HSE Test Math Practice Questions

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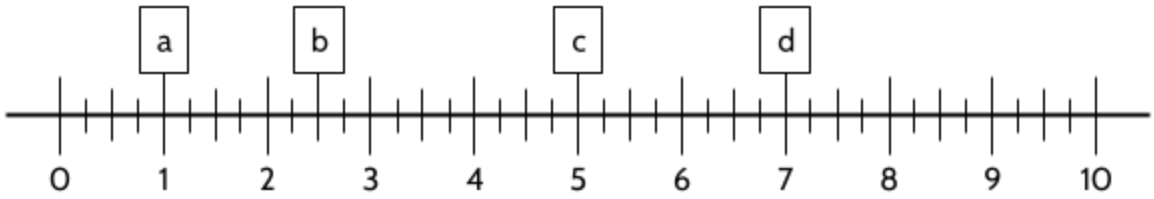
These test practice questions are from the NYSED/CUNY Fast Track GRASP Math Packets, which can be found at http://www.collectedny.org/ftgmp.

Number & Quantity

Number Lines and the Coordinate Grid

1) Which of the following points on the number line shows the number $\frac{5}{2}$?



A. a

B. b

C. c

D. d

2) Which of the following numbers is <u>not</u> represented by the point on the number line?

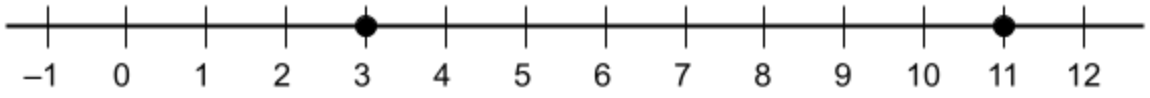
A. $3\frac{1}{2}$

B. $\frac{14}{4}$

C. 3.5

D. 3.2

3) The numbers 3 and 11 are plotted on a number line. What is the distance, in units, between the two points?



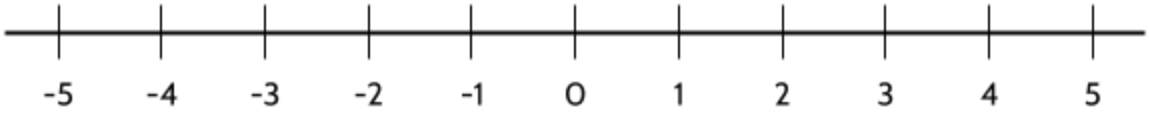
A. 7

B. 8

C. 9

D. 14

4) If the numbers -3 and 2 were plotted on a number line, what would be the distance, in units, between the two points?



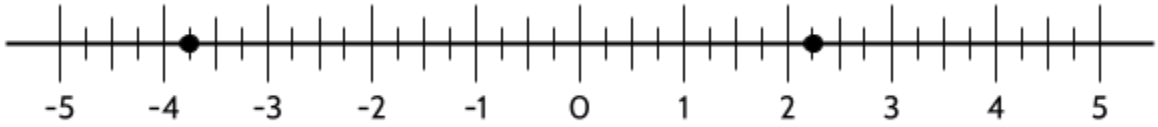
A. -6

B. -5

C. -1

D. 5

5) The numbers -3 ¾ and 2 ¼ are plotted on a number line. What is the distance, in units, between the two points?



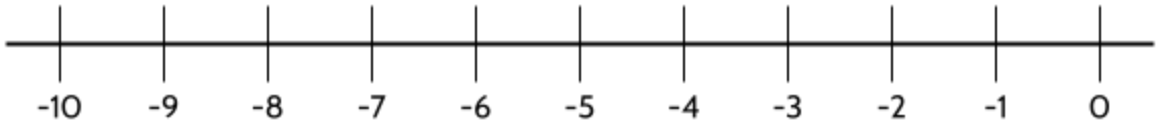
A. $-\ 6\frac{3}{8}$

B. $-\ 1\frac{1}{2}$

C. $1\frac{1}{2}$

D. 6

6) If the numbers -10 and -2 were plotted on a number line, what would be the distance, in units, between the two points?



A. -12

B. -8

C. 8

D. 20

7) A list of numbers is shown.

$\frac{1}{2}, 0.35, \frac{5}{8}, 0.8, \frac{3}{4}$

Which list shows the numbers in order from least to greatest?

A. $0.35, \frac{1}{2}, \frac{5}{8}, \frac{3}{4}, 0.8$

B. $0.35, \frac{1}{2}, \frac{5}{8}, 0.8, \frac{3}{4}$

C. $0.8, 0.35, \frac{1}{2}, \frac{3}{4}, \frac{5}{8}$

D. $0.35, \frac{1}{2}, \frac{3}{4}, \frac{5}{8}, 0.8$

8) A list of numbers is shown.

-5, $\frac{4}{5}$, -0.5, -8, 0

Which list shows the numbers in order from least to greatest?

A. 0, -0.5, $\frac{4}{5}$, -5, -8,

B. -0.5, -5, -8, 0, $\frac{4}{5}$

C. -8, -5, -0.5, 0, $\frac{4}{5}$

D. -8, -5, $\frac{4}{5}$, -0.5, 0

9) Which symbol makes this number sentence true?

$\frac{5}{8} \; ? \; \frac{10}{16}$

A. $>$

B. ≥

C. $<$

D. =

10) Which symbol makes this number sentence true?

$\frac{3}{4} \; ? \; \frac{3}{8}$

A. $>$

B. $<$

C. ≤

D. =

11) Which symbol makes this number sentence true?

$-\frac{3}{5}$? -0.5

A. $>$

B. $\geq$

C. $<$

D. $=$

12) What is the distance between 0 (zero) and point R on the number line?

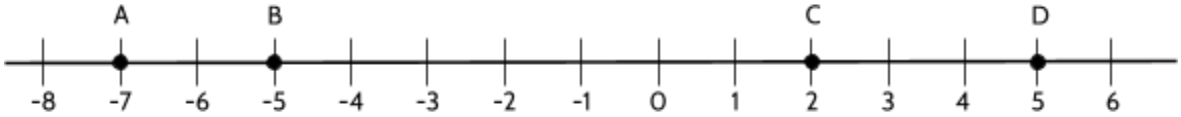
A. -3 ¼

B. -3 ⅓

C. 3 ⅓

D. 3 ¼

13) Which point does *not* have an absolute value of greater than 4?



A. Point A

B. Point B

C. Point C

D. Point D

14) What is the distance between -47 and -23 on the number line?

A. - 70

B. - 24

C. 24

D. 70

15) What is the distance between -13 and 3 on the number line?

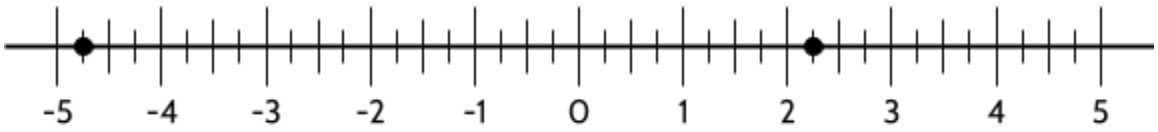
A. - 16

B. - 10

C. 10

D. 16

16) What is the distance between the two points on the number line?



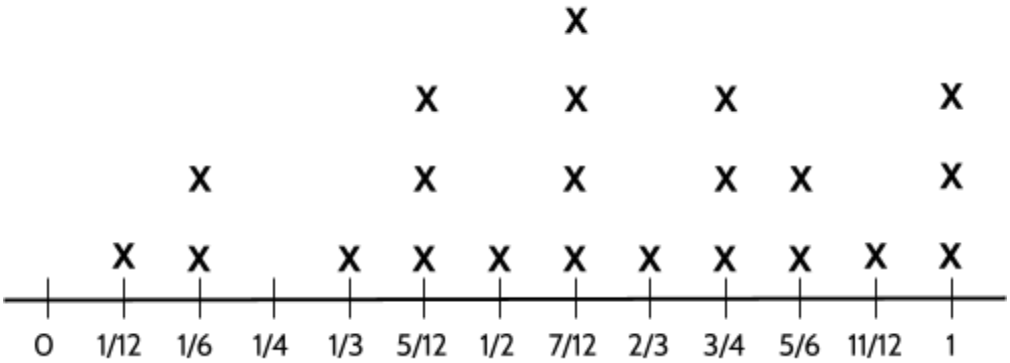
A. -7.5

B. 6

C. 7

D. 28

17) A gardener measured the growth of 22 plants for one week. The line plot below shows the amount of growth for each plant. What is the difference in growth between the plant that showed the most growth and the plant that showed the least growth?



A. $\frac{1}{4}$ inch

B. $\frac{7}{12}$ inch

C. $\frac{11}{12}$ inch

D. 1 inch

18) The temperature reading on a thermometer goes from -12°F to 9°F. What is the change in temperature?

A. -3°F

B. 3°F

C. 21°F

D. 23°F

19) What is the difference between the two points on the number line?

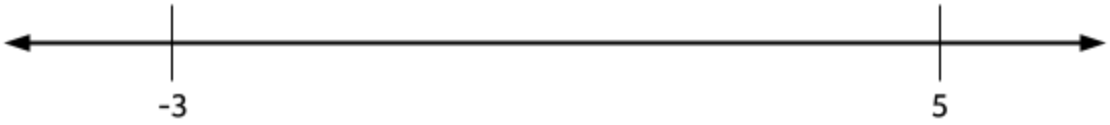
A. 6.5

B. 15

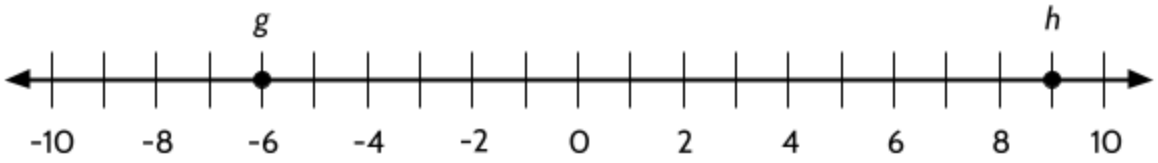
C. 50

D. 65

20) Plot the number 1 on the number line below. Draw a point on the line to represent the number.



21) What is the value of the expression |g| + |h|?



A. -15

B. -3

C. 3

D. 15

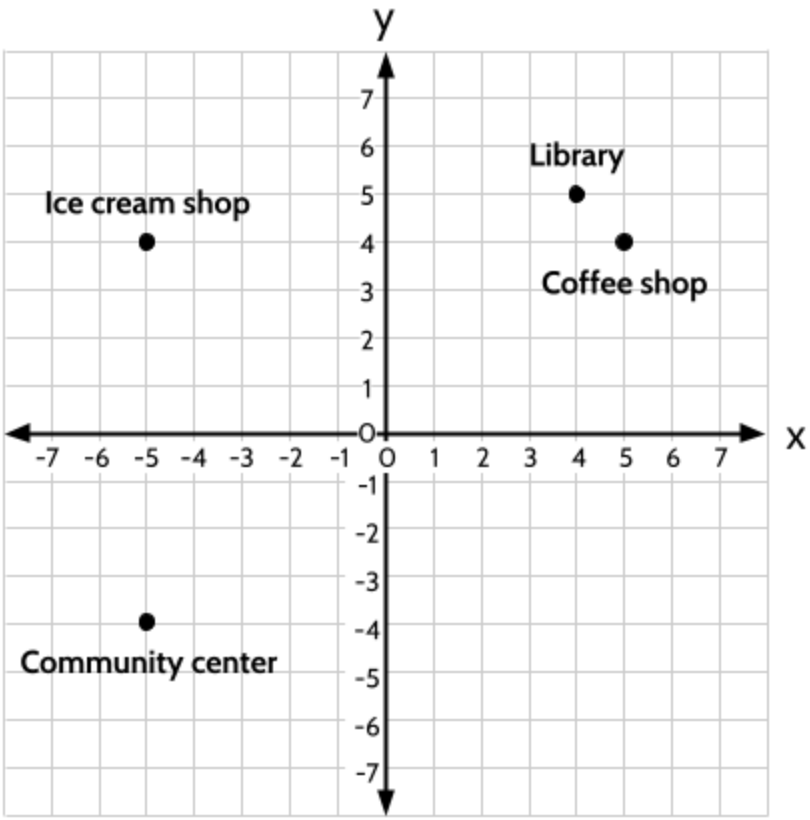
22) The graph below shows different locations in a neighborhood. Which location can be found at point (5, 4)?

A. Library

B. Coffee shop

C. Ice cream shop

D. Community center



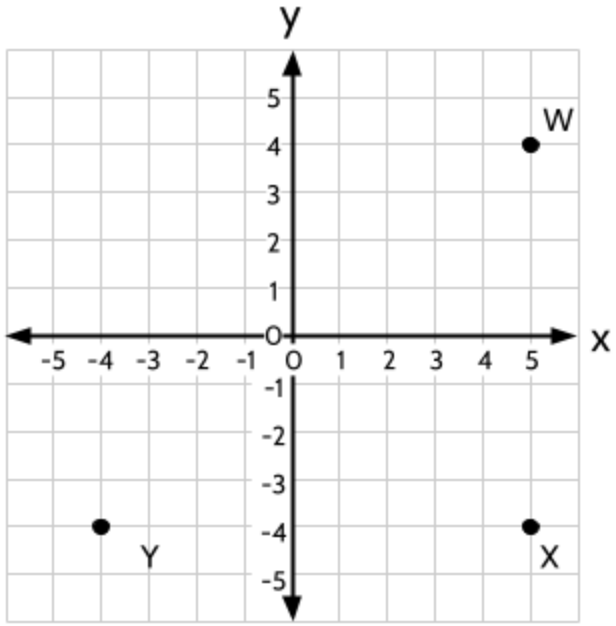
23) Which ordered pair describes the location of the point that would make a square with the other points on the graph?

A. (4, 4)

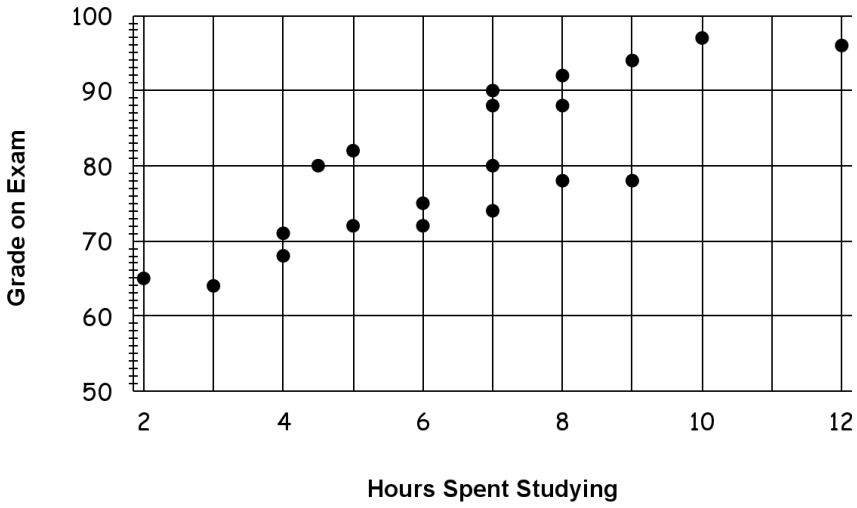
B. (-4, 4)

C. (4, -4)

D. (-4, -4)



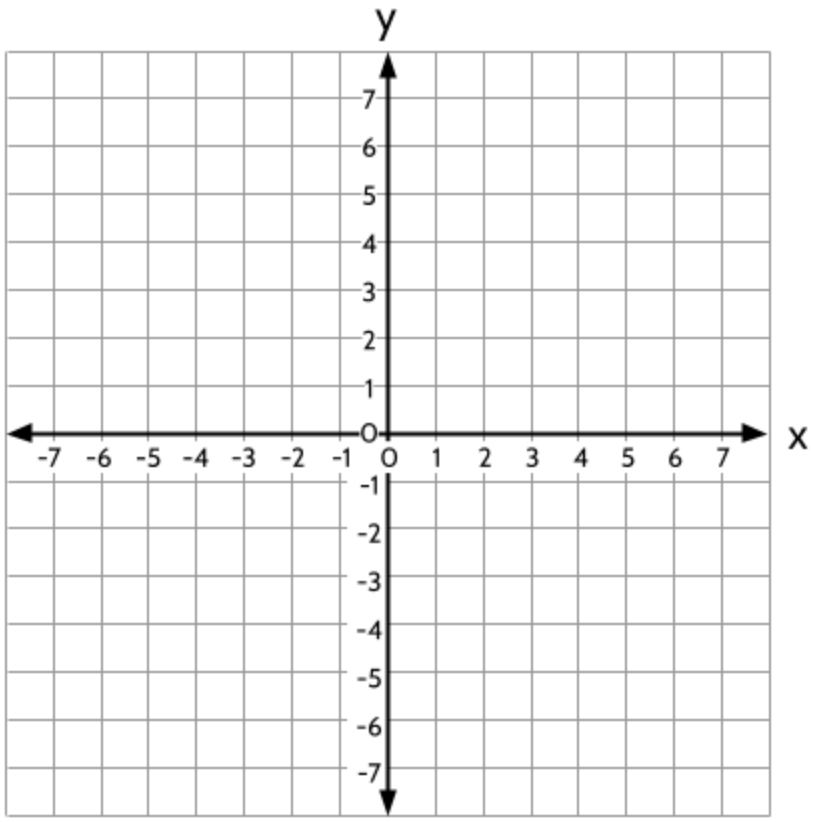
24) This scatter plot is comparing the number of hours spent studying for an exam and the grades students got on the exam.



How would you describe the correlation?

A. Positive correlation
B. Negative correlation
C. No correlation

25) Plot the point (3, -6) on the graph.



26) One day in December, there was a 100℉ difference in temperature between Minneapolis, Minnesota and San Juan, Puerto Rico. If it was -12℉ in Minneapolis, Minnesota, what was the temperature in San Juan, Puerto Rico?

27) Maurice had a negative balance of -$120 in his bank account. If he deposits $34, how much money is in his account?

A. -$154
B. -$86
C. $86
D. $154

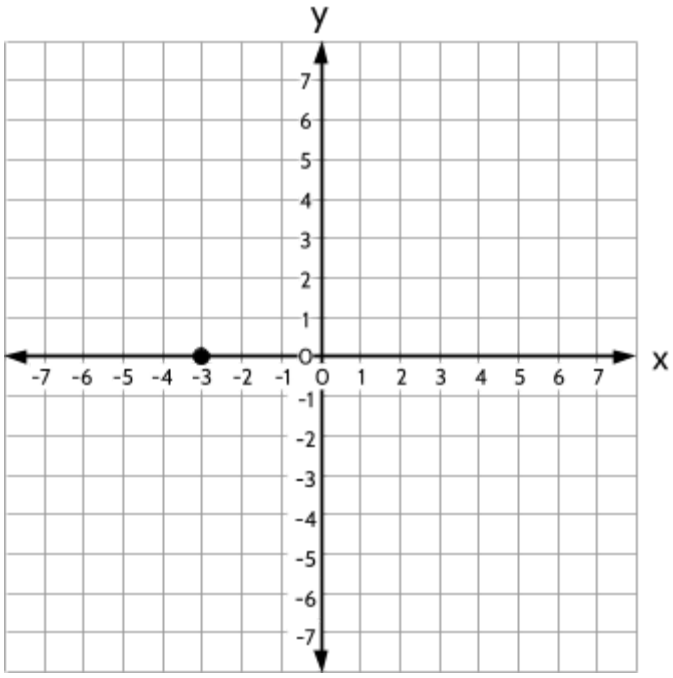
28) Which ordered pair represents the location of the point on the graph?

