour as a library assistant working y hours a week. She will work both jobs. She is able to work no more than 15 hours a week, due to school commitments. Edith wants to earn at least $80 a week, working a combination of both jobs.

Write a system of inequalities that can be used to represent the situation.

Graph these inequalities on the following set of axes.

Determine and state one combination of hours that will allow Edith to earn at least $80 per week while working no more than 15 hours.
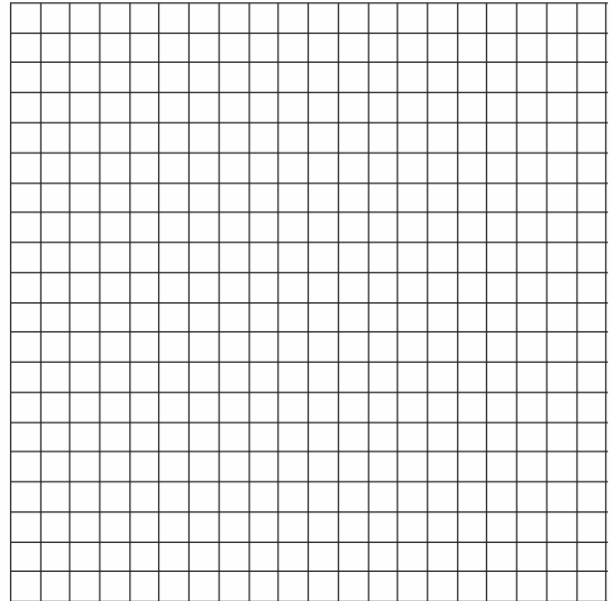
TOPIC 7: **Create equations that describe numbers or relationships.**
Standard A-CED.4 – Rearrange formulas to highlight a quantity of interest, using the same reasoning as in solving
equations. *For example, rearrange Ohm's Law V = IR to highlight resistance R.*

1) Solve for x in the following equation: $y = mx + b$

2) The equation for the volume of a cylinder is $V = \pi r^2 h$. The positive value of r, in terms of h and V, is

1) $r = \sqrt{\dfrac{V}{\pi h}}$ 3) $r = 2V\pi h$

2) $r = \sqrt{V\pi h}$ 4) $r = \dfrac{V}{2\pi}$

3) If $2m + 2p = 16$, p equals
1) $8 - m$
2) $16 - m$
3) $16 + 2m$
4) $9m$

6) Solve for x: $(a - x)(b - x) = x^2$

4) In the equation $A = p + prt$, t is equivalent to
1) $\dfrac{A - pr}{p}$
2) $\dfrac{A - p}{pr}$
3) $\dfrac{A}{pr} - p$
4) $\dfrac{A}{p} - pr$

7) If $\dfrac{x}{4} - \dfrac{a}{b} = 0$, $b \neq 0$, then x is equal to
1) $-\dfrac{a}{4b}$
2) $\dfrac{a}{4b}$
3) $-\dfrac{4a}{b}$
4) $\dfrac{4a}{b}$

5) Shoe sizes and foot length are related by the
formula $S = 3F - 24$, where S represents the shoe
size and F represents the length of the foot, in
inches.
   a) Solve the formula for F.
   b) To the *nearest tenth of an inch,* how long is
the foot of a person who wears a size $10\dfrac{1}{2}$
shoe?

8) Which equation is equivalent to $3x + 4y = 15$?
1) $y = \dfrac{15 - 3x}{4}$
2) $y = \dfrac{3x - 15}{4}$
3) $y = 15 - 3x$
4) $y = 3x - 15$

TOPIC 8: Understand solving equations as a process of reasoning and explain the reasoning.

Standard A-REI.1 – Explain each step in solving a simple equation as following from the equality of numbers asserted at the previous step, starting from the assumption that the original equation has a solution. Construct a viable argument to justify a solution method.

1) The graph of a linear equation contains the points (3,11) and (–2,1). Which point also lies on the graph?
   1) (2,1)
   2) (2,4)
   3) (2,6)
   4) (2,8)

2) Which equation has the same solutions as
$$x^2 + 6x - 7 = 0?$$
   1) $(x+3)^2 = 2$
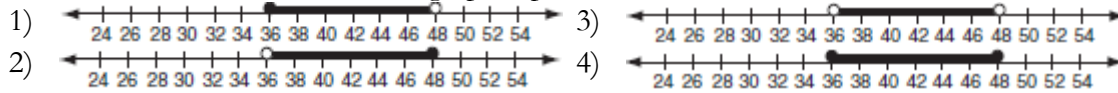   2) $(x-3)^2 = 2$
   3) $(x-3)^2 = 16$
   4) $(x+3)^2 = 16$

3) If $2x + 5 = -25$ and $-3m - 6 = 48$, what is the product of x and m?
   1) -270
   2) -33
   3) 3
   4) 270

4) Debbie solved the linear equation $3(x + 4) - 2 = 16$ as follows:

   [Line 1] $3(x + 4) - 2 = 16$

   [Line 2] $3(x + 4) = 18$

   [Line 3] $3x + 4 = 18$

   [Line 4] $3x = 14$

   [Line 5] $x = 4\frac{2}{3}$

   She made an error between lines
   1) 1 and 2
   2) 2 and 3
   3) 3 and 4
   4) 4 and 5

5) What is the solution set of the equation
$$\frac{x}{5} + \frac{x}{2} = 14?$$
   1) {4}
   2) {10}
   3) {20}
   4) {49}

6) In the equation $\frac{1}{4}n + 5 = 5\frac{1}{2}$, n is equal to
   1) 8
   2) 2
   3) $\frac{1}{2}$
   4) $\frac{1}{8}$

7) The number of people on the school board is represented by x. Two subcommittees with an equal number of members are formed, one with $\frac{2}{3}x - 5$ members and the other $\frac{x}{4}$ with members. How many people are on the school board?
   1) 20
   2) 12
   3) 8
   4) 4

8) Solve for m: $\frac{m}{5} + \frac{3(m-1)}{2} = 2(m-3)$

9) What is the solution set of the equation
$$x^2 - 5x = 0?$$
   1) {0,–5}
   2) {0,5}
   3) {0}
   4) {5}

10) The solutions of $x^2 = 16x - 28$ are
   1) -2 and -14
   2) 2 and 14
   3) -4 and -7
   4) 4 and 7

11) What is the positive solution of the equation $4x^2 - 36 = 0$?

19

12) Solve: $(x - 3)(x + 3) = 6x - 14$

13) If x is a real number, what is the solution set of the equation $\sqrt{1 - 2x} = 2$?
1) $\left\{\dfrac{3}{2}\right\}$ 3) $\{-2\}$
2) $\left\{-\dfrac{3}{2}\right\}$ 4) $\{\ \}$

14) What is the value of x in the equation $\sqrt{3 + x} - 5 = -2$?
1) 46   3) 3
2) 12   4) 6

15) Which point is not on the graph represented by $y = x^2 + 3x - 6$?
1) (-6, 12)   3) (2, 4)
2) (-4, -2)   4) (3, -6)

16) Solve the equation $4x^2 - 12x = 7$ algebraically for x.

17) If $4x^2 - 100 = 0$, the roots of the equations are:

1) -25 and 25   3) -5 and 5
2) -25, only   4) -5, only

18) What is the value of x in the equation:
$$\frac{x - 2}{3} + \frac{1}{6} = \frac{5}{6}?$$
1) 4   3) 8
2) 6   4) 11

19) Which equation has the same solution as $x^2 - 6x - 12 = 0$?

1) $(x+3)^2 = 21$
2) $(x-3)^2 = 21$
3) $(x+3)^2 = 3$
4) $(x-3)^2 = 3$

20) Write an equation that defines $m(x)$ as a trinomial where $m(x) = (3x-1)(3-x) + 4x^2 + 19$.

Solve for x when $m(x) = 0$.

Standard A-REI.3 – Solve linear equations and inequalities in one variable, including equations with coefficients represented by letters.
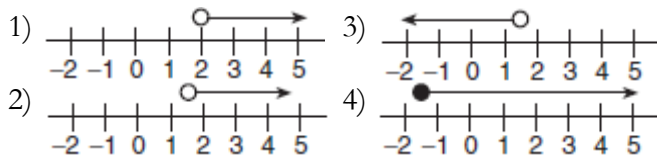
1) In order to be admitted for a certain ride at an amusement park, a child must be greater than or equal to 36 inches tall and less than 48 inches tall. Which graph represents these conditions?
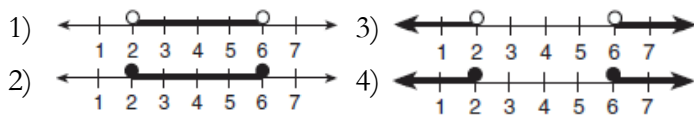
1) ![number line 24 to 54]

3) ![number line 24 to 54]

2) ![number line 24 to 54]

4) ![number line 24 to 54]

2) The inequality $\frac{1}{2}x + 3 < 2x - 6$ is equivalent to

1) $x < -\dfrac{5}{6}$ 3) $x < 6$

2) $x > -\dfrac{5}{6}$ 4) $x > 6$

6) Find the smallest possible value for x: $3(x+3) \le 5x–3$.

3) Which graph best represents the solution set for the inequality $x > \sqrt{2}$?

1) ![number line -2 to 5]

3) ![number line -2 to 5]

2) ![number line -2 to 5]

4) ![number line -2 to 5]

7) Given $2x + ax – 7 > –12$, determine the largest determine the largest integer value of **a** when x = –1.

4) Which graph represents the solution set for $2x – 4 \le 8$ and $x + 5 \ge 7$?

1) ![number line 1 to 7]

3) ![number line 1 to 7]

2) ![number line 1 to 7]

4) ![number line 1 to 7]

5) The solution set of the inequality $|x – 3| < 5$ is
   1) $\{x < 8 \text{ and } x < -2\}$ 3) $\{x < 8 \text{ and } x > -2\}$
   2) $\{x < 8 \text{ or } x < -2\}$ 4) $\{x > 8 \text{ or } x < -2\}$

TOPIC 9: Solve equations and inequalities in one variable.
Standard A-REI.4 – Solve quadratic equations in one variable.

1) <u>Solve by factoring</u>: $8x^2 + 20x = 12$

3) Jack is building a rectangular dog pen that he wishes to enclose. The width of the pen is 2 yards less than the length. If the area of the dog pen is 15 square yards, how many yards of fencing would he need to completely enclose the pen?

2) If the quadratic formula is used to find the roots of the equation $x^2 - 6x - 19 = 0$, the correct roots are:

1) $3 \pm 2\sqrt{7}$

3) $3 \pm 4\sqrt{14}$

2) $-3 \pm 2\sqrt{7}$

4) $-3 \pm 4\sqrt{14}$

4) Solve for x: $\frac{1}{2} x^2 - 3x + 2 = 0$
Leave your answer in simplest radical form.

TOPIC 10: Represent and solve equations and inequalities graphically.

__Standard A-REI.10__ – Understand that the graph of an equation in two variables is the set of all its solutions plotted in the coordinate plane, often forming a curve (which could be a line).

1) On the set of axes below, draw the graph of the equation $y = -\frac{3}{4}x + 3$.
   Is the point (3,2) a solution to the equation?
   Explain your answer based on the graph drawn.
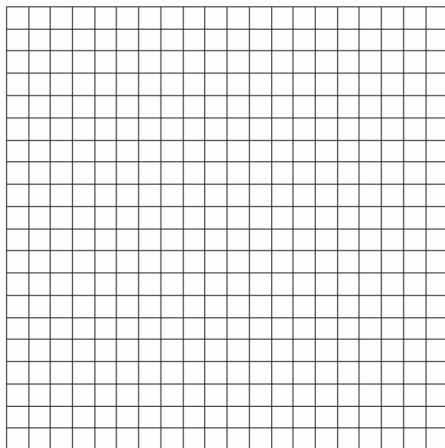
2) Which point lies on the line whose equation is
   $2x - 3y = 9$?
   1) (−1,−3)
   2) (−1,3)
   3) (0,3)
   4) (0,−3)

3) Point $(k,-3)$ lies on the line whose equation is
   $x - 2y = -2$. What is the value of k?
   1) −8
   2) −6
   3) 6
   4) 8

4) Which inequality is represented by the accompanying graph?
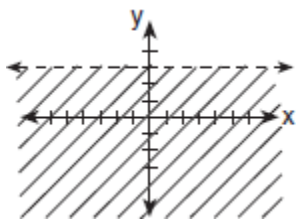
   1) $y < 3$
   2) $y > 3$
   3) $y \le 3$
   4) $y \ge 3$

5) Which inequality is shown in the accompanying diagram?
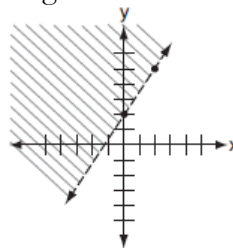
   1) $y > \frac{3}{2}x + 2$
   2) $y < \frac{3}{2}x + 2$
   3) $y \ge \frac{3}{2}x + 2$
   4) $y \le \frac{3}{2}x + 2$

6) Which ordered pair is in the solution set of the following system of inequalities?
   $$y < \frac{1}{2}x + 4$$
   $$y \ge -x + 1$$
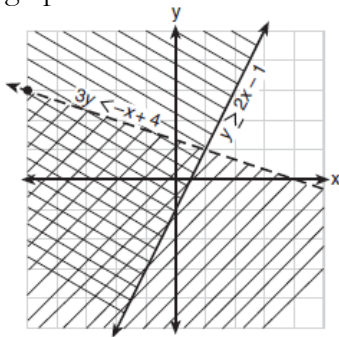   1) (−5,3)
   2) (0,4)
   3) (3,−5)
   4) (4,0)

7) Which coordinates represent a point in the solution set of the system of inequalities shown below?
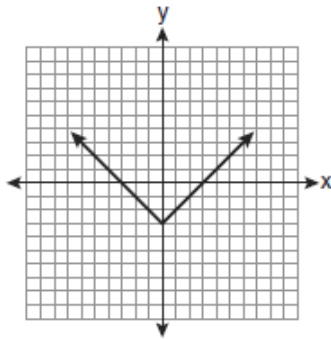 $$y \le \frac{1}{2}x + 13$$
   $$4x + 2y > 3$$
   1) (−4,1)
   2) (−2,2)
   3) (1,−4)
   4) (2,−2)

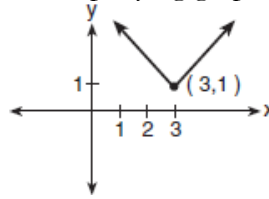8) Which point is a solution for the system of inequalities shown on the accompanying graph?

1) (−4,−1)
2) (2,3)
3) (1,1)
4) (−2,2)

9) Which equation is represented by the graph below?