A. (3, 0)

B. (0, 3)

C. (-3, 0)

D. (0, -3)



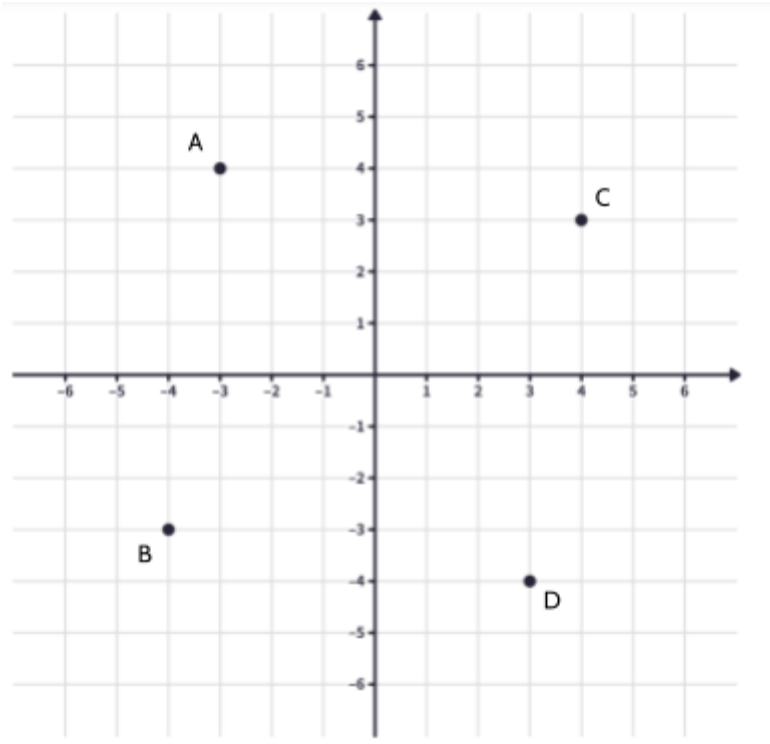
29) Which of the points on the graph represents the point (3, -4)?

A. Point A

B. Point B

C. Point C

D. Point D



30) Which quadrant is the ordered pair (-6, -7) found in?

A. I

B. II

C. III

D. IV

31) What is the distance between the points (4, -6) and (4, 3)?

A. -9 units

B. -3 units

C. 3 units

D. 9 units

32) Mount McKinley in Alaska is the tallest mountain in North America. Its elevation is 20,310 feet above sea level. Death Valley in California is the lowest point in North America. Its elevation is 282 feet below sea level. What is the difference in elevation between Mt. McKinley and Death Valley?

A. -20,592 feet

B. -20,028 feet

C. 20,028 feet

D. 20,592 feet

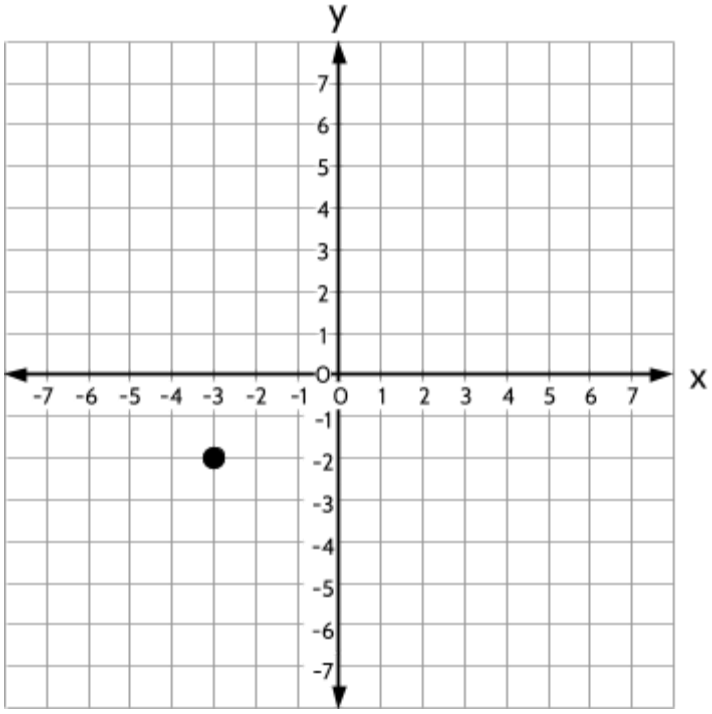
33) A point is placed on the graph below. If 4 is added to the *x* value and 5 is added to the *y*-value, which point represents the new point?

A. (1, 3)

B. (2, 2)

C. (2, 4)

D. (4, 5)



34) Which if the following number lines has been divided into thirds?

A.

B.

C.

D.

35) Which point represents ¾ on the number line?

A. Point A
B. Point B
C. Point C
D. Point D

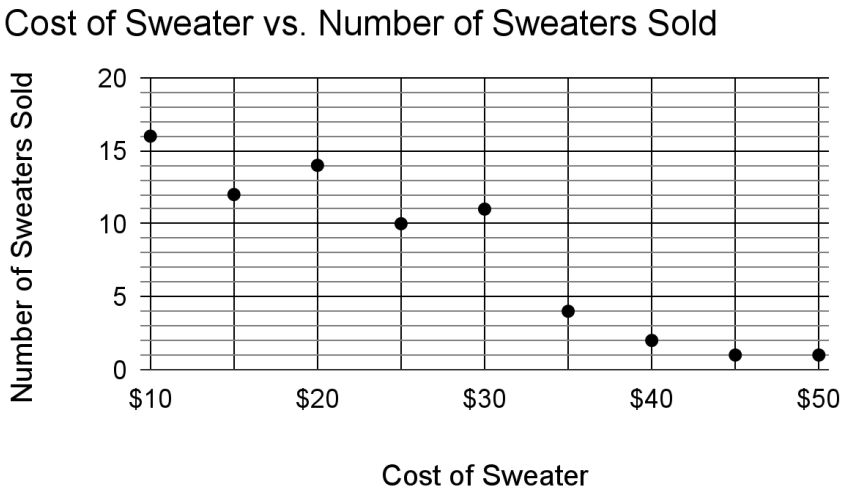
36) The table below shows the elevation of four places on Earth.

Which elevation is farthest away from sea level?

Location	**Elevation (in feet)**
Puerto Rico Trench	-27,480
Mount Everest	29,029
Challenger Deep	-35,876
Cerro Aconcagua	22,837

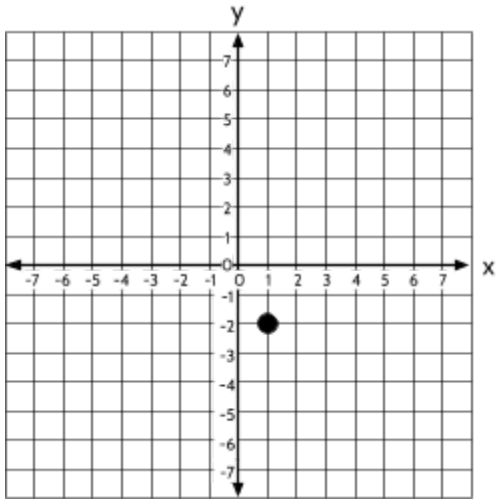
37) A store is investigating how the price of a sweater impacts how many are sold. They sold the same sweater at different prices and kept track of how many sweaters sold at each price.

What kind of correlation is there between the cost of the sweater and the number of sweaters sold?



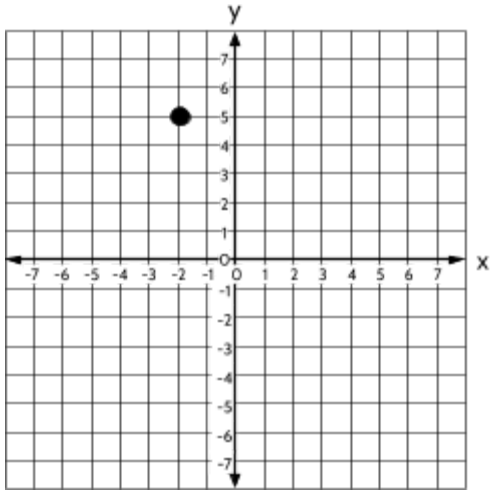
A. Positive correlation
B. Negative correlation
C. No correlation

38) Draw a line from each graph to the ordered pair that represents the point on the graph.



(-4, -6)

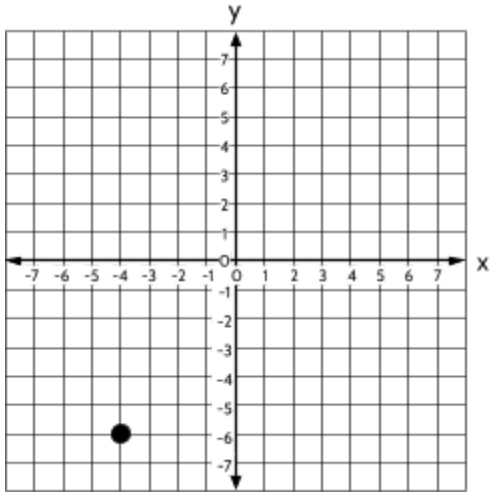
(-2, 5)



(-2, 1)

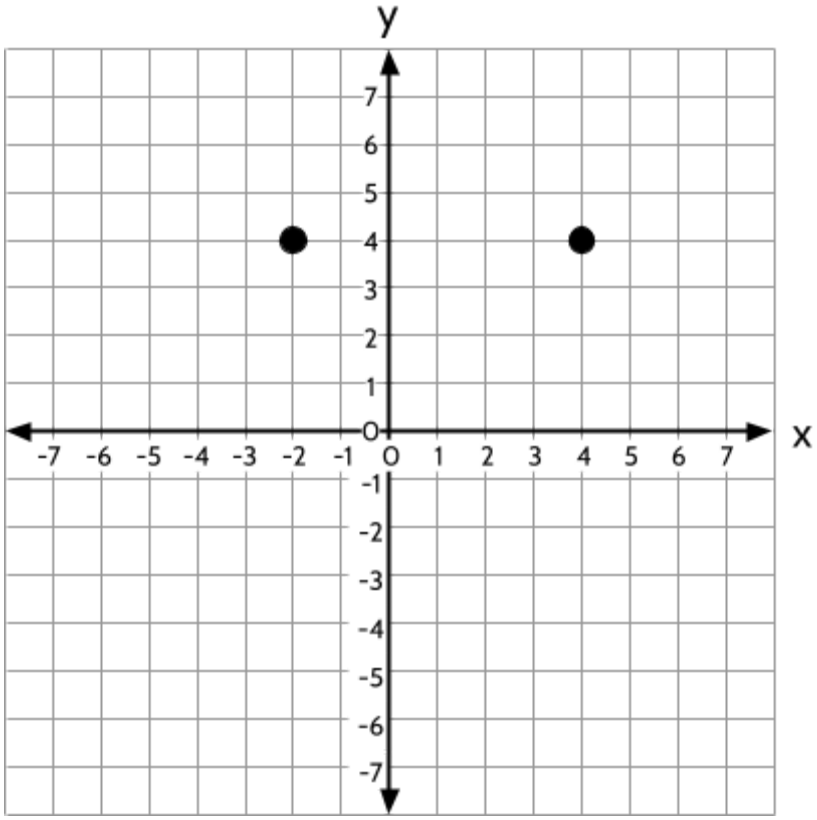
(5, -2)

(-4, 6)



(1, -2)

39) Two points have been plotted on the coordinate grid.



Which two ordered pairs describe two additional points that could be plotted on the coordinate grid to form a 4-sided figure with a perimeter of 24 units?

A. (-2, 0) and (4, 0)

B. (-2, -2) and (4, -2)

C. (-2, -3) and (4, -3)

D. (-2, 7) and (4, 7)

Number Lines and the Coordinate Grid - Answer Key

1) B. $\frac{5}{2}$ is equivalent to 2½

2) D

3) B

4) D

5) D

6) C

7) A

8) C

9) D. The fractions $\frac{5}{8}$ and $\frac{10}{16}$ are equivalent.

10) A

11) A

12) D

13) C

14) C

15) D

16) C

17) C

18) C

19) D

20) 1 is halfway between -3 and 5. There are multiple ways to figure out how to plot it on the number line, but your tick mark for 1 should be approximately halfway between -3 and 5

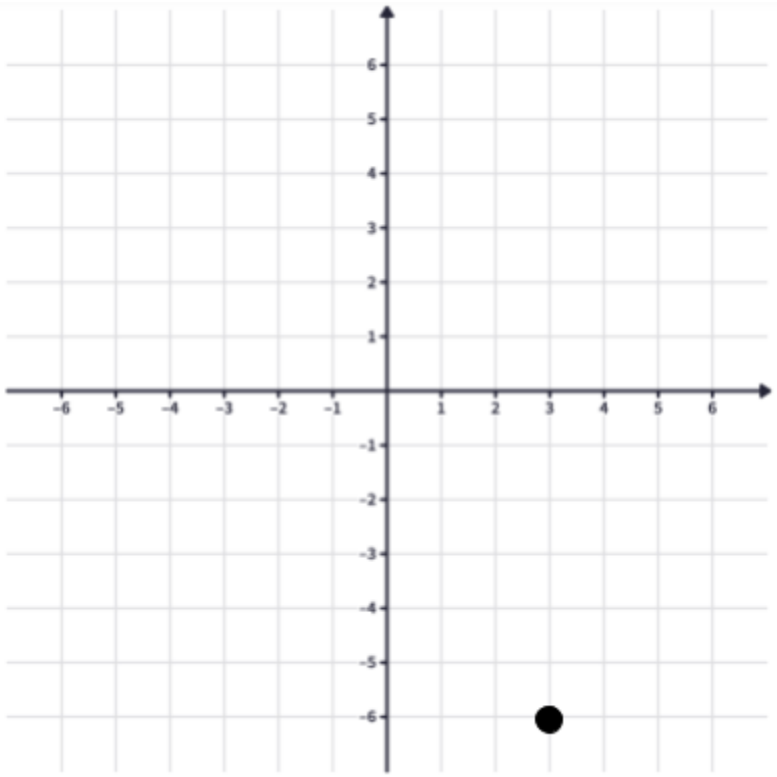
21) D

22) B

23) B

24) There is a positive correlation between studying and grades. In general, as the number of hours spent studying increases, the student grades also increase.

25)



26) 88℉

27) B

28) C

29) D

30) C

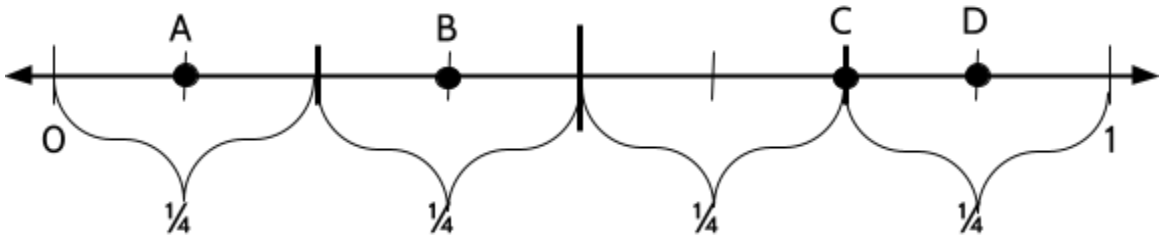
31) D

32) D

33) A

34) B. This is the only number line that is divided up into three equal pieces.

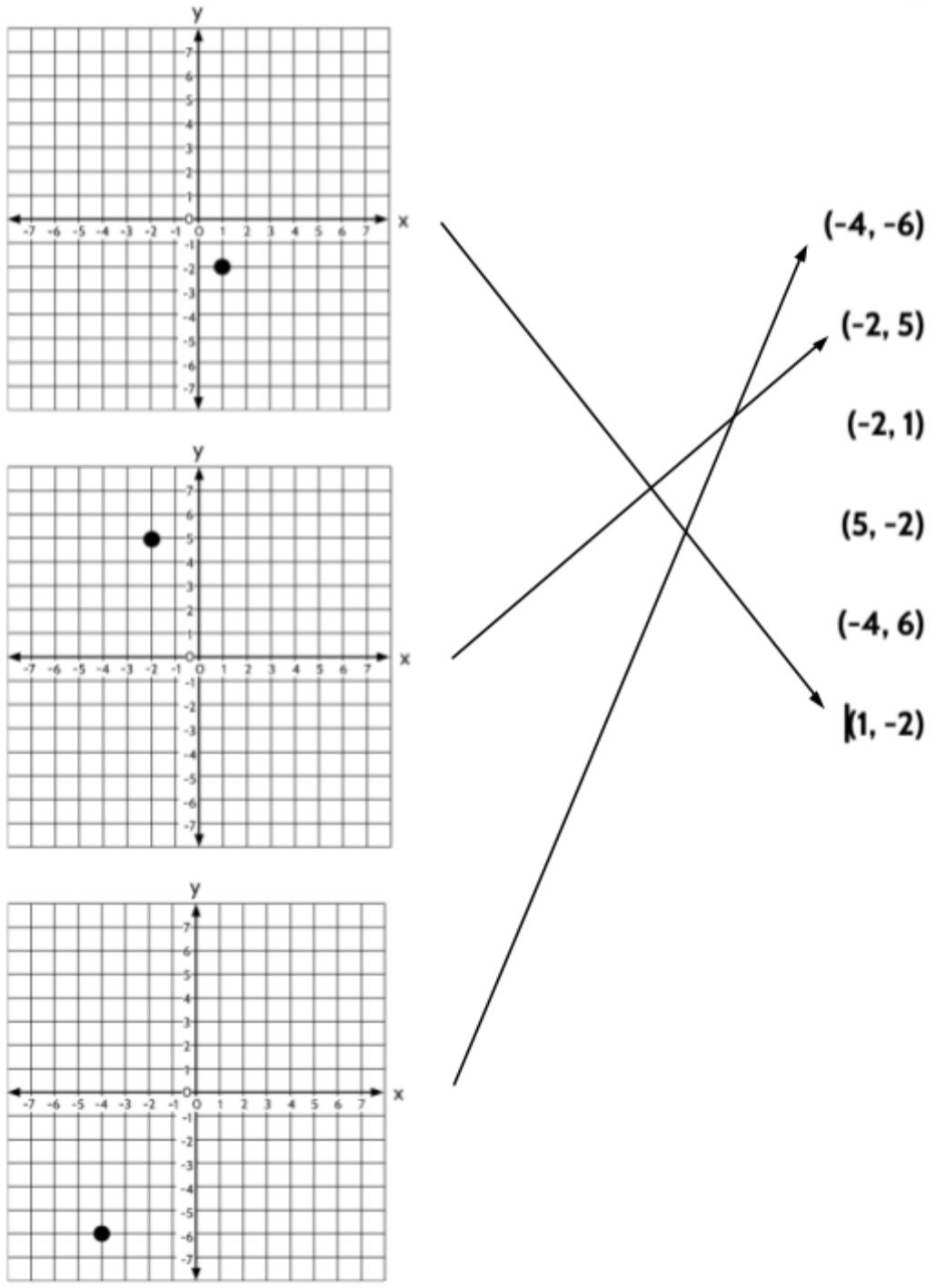
35) C



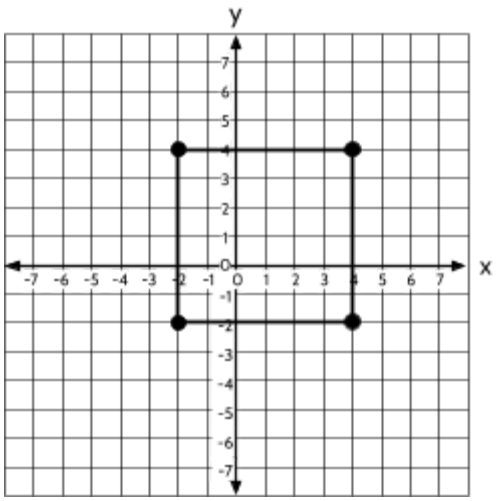
36) Challenger Deep, -35,876 feet.

37) There is a negative correlation between the cost of the sweater and the number of sweaters sold. As the price of the sweater increases, the number of sweaters sold decreases.

38)



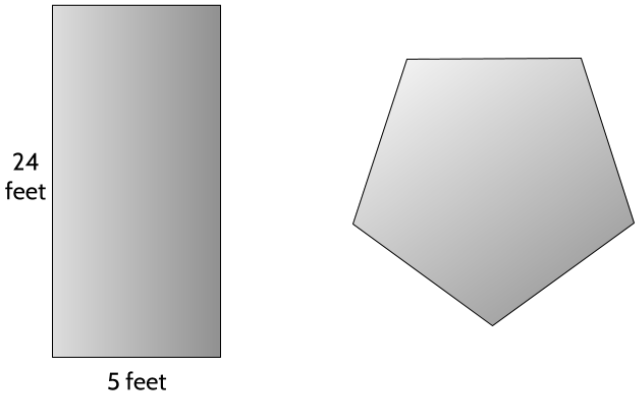
39) B. Each side is 6 units long and there are 4 sides, so the perimeter is 24 units.