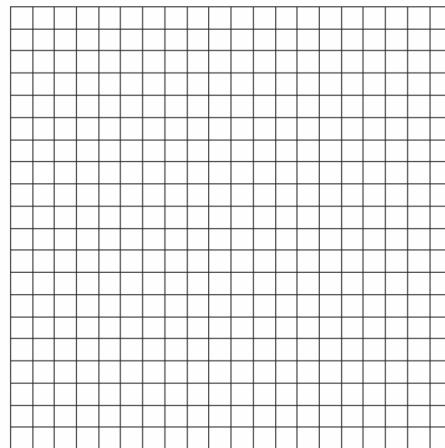1) $y = x^2 - 3$
2) $y = (x - 3)^2$
3) $y = |x| - 3$
4) $y = |x - 3|$

10) Which equation is represented by the accompanying graph?

1) $y = |x| - 3$
2) $y = (x - 3)^2 + 1$
3) $y = |x + 3| - 1$
4) $y = |x - 3| + 1$

11) Graph the solution to the following system:

$$y = -\frac{1}{2}x + 5 \quad \text{and} \quad y = 3x - 2$$

24

TOPIC 10: Represent and solve equations and inequalities graphically.

Standard A-REI.11 – Explain why the *x*-coordinates of the points where the graphs of the equations $y = f(x)$ and $y = g(x)$ intersect are the solutions of the equation $f(x) = g(x)$; find the solutions approximately, e.g., using technology to graph the functions, make tables of values, or find successive approximations. Include cases where $f(x)$ and/or $g(x)$ are linear, polynomial, rational, absolute value, exponential, and logarithmic functions.

1) Two functions, $y = |x - 3|$ and $3x + 3y = 27$, are graphed on the same set of axes. Which statement is true about the solution to the system of equations?
   1) (3,0) is the solution to the system because it satisfies the equation $y = |x - 3|$.
   2) (9,0) is the solution to the system because it satisfies the equation $3x + 3y = 27$.
   3) (6,3) is the solution to the system because it satisfies both equations.
   4) (3,0), (9,0), and (6,3) are the solutions to the system of equations because they all satisfy at least one of the equations.

2) Two equations were graphed on the set of axes below.
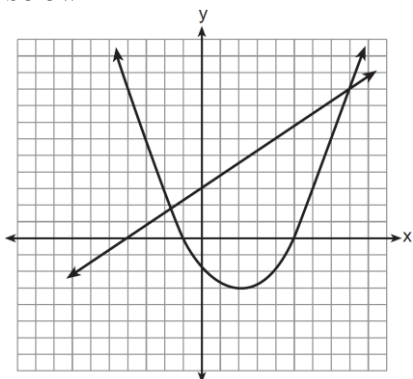
   Which point is a solution of the system of equations shown on the graph?
   1) **(8,9)**
   2) **(5,0)**
   3) **(0,3)**
   4) **(2,−3)**

3) Do the functions $f(x) = -x^2$ and $f(x) = x^2 - 2$ intersect?

4) Do the functions $f(x) = x^2$ and $f(x) = -x^2 - 2$ intersect?

5) Find the solution to the following system:
   $y = |x + 3|$ and $y = -x + 3$

6) Find the solution to the following system:
   $y = 2^x$ and $y = -2x + 8$

7) 2 cars leave from the same point. Car A leaves 1 hour before car B and travels at 50 MPH. Car B travels at 75 MPH in an effort to catch car A. Plot the distance traveled for both cars on the following grid. How many hours does it take car B to catch up to car A?
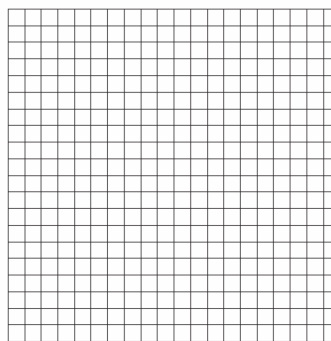

8) A rocket is launched from the ground and follows a parabolic path represented by the equation $y = -x^2 + 10x$. At the same time, a flare is launched from a height of 10 feet and follows a straight path represented by the equation $y = -x + 10$. Using the accompanying set of axes, graph the equations that represent the paths of the rocket and the flare, and find the coordinates of the point or points where the paths intersect.


25
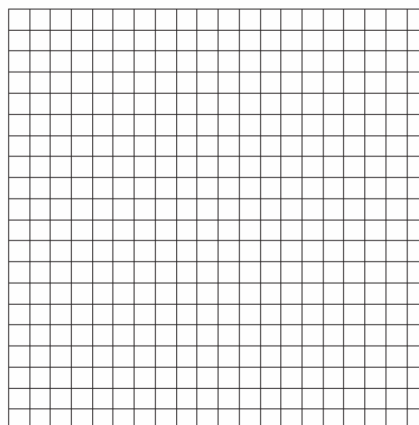
TOPIC 10: Represent and solve equations and inequalities graphically.

Standard A-REI.12 – Graph the solutions to a linear inequality in two variables as a half-plane (excluding the boundary in the case of a strict inequality), and graph the solution set to a system of linear inequalities in two variables as the intersection of the corresponding half-planes.

1) Let $f(x) = -2x^2$ and $g(x) = 2x - 4$. On the set of axes below, draw the graphs of $y = f(x)$ and $y = g(x)$.

Using this graph, determine and state *all* values of x for which $f(x) = g(x)$.
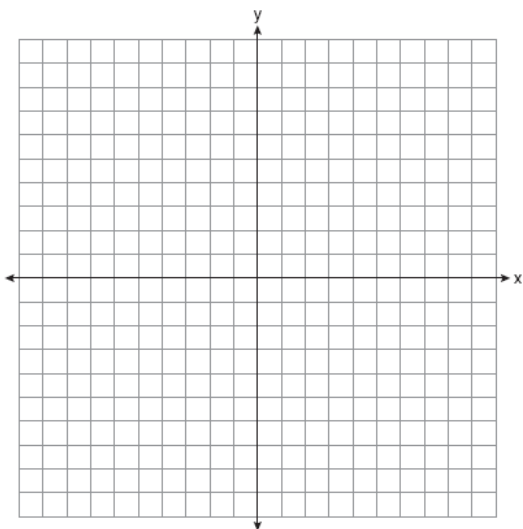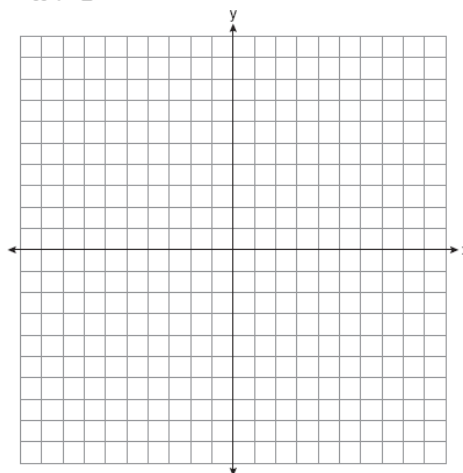
2) Graph the solution to the following system:

$$y > -\frac{1}{2}x + 5 \quad \text{and} \quad y \le 3x - 2$$
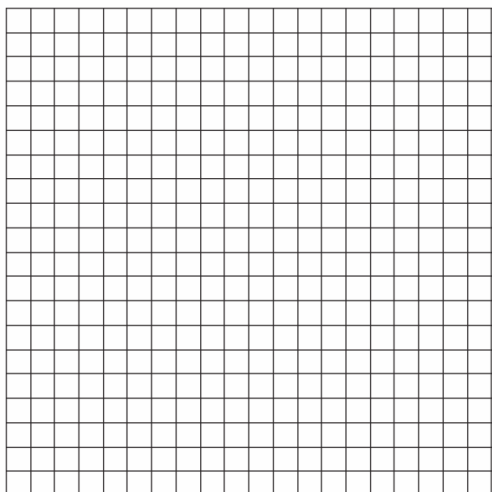
3) On the set of axes below, graph the following system of inequalities and state the coordinates of a point in the solution set.
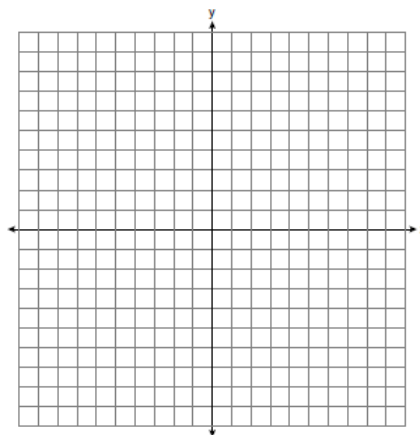
$$2x - y \ge 6$$

$$x > 2$$

4) On the set of axes below, graph the following system of inequalities.

$$y + x \ge 3$$

$$5x - 2y > 10$$

State the coordinates of *one* point that satisfies $y + x \ge 3$, but does *not* satisfy $5x - 2y > 10$.

5) The good people at Overcharge.com determine their profit follows the function $y = -x^2 + 8x - 7$. You were just hired by this company and have been asked to make a visual aid (a graph) to show your new boss where Overcharge.com is profitable. If the x-axis represent thousands of widgets produced and the y-axis represents profit in millions, use a linear inequality to show the region where Overcharge.com is profitable.
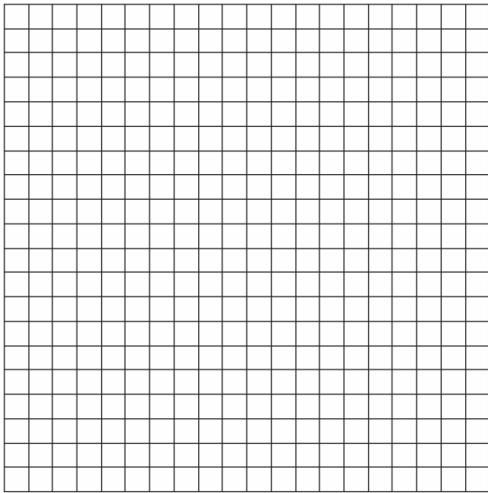
6) A company is considering building a manufacturing plant. They determine the weekly production cost at site A to be $A(x) = 3x^2$ while the production cost at site B is $B(x) = 8x+3$, where x represents the number of products, *in hundreds,* and $A(x)$ and $B(x)$ are the production costs, *in hundreds of dollars.*

Graph the production cost functions on the set of axes below and label them site A and site B.

State the positive value(s) of x for which the production costs at the two sites are equal. Explain how you determined your answer.

If the company plans on manufacturing 200 products per week, which site should they use? Justify your answer.
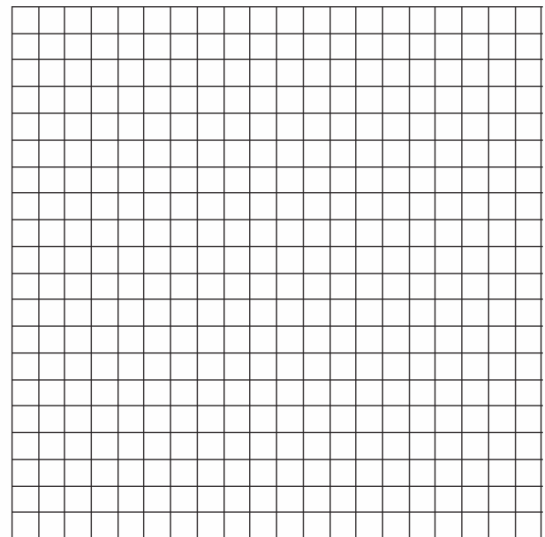
TOPIC 11: Solve systems of equations.

Standard A-REI.5 – Prove that, given a system of two equations in two variables, replacing one equation by the sum of that equation and a multiple of the other produces a system with the same solutions (more practice with systems).
Standard A-REI.6 – Solve systems of linear equations exactly and approximately (e.g., with graphs), focusing on pairs of linear equations in two variables.

1) Which system of equations has the same solution as the system below?

$$2x + 2y = 16$$
$$3x - y = 4$$

1) $2x+2y=16$
   $6x - 2y=4$
2) $2x + 2y = 16$
   $6x - 2y = 8$
3) $x+y=16$
   $3x - y = 4$
4) $6x+6y = 48$
   $6x+2y = 8$

2) What is the solution of the system of equations $c + 3d = 8$ and $c = 4d - 6$?

1) $c = -14, d = -2$
2) $c = -2, d = 2$
3) $c = 2, d = 2$
4) $c = 14, d = -2$

3) The equations $5x + 2y = 48$ and $3x + 2y = 32$ represent the money collected from school concert ticket sales during two class periods. If x represents the cost for each adult ticket and y represents the cost for each student ticket, what is the cost for each adult ticket?

1) $20
2) $10
3) $8
4) $4

4) Using the substitution method, Branden solves the following system of equations algebraically.

$$2x - y = 5$$
$$3x + 2y = -3$$

Which equivalent equation could Branden use?
1) $3x + 2(2x - 5) = -3$
2) $3x + 2(5 - 2x) = -3$
3) $3\left(y + \dfrac{5}{2} \right) + 2y = -3$
4) $3\left(\dfrac{5}{2} - y \right) + 2y = -3$

5) When solved graphically, which system of equations will have exactly one point of intersection?

1) $y = -x - 20$
   $y = x + 17$
2) $y = 0.5x + 30$
 $y = 0.5x - 30$
3) $y = \dfrac{3}{5}x + 12$
   $y = 0.6x - 19$
4) $y = -x + 15$
   $y = -x + 25$

6) Solve the following system algebraically:

$$y = \dfrac{1}{3}x - 3 \text{ and } 2x - y = 8$$

7) A local business was looking to hire a landscaper to work on their property. They narrowed their choices to two companies. Flourish Landscaping Company charges a flat rate of $120 per hour. Green Thumb Landscapers charges $70 per hour plus a $1600 equipment fee.

a) Write a system of equations representing how much each company charges.

b) Determine and state the number of hours that must be worked for the cost of each company to be the same.

c) If it is estimated to take at least 35 hours to complete the job, which company will be less expensive? Justify your answer.

d) Use of the grid below to illustrate where the costs will be the same.
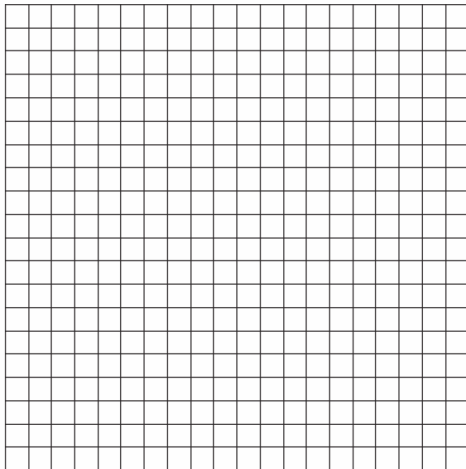
8) 2 cars leave from the same point. Car A leaves traveling at a speed of 50 MPH. Car B leaves 1 hour later and travels at a speed of 60 MPH.
a) How many hours does it take car B catch car A?
b) After how many hours total have they traveled the same distance?
c) Use the grid below, plotting distance in miles versus time in hours to justify your answers.
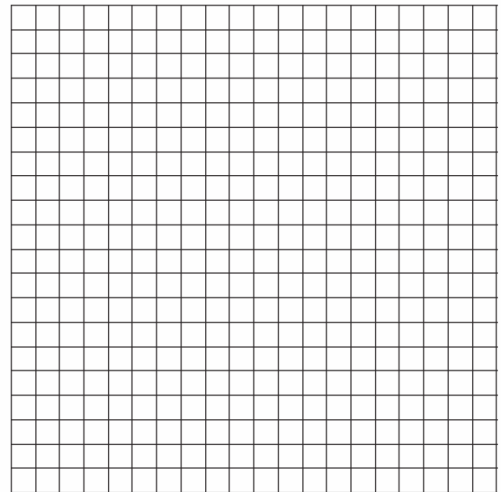
TOPIC 12: Understand the concept of a function and use function notation.