Geometry

Two-Dimensional Geometry

1) Each side of the pentagon below is 13 feet long. How much longer is the perimeter of the pentagon than the perimeter of the rectangle?



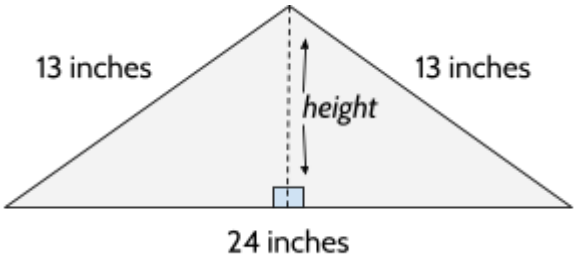
A. 7 feet

B. 11 feet

C. 16 feet

D. 36 feet

2) The dotted line below represents the height of the triangle. If the dotted line divides the base of the triangle in half, what is the height of the triangle?



[Not drawn to scale]

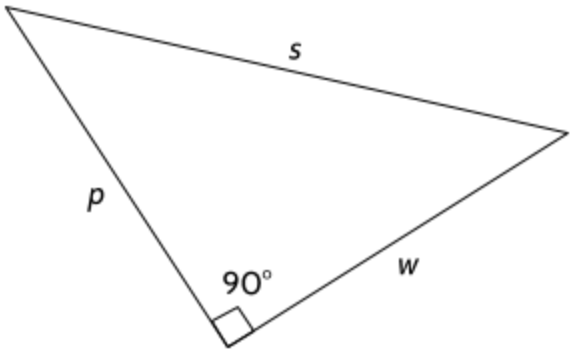
A. 5 inches

B. 12 inches

C. 20 inches

D. 50 inches

3) *s*, *w*, and *p* represent the sides of the right triangle below.



Which of the following statements is <u>not</u> true?

A. $p^2 + w^2 = s^2$

B. $s^2 - p^2 = w^2$

C. $s^2 + p^2 = w^2$

D. $s^2 - w^2 = p^2$

4)

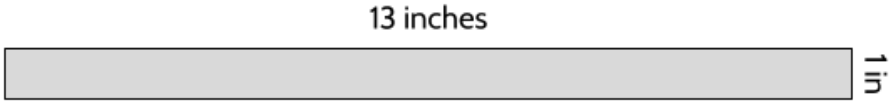
Which of the rectangles below has the same area but a <u>different</u> perimeter from the rectangle above?

A.

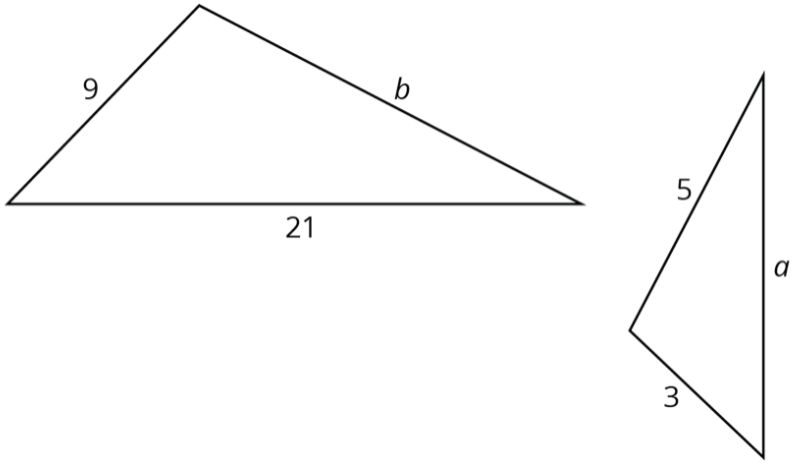
B.

C.

D.



5) These two triangles are similar. What is the perimeter of the larger triangle?



[Not drawn to scale]

A. 15 cm

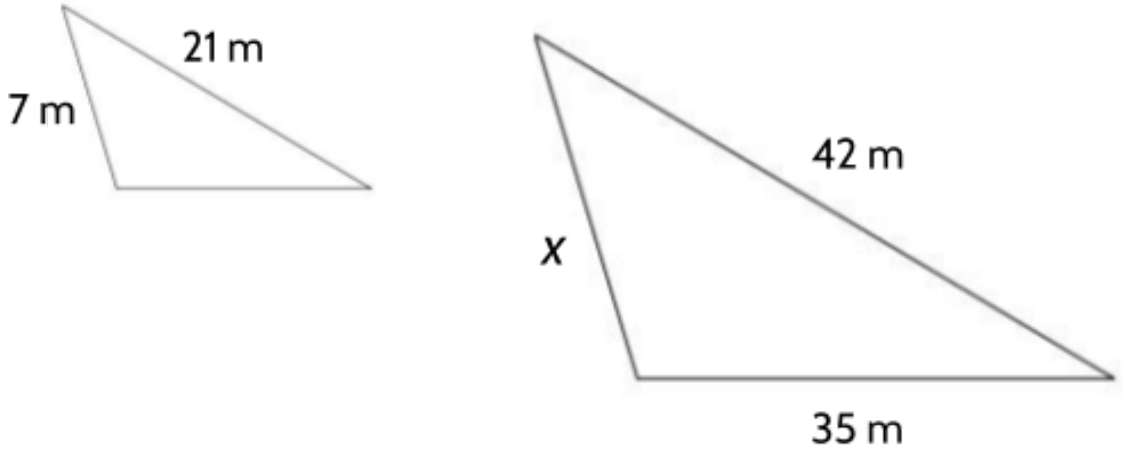
B. 30 cm

C. 45 cm

D. 60 cm

Explain why you chose your answer.

6) Below are two similar triangles.



[Not drawn to scale]

What is the length of side *x*?

A. 3.5 m

B. 7 m

C. 14 m

D. 28 m

Explain why you chose your answer.

7) Which of the following could represent the lengths of the sides of a right triangle?

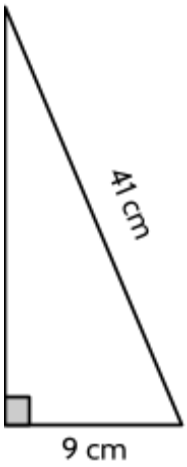
A. 9, 16, 25

B. 5, 12, 12

C. 15, 30, 45

D. 24, 32, 40

8) What is the perimeter of the triangle in the diagram below?



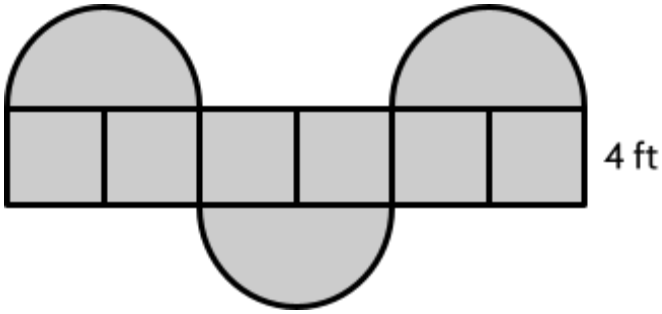
A. 40 cm

B. 42 cm

C. 50 cm

D. 90 cm

9) What is the approximate perimeter of this shape, composed of squares and semicircles?



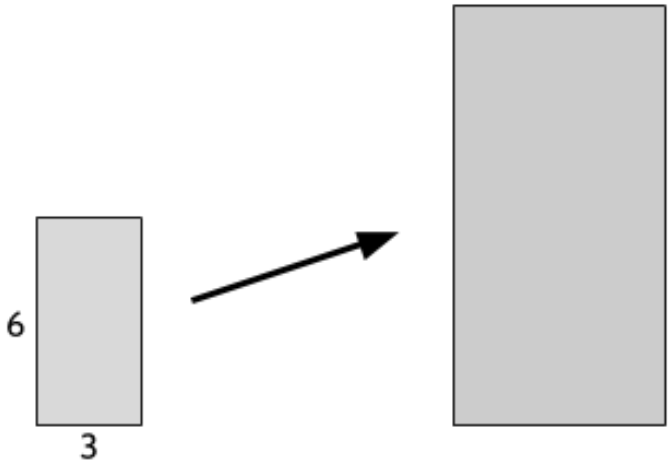
A. 50.84 ft

B. 69.68 ft

C. 107.36 ft

D. 133.68 feet

10) The smaller rectangle below has been increased by a scale factor of 2 to create the larger rectangle.



Part One:

How does enlarging a rectangle by a scale factor of 2 affect its area?

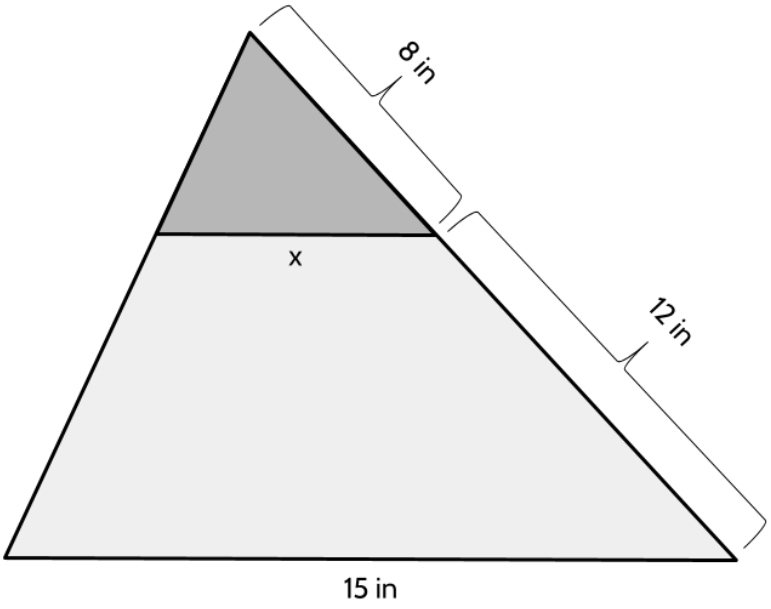
A. The area doesn't change.
B. The area is twice as big in the larger rectangle.
C. The area is three times as big in the larger rectangle.
D. The area is four times as big in the larger rectangle.

Part Two:

How does enlarging a rectangle by a scale factor of 2 affect its perimeter?

A. The perimeter doesn't change.
B. The perimeter is twice as long in the larger rectangle.
C. The perimeter is three times as long in the larger rectangle.
D. The perimeter is four times as long in the larger rectangle.

11) The small triangle has been dilated to create the large triangle.



[Not drawn to scale]

Part One:

What is the scale factor of the dilation?

A. 1.5

B. 1.6

C. 2.5

D. 11

Part Two:

What is the value of *x*?

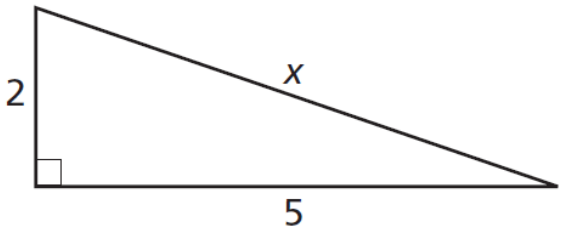
A. 6 in

B. 7 in

C. 10 in

D. 20 in

12) What is the length of side *x* in the triangle below?



[not drawn to scale]

A. 7

B. $\sqrt{7}$

C. 29

D. $\sqrt{29}$

13) The length of one side of a rectangle is 22 cm and its perimeter is 72 cm. What is the area of the rectangle?

A. 308 sq. cm

B. 528 sq. cm.

C. 616 sq. cm

D. 1584 sq. cm

14) Loretta is putting weather stripping around her door frame and needs to figure out the perimeter. The diagram below represents the dimensions of the doorway.

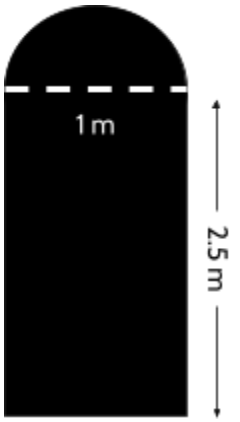
What is the approximate perimeter of Loretta's doorway?

A. 4.07 m

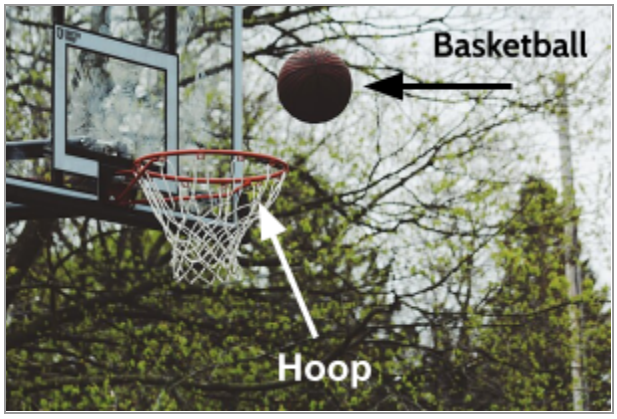
B. 7.57 m

C. 9.14 m

D. 10.14 m



15) According to rules of the National Basketball Association (NBA), a basketball hoop must have a circumference of about 56.52 inches. If an NBA basketball has an approximate diameter of 9.4 inches, what is the approximate difference between the diameter of a basketball hoop and the diameter of a basketball?



A. 8.6 inches

B. 18 inches

C. 29.5 inches

D. 47 inches

16) All segments in the diagram below measure 3 feet in length and all the angles are right angles.

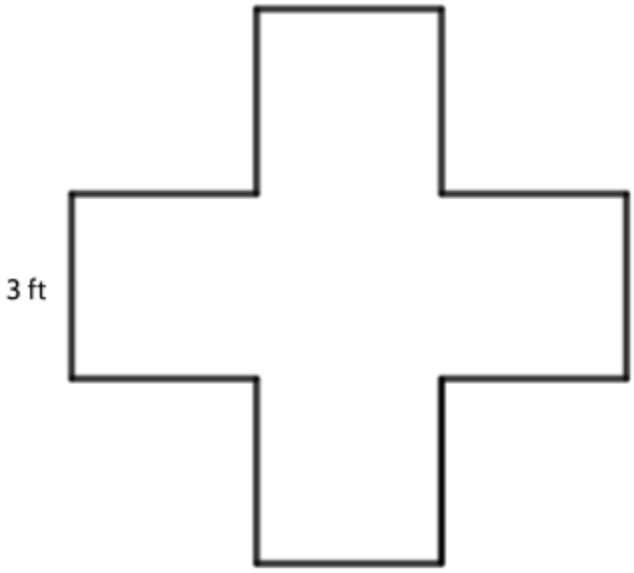
What is the area of this figure?

A. 27 square feet

B. 36 square feet

C. 45 square feet

D. 56 square feet



17) Jesse drew a triangle with sides 10 cm, 26 cm, and 18 cm. Is Jesse's triangle a right triangle?

A. Yes, because 26 is bigger than 10 and 18.

B. Yes, because 10 + 18 is bigger than 26.

C. No, because 10 + 18 doesn't equal 26.

D. No, because 100 + 324 equals 424.

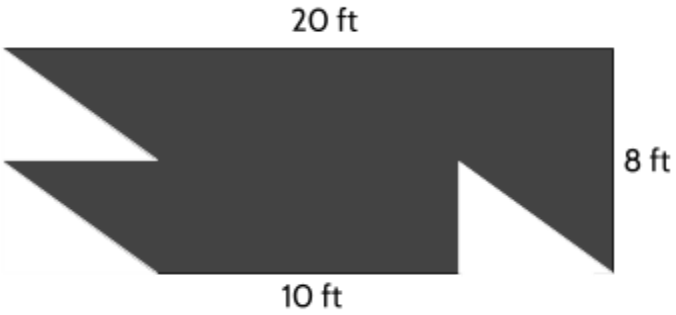
18) Isuri made a design by cutting three identical triangles out of a rectangle. What is the area of the piece they had left?

A. 30 sq ft

B. 80 sq ft

C. 130 sq ft

D. 160 sq ft



19) A circular shield has an area of 706.5 square inches. Using $\pi \cong 3.14$, what is its approximate diameter?

A. 15 inches

B. 30 inches

C. 94.2 inches

D. 225 inches

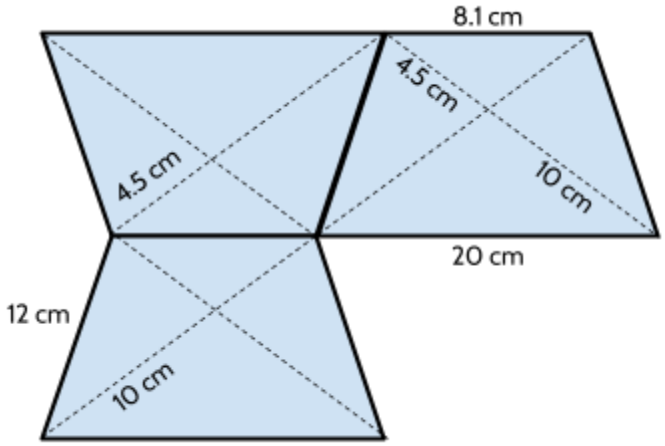
20) The design below was made with three identical trapezoids. What is the perimeter of the design?

A. 40.1 cm

B. 69.1 cm

C. 116.1 cm

D. 145.1 cm



21) The circumference of a circular cake is 50.24 inches. What is the approximate radius of the cake?

A. 4 inches

B. 8 inches

C. 16 inches

D. 32 inches

22) The area of a rectangle is 140 m^2. The perimeter of the rectangle is 48 m. What are the dimensions of the rectangle?

A. 14 m and 10 m

B. 20 m and 7 m

C. 28 m and 5 m

D. 45 m and 3 m

23) What is the perimeter of a square with an area of 324 ft^2?

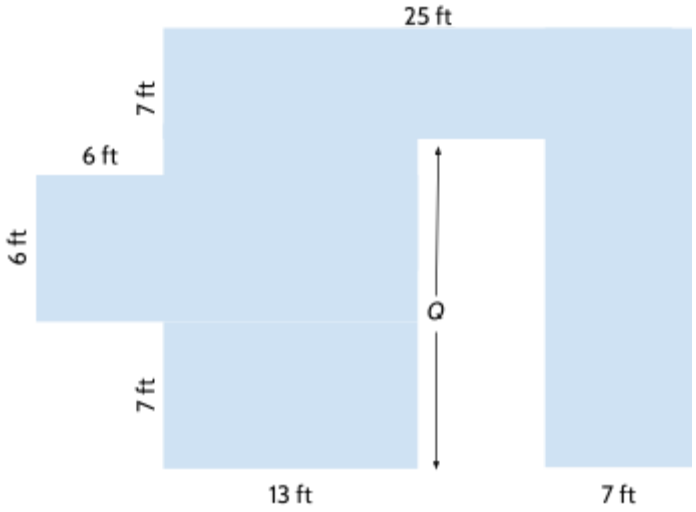
A. 18 ft

B. 36 ft

C. 72 ft

D. 81 ft

24) All angles in the polygon below are right angles. If the perimeter of this polygon is 132 feet, what is the length of side *Q*?



A. 15 ft
B. 30 ft
C. 61 ft
D. 71 ft

25) Jay and Tracy are installing rectangular solar panels on the roof of their garage. The solar panels are 6.5 feet long. If the area of each panel is 22.75 square inches, what is the width of each panel?

A. 3.5 feet
B. 4.875 feet
C. 7 feet
D. 9.75 feet

26) The legs of a right triangle are 8 yards and 12 yards. Which of the following statements is true about the length of the missing side?

A. The length of the missing side is between 14 and 15 yards.
B. The length of the missing side is between 15 and 16 yards.
C. The length of the missing side is between 16 and 17 yards.
D. The length of the missing side is between 17 and 18 yards.

27) Each side of a stop sign is equal in length. If one side measures 12 ½ inches, what is the perimeter of the stop sign?

28) Maggie is planning a rectangular garden that is 8 feet by 12 feet. If Maggie wants one half the area of the garden to be strawberries, which of the following could be the dimensions of the strawberry patch?

A. 2 feet by 3 feet

B. 4 feet by 6 feet

C. 6 feet by 8 feet

D. 6 feet by 10 feet

29) At a mattress store, mattresses are available in the following sizes:

- Twin mattress: 38 inches by 75 inches.
- Full mattress: 53 inches by 75 inches.
- Queen mattress: 60 inches by 80 inches.
- King mattress: 76 inches by 80 inches.

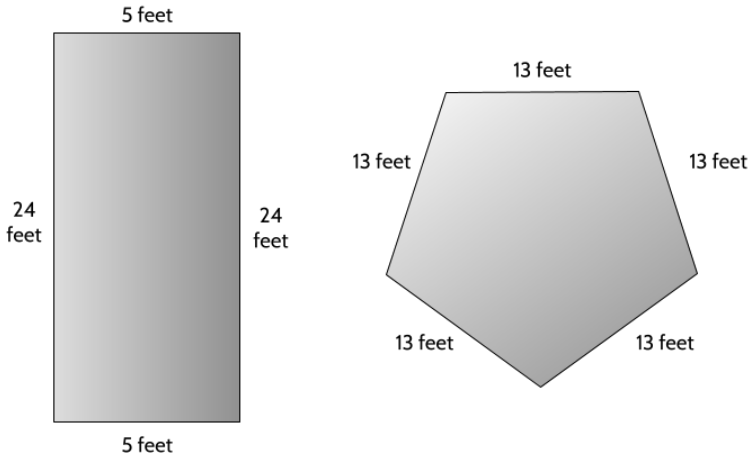
Jay has a twin mattress and replaces it with a full mattress. How much larger is the area of their new mattress?

A. 15 square inches
B. 30 square inches
C. 1125 square inches
D. 2850 square inches

Two-Dimensional Geometry - Answer Key

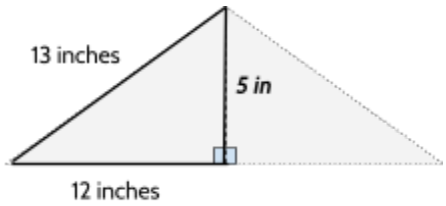
Note: *The explanations given are not the only way to solve these problems. They are just an example of one way. If you did it differently, and got the correct answer, then you probably used an effective strategy.*

1) Choice A. The perimeter of the pentagon is 65 feet and the perimeter of the rectangle is 58 feet. Choice D is what you get if you forget to add the unlabeled sides of the rectangle.



2) Choice A. You can imagine the dotted line dividing this into two right triangles. The length of the hypotenuse is 13 inches. The length of one of the legs is 12 inches.

$12^2 + \square^2 = 13^2$ $\quad$ $144 + \square^2 = 169$ $\quad$ $144 + 25 = 169$ $\quad$ $5^2 = 25$



3) Choice C

4) Choice B. The question is asking for a rectangle with the same area and different perimeter. A 12 × 2 rectangle has an area of 24 square inches and a perimeter of 28 inches. The 8 by 3 rectangle is the only other rectangle with an area of 24 square inches. Be careful: The rectangle in Choice C has an area of 28 sq. in. The rectangle in Choice D has the same perimeter but a different area.

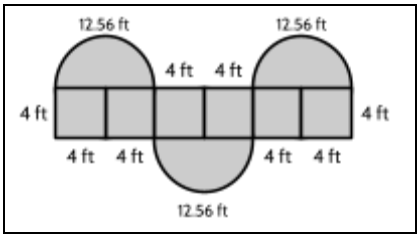
5) Choice C. First you need to determine the scale factor. From the corresponding sides of 3 and 9, we know the larger triangle is three times larger than the smaller triangle. The missing side length, *b*, of the larger triangle corresponds to the side length of 5 in the smaller triangle, so the length of *b* is 15. The perimeter of the larger triangle is 45 (9 + 21 + 15).

6) Choice C. 14 m. The corresponding sides have each been enlarged by a scale factor of 2. 7 m is the side that corresponds to side *x*, and 7 × 2 = 14.

7) Choice D. $24^2 + 32^2 = 40^2$. The Pythagorean Theorem doesn't work for the other options.

8) Choice D. To find the perimeter, we first need to find the length of the missing side. We are given the hypotenuse and one of the legs of a right triangle.
$41^2 = 1681$ $9^2 = 81$ 1681 - 81 = 1600 $\sqrt{1600} = 40$ 41 + 9 + 40 = 90cm

9) Choice B. Eight sides of the squares are included in the perimeter. Each of those sides measures 4 feet and 8 × 4 = 32 feet. Each circle has a diameter of 8. If we multiply the diameter by π, we get the circumference. 8 × 3.14 = 25.12 feet. Since we only have half of the circle as part of the perimeter, we divide 25.12 by 2, which is 12.56. Each semicircle has a circumference of 12.56 and there are three of them, so 12.65 × 3 = 37.68 feet.32 + 37.68 = 69.68 feet.



10) **Part One:** Choice D. The area is four times as big in the larger rectangle. The area of the small rectangle is 18 (3 × 6). The area of the large rectangle is 72 (6 × 12).

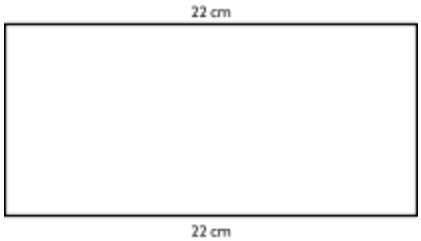
Part Two: Choice B. The perimeter is twice as long in the larger rectangle. The perimeter of the small rectangle is 18 (3 + 6 + 3 + 6). The perimeter of the large rectangle is 36 (6 + 12 + 6 + 12).

11) **Part One:** Choice C. 2.5

Part Two: Choice A. One side of the small triangle is 8 in. The corresponding side of the large triangle is 20 in (8 + 12). 20 ÷ 8 = 2.5 (scale factor). 2.5*x* = 15 --> *x* = 6

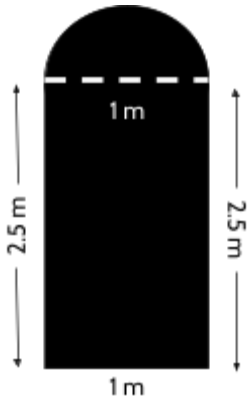
12) Choice D. 52 + 22 = 29. The length of the hypotenuse is the square root of 29. For this problem, the correct answer choice is written as a square root.

13) Choice A. We know one side measures 22 cm and the perimeter is 72 cm. It can help to sketch the rectangle:



We have 44 of the 72 cm we need for the perimeter. We need 28 more cm to make a perimeter of 72 cm. Since we have two sides, we need that 28 to be divided between those 2 sides. That means each shorter side is 14 cm. 14 cm × 22 cm is 308 sq cm.

14) Choice B.



The perimeter of the rectangular part of the door is

2.5 m + 2.5 m + 1 m = 6 m

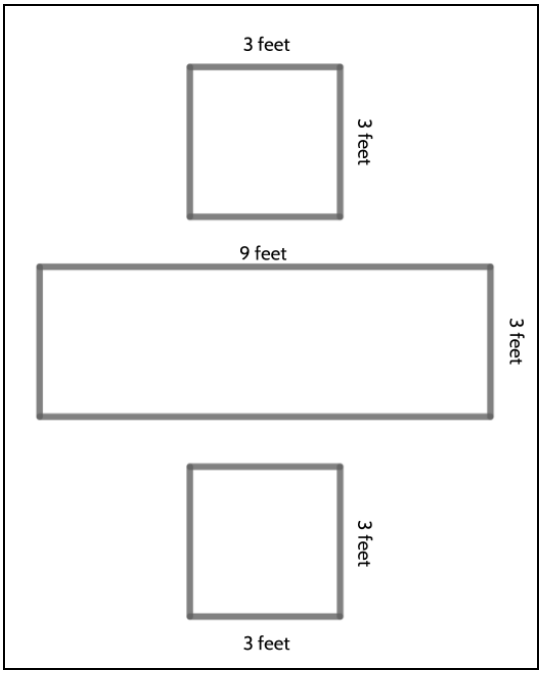
The circumference of the circular part of the doorway is half the circumference of a circle with a diameter of 1 m.

3.14 × 1 = 3.14 m 3.14/2 = 1.57 m

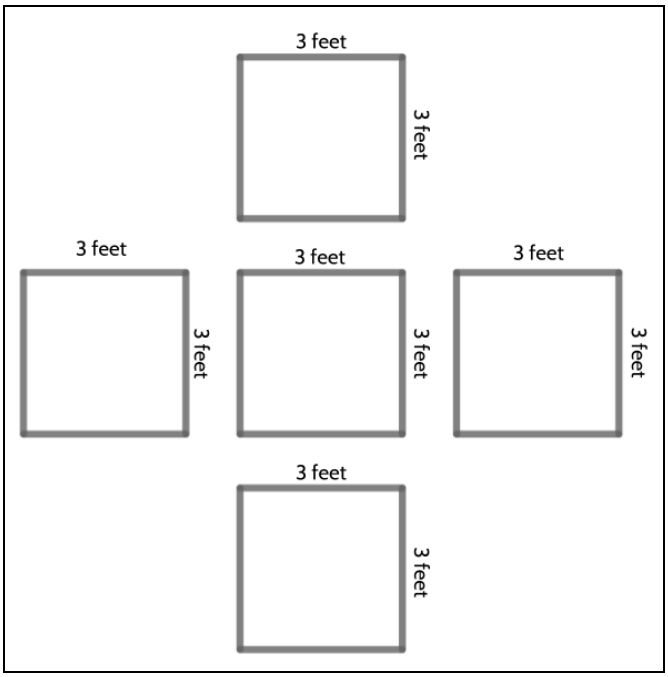
6 m + 1.57 m = 7.57 m

15) Choice B. If the circumference of a basketball hoop is 56.52 inches, then its diameter is 18 inches. 18 - 9.4 = 8.6 inches.

16) Choice C. There are a few different ways you might break up this shape. Here are two examples:



9 sq ft + 27 sq ft + 9 sq ft = 45 sq ft



9 sq ft + 9 sq ft + 9 sq ft + 9 sq ft + 9 = 45 sq ft

17) Choice D.

18) Choice C. The area of the rectangle is 160 square yards. The area of each triangle is 10 square yds. The area of all the triangles is 30 square yards. 160 - 30 = 130 square yds.

19) Choice B is the correct answer. Choice A, 15 inches, is the radius of the shield. Choice C 94.2 inches, is the circumference of the shield.

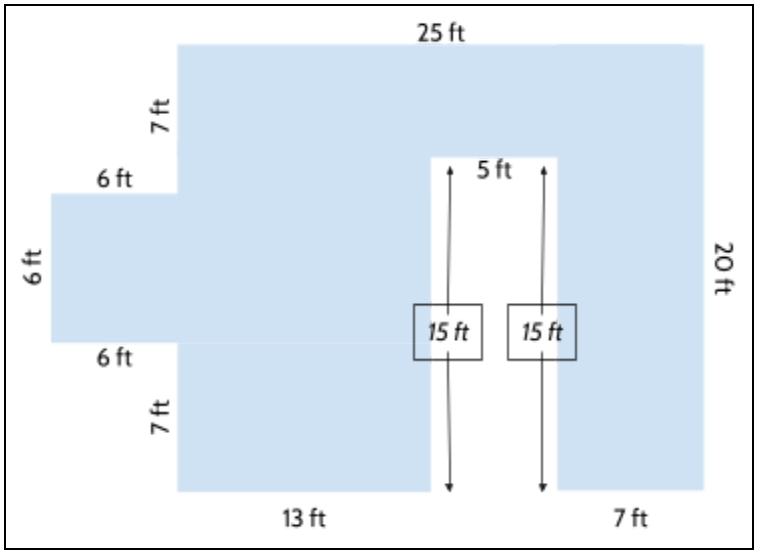
20) Choice C. 12 cm + 12 cm + 12 cm + 12 cm + 20 cm + 20 cm + 20 cm + 8.1 cm = 116.1 cm

21) Choice B. If the circumference is 50.24 in, the diameter would be approximately 16 in, so the radius would be 8 in.

22) Choice A.

23) Choice C.

24) Choice A. This diagram shows all sides labeled. To find the lengths of the two sides marked with arrows, you need to use the fact that the total perimeter is 132 feet. All the other sides add up to 102 ft, so the two remaining sides must add up to 30 feet. Because they are the same length as each other, they are 15 feet each.



25) Choice A.

26) Choice A. The relationship between the length of the sides of a right triangle can be expressed as $a^2 + b^2 = c^2$, so in this case, $8^2 + 12^2 = 208$. If $c^2 = 208$, then $c = \sqrt{208}$. Since $\sqrt{208}$ = 14.42.., then c is between 14 and 15 yards.

27) 100 inches. Each side measures 12 ½ in length and there are 8 sides. We can add 12 ½ + 12 ½ + 12 ½ + 12 ½ + 12 ½ + 12 ½ + 12 ½ + 12 ½ = 100. Or we can multiply 12 ½ × 8.

28) Choice C. The area of the entire garden is 96 square feet. A 6 by 8 ft garden has an area of 48 sq feet, which is half of 96 square feet.

29) Choice C. The area of a twin mattress is 2850 sq. in. The area of a full mattress is 3975 sq. in. The difference is an area of 1125 square inches.

Two-Dimensional Geometry: Population Density

1) There are about 20 million people in New York State, with a total land area of about 47,000 square miles.

   What is the population density of New York State?

   A. 0.0004 people per sq. mile
   B. 426 people per sq. mile
   C. 2,350 people per sq. mile
   D. 940,000 people per sq. mile

2) The following chart shows the population and area of the five boroughs of New York City.

Borough	Population (2020)	Area (sq. miles)
Bronx	1,472,654	42
Brooklyn	2,736,074	71
Manhattan	1,694,251	23
Queens	2,405,464	109
Staten Island	495,747	59

   Based on the chart, which answer choice lists the boroughs from greatest to least population density?

   A. Manhattan, Brooklyn, Bronx, Queens, Staten Island
   B. Brooklyn, Queens, Manhattan, Bronx, Staten Island
   C. Queens, Brooklyn, Staten Island, Bronx, Manhattan
   D. Manhattan, Queens, Brooklyn, Bronx, Staten Island

3) In 2020, the total New York City population was about 8.8 million people. The area of New York City is about 300 square miles. By 2040, the population of New York City is projected to grow by 200,000 people from the 2020 population level. If this happens, what will the population density be for New York City in 2040?

   A. 34.9 ppl/mi^2
   B. 1,333 ppl/mi^2
   C. 28,667 ppl/mi^2
   D. 30,000 ppl/mi^2

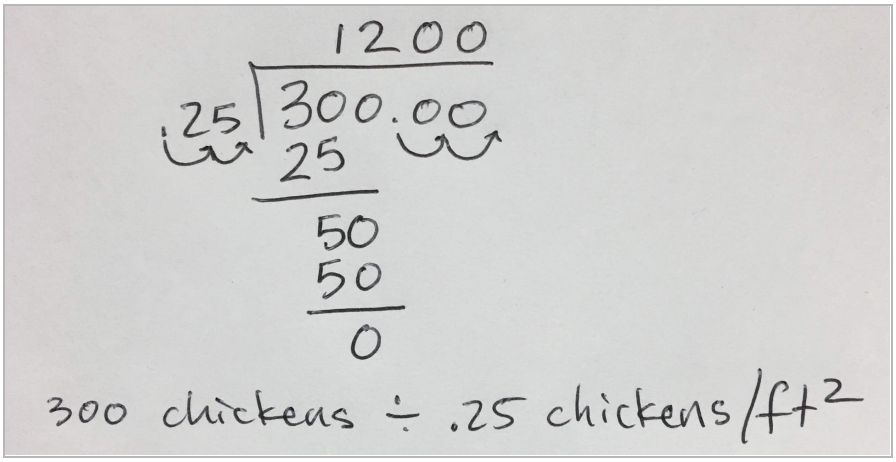
4) Albany is about 22 square miles in area and has a population density of about 4,500 people/mi^2. What is the population of Albany?

   A. 0.005 people per square mile
   B. 205 people per square mile
   C. 99,000 people
   D. 205,000 people

5) Between 2000 and 2010 in New York State, the population density increased from 345 people per square mile to 352 people per square mile. The land area of New York State is about 55,000 square miles. What was the increase in population?

   A. 7 people
   B. 156 people
   C. 385,000 people
   D. 19,360,000 people

6) A farmer did some calculations while planning an addition to her farm. What does the number 1,200 represent in her notes below?



A. How much land is needed to raise the chickens
B. How many chickens will fit in each square foot of land
C. How many chickens the farmer can raise
D. The increase in the population of chickens

7) In New York City there are 7 libraries for every 10 square miles of area. New York City is about 300 square miles in size. About how many libraries are there in New York City?

A. 30
B. 43
C. 70
D. 210

8) The approximate 2020 U.S. state populations and population densities are shown in the table below.

State	Population Density (people/sq. mi.)	Population (2020)
Florida	401	21,500,000
Illinois	231	12,800,000
New York	429	20,200,000
Pennsylvania	291	13,000,000

Based on the table above, which list shows the states' areas in order from largest to smallest?

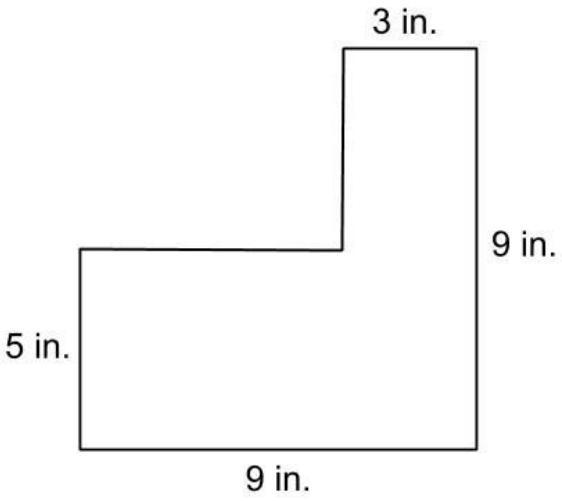
A. New York, Florida, Pennsylvania, Illinois

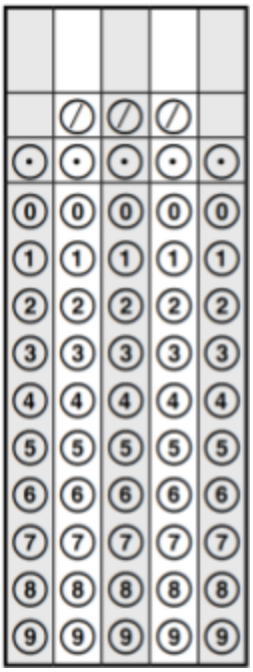
B. Illinois, Florida, New York, Pennsylvania

C. Florida, New York, Pennsylvania, Illinois

D. Pennsylvania, New York, Florida, Illinois

9) What is the area of this figure in square inches? Write your answer in the grid.





10) There are about 330 million people in the United States, with a total land area of about 3.8 million square miles.

What is the population density of the United States?