Standard F-IF.1 – Understand that a function from one set (called the domain) to another set (called the range) assigns to each element of the domain exactly one element of the range. If f is a function and x is an element of its domain, then f(x) denotes the output of f corresponding to the input x. The graph of f is the graph of the equation y = f(x).

1) The function $h(t)$ -16t^2 + 144 represents the height, $h(t)$, in feet, of an object from the ground at t seconds after it is dropped. A realistic domain for this function is
   1) $-3 \le t \le 3$ 3) $0 \le h(t) \le 144$
   2) $0 \le t \le 3$ 4) All real numbers

2) The function f has a domain of {1, 3, 5, 7} and a range of {2, 4, 6}. Could f be represented by {(1,2), (3,4), (5,6), (7,2)}?
   Justify your answer.

3) Does the following set of ordered pairs represent a function? {(6,-2), (3,-1), (2,0), (3,1), (6,2)}

4) Using set notation, state the domain and range of the function: $f(x) = x + 2$

5) Using set notation, state the domain and range of the function: $f(x) = x^2 + 2$

6) Using set notation, state the domain and range of the function: $f(x) = 2^x$. Does this function have an asymptote? If so, state the equation of the asymptote.

7) Given the following set of ordered pairs: {(-2,-9), (-1,-7), (0,-5), (1,-3)}, which of the following represents the domain?
   a. {-9, -7, -5, -3, -2, -1, 0, 1}
   b. {-9, -7, -5, -3}
   c. {-2, -1, 0, 1}
   d. (-2, -1, 0, 1)

8) Using set notation, state the domain and range of the function: $f(x) = |x + 2| - 1$.

9) Which of the following is *not* a fucntion?
   1) {(0,0), (1,1), (2,2), (3,3)}
   2) {(1,1), (2,1), (3,1), (4,1)}
   3) {(1,2), (3,4), (5,6), (7,8)}
   4) {(1,2), (1,2), (1,3), (1,4)}

10) Which of the following is *not* a fucntion?
   1) y = 1
   2) y = x
   3) x = 1
   4) y = x²

11) State the domain and range of the following relation.
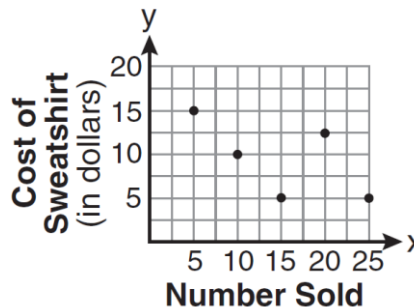
12) Given the function: $f(x) = x^3 - 4x$
   1. Find all x-intercepts.
   2. State the range over the domain $-3 \ge x \ge 3$.
   3. State the domain and range of the function given no restrictions.

13) For which value(s) of the domain is the expression $\dfrac{x-3}{x^2-4}$ undefined?
   1) {3}   3) {-2, 2}
   2) {2}   4) {-2}

1) A sunflower is 3 inches tall at week 0 and grows 2 inches each week. Which function(s) shown below can be used to determine the height, $f(n)$, of the sunflower in n weeks?

$$\text{I. } f(n) = 2n + 3$$
$$\text{II. } f(n) = 2n + 3(n - 1)$$
$$\text{III. } f(n) = f(n-1) + 2 \text{ where } f(0) = 3$$

1) I and II   3) III, only
2) II, only   4) I and III

13) If $f(x) = (x+2)^2 - 25$, find $f(x) = 0$.

3) If $f(x) = \dfrac{1}{3}x + 9$, which statement is always true?

1) $f(x) < 0$ 3) If x<0, then $f(x) < 0$
2) $f(x) > 0$ 4) If x<0, then $f(x) < 0$

4) If $f(x) = \sqrt{29 - x^2}$, find $f(-2)$.

5) The statement $f(-2) = 3$, implies which of the following?
1) 3 is the domain and -2 is the range.
2) The coordiante (-2, 3) would be incuded in this function.
3) The coordiante (3, -2) would be incuded in this function.
4) Both -2 and 3 are elements of the doamin of this function.

6) Given: the function f defined by $f(x) = 3x^2 - 4$. Which statement is true?
1) $f(0) = 0$
2) $f(-2) = f(2)$
3) $f(5) + f(2) = f(7)$
4) $f(5) \cdot f(2) = f(10)$

7) Overcharge wireless charges $25 a month plus 5 cents per text message. If your texting is represented by $c(t) = 25 + 0.05x$, where c is your final cost and t is the number of text messages, find:
   a) How many text messages you can send if your parents cap your cell phone bill at $40.
   b) Write your answer to part a as a complete domain representing the number of text messages you can send before you annoy your parents.

8) If $f(x) = x^2 - 3$, then $f(a - b)$ is equivalent to
1) $a^2 - b^2 - 3$
2) $a^2 - 2ab - b^2 - 3$
3) $a^2 - 2ab + b^2 - 3$
4) $a^2 + b^2 - 3$

9) If the domain of $f(x) = 2x + 1$ is $\{-2 \le x \le 3\}$, which integer is *not* in the range?
1) −4
2) −2
3) 0
4) 7

10) What is the range of the function $f(x) = |x + 1|$

11) An astronaut drops a rock off the edge of a cliff on the Moon. The distance, $d(t)$, in meters, the rock travels after t seconds can be modeled by the function $d(t) = 0.8t^2$. What is the average speed, in meters per second, of the rock between 5 and 10 seconds after it was dropped?
1) 12   3) 60
2) 20   4) 80

12) If $f(1) = 3$ and $f(n) = -2f(n - 1) + 1$, then $f(5) =$
1) −5   3) 21
2) 11   4) 43

Standard F-IF.3 – Recognize that sequences are functions, sometimes defined recursively, whose domain is a subset of the integers. *For example, the Fibonacci sequence is defined recursively by $f(0) = f(1) = 1$, $f(n+1) = f(n) + f(n-1)$ for $n \geq 1$.*

Definitions

Arithmetic sequence – A sequence of numbers that has a constant difference between consecutive terms. This means that you can always get from one term to the next by adding or subtracting the same number. This is known as a common difference.

Geometric sequence – A sequence of numbers that has a constant multiplier between consecutive terms. This means that you can always get from one term to the next by multiplying or dividing by the same number. This is known as a common ratio.

♦ <u>Note</u>: The state website lists this topic as "shared" with Algebra 2. This may/can appear under the category of "recognizing patterns" and may be asked as follows.

1) The third term in an arithmetic sequence is 10 and the fifth term is 26. If the first term is a_1, which is an equation for the nth term of this sequence?
   - (1) $a_n = 8n + 10$
   - (2) $a_n = 8n - 14$
   - (3) $a_n = 16n + 10$
   - (4) $a_n = 16n - 38$

2) What is the common difference of the arithmetic sequence $5, 8, 11, 14$?
   - 1) $\dfrac{8}{5}$
   - 2) -3
   - 3) 3
   - 4) 9

3) What is the common difference in the sequence $2a + 1, 4a + 4, 6a + 7, 8a + 10, \ldots$?
   - 1) $2a + 3$
   - 2) $-2a - 3$
   - 3) $2a + 5$
   - 4) $-2a + 5$

4) Which arithmetic sequence has a common difference of 4?
   - 1) $\{0, 4n, 8n, 12n, \ldots\}$
   - 2) $\{n, 4n, 16n, 64n, \ldots\}$
   - 3) $\{n + 1, n + 5, n + 9, n + 13, \ldots\}$
   - 4) $\{n + 4, n + 16, n + 64, n + 256, \ldots\}$

5) What is the common ratio of the geometric sequence shown below?
   $$-2, 4, -8, 16, \ldots$$
   - 1) $-\dfrac{1}{2}$
   - 2) 2
   - 3) -2
   - 4) -6

6) What is the common ratio of the sequence
   $$\frac{1}{64} a^5 b^3, -\frac{3}{32} a^3 b^4, \frac{9}{16} ab^5, \ldots?$$
   - 1) $-\dfrac{3b}{2a^2}$
   - 2) $-\dfrac{6b}{a^2}$
   - 3) $-\dfrac{3a^2}{b}$
   - 4) $-\dfrac{6a^2}{b}$

7) If a sequence is defined recursively by $f(0) = 2$ and $f(n + 1) = -2f(n) + 3$ for $n \geq 0$, then $f(2)$ is equal to
   - 1) 1
   - 2) -11
   - 3) 5
   - 4) 17

Standard F-IF.4 – For a function that models a relationship between two quantities, interpret key features of graphs and tables in terms of the quantities, and sketch graphs showing key features given a verbal description of the relationship. Key features include: intercepts; intervals where the function is increasing, decreasing, positive, or negative; relative maximums and minimums; symmetries; end behavior; and periodicity.
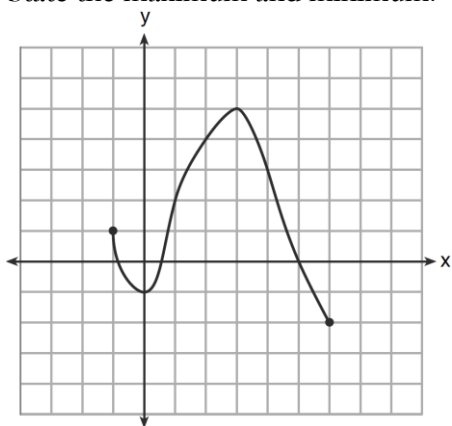
1) The value of the *x*-intercept for the graph of
$4x - 5y = 40$ is
  1) 10   3) -4/5
  2) 4/5   4) -8

2) Given: The graph below:
  a) State the intervals where the function is increasing and decreasing using set notation.
  b) Approximate the x & y intercepts.
  c) State the maximum and minimum.

3) Given the function $f(x) = 3x^2 - x - 2$; find:
  a) Where the maxima/minima occurs.
  b) The value of the maxima/minima.
  c) The zeros of the function.

4) Which of the following has all range values greater than 0?
  1) $f(x) = x^2$ 3) $f(x) = |x|$
  2) $f(x) = |x+1|$ 4) $f(x) = |x-1| + 1$

5) The accompanying diagram represents the biological process of cell division.
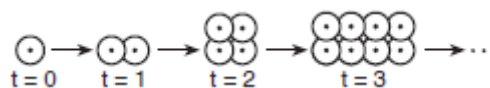
If this process continues, which expression best represents the number of cells at any time, *t*?
  (1) $t + 2$ (3) t^2
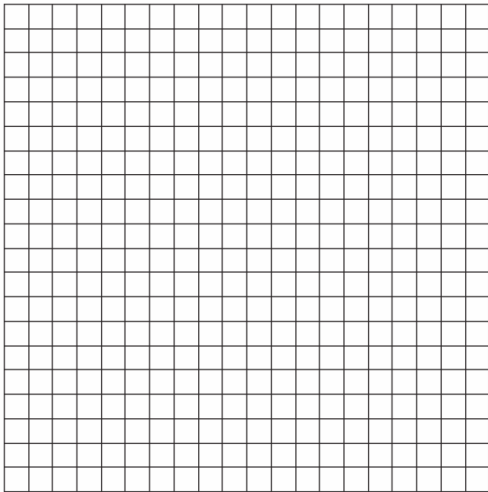 (2) $2t$ (4) 2^t

6) Which of the following increases at the greatest rate in the interval $0 \le x \le 3$?
    I $f(x) = 5x$
    II $f(x) = 5^x$
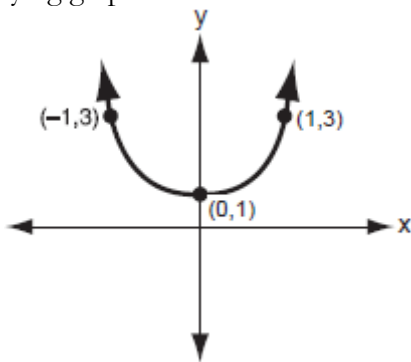   III $f(x) = 5x^2$
  1)   I only   3) II and III
  2)   I and II   4) II only

7) State the axis of symmetry of $f(x) = 5x^2 - 10$.

8) On the following grid, graph the function
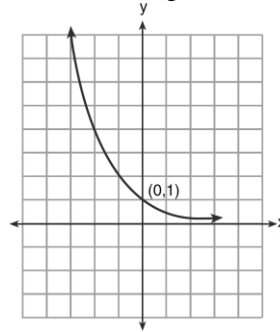$f(x) = \dfrac{1}{x}$ for $0 \le x \le 3$ and state all asymptotes.

9) Which equation is represented by the accompanying graph?

1) $y = 2x^2 + 1$
2) $y = 2(x^2 + 1)$
3) $y = x^2$
4) $y = 2x^2$

10) What is the equation of the graph shown below?

1) $y = 2^x$
2) $y = 2^{-x}$
3) $x = 2^y$
4) $x = 2^{-y}$

11) The strength of a medication over time is represented by the equation $y = 200(1.5)^{-x}$, where x represents the number of hours since the medication was taken and y represents the number of micrograms per millimeter left in the blood. Which graph best represents this relationship?
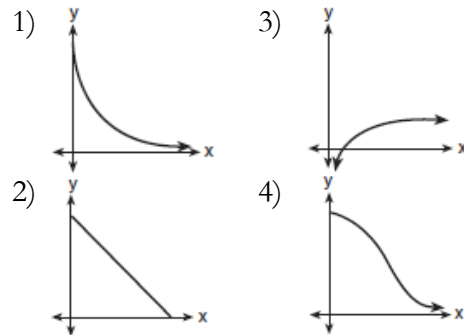
12) Four points on the graph of the function $f(x)$ are shown below.
$$\{(0, 1), (1, 2), (2, 4), (3, 8)\}$$
Which equation represents $f(x)$?
1) $f(x) = 2^x$
2) $f(x) = 2x$
3) $f(x) = x + 1$
4) $f(x) = \log_2 x$

TOPIC 13: Interpret functions that arise in application in terms of the context.