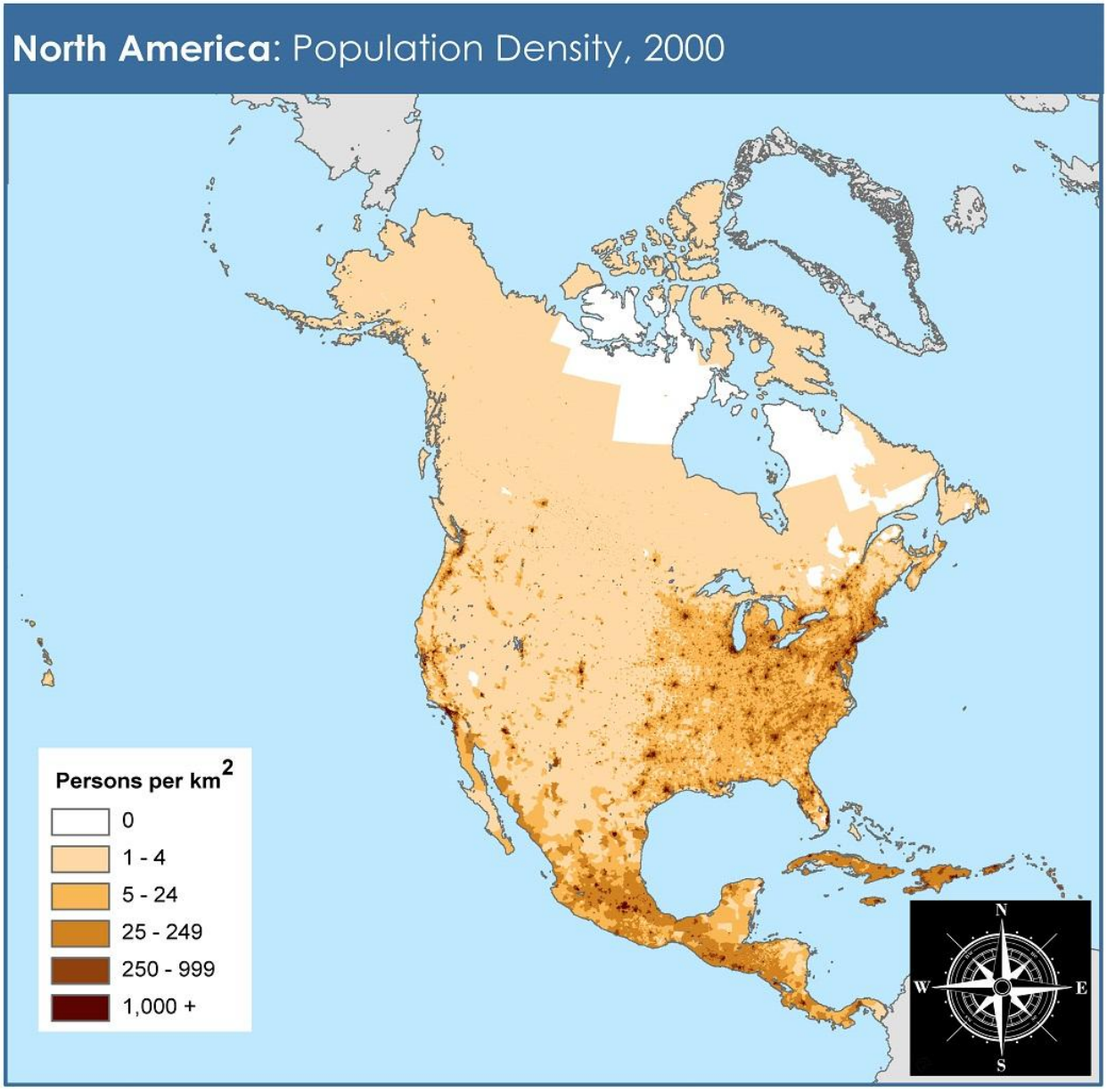
A. 0.01 people per sq. mile

B. 9 people per sq. mile

C. 87 people per sq. mile

D. 1,235 people per sq. mile

Look at the map below. You may want to also look at other maps online to identify countries in North America. Then answer the next three questions.



adapted from NASA Socioeconomic Data and Applications Center (http://sedac.ciesin.columbia.edu)

11) Which part of the United States is the most densely populated?

A. West
B. Midwest
C. South
D. Northeast

12) What is the main reason the far northern part of North America is sparsely populated?

A. low economic opportunities
B. low birth rates
C. extreme weather
D. war and conflict

13) One characteristic common to the geographical regions below is that they all...

Siberian Plain
Sahara Desert
Amazon Basin
Antarctica

A. have a low population density
B. are located between major river valleys
C. are major religious centers
D. have large areas of valuable farmland

14) If you know the density and the area, one way to find the population is to...

A. Divide the area by the density
B. Divide the density by the area
C. Divide the population by the area
D. Multiply the density and the area

Population Density - Answer Key

1) The correct answer is **B** (*426 people per sq. mile*). You can get this answer by imagining all the people in the state spread out evenly over each square mile. The population (20,000,000) divided by the area (47,000) is 425.53, which can be rounded to 426.

   A, C and D are *distractors*, which are answers that look like they might be correct but are not. The people who wrote the test write distracting answers to make you prove you really understand. Don't feel bad if you choose one of these answers. The distractors are based on common mistakes that many people make.

   Here is an explanation of the wrong answers:

   A (*0.0004 people per sq. mile*): A person might get this answer if they forget the zeros in 20 million. 20 divided by 47,000 equals 0.0004. We need to remember that 20 million means 20,000,000. That is the number that should be used in the calculation. We should also stop to think about what 0.0004 people per square mile would mean. That's much, much less than 1 person for every square mile in New York State. It would mean there were only 20 (twenty) people in the whole state. A population density of 0.0004 ppl/mi^2 would be similar to the population density of Antarctica, where only about 1,000 scientists live on 5.4 million square miles of land.

   C (*2,350 people per sq. mile*): You will get 2,350 people per sq. mile as an answer if you divide 47,000 by 20. However, it's 20 million, not 20. When you calculate the density, you should use 20,000,000. Also, in calculating population density we usually divide the population by the area, instead of the other way around.

   D (*940,000 people per sq. mile*): Sometimes, if we don't know what to do in a problem, we might grab a couple numbers from the problem and try something. 47,000 multiplied by 20 is 940,000 but this doesn't really make sense with the situation. Multiplying the population by the area doesn't give you the density. If there were 940,000 people per square mile all across New York State, the total population of the state would be 40 billion people. Since there are "only" 7.4 billion people on Earth, this isn't really possible.

2) The correct answer is **A** (*Manhattan, Brooklyn, Bronx, Queens, Staten Island*). To figure out the right answer, you should calculate the population density of each of the 5 boroughs and then see which borough has the most people per square mile. With 73,663 people per square mile, Manhattan has the highest population density of the 5 boroughs. You can calculate the population density by dividing 1,694,251 (population) by 23 (area). If you live in New York City, you might already know that Manhattan is the most crowded

borough from personal experience. It is the business center of the city and is a small island with lots of people crowded together. Brooklyn is the second most dense borough, with 38,536 people per square mile.

Here is an explanation of the wrong answers:

B (*Brooklyn, Queens, Manhattan, Bronx, Staten Island*): This lists the boroughs in order from greatest to least **population**, not population density. With 2.7 million people, Brooklyn has the highest population, but not the highest population density.

C (*Queens, Brooklyn, Staten Island, Bronx, Manhattan*): This lists the boroughs in order from greatest to least **area**, not population density. With 190 square miles in area, Queens is the biggest in land mass, but not in population density.

D (*Manhattan, Queens, Brooklyn, Bronx, Staten Island*): This list is almost correct, except Queens is out of order. The rest of the boroughs are in the right order. Someone might choose this answer if they figured out that Manhattan was the most densely populated, but didn't calculate the density of the other boroughs.

3) D

4) C

5) C

6) A

7) D

8) B

9) 57

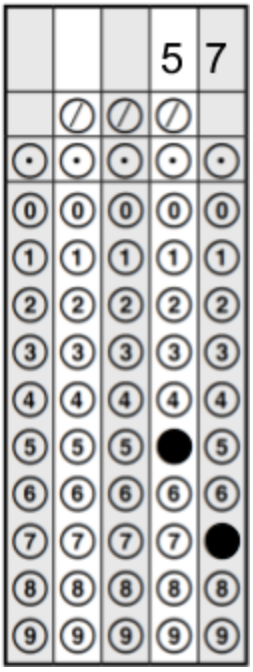
10) C

11) D

12) C

13) A

14) D



Density of Matter (Volumetric Density)

1) The following chart shows the mass (grams) and volume (milliliters) of four liquid samples.

Liquid	Mass (g)	Volume (ml)
Honey	504	355
Rubbing Alcohol	395	500
Vegetable Oil	870	946
Water	237	237

Part I: Based on the chart, which liquid has the highest density?

A. Honey
B. Rubbing Alcohol
C. Vegetable Oil
D. Water

Part II: If these four liquids were combined in a jar, which liquid would rise to the top?

A. Honey
B. Rubbing Alcohol
C. Vegetable Oil
D. Water

2) A cube of platinum weighs 73.1 grams and has a volume of 3.4 cubic centimeters. What is the approximate density of platinum?

A. 0.047 grams per cubic centimeter
B. 21.5 grams per cubic centimeter
C. 69.7 grams per cubic centimeter
D. 248.5 grams per cubic centimeter

3) The density of an object is

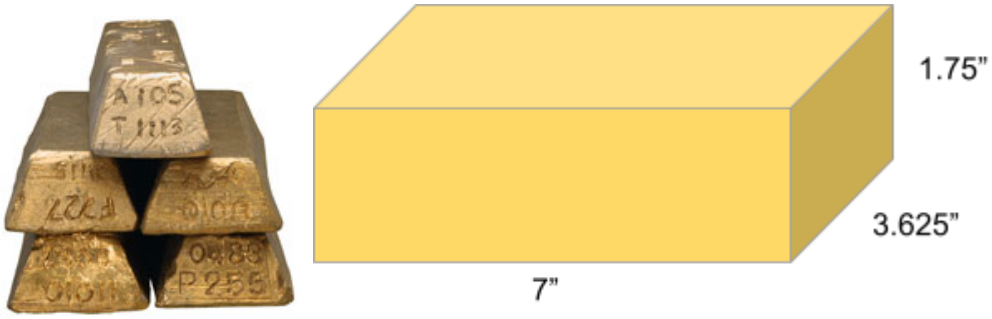
A. The volume divided by the mass (*D = v/m)*

B. The mass divided by the volume (*D = m/v)*

C. The same as its weight

D. The same as the size of the object

4) In the American system of measurement, the density of gold is about 0.7 pounds per cubic inch. The dimensions of a standard gold bar are 7 inches by 3.625 inches by 1.75 inches. About how heavy is a solid gold bar?



A. 5 lb

B. 9 lb

C. 31 lb

D. 63 lb

5) The density of salt is 2.16 grams per cubic centimeter. A restaurant manager ordered a delivery of bags of salt, each of which weighs 500 grams. What is the volume of one of these bags of salt?

A. 231 cm^3

B. 498 cm^3

C. 502 cm^3

D. 1080 cm^3

6) The density of honey is 1.45 grams per milliliter. If the honey in a full jar weighs 250 grams, what is the volume of the jar?

A. 172 ml

B. 251 ml

C. 363 ml

D. 395 ml

7) The density of brass is 0.3 pounds per cubic inch. One pound is approximately 453.6 grams. One cubic inch is approximately 16.4 cubic centimeters. What is the approximate density of brass in grams per cubic centimeter?

A. 4.9 g/cm^3

B. 8.3 g/cm^3

C. 27.7 g/cm^3

D. 136.1 g/cm^3

8) A wooden cube has an edge length of 6 centimeters and a mass of 137.8 grams. Determine the density of the cube, to the nearest thousandth. Then use the table below to identify the wood.

Type of Wood	Density (g/cm^3)
Pine	0.373
Hemlock	0.431
Elm	0.554
Birch	0.601
Ash	0.638
Maple	0.676
Oak	0.711

State which type of wood the cube is made of, using the density table above.

A. Ash

B. Elm

C. Oak

D. Pine

Density of Matter - Answer Key

1) Part I: The correct answer is **A** (*Honey*). Honey is also the only substance where the mass is greater than the volume, so all the other substances have densities of less than 1. Honey's density of 1.42 g/ml can be calculated by dividing the mass (504 g) by the volume (355 ml). This is higher than the calculated density of each of the other liquids: rubbing alcohol (0.79 g/ml), vegetable oil (0.92 g/ml), water (1 g/ml).

   Part II: The correct answer is **B** (*Rubbing Alcohol*). Its density of 0.79 g/ml is lower than the density of the other liquids. Since rubbing alcohol is lighter than the other liquids, it will float to the top of the jar.

   Here's a challenge question: Can you predict the order of all four liquids as they separate in a jar?

2) B - 21.5 grams per cubic centimeter

3) B - The mass divided by the volume (*D = m/v)*

4) C - 31 lb

5) A - 231 cm^3

6) A - 172 ml

7) B - 8.3 g/cm^3

8) A - Ash

Probability and Statistics

Answer the following questions. You can check your answers in the answer key at the end of the packet.

1) A restaurant sells kids' meals consisting of one main course, one side dish, and one drink, as shown in the table below.

Kids' Meal Choices

Main Courses	Side Dishes	Drinks
hamburger	french fries	milk
pizza	applesauce	juice

Which of these meal combinations is <u>not</u> possible?

A. hamburger, french fries, juice

B. pizza, french fries, milk

C. hamburger, pizza, juice

D. pizza, applesauce, juice

2) A frozen yogurt shop offers chocolate and vanilla yogurt and three different toppings: fruit, nuts, and sprinkles. How many different choices are possible for a single serving of frozen yogurt with one topping?

A. 15

B. 8

C. 6

D. 5

3) Guillermo is buying a new car. The model he likes is available as a convertible or a hatchback. He has to choose between automatic or standard transmission. The available colors are red, white, or grey.

How many different combinations are possible?

A. 2
C. 12
B. 7
D. 16

4) A deli has five types of meat, two types of cheese, and three types of bread. How many different sandwiches, consisting of one type of meat, one type of cheese, and one type of bread, does the deli serve?

A. 10
C. 25
B. 13
D. 30

5) A bag contains six green marbles, four white marbles, and three red marbles. What is the probability of drawing a green or a white marble from the bag?

A. $\frac{10}{13}$
C. $\frac{3}{13}$
B. $\frac{3}{10}$
D. $\frac{4}{13}$

6) Marilyn selects a piece of candy at random from a jar that contains six cherry, five peppermint, four butterscotch, and two lemon candies.

What is the probability that the candy she selects is <u>not</u> a cherry candy?

A. $\frac{6}{17}$
C. $\frac{11}{6}$
B. $\frac{11}{17}$
D. $\frac{17}{11}$

7) A box contains six black balls and four white balls. What is the probability of selecting a black ball at random from the box?

A. 6%
B. 20%
C. 40%
D. 60%

8) A box contains three pennies, seven nickels, six dimes, and four quarters. What is the probability that a coin drawn at random is a penny?

A. 15%
B. 20%
C. 35%
D. 85%

9) How many possible outcomes are there when two six-sided number cubes (dice) are thrown?

A. 2
B. 12
C. 36
D. 72

10) Two fair coins are tossed.

Part I: Which answer choice shows the sample space for this event?

A. {[HH], [TT]}
B. {[HT], [HH], [TT]}
C. {[HH], [TT], [TH]}
D. {[HT], [HH], [TT], [TH]}

Part II: What is the probability that two tails appear?

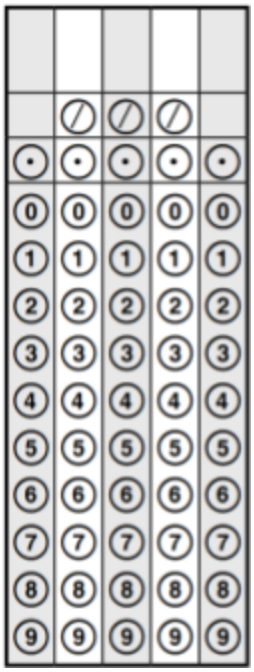
A. 25%
B. 33%
C. 50%
D. 75%

Part III: What is the probability that at least one head appears?

A. 25%
B. 33%
C. 50%
D. 75%

11) The faces of a cube are numbered from 1 to 6. What is the probability of <u>not</u> rolling a 5

on a single toss of this cube? Write your answer as a fraction.



12) When a fair coin was tossed ten times, it landed heads up the first seven times. What is the probability that on the eighth toss the coin will land with tails up?

A. 50%
C. 90%
B. 75%
D. 99%

13) If the probability of a spinner landing on red in a game is $\frac{1}{5}$, what is the probability of it not landing on red?

A. 20%
C. 50%
B. 25%
D. 80%

14) Which event is <u>certain</u> to happen?

A. Everyone walking into an elevator will have brown hair.

B. Flipping a coin and getting either a head or a tail.

C. All babies born in June will be males.

D. The sun will rise in the west.

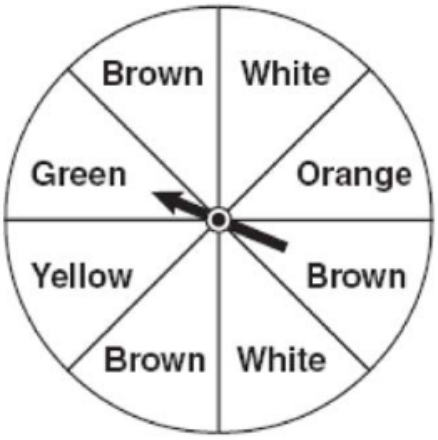
15) Jakima is playing a game using a wheel divided into eight equal sections, as shown in the diagram. What are the chances that the spinner will land on green or brown?

A. $\frac{1}{8}$

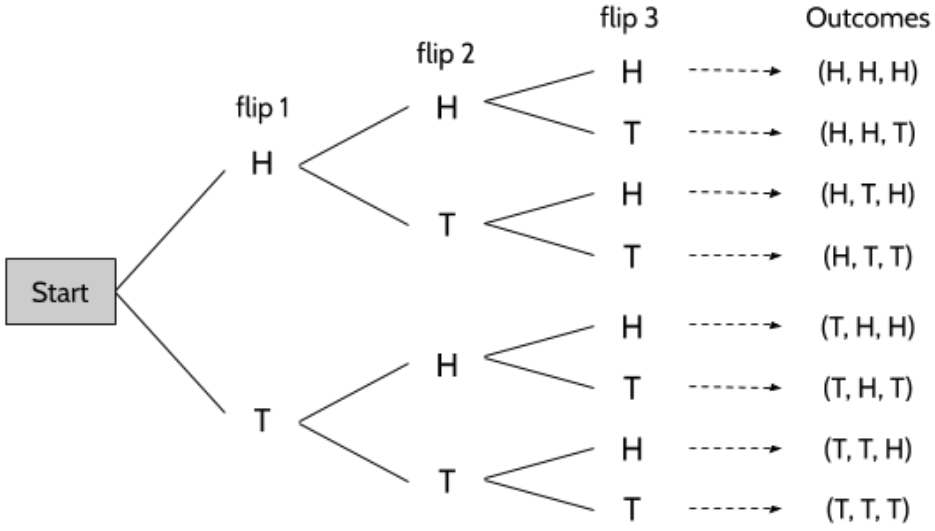
B. $\frac{3}{8}$

C. $\frac{1}{2}$

D. $\frac{4}{4}$



16) Dexter is flipping three fair coins in a probability experiment.



What is the probability that when Dexter flips the three coins, he gets only one tail?

A. $\frac{1}{8}$

B. $\frac{3}{8}$

C. $\frac{1}{2}$

D. $\frac{7}{8}$

17) The table shows the gender and color of 10 puppies in a litter.

Gender and Color of Puppies		
	Male	Female
Black	4	2
Brown	1	3

Part I: If a puppy selected at random from the group is brown, what is the probability it is a male?

A. $\frac{1}{10}$

B. $\frac{1}{4}$

C. $\frac{1}{3}$

D. $\frac{1}{2}$

Part II: Which of the following statements is <u>not</u> true?

A. Most of the female puppies are black.

B. 50% of the puppies are female.

C. Most of the puppies are black.

D. 40% of the puppies are brown.

18) A random group of students from an adult education program were surveyed about which movie they like best.

	Movie A	**Movie B**	**Movie C**	**Movie D**
Students	25	14	8	3

Based on the survey responses, what is the probability that another student from the program prefers Movie B?

A. 14%

B. 25%

C. 28%

D. 72%

19) A small town is conducting a survey to determine whether community members are in favor of raising taxes to fund a new community center. Which sample of the population would provide the most *unbiased* responses?

A. Senior citizens living on a fixed income

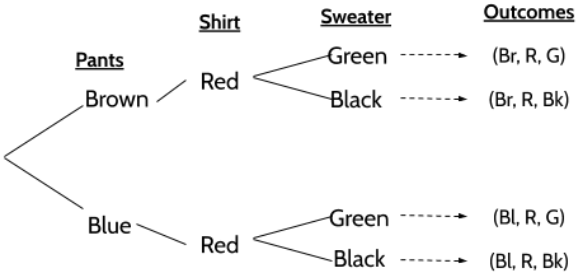
B. Every 5th person 18 years or older who comes in the town's only supermarket

C. Parents at the public school

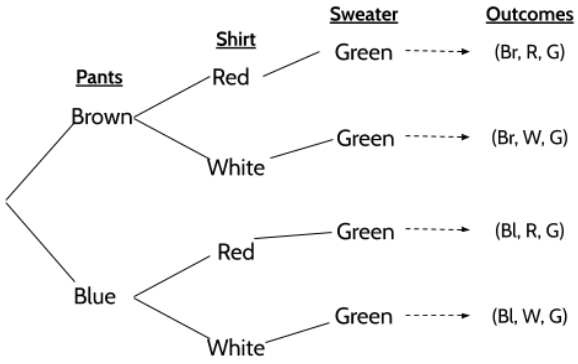
D. Community members who oppose any increase in taxes

20) Erika is traveling for work. She has brought two pairs of pants, two shirts, and two sweaters. Which tree diagram below represents all of her clothing options?

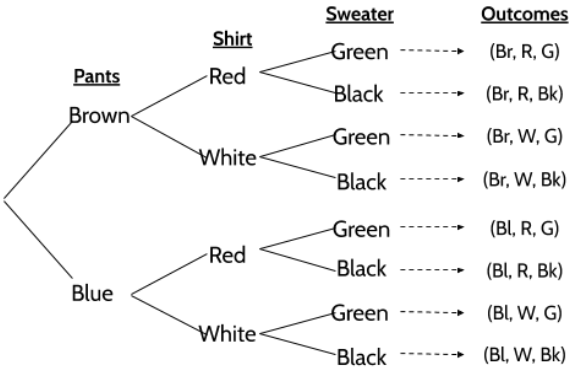
A.



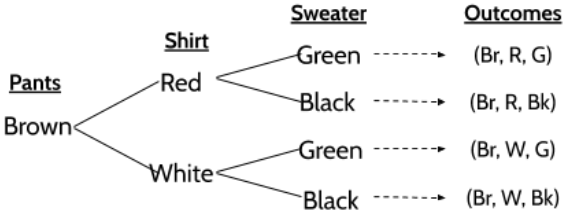
B.



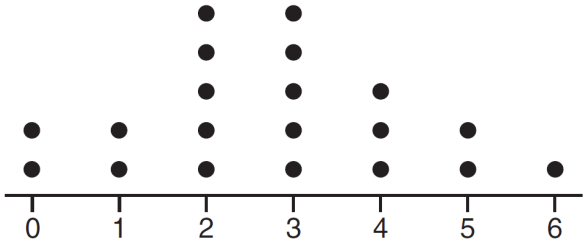
C.



D.



21) The dot plot shown below represents the number of pets owned by students in a class.



Part I: What is the range of the data?

A. 0

B. 2

C. 3

D. 6

Part II: Which statement about the data is true?

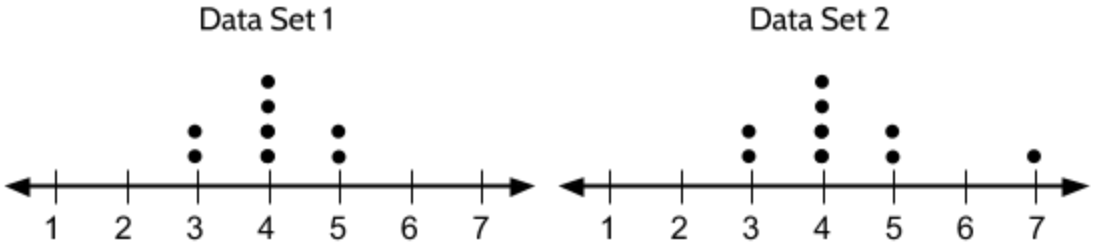
A. The median is larger than the mean.

B. The mean is larger than the median.

C. The mode is 6.

D. Most students own 2 or fewer pets.

22) The frequency distributions of two data sets are shown in the dot plots.



Which two measures are the same for each dotplot?

Choose two answers.

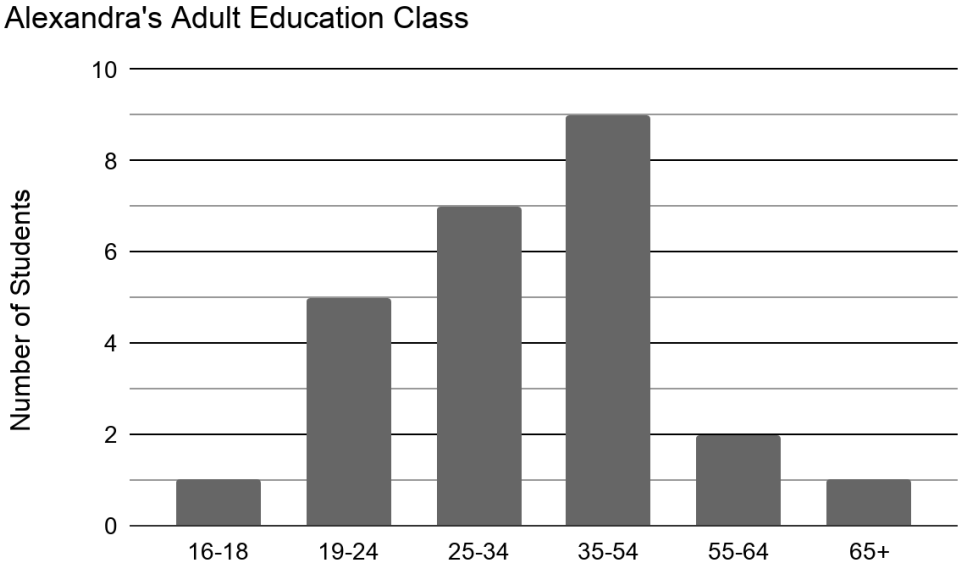
A. median

B. mean

C. mode

D. range

23) Alexandra teaches a high school equivalency class at her local library. The graph shows her class and the students' ages.



Part I: How many students are in Alexandra's class?

A. 9
C. 25
B. 10
D. 65

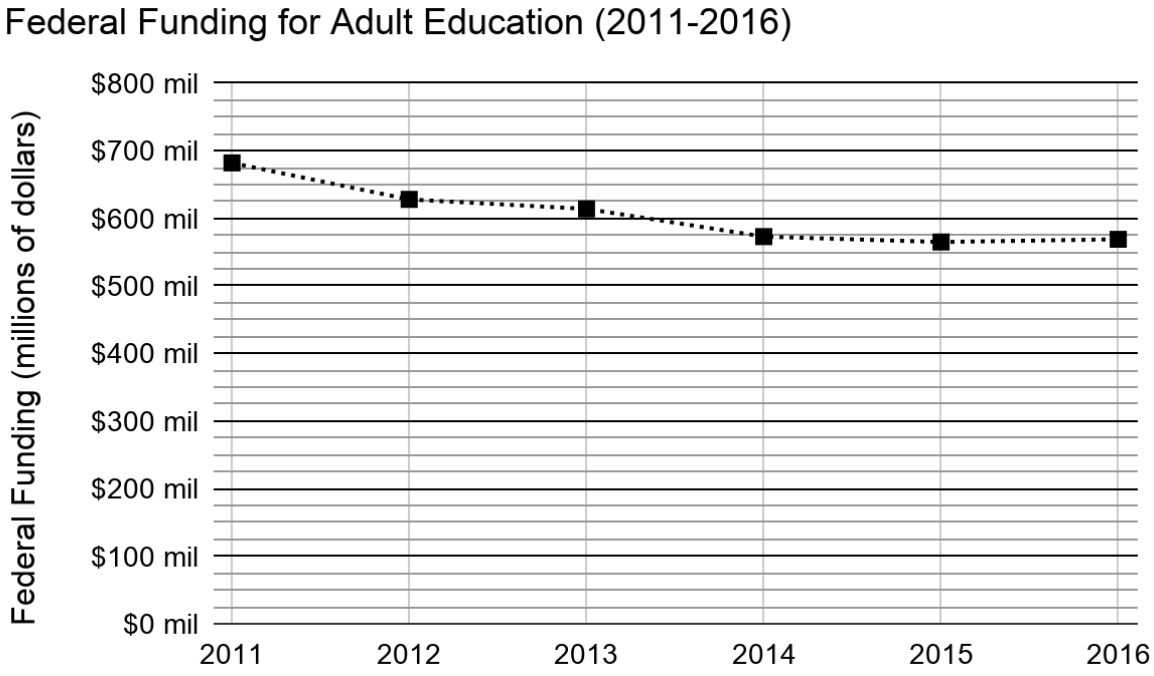
Part II: What percentage of Alexandra's students are between 25 and 34 years old?

A. 7%
C. 28%
B. 10%
D. 78%

Part III: If a 22-year-old student joins the class, which bar on the graph would change?

A. 16-18
C. 25-34
B. 19-24
D. 35-54

24) The following chart shows how much money the federal government invested in adult education between 2011 and 2016.



nationalskillscoalition.org

During which period did the funding go down the most?

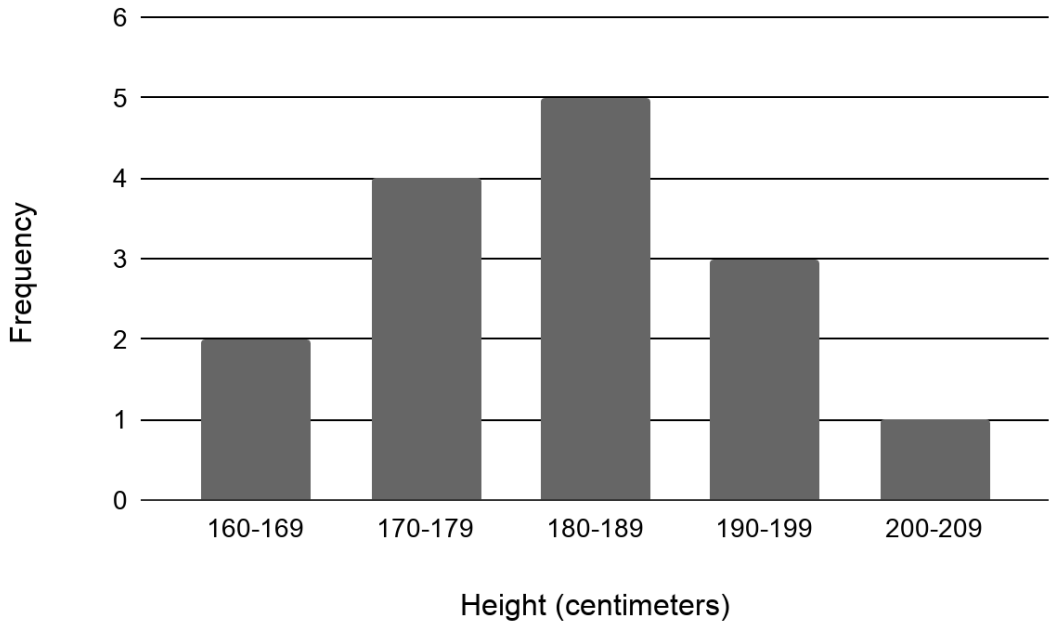
A. 2011-2012

B. 2012-2013

C. 2013-2014

D. 2014-2015

25) The graph below shows the heights of the students in Syed's exercise class.



What is the total number of students in the class?

A. 5

B. 6

C. 15

D. 18

26) A car dealership has 15 cars for sale. The least expensive car costs $10,000. The most expensive car costs $20,000. The mean sales price for the 15 cars is $16,000. Another car, priced at $24,000, is added to the dealership's inventory.

Which two statistical measures will not necessarily increase? Choose two answers.

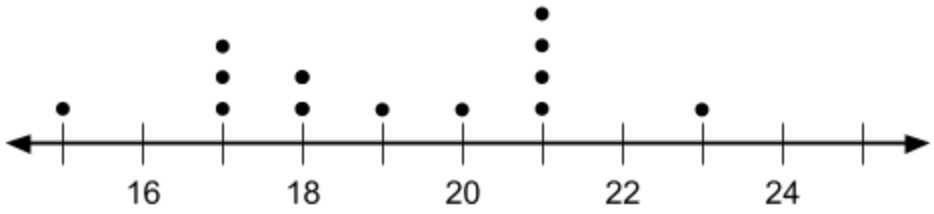
A. mean

B. median

C. mode

D. range

27) The following line plot shows the ages of a group of people who play soccer together on Saturdays.



Part I: What is the difference in age between the youngest and oldest player?

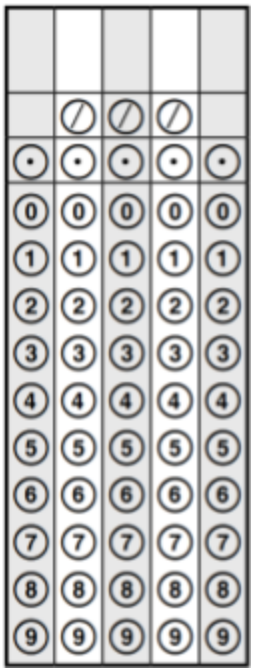
A. 4

B. 5

C. 6

D. 8

Part II: What is the median age of the soccer players? Write your answer in the grid.



28) Minerva collects data from two different companies, each with five employees. The results of the study, based on each worker's age and salary, are listed in the tables below.

Company 1	
Worker's Age in Years	Salary in Dollars
25	31,000
26	32,000
27	33,000
27	36,000
30	38,000

Company 2	
Worker's Age in Years	Salary in Dollars
25	29,000
26	35,000
28	35,000
30	36,000
31	65,000

Which statement is true about these data?

A. The median salaries in both companies are greater than $34,000.

B. The salary range in company 2 is greater than the salary range in company 1.

C. The mean salary in company 1 is greater than the mean salary in company 2.

D. The mean age of workers at company 1 is greater than the mean age of workers at company 2.

29) How many tickets were sold on Friday, if the total sales for the five days is $234 and each ticket costs $4.50?

Day	Frequency
Monday	𝍸 |
Tuesday	𝍸 𝍸
Wednesday	𝍸 𝍸 ||
Thursday	𝍸 ||||
Friday	?

A. 15

B. 37

C. 52

D. 67

30) Which phrase best describes the relationship between the number of miles driven and the amount of gasoline used?

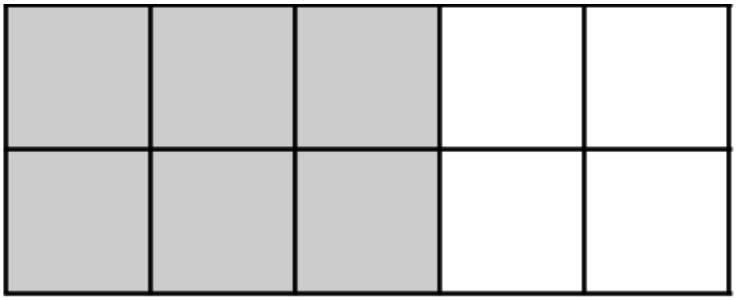
A. causation, but not correlation

B. correlation, but not causation

C. both correlation and causation

D. neither correlation nor causation

31) Examine the rectangle.



Which of the following statements are true? Select all that apply.

A. The ratio of grey squares to white squares is 6:4.

B. The grey squares are 60% of the rectangle.

C. The white squares are $\frac{4}{10}$ of the rectangle.

D. The white squares are 4% of the rectangle.

E. $\frac{3}{5}$ of the squares are grey.

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

A.

Interval	Frequency
61-70	2
71-80	2
81-90	7
91-100	10

B.

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

C.

Interval	Frequency
61-70	2
71-80	0
81-90	8
91-100	10

D.

Interval	Frequency
61-70	2
71-80	0
81-90	6
91-100	2

33) Jenna took a survey of her senior class to see whether they preferred pizza or burgers. The results are summarized in the table.

Of the people who preferred burgers, approximately what percentage were female?

	Pizza	Burgers
Male	23	42
Female	31	26

A. 21

B. 38

C. 46

D. 62

34) A public opinion poll was taken to explore the relationship between age and support for a candidate in an election. The results of the poll are summarized in the table below.

Age	For	Against	No Opinion
21-40	30	12	8
41-60	20	40	15
Over 60	25	35	15

What percent of the 21-40 age group was for the candidate?

A. 15
B. 25
C. 40
D. 60

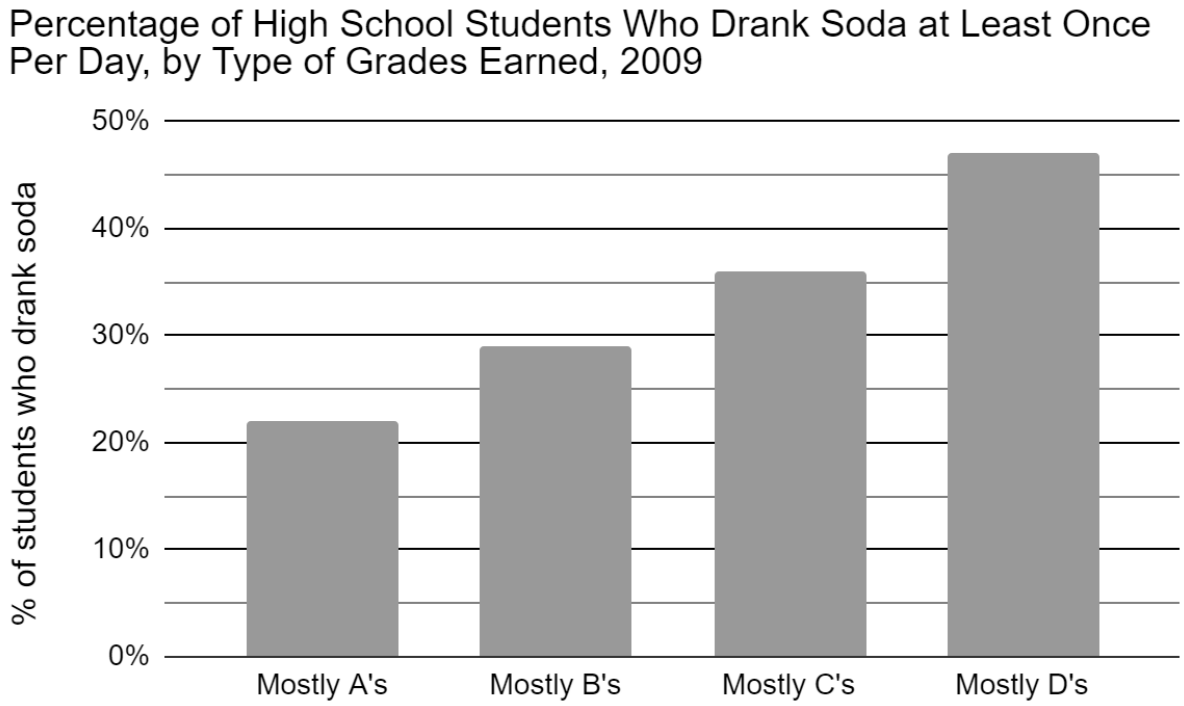
35) Which relationship can best be described as causal?

A. Snow is falling and stores sell out of snow shovels.
B. The alarm goes off and the sun rises.
C. The car is moving slowly and the driver is singing.
D. Ice cream and sunglasses sales are high.

36) Which situation describes a correlation that is not a causal relationship?

A. The car is driven farther and more gasoline is needed.
B. The microwave is more powerful and the food cooks faster.
C. The runner is faster and finishes the race quicker.
D. In the summer, ice cream sales go up and more sunglasses are sold.

37) The Centers for Disease Control and Prevention (CDC) has provided a graph that groups students by the grades they earned. It also shows the percentage of high school students in each group who drank soda at least one time per day.



Center for Disease Control and Prevention, Youth Risk Behavior Survey, http://www.cdc.gov/healthyyouth/health_and_academics/data.htm

Which conclusion can be drawn about the relationship between drinking soda and getting poor grades?

A. There is a correlation between drinking soda and earning poor grades.

B. Drinking soda causes students to earn poor grades.

C. Getting poor grades more likely causes students to drink soda.

D. There is no relationship between drinking soda and earning poor grades.

38) Cheap and Fast gas station is conducting a consumer satisfaction survey. Which method of collecting data would most likely lead to a biased sample?

A. interviewing every 5th customer to come into the station

B. interviewing customers who call an 800 number posted on the customers' receipts

C. interviewing customers chosen at random by a computer at the checkout

D. interviewing every customer who comes into the station on a day of the week chosen at random out of a hat

39) Four hundred licensed drivers participated in the math club's survey on driving habits. The table below shows the number of drivers surveyed in each age group.

Ages of People in Survey on Driving Habits	
Age Group	**Number of Drivers**
16-25	150
26-35	129
36-45	33
46-55	57
56-65	31

Which statement best describes a conclusion based on the data in the table?

A. It may be biased because no one younger than 16 was surveyed.

B. It would be fair because many different age groups were surveyed.

C. It would be fair because the survey was conducted by the math club students.

D. It may be biased because the majority of drivers surveyed were in the younger age intervals.

40) A survey completed at a large university asked 2,000 students to estimate the average number of hours they spend studying each week. Every tenth student entering the library was surveyed. The data showed that the average number of hours that students spend studying was 16 hours per week.

Which characteristic of the survey could create a bias in the results?