Standard F-IF.5 – Relate the domain of a function to its graph and, where applicable, to the quantitative relationship it describes. For example, if the function h(n) gives the number of person-hours it takes to assemble n engines in a factory, then the positive integers would be an appropriate domain for the function.

1) Let f be a function such that $f(x) = 2x - 4$ is defined on the domain $2 \le x \le 6$. The range of this function is

  1) $0 \le y \le 8$ 3) $2 \le y \le 6$
  2) $0 \le y \le \infty$ 4) $-\infty \le y \le \infty$

2) Which graph illustrates a quadratic relation whose domain is all real numbers?

  1)

  3)

  2)

  4))
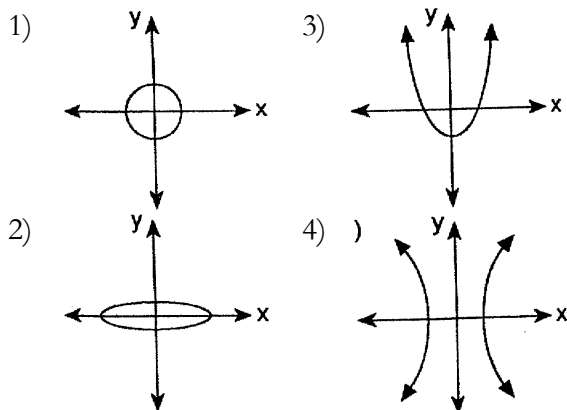
3) Neil, whose hero is Forrest Gump, works hard at being an elite runner. He continues to shave time off his pace at most every race distance. If the world record for the fastest mile is 3:43, which of the following would be an acceptable domain to use to describe the best mile, in minutes, Neil can run?

  1) All real values   3) $x \le 4$
 2) $0 \le x \le 4$ 4) $x \ge 4$

4) You have been eating your Wheaties, which has helped you to grow. You expect to grow x inches per year every year in high school. You are currently 5 feet tall. If n represent the number of years, which of the following best represents your height projection during your high school years?

  1) $f(n) = nx + 5$ inches   3) $f(n) = nx + 60$ inches
  2) $f(x) = nx + 5$ inches   4) $f(x) = nx + 60$ inches

5) What is the domain of the function $f(x) = \dfrac{3x^2}{x^2 - 49}$?

  1) $\{x \,|\, x \in \textbf{real numbers}, x \ne 7\}$
  2) $\{x \,|\, x \in \textbf{real numbers}, x \ne \pm 7\}$
  3) $\{x \,|\, x \in \textbf{real numbers}\}$
  4) $\{x \,|\, x \in \textbf{real numbers}, x \ne 0\}$

6) The accompanying graph shows the elevation of a certain region in New York State as a hiker travels along a trail.

Distance Hiker Travels (mi)
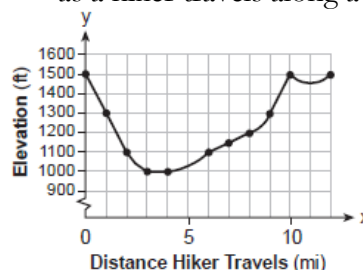
What is the domain of this function?
  1) $1,000 \le x \le 1,500$
  2) $1,000 \le y \le 1,500$
  3) $0 \le x \le 12$
  4) $0 \le y \le 12$

7) You invest $1000 dollars with Risky Stocks Incorporated. Your balance can be modeled using the equation $A(t) = 1000(0.85)^t$, where A represents the amount you have accrued and t represents time in months.
  a) Does your balance increase or decrease over time? Explain your answer.
  b) Can your balance ever be negative?
  c) What would be an acceptable range to use to describe this function?
  d) After how many months will your balance be under $100?

8) If $\textbf{f}(x) = \dfrac{1}{\sqrt{2x - 4}}$, the domain of $\textbf{f}(x)$ is
  1) $x = 2$
  2) $x < 2$
  3) $x \ge 2$
  4) $x > 2$

35

Standard F-IF.6 – Calculate and interpret the average rate of change of a function (presented symbolically or as a table) over a specified interval. Estimate the rate of change from a graph.

1) In a baseball game, the ball traveled 350.7 feet in 4.2 seconds. What was the average speed of the ball, in feet per second?
   1) 83.5
   2) 177.5
   3) 354.9
   4) 1,472.9

2) The chart below compares two runners.

Runner	Distance, in miles	Time, in hours
Greg	11	2
Dave	16	3

Based on the information in this chart, state which runner has the faster rate. Justify your answer.

3) What is the slope of the line that passes through the points $(-6, 1)$ and $(4, -4)$?
   1) -2
   2) 2
   3) $-\dfrac{1}{2}$
   4) $\dfrac{1}{2}$

4) A car travels 110 miles in 2 hours. At the same rate of speed, how far will the car travel in h hours?
   1) $55h$
   2) $220h$
   3) $\dfrac{h}{55}$
   4) $\dfrac{h}{220}$

5) During a 45-minute lunch period, Albert (A) went running and Bill (B) walked for exercise. Their times and distances are shown in the accompanying graph. How much faster was Albert running than Bill was walking, in miles per hour?
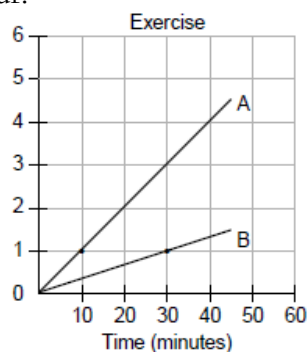
6) Bob and Latoya both drove to a baseball game at a college stadium. Bob lives 70 miles from the stadium and Latoya lives 60 miles from it, as shown in the accompanying diagram. Bob drove at a rate of 50 miles per hour, and Latoya drove at a rate of 40 miles per hour. If they both left home at the same time, who arrived at the stadium first?
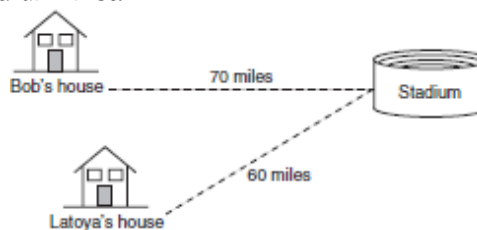
7) In a linear equation, the independent variable increases at a constant rate while the dependent variable decreases at a constant rate. The slope of this line is
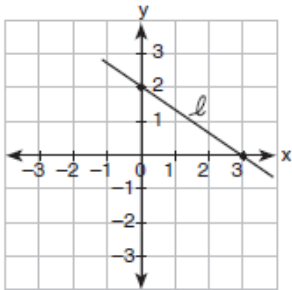   1) zero
   2) negative
   3) positive
   4) undefined

8) The data in the table below are graphed, and the slope is examined.

x	y
0.5	9.0
1	8.75
1.5	8.5
2	8.25
2.5	8.0

The rate of change represented in this table can be described as
1) negative
2) positive
3) undefined
4) zero

9) Calculate the slope of line ℓ in the accompanying diagram?

10) Hannah took a trip to visit her cousin. She drove 120 miles to reach her cousin's house and the same distance back home. It took her 1.2 hours to get halfway to her cousin's house. What was her average speed, in miles per hour, for the first 1.2 hours of the trip? Hannah's average speed for the remainder of the trip to her cousin's house was 40 miles per hour. How long, in hours, did it take her to drive the remaining distance? Traveling home along the same route, Hannah drove at an average rate of 55 miles per hour. After 2 hours her car broke down. How many miles was she from home?
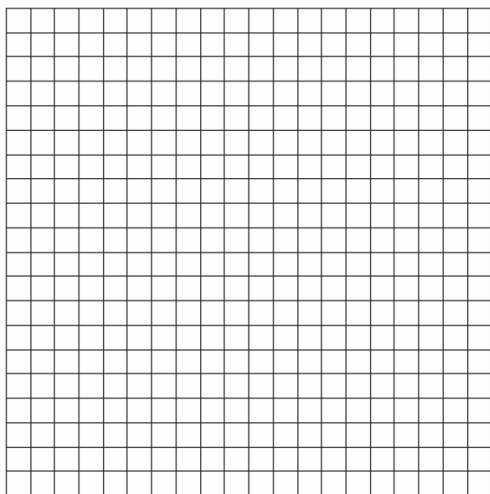
1) Which function has the same *y*-intercept as the graph below?
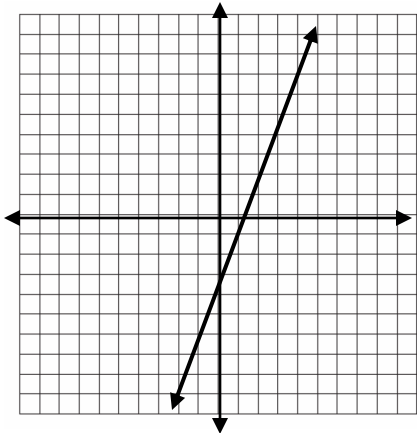
1) $y = \dfrac{12 - 6x}{4}$

2) $27 + 3y = 6x$

3) $6y + x = 18$

4) $y + 3 = 6x$

2) On the same set of axes, graph the following:
(you may need the aid of your calculator)

     a) $y = x^3$

     b) $y = x^3 + 5$. Describe how did the graph changed from part a.

   c) $y = (x + 5)^3$. Describe how did the graph changed from part a.

3) The members of the Lincoln High School Prom Committee are trying to raise money for their senior prom. They plan to sell teddy bears. The senior advisor told them that the profit equation for their project is $y = -0.1x^2 + 9x - 50$, where x is the price at which the teddy bears will be sold and y is the profit, in dollars. On the grid below, graph this relationship so that $0 \le x \le 90$ and $-50 \le y \le 160$. How much profit can the committee expect to make if they sell the teddy bears for $20 each? What price should they charge for the teddy bears to make the maximum profit possible?
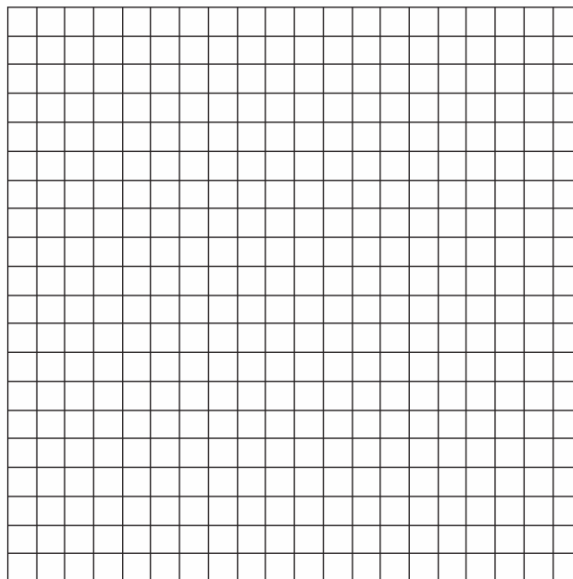
4) The table below lists the total cost for parking for a period of time on a street in Albany, N.Y. The total cost is for any length of time up to and including the hours parked. For example, parking for up to and including 1 hour would cost $1.25; parking for 3.5 hours would cost $5.75.

Hours Parked	Total Cost
1	$1.25
2	$2.50
3	$4.00
4	$5.75
5	$7.75
6	$10.00

a) Graph the step function that represents the cost for the number of hours parked.

b) Explain how the cost per hour to park changes over the six-hour period.
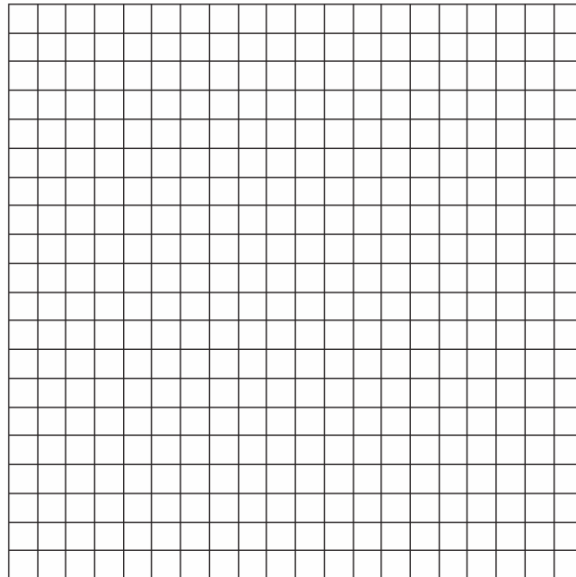
TOPIC 14: Analyzing functions using different representations.

Standard F-IF.8 – Write a function defined by an expression in different but equivalent forms to reveal and explain different properties of the function.

1) One of the roots of the equation $x^2 + 3x - 18 = 0$ is 3. What is the other root?
   1) 15
   2) 6
   3) **–6**
   4) –21

2) For which equation is the solution set $\{-5, 2\}$?
   1) $x^2 + 3x - 10 = 0$
   2) $x^2 - 3x = 10$
   3) $x^2 + 3x = -10$
   4) $x^2 - 3x + 10 = 0$

3) What are the vertex and axis of symmetry of the parabola $y = x^2 - 16x + 63$?
   1) vertex: $(8, -1)$; axis of symmetry: $x = 8$
   2) vertex: $(8, 1)$; axis of symmetry: $x = 8$
   3) vertex: $(-8, -1)$; axis of symmetry: $x = -8$
   4) vertex: $(-8, 1)$; axis of symmetry: $x = -8$

4) What is an equation of the axis of symmetry of the parabola represented by $y = -x^2 + 6x - 4$?
   1) $x = 3$
   2) $y = 3$
   3) $x = 6$
   4) $y = 6$

5) The height, y, of a ball tossed into the air can be represented by the equation $y = -x^2 + 10x + 3$, where x is the elapsed time.
   a) At what time will it reach a maximum height?
   b) What is the maximum height of the ball?
   c) To the nearest tenth, how many seconds does it take to hit the ground?

6) You invest $1000 dollars with Risky Stocks Incorporated. Your balance can be modeled using the equation $A(t) = 1000(1.05)^t$, where A represents the amount you have accrued and t represents time.
   a) What is the percent rate of of change over time t?
   b) Is your money growing or are you losing money?

7) Find the x-intercepts of the function $f(x) = 2x^2 + 5x$.

8) Solve by completing the square: $4x^2 - 8x - 1 = 0$

9) Some banks charge a fee on savings accounts that are left inactive for an extended period of time. The equation $y = 5000(0.98)^x$ represents the value, y, of one account that was left inactive for a period of x years.
   What is the y-intercept of this equation and what does it represent?
   1) 0.98, the percent of money in the account initially
   2) 0.98, the percent of money in the account after x years
   3) 5000, the amount of money in the account initially
   4) 5000, the amount of money in the account after x years

10) Given the function $f(x) = -x^2 + 8x + 9$, state whether the vertex represents a maximum or minimum point for the function. Explain your answer.

Rewrite $f(x)$ in vertex form by completing the square.

Standard F-IF.9 – Compare properties of two functions each represented in a different way (algebraically, graphically, numerically in tables, or by verbal descriptions). For example, given a graph of one quadratic function and an algebraic expression for another, say which has the larger maximum.

1) Which of the following increases at the greatest rate?

1) $f(x) = 2x^2$ 3) $f(x) = \dfrac{1}{2}x^2$

2) $f(x) = x^2$ 4) They all increase at the same rate.

2) Given the following quadratic functions, determine which has the higher maximum value.

Function A – $f(x) = -x^2 + 2x + 5$

Function B – A quadratic function with x-intercepts of -1 and 4, a y-intercept of 4, and a negative quadratic coefficient.

3) Neil and Dave meet for a run every Saturday morning at 7 a.m. This week Neil is running late (no pun intended) and does not make it there by 7. Dave starts running promptly at 7 running at a rate of 7.5 miles per hour. Neil arrives 5 minutes later and follows the same course and runs at 8 minute per mile pace trying to catch up.
   a) Will Neil ever catch his buddy Dave?
   b) Use the grid below, plotting distance in miles versus time in minutes to justify your answer for part a.
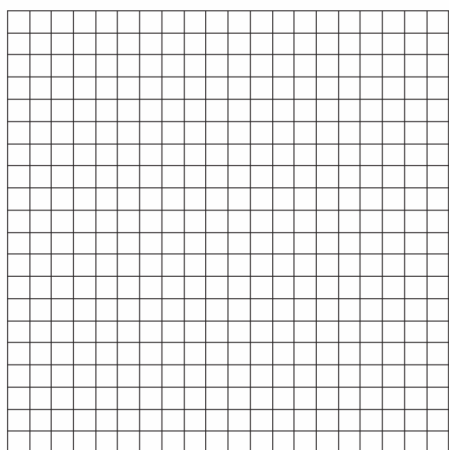
4) Line A contains the points (-2, -5) and (3, 10). Line B is given by the equation $4y = 3x + 8$. What can you conclude about the slopes of the two lines?

1) They are the same.
2) Line A has a greater slope.
3) Line B has a greater slope.
4) There is not information.

5) List the following functions in order of least to most roots.

I. $f(x) = (x^2 - 9)(x + 2)$

II. $f(x) = x^3 + 2x^2 - 4x - 8$

III. $f(x) = x^4$

6) Which of the following has a higher maximum value, $f(x) = -(x-1)^2 + 5$ or the following function?
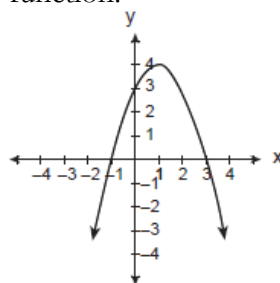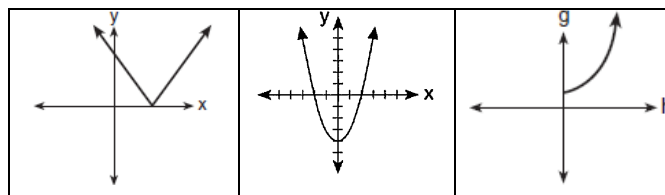

7) The equation(s) of the asymptote(s) for the function $f(x) = \dfrac{x-3}{x^2 - 4}$, is(are):

1) $x = \pm 2$ 3) $x = \pm 2$ and x = 3
2) x = 3   4) x = 0

8) Identify each of the following functions:

TOPIC 15: Build a function that models a relationship between two quantities.
Standard F-BF.1 – Write a function that describes a relationship between two quantities.

1) You enjoy a cup of hot coffee, served fresh from the Keurig at a temperature of 180° Fahrenheit. The coffee will be safe to drink at 120°. The following table shows coffee temperature as a function of time over the first 10 minutes. Although the relationship is not entirely linear, use a linear regression analysis to find the equation to represent this cooling behavior *rounding to the nearest hundredth.*

Use this equation to predict how long it will take to take your first sip of coffee (at 120°) *to the nearest minute.*

Describe the correlation of the data in this table.

Time (minutes)	Temperature (Fahrenheit)
0	182
1	180
2	174
3	171
4	168
5	164
6	161
7	158
8	155
9	153
10	151

2) The mid-September statewide average gas prices, in dollars per gallon, (y), for the years since 2000, (x), are given in the table below.

Year Since 2000 (x)	Price Per Gallon (y)
1	1.345
2	1.408
3	1.537
4	1.58

Write a linear regression equation for this set of data. Using this equation, determine how much *more* the actual 2005 gas price was than the predicted gas price if the actual mid-September gas price for the year 2005 was $2.956.

3) A population of single-celled organisms was grown in a Petri dish over a period of 16 hours. The number of organisms at a given time is recorded in the table below.

Time, hrs (x)	Number of Organisms (y)
0	25
2	36
4	52
6	68
8	85
10	104
12	142
16	260

Determine the exponential regression equation model for these data, rounding all values to the *nearest ten-thousandth.* Using this equation, predict the number of single-celled organisms, to the *nearest whole number*, at the end of the 18th hour.

4) Krystal was given $3000 when she turned 2 years old. Her parents invested it at a 2% interest rate compounded annually. No deposits or withdrawals were made. Which expression can be used to determine how much money Krystal had in the account when she turned 18?
1) $3000(1 + 0.02)^{16}$ 3) $3000(1 + 0.02)^{18}$
2) $3000(1 - 0.02)^{16}$ 4) $3000(1 - 0.02)^{18}$

5) Tom deposited $3000 in an account in the Lansing National Bank, earning 4.2% interest, compounded annually. He made no deposits or withdrawals. Write an equation that can be used to find B, his account balance after t years.

6) Caitlin has a movie rental card worth $175. After she rents the first movie, the card's value is $172.25. After she rents the second movie, its value is $169.50. After she rents the third movie, the card is worth $166.75. Assuming the pattern continues, write an equation to define $A(n)$, the amount of money on the rental card after n rentals. Caitlin rents a movie every Friday night. How many weeks in a row can she afford to rent a movie, using her rental card only? Explain how you arrived at your answer.

Standard F-BF.3 – Identify the effect on the graph of replacing f(x) by f(x) + k, k f(x), f(kx), and f(x + k) for specific values of k (both positive and negative); find the value of k given the graphs. Experiment with cases and illustrate an explanation of the effects on the graph using technology. Include recognizing even and odd functions from their graphs and algebraic expressions for them.

1) Which transformation of the graph of $y = x^2$ would result in the graph of $y = x^2 + 2$?

1) D_2 (Dilation)

2) $T_{0,2}$ (Translation)

3) r_{y-2} (reflection)

4) $R_{0,90°}$ (Rotation)

2) Which transformation of $y = 2^x$ results in the function $y = 2^x - 2$?

1) $T_{0,-1}$ (Translation)

2) $T_{0,-2}$ (Translation)

3) r_{y-axis} (reflection)

4) r_{x-axis} (reflection)

3) A polygon is transformed according to the rule: $(x,y) \rightarrow (x + 2, y)$. Every point of the polygon moves two units in which direction?
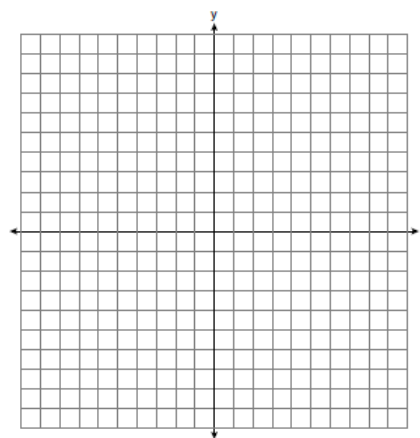
1) up
2) down
3) left
4) right

4. Describe the difference between $f(x) = x^4$ and $g(x) = -x^4$.

5. Describe the difference between $f(x) = x^2$, $g(x) = (x + 3)^2$ and $h(x) = x^2 + 3$.

6. Which of the following is a shift up 2 and to the right 3 for the function $f(x) = |x|$?

1) $f(x) = |x + 3| + 2$

2) $f(x) = |x - 3| + 2$

3) $f(x) = |x + 2| + 3$

4) $f(x) = |x - 2| + 3$

7) On the axes below, graph $f(x) = |3x|$.

If $g(x) = f(x) - 2$, how is the graph of $f(x)$ translated to form the graph of $g(x)$?

If $h(x) = f(x - 4)$, how is the graph of $f(x)$ translated to form the graph of $h(x)$?

8) The vertex of the parabola represented by $f(x) = x^2 - 4x + 3$ has coordinates (2, –1). Find the coordinates of the vertex of the parabola defined by $g(x) = f(x - 2)$. Explain how you arrived at your answer.

TOPIC 17: Construct and compare linear, quadratic and exponential models and solve problems.
Standard F-LE.1 – Distinguish between situations that can be modeled with linear functions and with exponential functions.

1) In 2012, the state of Iowa produced approximately 1.9 billion bushels of corn. That figure rose to 2.2 billion in 2013 and it is projected to rise to between 2.4-2.5 billion this year. Which of the following best describes the behavior of this growth in production?

      1) linear   3) exponential
      2) quadratic   4) cosmic

2) Money invested in a bank account is compounded regularly at designated times. This means they calculate the interest based on what you have at any given time. So as your money grows (assuming you do not spend it), the interest added grows as you now have more money from which to take a percentage. Which of the following best describes the behavior?

      1) linear   3) exponential
      2) quadratic   4) preferred

3) The data collected by a biologist showing the growth of a colony of bacteria at the end of each hour are displayed in the table below.

Time, hour, (x)	Population (y)
0	250
1	330
2	580
3	800
4	1650
5	3000

Which of the following best describes the behavior?

      1) linear   3) exponential
      2) quadratic   4) unhealthy

4) We Make 'Em Quick Inc. made 1000 widgets this year and has increased production by 10 percent each year. Which of the following best represents of this growth in production?

      1) $1000 + 10x$
      2) $1000 + 0.10x$
      3) $1000(10)^x$
      4) $1000(1+0.10)^x$
      5) $1000(1+10)^x$

5) Given the relation $f(t) = \left(\dfrac{1}{2}\right)^t$, where t stands for time, the graph of this relation will:

      1) increase steadily   3) stay at ½
      2) increase quickly   4) decrease

6) Given the following table of values:

x	0	1	2	3	4
y	1	2	4	8	

What value would you expect for x = 4?

7) The table below represents the function *F*.

x	3	4	6	7	8
F(x)	9	17	65	129	257

The equation that represents this function is
1) $F(x) = 3^x$ 3) $F(x) = 2^x + 1$
2) $F(x) = 3x$ 4) $F(x) = 2x + 3$

TOPIC 17: Construct and compare linear, quadratic and exponential models and solve problems.

Standard F-LE.2 – Construct linear and exponential functions, including arithmetic and geometric sequences, given a graph, a description of a relationship, or two input-output pairs (include reading these from a table).

1) Given the following table of values:

x	0	1	2	3	4
y	1	2	4	8	

Write the equation for this function.

2) Given the following table of values:

| x	0	1	2	3	4
y	10	12	14	16	18

a) Write the equation for this function.
b) Using this equation, find the x-intercept.

3) Which of the following is **parallel** to the function in the table:

x	0	1	2	3	4
y	2	-1	-4	-7	-10

1) y + 2x = 3   3) 2y + 3x = –2
2) y – 3x = 2   4) 2y + 6x = 2

4) The gas tank in a car holds a total of 16 gallons of gas. The car travels 75 miles on 4 gallons of gas. If the gas tank is full at the beginning of a trip, which graph represents the rate of change in the amount of gas in the tank?

1)

3)

2)

4)
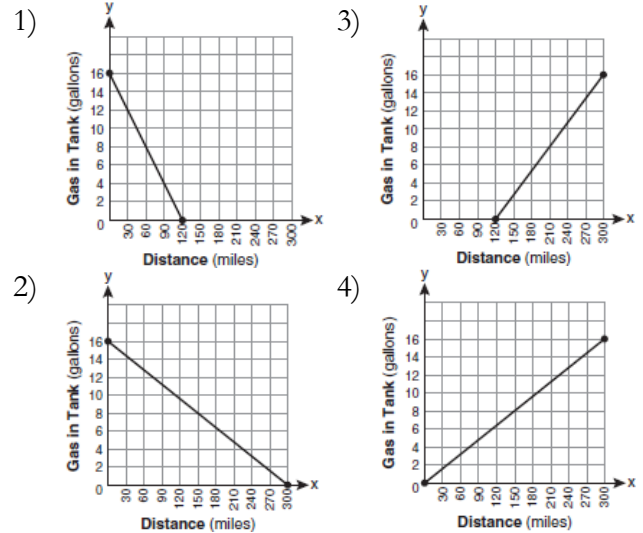
5) Using a table of values: $0 \le x \le 6$ Which increases more quickly $f(x) = 4x$ or $f(x) = x^2$? Explain the difference between the two functions (classify).

6) If (0, 1) and (3, 7) are both points on the graph of line **n**, which of the following points also lies on the graph of line **n**?
   1) (3, 8)
   2) (3, 1)
   3) (2, 6)
   4) (2, 4)
   5) (1, 3)

TOPIC 17: Construct and compare linear, quadratic and exponential models and solve problems.
Standard F-LE.3 – Observe using graphs and tables that a quantity increasing exponentially eventually exceeds a quantity increasing linearly, quadratically, or (more generally) as a polynomial function.

1) Which of the following is a linear equation?

    1) $f(x) = x^2$ 3) $f(x) = 2^x$

    2) $f(x) = 2x$ 4) $2x + 1$

2) After what value of x will $f(x) = 2^x$ surpass $f(x) = x^2 + 10$? What is the corresponding y value for x?

3) Which of the following is a quadratic equation?

    1) $f(x) = x^2$

    2) $f(x) = x^3 + x^2 + x + 4$

    3) $f(x) = 4x$

    4) $f(x) = 4^x$

4) Big Bucks Banking Company (3B) claims its investment strategy will not be beaten and does have quite an impressive return rate compared to its competitor bank, Print Cash Incorporated (PCI). 3B's formula for profit can be modeled as $y = 2x^{54} + 36x^{52} + 2500$ return rate compared to PCI's model, which is $y = 999^x$. Big Bucks Banking Company claims its investment strategy is the best cannot be surpassed.

    a) Is Big Bucks Banking Company claim correct?

    b) If Print Cash Incorporated does surpass its key competitor; at what value of x would that occur?

1) A satellite television company charges a one-time installation fee and a monthly service charge. The total cost is modeled by the function $y = 40 + 90x$. Which statement represents the meaning of each part of the function?