A. the size of the sample

B. the size of the population

C. the method of analyzing the data

D. the method of choosing the students who were surveyed

41) A medical researcher is selecting participants for a study on the effects of a drug on memory. She is separating the participants into two groups. The first group will receive the drug and the second group will receive a placebo.

Which method will ensure a random selection of participants in each group?

A. The participants are selected based on their age.

B. The group selections are made by selecting names out of a hat.

C. The men are put in one group and the women are put in the other.

D. The participants are allowed to choose which group they want to be in.

42) What percent of New Yorkers have a high school degree?

A. 14%

B. 59%

C. 68%

D. 86%

	New York Residents	New Jersey Residents	
High school graduate or higher	16,700,000	7,800,000	
Hasn't graduated high school yet	2,700,000	900,000	

43) Analyze the data below.

Year	Price of 1 lb. of Bread	Federal Minimum Wage (hourly)*
1930	$0.09	None
1940	$0.10	$0.30
1950	$0.12	$0.75
1960	$0.23	$1.00
1970	$0.25	$1.60
1980	$0.50	$3.10
1990	$0.75	$3.80
2000	$1.99	$5.15
2010	$2.99	$7.25

* The first Federal minimum wage was introduced in 1938 by the Fair Labor Standards act, under President Franklin Delano Roosevelt.

Purchasing power is a measure of how much a person can buy with their wages. Given that definition, which interpretation of the data from 1940 to 2010 is correct?

A. The purchasing power of minimum wage earners increased steadily.

B. The purchasing power of minimum wage earners decreased steadily.

C. The purchasing power of minimum wage earners was weakest in 2010.

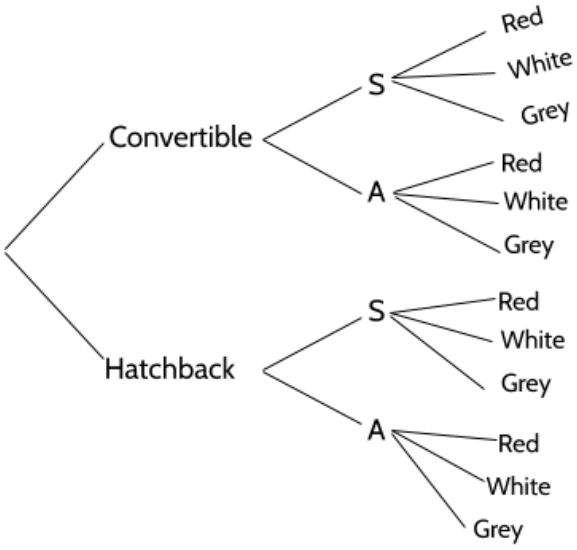
D. The purchasing power of minimum wage earners was strongest in 2010.

Probability and Statistics - Answer Key

1) C

2) C (Chocolate with fruit, chocolate with nuts, chocolate with sprinkles, vanilla with fruit, vanilla with nuts, vanilla with sprinkles)

3) C



4) D. Five types of meat, multiplied by 2 types of cheese, multiplied by 3 types of bread. 5 × 2 × 3 = 30

5) A. There are 10 desired outcomes (6 green and 4 white). There are 13 total marbles in the bag.

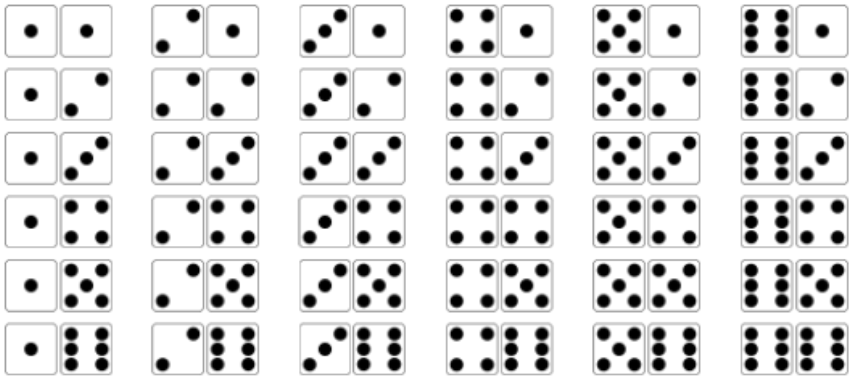
6) B. There are 17 total candies in the jar. If 6 of them are cherry, then 11 of them are <u>not</u> cherry. A is the probability of selecting a cherry.

7) D. There are 6 black balls and 10 balls total. $\frac{6}{10} = \frac{60}{100}$

8) A. There are 20 coins total and 3 pennies.

3	6	9	12	**15**
20	40	60	80	**100**

9) C



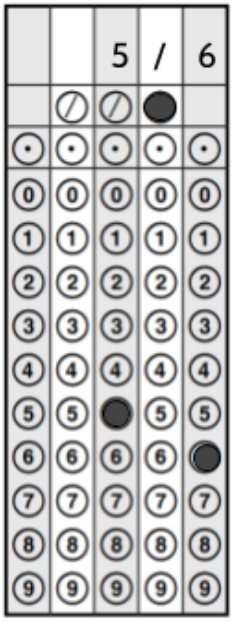
All possible rolls of two dice

10) Part I: D

Part II: A. There are four possible outcomes and only one of them includes 2 tails, which is a probability of ¼. Since the answer choices are in percentages, the answer is 25%.

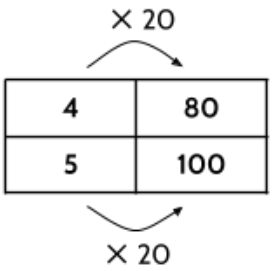
Part III: D. There are 4 possible outcomes and 3 of them contain at least one head.

11)



12) A. Remember that no matter how the coin has landed on previous flips, the probability of getting a tails is always ½ or 50%. Chance has no memory.

13) D. The probability of the spinner not landing on red is ⅘.



14) B

15) C. 4 of the 8 sections are Brown or Green so the probability of a spin landing on one of those two colors is $\frac{1}{2}$.

16) B. There are three outcomes with only one tail: (H,H,T), (H,T, H), and (T,H,H) out of 8 possible outcomes.

17) Part I: B

Part II: A. Of the female puppies, 3 are brown and 2 are black so it is not true to say that "Most of the female puppies are black." B is true because 5 out of the 10 puppies are female. C is true because 6 of the 10 puppies are black. D is true because 4 out of 10 of the puppies are brown.

18) C. 14 out of 50 students in the random group prefer Movie B. 14 out of 50 is equivalent to 28 out of 100, or 28%.

19) B

20) C

21) Part 1: D. In the graph, 0 represents the fewest number of pets owned and 6 represents the greatest number of pets. The difference between 0 and 6 is 6.

Part II: A. The mean for this set of numbers is 2.75. The median is 3. Nine students own 2 or fewer pets, and 11 students own 3 or more pets.

22) A and C. Both sets have a median of 4 and a mode of 4.

23) Part I: C. There are one student 16-18, five students 19-24, seven students 25-34, nine students 35-54, two students 55-64, and one student who is 65+.

Part II: C. 7 out of 25 students are between 25 and 34 years old.

Students 25-34	7	14	21	28
Total Students	25	50	75	100

Part III: B.

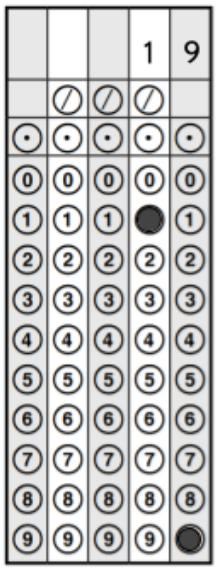
24) A

25) C

26) B and C . The question is asking which statistical measures will not necessarily increase. If the most expensive car is $20,000, adding another car that costs $24,000 will not increase the mode. We know it would be the only car with a sales price of $24,000, so it won't impact the mode. Adding a car costing $24,000 might impact the median, but it might not. Can you create a set of 15 prices where the median would not increase if you added a car costing $24,000?

We can eliminate A: If the mean sales price for the original 15 cars is $16,000, then the total cost for all the cars is $240,000 (16,000 × 15). If we add $24,000 to that total we get $264,000. If we divide that new total cost by 16 cars, the new mean is $16,500.

We can eliminate D: Since the most expensive car is $20,000, if a more expensive car is added to the inventory then the range has to increase.



27) Part I: D. The youngest person is 15 and the oldest is 23. That is a difference of 8.

Part II: ~~15~~, ~~17~~, ~~17~~, ~~17~~, ~~18~~, ~~18~~, 19, ~~20~~, ~~21~~, ~~21~~, ~~21~~, ~~21~~, ~~23~~
(gridded answer response on the right.)

28) B. The salary range at Company 1 is $7,000 and the salary range at Company 2 is $34,000. A can be eliminated because the median salary in Company 1 is $33,000. C can be eliminated because the mean salary at Company 1 is $34,000 and the mean salary in Company 2 is $40,000. D can be eliminated because the mean age at Company 1 is 27 and at Company 2 it is 28.

29) A. There are 37 tick marks on the frequency table. If each ticket costs $4.50, that is $166.50. If total ticket sales were $234, they need to sell $67.50. Since each ticket costs

$4.50, 15 tickets cost $67.50. Be careful of answer D - $67 is close to the ticket sales for Friday, not the number of tickets sold on Friday.

30) C

31) A, B, C, E

32) D

33) B. 68 people preferred burgers and 26 of those were female. $\frac{26}{68} = 0.38235...$

34) D. There are 50 people in the 21-40 age group and 30 of those people were for the candidate. 30 out of 50 is equivalent to 60 out of 100.

35) A. Snowfall would cause an increase in the sales of snow shovels.

36) D. A rooster crowing does not cause the sun to rise, but since roosters tend to crow when the sun is rising, the relationship is correlated.

37) A. The graph shows a relationship between grades and soda. The lower the grades earned, the higher percentage of students who drank soda. We can eliminate D, which claims there is no relationship. B and C suggest that there is a casual relationship. B suggests that drinking soda causes low grades. C suggests that getting low graders causes more soda consumption. There is nothing in the graph to support either suggestion.

38) B. Only interviewing customers who call an 800 number would not result in a random sample of all Cheap and Fast customers. Each of the other answer choices are random.

39) D

40) D. By only surveying students who entered the library, the university was creating a bias in their survey. The sample was <u>not</u> a random sample of *students at the university*, it was a random sample of *students entering the library*.

41) B

42) D. $\frac{16{,}700{,}000}{(16{,}700{,}00+2{,}700{,}000)} \simeq \frac{86}{100} \simeq 86\%$

43) C. In 2010, you could buy only 2.4 pounds of bread for an hour's work ($\frac{\$7.25}{\$2.99}$). If you divide the hourly wage by the price of bread for each of the other years, you will see that people could buy more bread for an hour's work in each of those years.

Algebra and Functions

Exponents

1) What is the product of 4^3 and 4^5?

A. 4^{-2}
C. 4^8
B. 4^2
D. 4^{15}

2) What is the product of x^2 and x^3?

A. x^6
C. x
B. x^5
D. x^{-1}

3) What is 5^6 divided by 5^2?

A. 5^{-4}
C. 5^4
B. 5^3
D. 5^{12}

4) What is x^{10} divided by x^6?

A. x^{60}
C. $x^{5/3}$
B. x^4
D. x^{-4}

5) Evaluate the expression below.

$$(5^4 \times 5^7) \div 5^2$$

A. 5^7
C. 5^{14}
B. 5^9
D. 5^{20}

6) Which of the following is equal to the $\frac{(x^5)(x^4)}{x^3}$?

A. $\frac{1}{3}$

B. x^3

C. $x^{20/3}$

D. x^6

7) Simplify the expression below.

$$3x + 9x$$

A. 12

B. $12x$

C. $12x^2$

D. $12(x + x)$

8) Evaluate $(5^3)^4$.

A. 5^7

B. 5^{12}

C. $5^{3/4}$

D. $5^{4/3}$

9) What is the value of $\sqrt{5^4}$?

A. 25

B. $\frac{1}{25}$

C. $\frac{1}{625}$

D. 625

10) Which of the following numerical expressions is equivalent to $(3^2)(3^{-5})$?

A. 27

B. $\frac{1}{27}$

C. 3^{-10}

D. $\frac{1}{59{,}049}$

11) Which two equations represent exponential decay? Select two correct answers.

A. $y = (1.02)^x$

B. $y = (\frac{1}{2})^x$

C. $y = (0.98)^x$

D. $y = (\frac{3}{2})^x$

12) Alicia has invented a new app for smartphones that two companies are interested in purchasing for a 2-year contract.

Company A is offering her $10,000 for the first month and will increase the amount each month by $5000.

Company B is offering $500 for the first month and will double their payment each month from the previous month.

Monthly payments are made at the end of each month. What is the first month in which Company B's payment will be higher than company A's payment?

A. 9

B. 7

C. 6

D. 8

13) The number of rabbits in a population over time can be calculated with the function $R(t) = (100)(1.4)^t$, where $R(t)$ is the population and t is the amount of time in years.

I. What is the percent change in the population?

A. 0.4%

B. 4%

C. 40%

D. 140%

II. What kind of function is this?

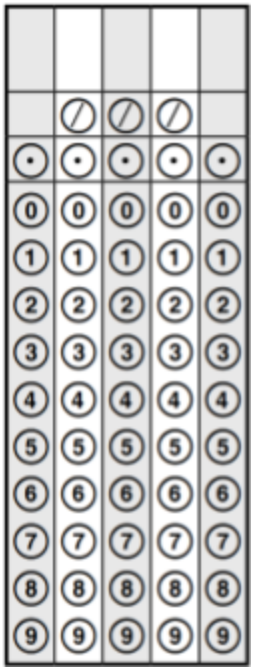
A. linear growth

B. linear decay

C. exponential growth

D. exponential decay

III. What was the rabbit population after 2 years? (Enter your answer in the gridded response area to the right.)



IV. What is the approximate rabbit population after 5 years?

A. 140

B. 538

C. 700

D. 952

14) What is the value of 3^{-2}?

A. $\frac{1}{9}$

B. -6

C. -9

D. 1.7

15) Evaluate $64^{1/3}$.

A. $\frac{3}{64}$

B. $\frac{1}{192}$

C. 8

D. 4

16) Which of these is equivalent to $\frac{(x^{-2})(x^{3})}{2}$?

A. $\frac{x^{-6}}{2}$

B. $\frac{x}{2}$

C. x^{-3}

D. $\sqrt{x^{-6}}$

17) The population growth of a colony of E. coli bacteria is shown in the table below.

Hours	Population
0	1
1	8
2	64
3	512
4	4,096
5	32,768

Which of the functions below determines the population of bacteria, P, after t hours?

A. $P = 8^t$

B. $P = 2^t$

C. $P = 8t$

D. $P = t^8$

18) The population of mosquitoes in a swamp is estimated over the course of twenty weeks, as shown in the table.

Time (weeks)	Population
0	100
1	200
2	400
3	800
4	1600

Which of the following best describes the estimated population of mosquitos during the four weeks?

A. Increasing linear

B. Decreasing linear

C. Exponential growth

D. Exponential decay

19) Choose all expressions below that are equivalent to $64^{1/2}$.

A. $\frac{1}{64}$

B. $\frac{1}{128}$

C. 8

D. 4

E. $64 \cdot 64$

F. $\sqrt{64}$

G. $\frac{1}{\sqrt{64}}$

H. 2^3

20) Andrea is comparing two options for investing an initial amount of $5,000 in an investment account .

Investment option 1: An additional $52 is added to the investment account every month.

Investment option 2: An amount equal to 1% of the current value of the account is added to the account every month.

As the amount of money in the account grows over time, which investment option will make the <u>most</u> money for Andrea? How many months will pass before the better investment option exceeds the other option?

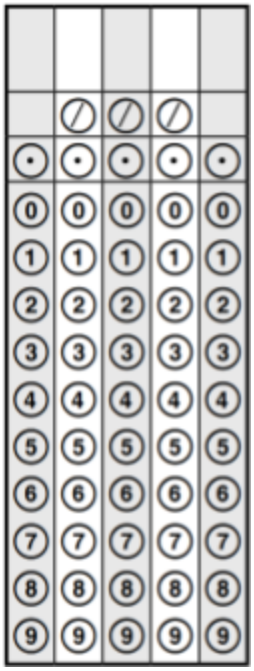
A. Investment option 1 is better; it will always exceed option 2.

B. Investment option 1 is better; it will exceed option 2 in less than a year.

C. Investment option 2 is better; it will always exceed option 1.

D. Investment option 2 is better; it will exceed option 1 in less than a year.

21) What is the value of $(3^4)^{\frac{1}{2}}$?
(Enter your answer in the gridded response area to the right.)



Exponents - Answer Key

1) C
2) B
3) C
4) B
5) B
6) D
7) B
8) B
9) A
10) B
11) B, C
12) D
13) I. 40%
    II. exponential growth
    III. 196
    IV. B
14) A
15) D
16) B
17) A
18) C
19) C, F, H
20) D
21) 9

Expressions, Equations, and Inequalities

Cylinder:	$V = \pi r^2 h$	
Pyramid:	$V = \frac{1}{3}Bh$	*V* = volume *r* = radius *h* = height *B* = area of base
Cone:	$V = \frac{1}{3}\pi r^2 h$	
Sphere:	$V = \frac{4}{3}\pi r^2$	

1) Which question cannot be answered by the solution to the equation $3x = 27$?

   A. Elena read three times as many pages as Noah. She read 27 pages. How many pages did Noah read?

   B. Lin has 27 stickers. She gives 3 stickers to each of her friends. With how many friends did Lin share her stickers?

   C. Diego paid $27 to have 3 pizzas delivered and $35 to have 4 pizzas delivered. What is the price of one pizza?

   D. The coach splits a team of 27 students into 3 groups to practice skills. How many students are in each group?

2) During a sale, an appliance that costs $275.00 is being sold at a discount for $220.00. Which equation can be used to find the size of the discount, d, during the sale?

   A. $220 - d = 275$

   B. $275 - d = 220$

   C. $220 - 220d = 275$

   D. $275 - 275d = 220$

3) Consider the steps that a mathematician writes as she solves the equation $5x + 2 = 3x - 7$.

Equation:	$5x + 2 = 3x - 7$
Step 1:	$2x + 2 = \quad - 7$
Step 2:	$2x = \quad - 9$
Solution:	$x = \quad -\frac{9}{2}$

Which statement explains why the solution following Step 2 is a valid step?

A. If you add 2 to both sides of an equation, the sides remain equal.

B. If you subtract 2 from both sides of an equation, the sides remain equal.

C. If you multiply both sides of an equation by 2, the sides remain equal.

D. If you divide both sides of an equation by 2, the sides remain equal.

4) Marie currently has a collection of 58 stamps. If she buys s stamps each week for w weeks, which expression represents the total number of stamps she will have?

A. $58sw$

B. $58 + sw$

C. $58s + w$

D. $58 + s + w$

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

A. $x^2 + 16$

B. $4x + 16$

C. $5x + 4$

D. $5x + 20$

6) Jose wants to ride his bike a total of 50 miles this weekend. If he rides m miles on Saturday, which expression represents the number of miles he must ride on Sunday?

A. $m - 50$

B. $m + 50$

C. $50 - m$

D. $50m$

7) The length of a rectangular room is 5 feet more than the width, w, of the room. Which expression represents the area of the room?

A. $5w$

B. $5w + w$

C. $w(w + 5)$

D. $w^2 + 25$

8) A rectangle has a height of x and a length of $x + 4$.

Part A:

What is the rectangle's area?

A. $2x + 4$

B. $4x + 8$

C. $x^2 + 4x$

D. $x^2 + 4$

Part B:

What is the rectangle's perimeter?

A. $2x + 4$

B. $4x + 8$

C. $x^2 + 4x$

D. $x^2 + 4$

9) To watch a basketball game, spectators must buy a ticket at the door. The cost of an adult ticket is $30 and the cost of a student ticket is $15. If the number of adult tickets sold is represented by a and the number of student tickets sold is represented by$s$, which expression represents the amount of money collected at the door from the ticket sales?

A. $45as$

B. $45(a + s)$

C. $(30a)(15s)$

D. $30a + 15s$

10) Pietro took the following steps to solve for *p* in the equation $5p + 7 = 2p + 28$.

Equation:	$5p + 7 = 2p + 28$
Step 1:	$5p = 2p + 21$
Step 2:	$3p = 21$
Step 3:	$p = 7$

In which step, if any, did Pietro make an error?