   1) y is the total cost, x is the number of months of service, $90 is the installation fee, and $40 is the service charge per month.

   2) y is the total cost, x is the number of months of service, $40 is the installation fee, and $90 is the service charge per month.

   3) x is the total cost, y is the number of months of service, $40 is the installation fee, and $90 is the service charge per month.

   4) x is the total cost, y is the number of months of service, $90 is the installation fee, and $40 is the service charge per month.

2) Which situation could be modeled by using a linear function?

   1) a bank account balance that grows at a rate of 5% per year, compounded annually

   2) a population of bacteria that doubles every 4.5 hours

   3) the cost of cell phone service that charges a base amount plus 20 cents per minute

   4) the concentration of medicine in a person's body that decays by a factor of one-third every hour

3) The breakdown of a sample of a chemical compound is represented by the function $p(t) = 300(0.5)^t$, where $p(t)$ represents the number of milligrams of the substance and t represents the time, in years. In the function $p(t)$, explain what 0.5 and 300 represent.

4) True or false. Exponential functions only increase.

5) Label the following as linear, quadratic or exponential.

x	0	2	4	6	8
y	0	2	8	18	32

x	0	2	4	6	8
y	2	1	0	-1	-2

x	0	1	2	3	4
y	1	2	4	8	16

6) Which of the following has a domain and range consisting of all real values?

   1) $f(x) = 2^x$ 3) $f(x) = 2$

   2) $f(x) = x^2$ 4) $f(x) = x + 2$

7) Label the following exponential functions as increasing, decreasing or remains the same.

   I. $f(x) = 1^x$

   II. $f(x) = 2^x$

   III. $f(x) = -2^x$

   IV. $f(x) = 2 \cdot 1^x$

   V. $f(x) = 2/x$

Standard S-ID.7 – Interpret the slope (rate of change) and the intercept (constant term) of a linear model in the context of the data.

1) The membership fee at a gym is $75. Members must then pay $19 each month. Express the cost (c) of using the gym as a function of m, where m represents the number of months the member participates.

    1) $c = 19 + 75m$
    2) $c = 75 + 19m$
    3) $c = 75 + 19$
    4) $c = 19m - 75$
    5) $c = 94m$

2. What does the slope of a linear function represent?

    1) The value of the independent variable.
    2) The value of the dependent variable.
    3) The value of the y-intercept
   4) The relationship between the dependent and independent variable.

3) In a given linear equation, the value of the independent variable decreases at a constant rate while the value of the dependent variable increases at a constant rate. The slope of this line is

    1) positive
    2) negative
    3) zero
    4) undefined

4) What is the slope of the line passing through the points $(-2,4)$ and $(3,6)$?

    1) $-\dfrac{5}{2}$
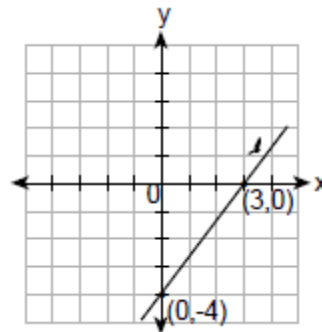   2) $-\dfrac{2}{5}$
    3) $\dfrac{2}{5}$
    4) $\dfrac{5}{2}$

5) The accompanying figure shows the graph of the equation $x = 5$.
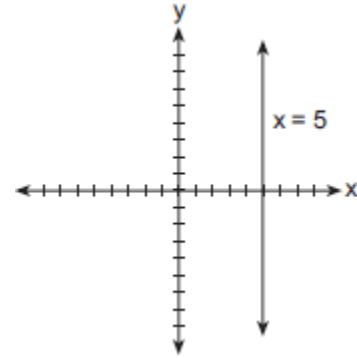
What is the slope of the line $x = 5$?

    1) 5
    2) −5
    3) 0
    4) undefined

6) What is the slope of line ℓ shown in the accompanying diagram?

    1) $\dfrac{4}{3}$
    2) $\dfrac{3}{4}$
    3) $-\dfrac{3}{4}$
    4) $-\dfrac{4}{3}$

7) Which equation represents a line parallel to the y-axis?
1) $x = y$
2) $x = 4$
3) $y = 4$
4) $y = x + 4$

8) Which equation represents a line that is parallel to the line $y = 3 - 2x$?
1) $4x + 2y = 5$
2) $2x + 4y = 1$
3) $y = 3 - 4x$
4) $y = 4x - 2$

9) Which equation represents a line that is parallel to the line whose equation is $2x + 3y = 12$?
1) $6y - 4x = 2$
2) $6y + 4x = 2$
3) $4x - 6y = 2$
4) $6x + 4y = -2$

10) The graphs of the equations $y = 2x - 7$ and $y - kx = 7$ are parallel when k equals
1) -2
2) 2
3) -7
4) 7

11) An equation of the line that has a slope of 3 and a y-intercept of -2 is
1) $x = 3y - 2$
2) $y = 3x - 2$
3) $y = -\dfrac{2}{3}x$
4) $y = -2x + 3$

12) Which of the following has the greatest slope?

x	0	1	2	3	4
y	-5	-2	1	4	7

x	0	1	2	3	4
y	0	2	4	6	8

x	0	1	2	3	4
y	5	4	3	2	1

49

1) The table below shows the number of grams of carbohydrates, x, and the number of Calories, y, of six different foods.

Carbohydrates (x)	Calories (y)
8	120
9.5	138
10	147
6	88
7	108
4	62

Which equation best represents the line of best fit for this set of data?

1) $y = 15x$　　　　3) $y = 0.1x - 0.4$
2) $y = 0.07x$　　　4) $y = 14.1x + 5.8$

2) Which value of r represents data with a strong positive linear correlation between two variables?
1) 0.89
2) 0.34
3) 1.04
4) 0.01

3) Which value of r represents data with a strong negative linear correlation between two variables?
1) −1.07
2) −0.89
3) −0.14
4) 0.92

4) Which calculator output shows the strongest linear relationship between x and y?

1) Lin Reg
   $y = a + bx$
   $a = 59.026$
   $b = 6.767$
   $r = .8643$

2) Lin Reg
   $y = a + bx$
   $a = .7$
   $b = 24.2$
   $r = .8361$

3) Lin Reg
   $y = a + bx$
   $a = 2.45$
   $b = .95$
   $r = .6022$

4) Lin Reg
   $y = a + bx$
   $a = -2.9$
   $b = 24.1$
   $r = -.8924$

5) Which graph represents data used in a linear regression that produces a correlation coefficient closest to **−1**?
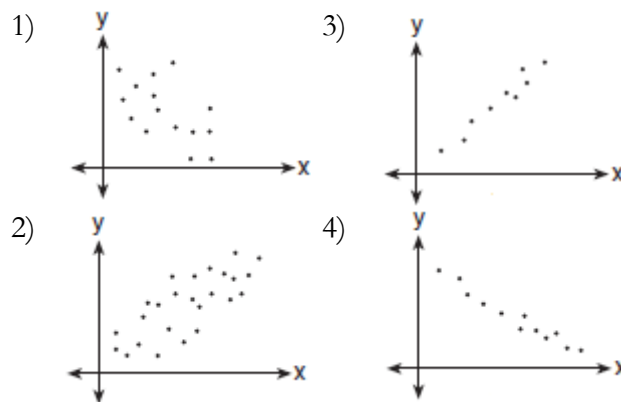
6) The relationship of a woman's shoe size and length of a woman's foot, in inches, is given in the accompanying table.

Woman's Shoe Size	5	6	7	8
Foot Length (in)	9.00	9.25	9.50	9.75

The linear correlation coefficient for this relationship is
1) 1
2) −1
3) 0.5
4) 0

7) As shown in the table below, a person's target heart rate during exercise changes as the person gets older.

Age (years)	Target Heart Rate (beats per minute)
20	135
25	132
30	129
35	125
40	122
45	119
50	115

Which value represents the linear correlation coefficient, rounded to the *nearest thousandth*, between a person's age, in years, and that person's target heart rate, in beats per minute?
1) −0.999
2) −0.664
3) 0.998
4) 1.503

8) The accompanying table shows the percent of the adult population that married before age 25 in several different years. Using the year as the independent variable, find the linear regression equation. Round the regression coefficients to the *nearest hundredth*. Using the equation found above, estimate the percent of the adult population in the year 2009 that will marry before age 25, and round to the *nearest tenth of a percent*.

Year (x)	Percent (y)
1971	42.4
1976	37.4
1980	37.1
1984	34.1
1989	32.1
1993	28.8
1997	25.7
2000	25.5

9) In a mathematics class of ten students, the teacher wanted to determine how a homework grade influenced a student's performance on the subsequent test. The homework grade and subsequent test grade for each student are given in the accompanying table.

Homework Grade (x)	Test Grade (y)
94	98
95	94
92	95
87	89
82	85
80	78
75	73
65	67
50	45
20	40

a Give the equation of the linear regression line for this set of data *rounding to the nearest thousandth*.

b A new student comes to the class and earns a homework grade of 78. Based on the equation in part *a*, what grade would the teacher predict the student would receive on the subsequent test, to the *nearest integer*?

Correlation – A mutual relation of two or more things; *Statistics*: the degree to which two or more attributes or measurements on the same group of elements show a tendency to vary together.

Causation – The action of causing producing; the relation of cause to effect; causality; anything that produces an effect. Causation, or causality, is the capacity of one variable to influence another. The first variable may bring the second into existence or may cause the incidence of the second variable to fluctuate.

KEY – Correlation does <u>not</u> imply causation.

1) Which situation describes a correlation that is *not* a causal relationship?
   1) The rooster crows, and the Sun rises.
   2) The more miles driven, the more gasoline needed
   3) The more powerful the microwave, the faster the food cooks.
   4) The faster the pace of a runner, the quicker the runner finishes.

2) The following plot shows the relationship between age and height of a group of freshmen.
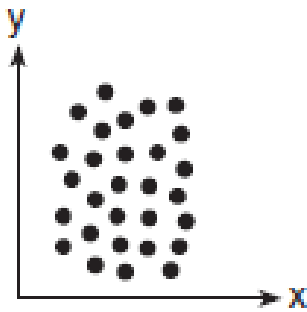
Based on this scatter plot, it would be reasonable to conclude:
   1) Freshmen are typically short.
   2) There is a good correlation between height and age.
   3) Increase in age always results in an increase in height.
   4) Age does not cause one to be taller. There are many other factors involved.

3) Which relationship can best be described as causal?
   1) height and intelligence
   2) shoe size and running speed
   3) number of correct answers on a test and test score
   4) number of students in a class and number of students with brown hair

4) Which situation does *not* describe a causal relationship?
   1) The higher the volume on a radio, the louder the sound will be.
   2) The faster a student types a research paper, the more pages the paper will have.
   3) The shorter the distance driven, the less gasoline that will be used.
   4) The slower the pace of a runner, the longer it will take the runner to finish the race.

5) Which phrase best describes the relationship between the number of miles driven and the amount of gasoline used?
   1) causal, but not correlated
   2) correlated, but not causal
   3) both correlated and causal
   4) neither correlated nor causal

TOPIC 20: Summarize, represent and interpret data on two categorical and quantitative variables.
Standard **S-ID.5** – Summarize categorical data for two categories in two-way frequency tables. Interpret relative frequencies in the context of the data (including joint, marginal, and conditional relative frequencies). Recognize possible associations and trends in the data.

1) Which of the following is categorical data?
   1) scores of students in an algebra class
   2) ages of students in a biology class
   3) numbers of students in history classes
   4) eye colors of students in an economics class

2) Three high school juniors, Reese, Matthew, and Chris, are running for student council president. A survey is taken a week before the election asking 40 students which candidate they will vote for in the election. The results are shown in the table below.

Candidate's Name	Number of Students Supporting Candidate
Reese	15
Matthew	13
Chris	12

Based on the table, what is the probability that a student will vote for Reese?

1) $\frac{1}{3}$ 2) $\frac{3}{5}$ 3) $\frac{3}{8}$ 4) $\frac{5}{8}$

3) Two cubes with sides numbered 1 through 6 were rolled 20 times. Their sums are recorded in the table below.

4	9	8	9	2
9	4	6	12	10
8	7	9	11	10
8	7	9	3	5

What is the empirical probability of rolling a sum of 9?

1) $\frac{4}{20}$ 2) $\frac{5}{20}$ 3) $\frac{4}{36}$ 4) $\frac{5}{36}$

4) The accompanying Venn diagram shows the results of a survey asking 100 people if they get news by reading newspapers or by watching television.

Sources of News
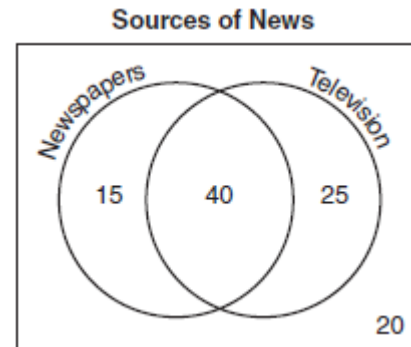
What is the probability that a person selected at random from this survey does not claim television as a source of getting the news?

1) $\frac{15}{100}$ 2) $\frac{35}{100}$ 3) $\frac{55}{100}$ 4) $\frac{75}{100}$

5) The graph below shows the hair colors of all the students in a class.

Class Hair Color
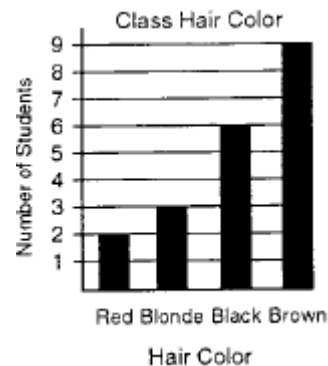
What is the probability that a student chosen at random from this class has black hair?

6) Casey purchased a pack of assorted flower seeds and planted them in her garden. When the first 25 flowers bloomed, 11 were white, 5 were red, 3 were blue, and the rest were yellow. Find the empirical probability that a flower that blooms will be yellow.

53

TOPIC 20: Summarize, represent and interpret data on two categorical and quantitative variables.
Standard S-ID.6 – Represent data on two quantitative variables on a scatter plot, and describe how the variables are related.

1) Given the following table:

Drop Height (x) (cm)	Bounce Height (y) (cm)
100	26
90	23
80	21
70	18
60	16

Which of the following equation forms best fits the data in the table above?
1) Linear
2) Quadratic
3) Exponential
4) Differential

2) Given the following table:

Trial	0	1	3	4	6
Coins Returned	1,000	610	220	132	45

Which of the following equation forms best fits the data in the table above?
1) Linear
2) Quadratic
3) Exponential
4) Differential

3) Which of the following would not be a good fit for a linear model?
1) Compounded interest on an investment.
2) Snowing an inch per hour for five hours.
3) The amount of gasoline used as compared to miles driven.
4) The number of seconds that occur each minute.

4) About a year ago, Joey watched an online video of a band and noticed that it had been viewed only 843 times. One month later, Joey noticed that the band's video had 1708 views. Joey made the table below to keep track of the cumulative number of views the video was getting online.

Months Since First Viewing	Total Views
0	843
1	1708
2	Forgot to record
3	7124
4	14,684
5	29,787
6	62,381

a) Write a regression equation that best models these data. Round all values to the nearest hundredth. Justify your choice of regression equation.

b) As shown in the table, Joey forgot to record the number of views after the second month. Use the equation from part *a* to estimate the number of full views of the online video that Joey forgot to record.

5) You are studying for the Common Core Algebra 1 Regents Exam. This exam has been tested on a focus group from the good people of Math Tests Incorporated. The numbers of hours spent studying vs. actual score is listed in the table below:

Hours studied	Exam Score
0	30
3	45
5	55
6	Not reported
8	80
10	99

a) Using a linear regression, determine the equation that best models this trend, rounding to the nearest hundredth.
b) Describe the correlation (weak/strong ; negative/positive)
c) Using the equation from part a, predict the exam score for someone who studied for 6 hours.
d) Use the equation from part *a* to find all the predicted values necessary to complete the following table.

Hours studied	Exam Score	Predicted Score	Residual (Actual – Predicted)
0	30		
3	45		
5	55		
8	80		
10	99		

e) Create a residual plot on the axes below, using the residual scores in the table above (place y = 0 at the center of your plot).
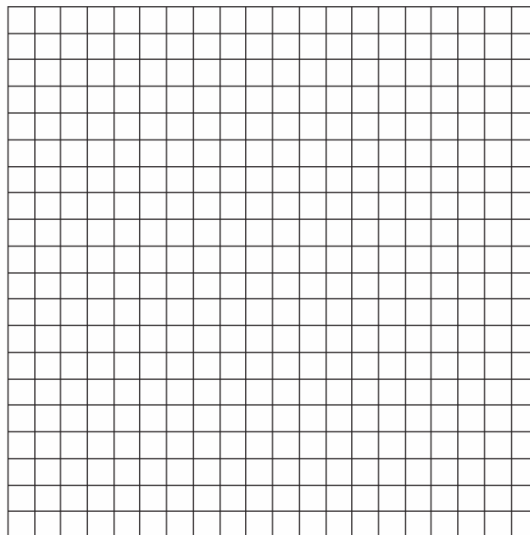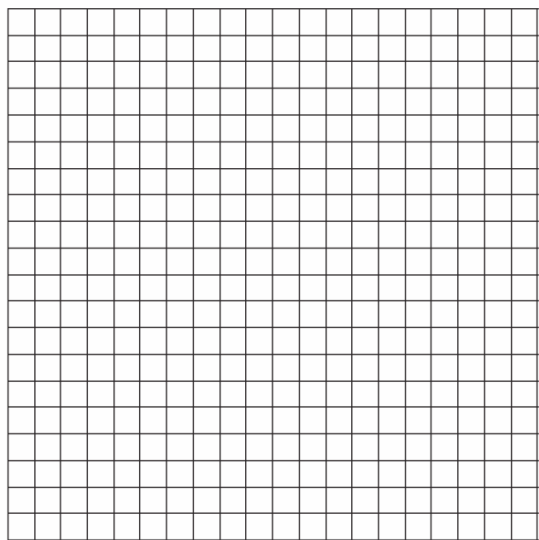

f) Based on the residual plot, state whether the equation is a good fit for the data. Justify your answer.

6. The table below represents the residuals for a line of best fit.

x	2	3	3	4	6	7	8	9	9	10
Residual	2	1	-1	-2	-3	-2	-1	2	0	3

Plot these residuals on the set of axes below (place y = 0 at the center of your plot).

Using the plot, assess the fit of the line for these residuals and justify your answer.

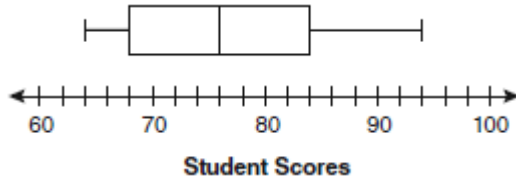## TOPIC 21: Summarize, represent and interpret data on a single count or measurement variable.
Standard S-ID.1 – Represent data with plots on the real number line (dot plots, histograms, and box plots).

1) What is the value of the median shown on the box-and-whisker plot below?
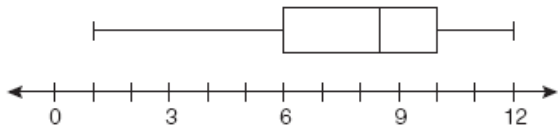
1) 6
2) 8.5
3) 10
4) 12

2) The box-and-whisker plot below represents students' scores on a recent English test.

Student Scores

What is the value of the upper quartile?
1) 68
2) 76
3) 84
4) 82

3) The test scores for 10 students in Ms. Sampson's homeroom were 61, 67, 81, 83, 87, 88, 89, 90, 98, and 100. Which frequency table is accurate for this set of data?

1)
Interval	Frequency
61–70	2
71–80	2
81–90	7
91–100	10

2)
Interval	Frequency
61–70	2
71–80	2
81–90	8
91–100	10

3)
Interval	Frequency
61–70	2
71–80	0
81–90	8
91–100	10

4)
Interval	Frequency
61–70	2
71–80	0
81–90	6
91–100	2

4) The accompanying histogram shows the heights of the students in Kyra's health class.

Height (cm)
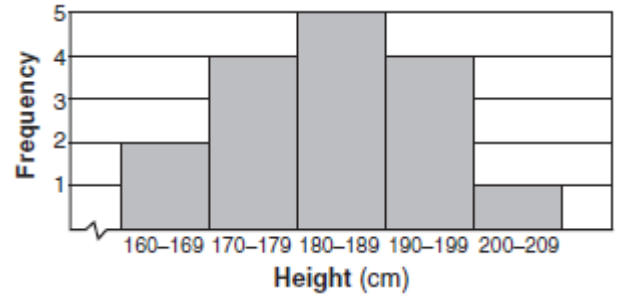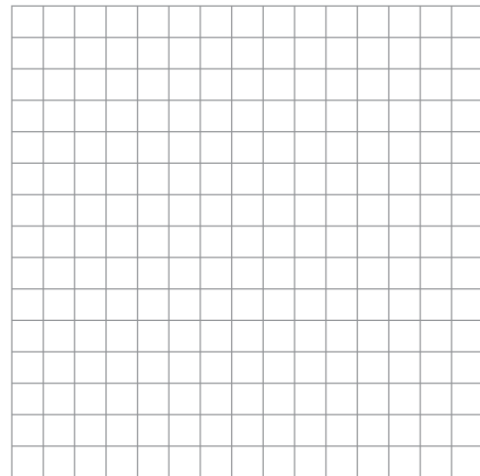
What is the total number of students in the class?
1) 5
2) 15
3) 16
4) 209

5) Ms. Hopkins recorded her students' final exam scores in the frequency table below.

Interval	Tally	Frequency
61–70	⾧	5
71–80	IIII	4
81–90	⾧ IIII	9
91–100	⾧ I	6

On the grid below, construct a frequency histogram based on the table.

6) The scores on a mathematics test were:
   70, 55, 61, 80, 85, 72, 65, 40, 74, 68, 84
   Complete the accompanying table, and use the table to construct a frequency histogram for these scores.

Score	Tally	Frequency
40–49		
50–59		
60–69		
70–79		
80–89		
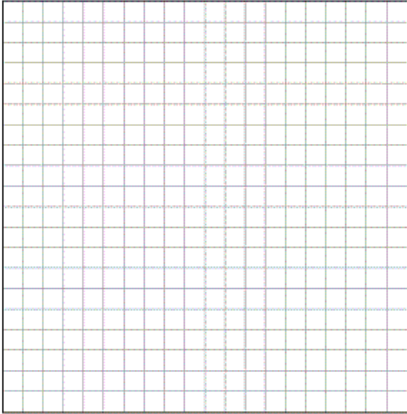
7) The accompanying table shows the weights, in pounds, for the students in an algebra class. Using the data, complete the cumulative frequency table and construct a cumulative frequency histogram on the grid below.

Interval	Frequency	Cumulative Frequency
91–100	6	
101–110	3	
111–120	0	
121–130	3	
131–140	0	
141–150	2	
151–160	2	
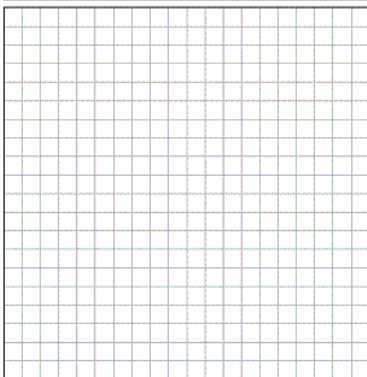
8) Twenty students were surveyed about the number of days they played outside in one week. The results of this survey are shown below.
   {6,5,4,3,0,7,1,5,4,4,3,2,2,3,2,4,3,4,0,7}
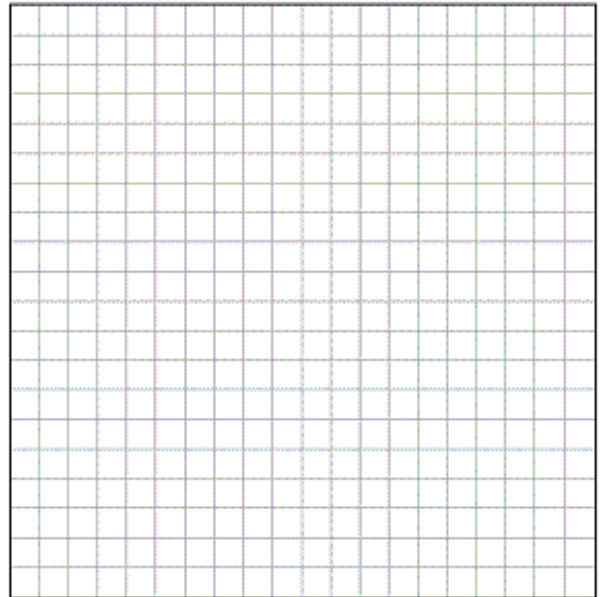   Complete the frequency table below for these data.

Interval	Tally	Frequency
0–1		
2–3		
4–5		
6–7		

Complete the cumulative frequency table below using these data.

Number of Days Outside

| Interval	Cumulative Frequency
0–1	
0–3	
0–5	
0–7	

On the grid below, create a cumulative frequency histogram based on the table you made.

58

TOPIC 21: Summarize, represent and interpret data on a single count or measurement variable.
Standard S-ID.2 – Use statistics appropriate to the shape of the data distribution to compare center (median, mean) and spread (inter-quartile range, standard deviation) of two or more different data sets.

1) A movie theater recorded the number of tickets sold daily for a popular movie during the month of June. The box-and-whisker plot shown below represents the data for the number of tickets sold, in hundreds.
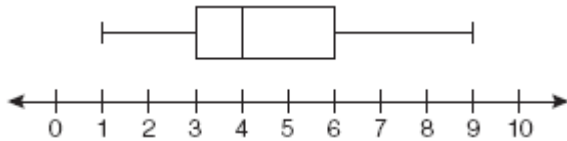

Which conclusion can be made using this plot?
1) The second quartile is 600.
2) The mean of the attendance is 400.
3) The range of the attendance is 300 to 600.
4) Twenty-five percent of the attendance is between 300 and 400.

2) The inter-quartile range of a set of 24 points will have how many points?
   1) 22   3) 6
   2) 18   4) 12

3) The test scores from Mrs. Gray's math class are shown below.
   72, 73, 66, 71, 82, 85, 95, 85, 86, 89, 91, 92
Construct a box-and-whisker plot to display these data.
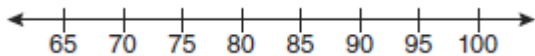
4) Using the line provided, construct a box-and-whisker plot for the 12 scores below.
   26, 32, 19, 65, 57, 16, 28, 42, 40, 21, 38, 10

Determine the number of scores that lie above the 75th percentile.

5) Given the following test scores on 2 exams, what can you conclude?

   Test 1: 52, 67, 85, 92, 77
   Test 2: 70, 81, 65, 82, 75

1) The tests have the same mean and a similar distribution.
2) The tests don't have the same mean and a similar distribution.
3) The tests have the same mean and test 1 is more varied than test 2.
4) The tests don't have the same mean and test 1 is more varied than test 2.

6) The average (arithmetic mean) of 80, 83, 89, and x is the same as the average of 80, 83, and 86. What is the average of 82 and x?
   1) 80   2) 81
   3) 82   4) 83   5) 84

7) Robin collected data on the number of hours she watched television on Sunday through Thursday nights for a period of 3 weeks. The data are shown in the table below.

	Sun	Mon	Tues	Wed	Thurs
Week 1	4	3	3.5	2	2
Week 2	4.5	5	2.5	3	1.5
Week 3	4	3	1	1.5	2.5

Using an appropriate scale on the number line below, construct a box plot for the 15 values.

TOPIC 21: Summarize, represent and interpret data on a single count or measurement variable.

Standard S-ID.3 – Interpret differences in shape, center, and spread in the context of the data sets, accounting for possible effects of extreme data points (outliers).

1) The data in the following histogram can be best described as:

Height (cm)
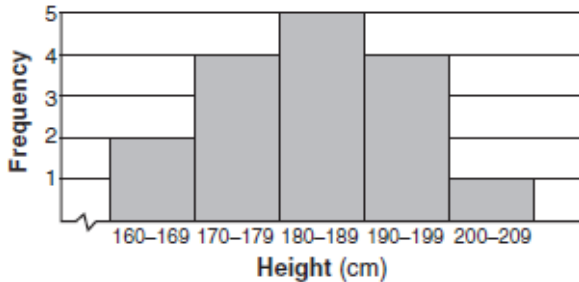
1) Skewed right   3) Triangular
2) Skewed left   4) Symmetric

2) What can be concluded if the mean equals the median of a data set?
 I. The histogram is shaped like a mound.
 II. The histogram is symmetric.
 III. The mean, median and mode are all the same.

 1) I only
 2) II only
 3) III only
 4) I and II
 5) II and III

3) You earned the following scores on 5 math exams: 20, 75, 68, 81 & 77. What is the best classification of the lowest score?
     1) A bad day   3) A loner
     2) Average killer   4) An outlier

4) For the group of data: 3, 3, 6, 7 and 16, which of the following is true?
     1) mode = mean
   2) mean > median
     3) median < mode
     4) median = mean

5) The accompanying box-and-whisker plots can be used to compare the annual incomes of three professions.
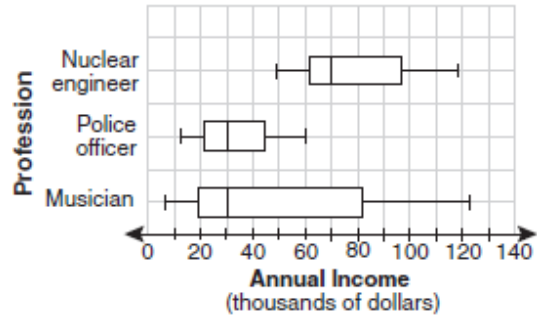
Based on the box-and-whisker plots, which statement is true?
1) The median income for nuclear engineers is greater than the income of all musicians.
2) The median income for police officers and musicians is the same.
3) All nuclear engineers earn more than all police officers.
4) A musician will eventually earn more than a police officer.

6) Given the following temperatures in Washingtonville, NY over the last 10 days.

 90, 94, 89, 92, 89, 103, 77, 92, 97, 90.

 a) Are any of the temperatures outliers?
 b) Calculate the lower value and higher value that would constitute an outlier (the range a value must be outside of).

7) The data in the following histogram can be described as:
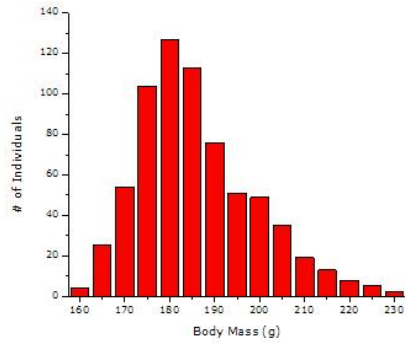
1) Skewed right 3) Triangular
2) Skewed left 4) Symmetric

. 8) The data in the following histogram can be described as:
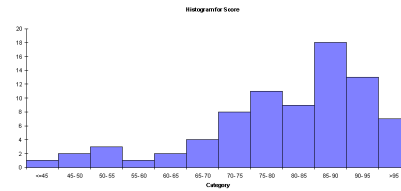
1) Positively skewed 3) Triangular
2) Negatively skewed 4) Symmetric

Answers

Topic 1
1) b
2) 3
3) 2
4) 48 degrees (48.2)
5) ANS: 4
6) ANS: 2
7) ANS: t = 3
8) 2
9) 4
10) b
11) d
12) b
13) b
14) c
15) d
16) d (trick: about means b is too precise)

Topic 2
1) 1
2) 3
3) 2
4) 1
5) 17
6) $5\sqrt{5}$
7) Danielle also correct; $\sqrt{20} = 2\sqrt{5}$
8) 2
9) 3
10) 3
11) $-2\sqrt{3}$
12) $6\sqrt{3}$
13) 2
14) $60 - 42\sqrt{5}$
15) $-1\sqrt{3}$
16) $288\sqrt{2}$
17) 2
18) 4
19) 1
20) 3/4
21) 3
22) Correct. IRR rational = IRR

Topic 3 (Standard A-SSE.1)
1) 2
2) 4
3) 1
4) 2
5) 4
6) 3
7) 1
8) $5x + 20$
9) $3w^2 - 7w$
10) $(n-4)/4$
11) a) $3d - 1200$; b) 1800
12) 4
13) 10 more than the quotient of 25 and x.
14) 5 less than 7 times a number is 33.
15) 7 less than ½ times a number is 15.
16) 1
17) 2
18) 4
19) 2
20) 2

Topic 3 (Standard A-SSE.2)
1) $(x^2 + 6)(x+1)(x-1)$
2) 3
3) 1
4) 4
5) $x - 9$
6) $4x^2 - 3y^3$
7) $b = 7$
8) 3
9) 2
10) 2
11) 3
12) 2
13) 1
14) 2
15) 3
16) $(3x - 2)(x + 1)$
17) $(2x + 5)(x - 1)$
18) $(2x + 3)(2x - 1)$
19) $(3 - x)(2 + x)$
20) $2(x - 7)(x + 5)$
21) 4 and 6

Topic 4
1) 3
2) 9; $(1/2)b^2$ was used
3) 3
4) 2
5) {-7, 4}
6) {1, 5}
7) 2
8) 2
9) $x = 3 \pm \sqrt{7}$
10) 2
11) 4
12) $y = (x - 3)^2 - 5$; <u>vertex</u>: (3, -5)

Topic 5
1) $x^2 - x - 12$
2) $x^2 - 3x - 18$
3) $-x^2 + 3x + 18$
4) $x^3 + x^2 - 21x - 45$
5) $x - 5$
6) $P(x) = -0.5x^2 + 500x - 350$
7) $2x^3 + 17x^2 + 25x - 50$
8) 2
9) 1
10) 3
11) 3
12) $4x + 3$
13) Area = $x^2 - 6x + 9$ inches
14) Perimeter = $4x - 12$ inches
15) Volume = $x^3 - 9x^2 + 27x - 27$
16) Length = $x - 5$
17) 4
18) 1
19) 1
20) c

Topic 6
1) 4
2) Downward;
   a < 1 (quadratic term negative)
3) {-2, 0, 3}
4) looks like "N"
        Zeros: {-2, 0, 3}
5) {-4, 0, 4}
6) {0, 1}
7) e
8) d
9) 1

Topic 7 (Standard A-CED.1)
1) 3
2) 4
3) 60 and 100 yards
4) 1
5) 3
6) 4 years
7)   a) x(2x)(x+2) = 2400
     b) H = 10; D = 20; W = 12   7)
8) $base = \dfrac{2(3x+5)}{x+3}$
9) 3
10) 4
11) 12/5 or 2.4
12) 2x(x-3) = 1.25x² and 80m²

Topic 7 (Standard A-CED.2)
1) 5:2 ratio
2) 1
3) 2
4) 2
5) 2
6)   Boys: 192
     Girls: 320

Topic 7 (Standard A-CED.3)
1) y = 0.20x + 30
2) $154
3) 3
4) Graph: $50 as a horizontal line
   2nd line: y = 0.20x + 30
   Break even at 100 texts
   (Intersection: (100, 50))
5) t = 4 seconds
6) No. Only 144 feet high.
7)   1 – 6 point question
       4 – 4 point questions
      32 – 2 point questions
8) 24 multiple choice
9) x+y > 15 and 4x+8y > 80

Topic 7 (Standard A-CED.4)
1) $x = \dfrac{y-b}{m}$
2) 1
3) 1
4) 2
5)   a) $F = \dfrac{S+24}{3}$
     b) 132.5 inches
6) $x = \dfrac{ab}{a+b}$
7) 4
8) 1

Topic 8 (Standard A-REI.1)
1) 4
2) 4
3) 4
4) 2
5) 3
6) 2
7) 2
8) m = 15
9) 2
10) 2
11) x = 3
12) {1, 5}
13) 2
14) 4
15) 4
16) {7/2, -1/2}
17) 3
18) 1
19) 2
20) $m(x) = x^2 + 10x + 16$; -8 & -2

Topic 9 (Standard A-REI.3)
1) 1
2) 4
3) 2
4) 2
5) 3
6) 6
7) 3

Topic 9 (Standard A-REI.4)
1) {-3, ½}
2) 1
3) 16 yards of fencing
4) $x = 3 \pm \sqrt{5}$

Topic 10 (Standard A-REI.10)
1) Line with m=-3/4, b = 3; NO
2) 4
3) 1
4) 1
5) 1
6) 4
7) 4
8) 1
9) 3
10) 4
11) System solution (2, 4)

Topic 10 (Standard A-REI.11)
1) 3
2) 1
3) yes
4) no
5) (0, 3)
6) (2, 4)
7) 2 hours for car B to catch up.
8) (1, 9) and (10, 0)

Topic 10 (Standard A-REI.12) *
1) −2 and 1
2) see appendix A
3) see appendix A
4) see appendix A
5) 1 < x < 7 (see appendix A)
6) Graph; x=3; Site A

Topic 11
1) 2
2) 3
3) 3
4) 1
5) 1
6) (3, -2)
7) a)Flourish: 120x
     Green Thumb: 70x + 1600
   b) 32 hours
   c) Green Thumb ($4050)
          (Flourish = $4200)
8) a) 5 hours
     b) 6 hours

Topic 12 (Standard F-IF.1)
1) 2
2) yes
3) no
4) D: $(-\infty, \infty)$
   R: $(-\infty, \infty)$
5) D: $(-\infty, \infty)$
   R: $[2, \infty)$
6) D: $(-\infty, \infty)$
   R: $(0, \infty)$
   Asymptote at x = 0
7) c
8) D: $(-\infty, \infty)$
   R: $\{-1, \infty\}$
9) 4
10) 3
11) D: $\{5, 10, 15, 20, 25\}$
    R: $\{5, 10, 12.5, 15\}$
12) a) $\{-2, 0, 2\}$
    b) $\{-15, 15\}$
    c) D: $(-\infty, \infty)$
       R: $(-\infty, \infty)$
13) 3

Topic 12 (Standard F-IF.2)
1) 4
2) -7 and 3
3) 4
4) 2
5) 2
6) 2
7) a) 300 texts
   b) $\{0, 300\}$
8) 3
9) 1
10) R: $[0, \infty)$
11) 1
12) 4

Topic 12 (Standard F-IF.3)
1) 2
2) 3
3) 1
4) 3
5) 3
6) 2
7) 3

Topic 13 (Standard F-IF.4)
1) 1
2) a) Increasing 0 to 3
      Decreasing -1 to 0 & 3 to 6
   b) x intercepts: $\{-1, -1/2, 5\}$
      y intercept: $\{-1\}$
   c) MAX = 5, min = -2
3) a) min at x = 1/6
   b) -0.2083
   c) $\{-2/3, 1\}$
4) 4
5) 4
6) 4
7) x = 0
8) Asymptotes: x = 0 and y = 0
9) 1
10) 2
11) 1
12) 1

Topic 13 (Standard F-IF.5)
1) 1
2) 3
3) 4
4) 3
5) 2
6) 3
7) a) decrease, <1 raised to x
   b) no
   c) $0 < y \leq 1000$
   d) 15 months

Topic 13 (Standard F-IF.6)
1) 1
2) Greg (5.5 MPH > 5.3 MPH)
3) 3
4) 1
5) 4 MPH faster
6) Bob (1.4 hrs. < 1.5)
7) 2
8) 1
9) slope = -2/3
10) a) 50 MPH
    b) 1.5 hours
    c) 10 miles from home.

Topic 14 (Standard F-IF.7)
1) 4
2) a)
   b) part a shifted up 5
   c) part 5 shifted left 5
3) a) parabola opening down
   b) $90 profit
   c) $45 each for MAX profit.
4) a) step function.
   b) Rate increases $0.25/hr.

Topic 14 (Standard F-IF.8)
1) 3
2) 1
3) 1
4) 1
5) a) 5 seconds
    b) 28 units
    c) 10.3 seconds
6) a) 5% change
    b) growing; >1 raised to x
7) {-5/2, 0}
8) $x = \dfrac{2 \pm \sqrt{5}}{2}$
9) 3
10) (4,25); $f(x) = -(x-4)^2 + 25$

Topic 14 (Standard F-IF.9)
1) 1
2) Function B (MAX 6.5 vs. 6)
3) a) no
    b) justification: parallel
    lines
    7.5 MPH = 8 min/mile
    pace
4) 2
5) in order: III, II, I
6) f(x) = $-(x-1)^2 + 5$ (higher
MAX)
7) 1
8) a) Absolute value
    b) Parabola (quadratic)
    c) Exponential

Topic 15
1) a) y = -3.21x + 181.23
    b) 19 minutes
    c) strong negative
2) a) y = 0.0834x + 1.259
    b) $1.28 more
3) a) y = $27.2025(1.1509)^x$
    b) 341 organisms
4) 1
5) B = $3000(1 + 0.042)^t$
6) $A(n) = 175 - 2.75n$ and 63

Topic 16
1) 2
2) 2
3) 4
4) f(x) = x^4 opens upward
    g(x) opens down
5) a) f(x) = parabola
    b) g(x) is parabola from a,
    left 3 units
    c) h(x) is parabola from a,
    up 3 units
6) 2
7) "V" graph;
    g(x) down 2; *f(x)* right 4
8) Vertex (4, -1); 2 units right.

Topic 17 (Standard F-LE.1)
1) 1
2) 3
3) 3
4) 4
5) 4
6) y = 16
7) 3

Topic 17 (Standard F-LE.2)
1) y = 2^x
2) a) y = 2x + 10
    b) (-5, 0)
3) 4
4) 2
5) a) f(x) = x^2
    b) f(x) = 4x is a line
        f(x) = x^2 is a parabola
6) 1

Topic 17 (Standard F-LE.3)
1) 2
2) a) Surpasses at x=5
    b) y = 32 (y = 25 for x^2)
3) 1
4) a) No
    b) x = 26

Topic 18
1) 2
2) 3
3) 0.5 = rate of decay;
   300 = inicial amount
4) false
5) a) $y = \frac{1}{2}x$
    b) $y = -\frac{1}{2}x + 2$
    c) $y = 2^x$
6) 4
7) I. same
    II. increasing
    III. decreasing
    IV. same
    V. decreasing

Topic 19 (Standard S-ID.7)
1) 2
2) 4
3) 2
4) 3
5) 4
6) 1
7) 2
8) 1
9) 2
10) 2
11) 2
12) first table

Topic 19 (Standard S-ID.8)
1) 4
2) 1
3) 2
4) 4
5) 4
6) 1
7) 1
8) a) $y = -0.58x + 1185.09$
    b) 19.9%
9) a) $y = 0.834x + 14.650$
    b) 80 on test

Topic 19 (Standard S-ID.9)
1) 1
2) 4
3) 3
4) 2
5) 3

Topic 20 (Standard S-ID.5)
1) 4
2) 3
3) 2
4) 2
5) 30%
6) 6/25

Topic 20 (Standard S-ID.6)
1) 1
2) 3
3) 1
4) a) $y = 836.47(2.05)^x$ pattern is
    exponential
    b) 3515 views
5) a) $y = 6.90x + 25.93$
    b) strong positive
    c) 67 on exam
    d)

Predicted Score	Residual
26	+4
47	-2
60	-5
81	-1
95	+4

    e) graph table above
    f) Good fit. Residuals both
        above & below
    (Also $r = +0.989$)

6) Correct plot; poor fit due to
pattern formed on residual plot.

Topic 21 (Standard S-ID.2)
1) 4
2) 4
3) Low = 66, Q1 = 71.5, Q2 = 85, Q3 = 90, High = 95
4) Low = 10, Q1 = 20, Q2 = 30, Q3 = 41, High = 65
5) 3
6) 2
7) An appropriate box plot is drawn.

Topic 21 (Standard S-ID.3)
1) 4
2) 4
3) 4
4) 2
5) 2
6) a) yes
    b) Low < 81.5 (outlier)
        High > 96.5 (outlier)
7) 1
8) 2