A. Step 1

B. Step 2

C. Step 3

D. Pietro did not make an error.

11) Matthew took the following steps to solve for x in the equation $3(x - 6) = 48$.

Equation:	$3(x - 6) = 48$
Step 1:	$3x - 18 = 48$
Step 2:	$3x = 30$
Step 3:	$x = 10$

In which step, if any, did Matthew make an error?

A. Step 1

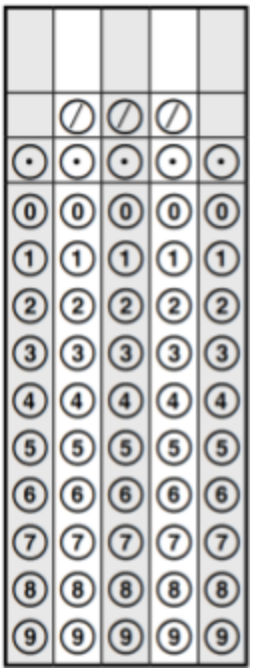
B. Step 2

C. Step 3

D. Matthew did not make an error.

12) The equation $0.25x - 50 = 240$ can be used to find the total height of a ramp, in meters, given the distance, x, from the beginning of the ramp.

What is the value of x, in meters? (Write your answer in the grid.)



13) When Abdul goes shopping for a couch at a furniture store, a salesperson offers a financing plan with zero interest for one year. To take advantage of the offer, Abdul has to give a down payment of $50. The rest of the purchase price will be evenly split into 12 monthly payments.

Part A:

Which of the following equations <u>does not</u> show the relationship between the amount in dollars, *q*, of each monthly payment and the total price in dollars, *p*, of the couch?

A. $\frac{p-50}{12} = q$

B. $p = 12q + 50$

C. $p - 50 = 12q$

D. $12(q + 50) = p$

Part B:

If the couch costs $350, how much will each of Abdul's monthly payments be?

A. $25.00

B. $29.17

C. $33.33

D. $50.00

14) A teacher asked the class to solve the equation $3(x + 2) = 21$. Robert wrote $3x + 6 = 21$ as his first step. Which property did he use?

A. associative property

B. commutative property

C. distributive property

D. zero property of addition

15) Consider the steps Carthian used to evaluate the expression $6 \div 2 \cdot (1 + 2)$.

Expression:	$6 \div 2 \cdot (1 + 2)$
Step 1:	$6 \div 2 \cdot 3$
Step 2:	$6 \div 6$
Step 3:	1

In which step, if any, did Carthian make an error?

A. Step 1

B. Step 2

C. Step 3

D. Carthian did not make an error.

16) If an object is moving at a constant speed for a certain amount of time, it is possible to find how far the object went by multiplying the rate and the time. In mathematical language, we call this relationship $distance = rate \times time$ or $d = r \cdot t$.

Rewrite the equation in terms of rate.

A. $r = d \cdot t$

B. $r = \frac{d}{t}$

C. $r = \frac{t}{d}$

D. $r = t \cdot d$

17) The formula $P = 2w + 2l$ can be used to find the perimeter of a rectangle, P, given the length, l, and the width, w, of the rectangle.

Which interpretation of $2w + 2l$ is correct?

A. The perimeter of a rectangle is twice the area of the rectangle.

B. A rectangle has two sides of length l and two sides of width w.

C. Half of the perimeter of a rectangle is equal to the length of one side of the rectangle.

D. To find the perimeter of a rectangle, add all the lengths of the sides of the rectangle and double the sum.

18) What is the volume of a cylinder with a radius of 3 in. and a height of 7 in.? (Round to

the nearest whole number.)

A. 21 in^3

B. 66 in^3

C. 198 in^3

D. 462 in^3

19) How is the volume of a cone affected by doubling the height?

A. The volume also doubles.

B. The volume triples in size.

C. The volume is four times bigger.

D. The volume is half as big.

20) Which expression represents "5 less than the product of 7 and x?"

A. $7(x - 5)$

B. $7x - 5$

C. $7 + x - 5$

D. $5 - 7x$

21) What is the largest whole number that makes $3x + 7 < 15$ true?

A. $\frac{8}{3}$

B. 2

C. $2\frac{2}{3}$

D. 3

22) A recreation center ordered a total of 15 tricycles and bicycles from a sporting goods store. The number of wheels for all the tricycles and bicycles totaled 38.

Part A:

How many bicycles did the recreation center order?

A. 7

B. 8

C. 15

D. 24

Part B:

Which system of equations models this scenario, with *t* representing the number of tricycles and *b* representing the number of bicycles ordered?

A. $3t + 2b = 15$
$t + b = 38$

B. $3t + 2b = 38$
$t + b = 15$

C. $3t = 15$
$2b = 38$

D. $3t - 2b = 15$
$t - b = 38$

23) Alicia purchased some half-gallons of ice cream for $3.50 each and some packages of ice cream cones for $2.50 each. She purchased 14 items in total and spent $43. Which system of equations could be used to determine how many of each item Alicia purchased?

Let H be half-gallons of ice cream.
Let P be packages of ice cream cones.

A. $3.50H + 2.50P = 14$
$H + P = 43$

B. $3.50H + 2.50P = 14$
$H - P = 43$

C. $3.50H + 2.50P = 43$
$H + P = 14$

D. $3.50H + 2.50P = 43$
$H - P = 14$

24) Isabella has 30 coins that total $4.80. All of her coins are dimes, x, and quarters, y.

Part A:

Which system of equations models this situation?

A. $x + y = 4.80$
$.10x + .25y = 30$

B. $x + y = 30$
$.10x + .25y = 4.80$

C. $x + y = 30$
$.25x + .10y = 4.80$

D. $x + y = 4.80$
$.25x + .10y = 30$

Part B:

Which of the following quantities of coins does Isabella have?

A. 28 dimes & 8 quarters

B. 8 dimes & 16 quarters

C. 18 dimes & 12 quarters

D. 12 dimes & 18 quarters

25) Consider the following system of equations.

$$2x + 3y = 38$$

$$x + y = 15$$

Which ordered pair is a solution to the system of equations?

A. $(7, 8)$

B. $(8, 7)$

C. $(12, 3)$

D. $(10, 6)$

26) The length of a rectangular window is 2 feet more than its width, w. The area of the window is 15 square feet. Which equation could not be used to find the dimensions of the window?

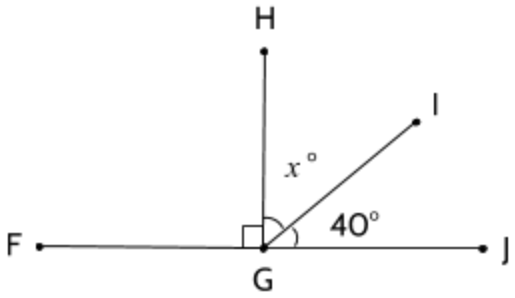
A. $2w = 15$

B. $w(w + 2) = 15$

C. $w^2 + 2w = 15$

D. $w^2 + 2w - 15 = 0$

27) In the diagram below, Angle FGH has a measure of 90°. Which equation could be used to find the value of x?



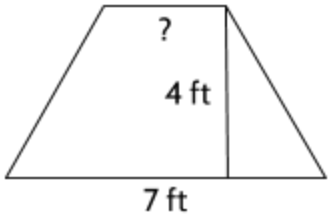
A. $x - 40 = 180$

B. $x - 40 = 90$

C. $x + 40 = 180$

D. $x + 40 = 90$

28) The formula for the area of a trapezoid is $A = \frac{1}{2}h(b_1 + b_2)$. The area of a trapezoid is 20 square feet, its height is 4 feet, and one base is 7 feet. What is the measurement of the second base of the trapezoid?



A. 3 feet

B. 40 feet

C. 54 feet

D. 110 feet

29) The formula for finding the area of a square is $A = s^2$. How could you rewrite this formula to solve for s?

A. $s = A$

B. $s = A^2$

C. $s = \sqrt{A}$

D. $s = \sqrt{A^2}$

30) A moving company sells two cardboard boxes with the same volume. The first box has a length of 25 inches, a width of 12 inches, and a height of 9 inches. The second box has a square base with a side length of 15 inches. What is the height of the second box?

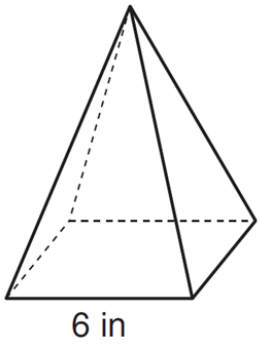
A. 9 in.

B. 12 in.

C. 15 in.

D. 25 in.

31) As shown in the diagram below, a regular pyramid has a square base whose side measures 6 inches. If the height of the pyramid measures 12 inches, its volume, in cubic inches, is



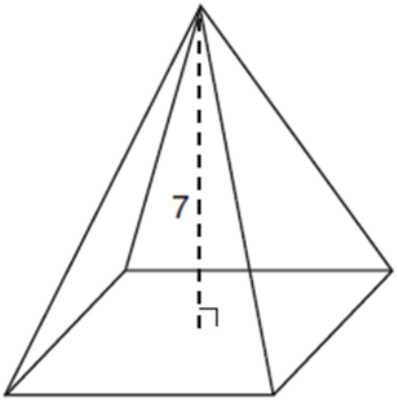
A. 72

B. 144

C. 288

D. 432

32) The pyramid shown below has a square base, a height of 7, and a volume of 84. What is the length of the side of the base?



A. 6

B. 12

C. 18

D. 36

33) Which ordered pair satisfies the system of equations below?

$2x - y = 11$

$x + y = 10$

A. $(5, 5)$

B. $(10, 9)$

C. $(10, 11)$

D. $(7, 3)$

34) Amy plans to sell twice as many magazine subscriptions as Shalisa. If Amy and Shalisa need to sell at least 90 subscriptions in all, which inequality could be used to determine how many subscriptions Shalisa, x, needs to sell?

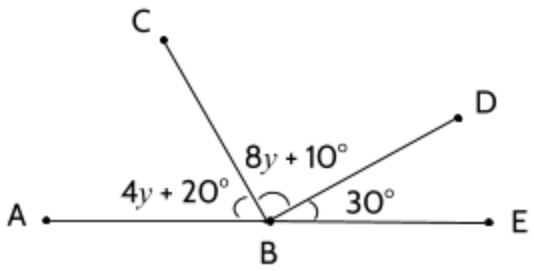
A. $x \geq 45$

B. $2x \geq 90$

C. $2x - x \geq 90$

D. $2x + x \geq 90$

35) In the diagram below, Line ABE is a straight angle.



Part A:

Which equation could be used to find the value of y?

A. $12y + 60 = 180$

B. $12y - 60 = 180$

C. $60 - 12y = 90$

D. $72y = 180$

Part B:

What is the measure of $\angle$CBE?

A. 60°

B. 90°

C. 120°

D. 180°

36) Ishmael wants to buy strawberries and raspberries to bring to a party. Strawberries cost $3.50 per pound and raspberries cost $3.80 per pound.

Part A:

If Ishmael only has $15 to spend on berries, which inequality represents the situation where he buys x pounds of strawberries and y pounds of raspberries?

A. $3.5x + 3.8y \leq 15$

B. $3.5x - 3.8y \leq 15$

C. $3.5x + 3.8y \geq 15$

D. $3.5x - 3.8y \geq 15$

Part B:

Which ordered pair is a solution to the inequality?

A. $(2.5, 2)$

B. $(2.5, 1.5)$

C. $(2.5, 2.5)$

D. $(2, 2.5)$

37) Maxine has a mathematical rule that she uses when it comes to love. Maxine says that, in her opinion, when it comes to the age difference between two people in a romantic relationship, the younger person should never be younger than half the older person's age plus seven more years.

Part A:

Which of the following relationships would not be allowed by Maxine's rule?

A. a 35 year-old and a 50 year-old

B. a 24 year-old and a 30 year-old

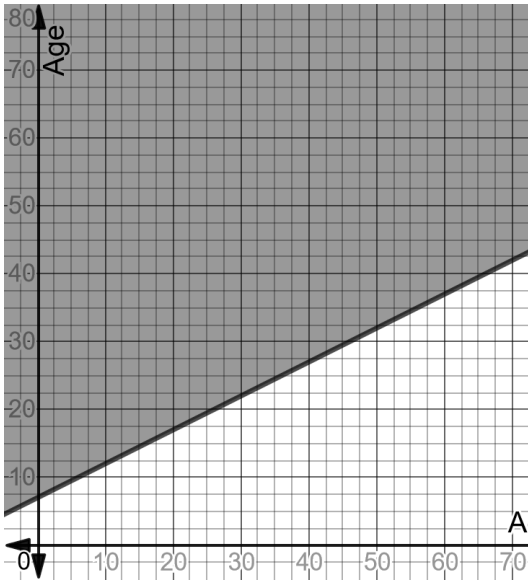
C. an 18 year-old and a 21 year-old

D. a 20 year-old and a 30-year-old

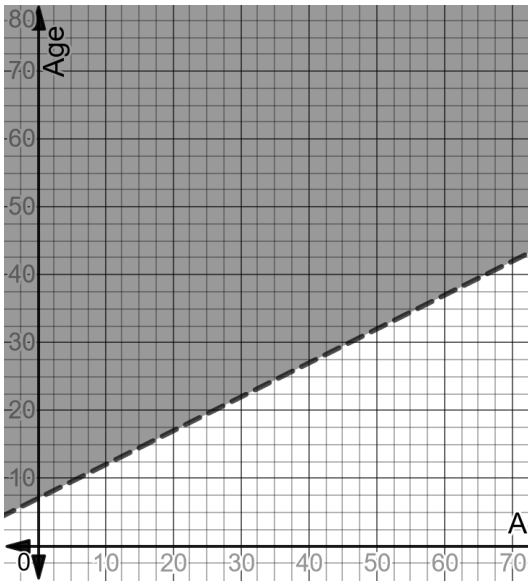
Part B: Maxine writes her mathematical rule in this way: $y \geq \frac{1}{2}x + 7$.

Which of the graphs below shows this inequality correctly?

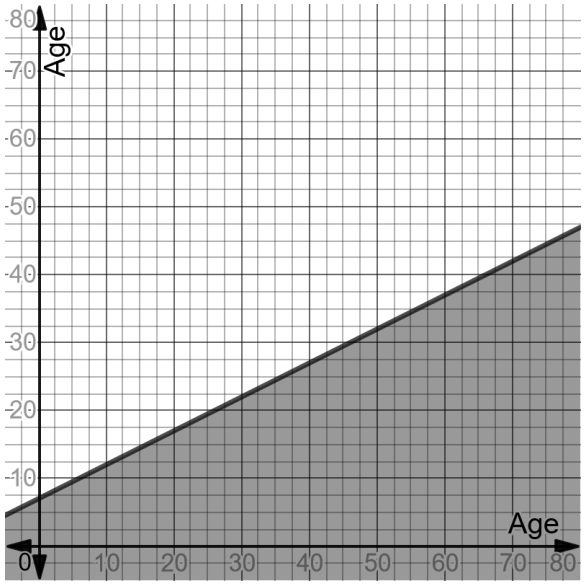
A.



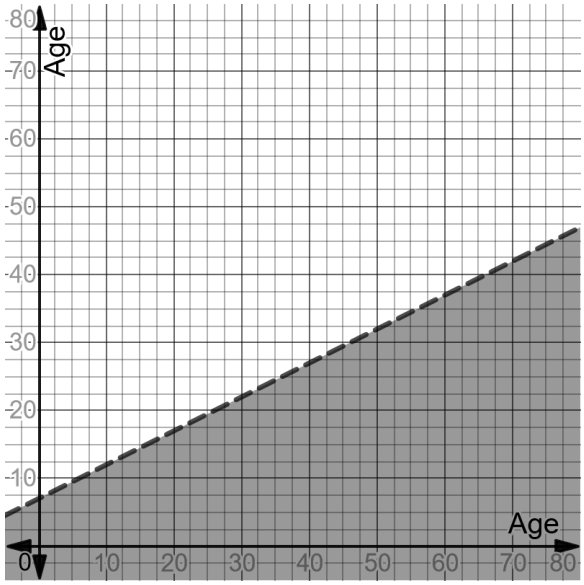
B.



C.



D.



Expressions, Equations, and Inequalities - Answer Key

1) C. The price per pizza isn't the same for 3 pizzas and for 4 pizzas. An equation would have to explain both prices.

2) B

3) D

4) B

5) D

6) C

7) C

8) Part A: C, Part B: B

9) D

10) D

11) B

12) 1160

13) Part A: D, Part B: A

14) C

15) B

16) B

17) B

18) C

19) A

20) B

21) B

22) Part A: A, Part B: B

23) C

24) Part A: B, Part B: C

25) A

26) A

27) D

28) A

29) C

30) B

31) B

32) A

33) D

34) D

35) Part A: A, Part B: C

36) Part A: A, Part B: B

37) Part A: D, Part B: A

Linear Functions

1) Last week, Samantha sold iced tea at the park. Her profit can be represented by the function P(c) = 0.75c - 9.46, where P(c) represents her profits, and c represents the number of cups of iced tea she sold.

   Part One: Which statement correctly describes the meaning of 0.75 and 9.46 in the function?

   A. Samantha charged $0.75 per cup of ice tea and it cost her $9.46 to make the ice tea she sold.

   B. Samantha charged $0.75 per cup of ice tea and she earned $9.46 selling iced tea.

   C. It cost Samantha $0.75 to make each cup of iced tea, and she earned $9.46 selling iced tea.

   D. It cost Samantha $0.75 to make each cup of iced tea, and she charged $9.46 per cup.

   Part Two: This week Samantha is planning on raising the price by 50 cents per cup. Which function can be used to determine her profit for this week?

   A. $P(c) = .75c - 9.96$

   B. $P(c) = 1.25c - 9.46$

   C. $P(c) = .25c - 9.46$

   D. $P(c) = .75c - 8.96$

2) The cost of membership at a new gym can be modeled by the function $C(m) = 50m + 75$. Which of the following statements is true?

   A. Membership costs $125 per month.

   B. It costs $50 to join the gym and then you pay $75 each month.

   C. Being a member for two years would cost $1350.

   D. It costs $75 dollars to join the gym and then you pay $50 each month.

3) Which of the following methods could *not* be used to calculate the rate of change of the function described in the table below?

x	f(x)
3	52
6	100
7	116
21	340
42	676

A. (100-52) ÷ 3

B. 116-100

C. (340-116) ÷ 3

D. (676-340) ÷ 21

4) In 2018, the United States Postal Service (USPS) raised its rates for mailing letters. The new charge was $0.50 to mail a letter weighing up to 1 oz. and $0.21 for each additional ounce. Which function would determine the cost of sending a letter through the USPS?

A. $y = 0.5x + 0.21$

B. $y = 0.21x + 0.50$

C. $y = 0.5(x - 1) + 0.21$

D. $y = 0.21(x - 1) + 0.50$

5) Alexis has $50 in a loose change jar and Melvin has $10 in his own jar. They each decide to save a certain amount of money each week. Alexis adds $5 to her jar each week. Melvin adds $15 every week. Which statement is not true?

A. If they graphed these two functions, Melvin's graph would have a steeper line.

B. After 2 weeks, Melvin would have $40 in his jar.

C. After 4 weeks, Alexis and Melvin have the same amount of money in their jar.

D. If they graphed these two functions, Alexis's graph would have a steeper line.

6) A function is shown in the table.

x	f(x)
-4	18
-1	27
0	30
3	39
10	60

If included in the table, which ordered pair would result in the relationship no longer being a function?

A. (-2, 24)

B. (2, 36)

C. (3, 42)

D. (7, 51)

7) A typical shower in the United uses about 2 gallons of water per minute. If 1 gallon equals 16 cups, how many cups of drinking water are used in a 15-minute shower?

A. 30

B. 60

C. 240

D. 480

8) Which set of related x and y values represent a function?

A. {(1,9), (2,15), (3,21), (2,13), (4,27)}

B. {(5,31), (2,13), (0,1), (4,25), (1,7)}

C. {(7,25), (1,7), (9,31), (3,13), (7,21)}

D. {(0,2), (4,22), (2,12), (2,17), (5,27)}

9) A community center planted a tree to honor the opening of a new childcare center. The height of the tree as it grows can be represented by the function $h = 15t + 36$ where *h* represents the height of the tree (in inches) and *t* represents the number of years. Which interpretation of the function is correct?

   A. The tree was 3 feet tall when it was planted and grows 15 inches each year.

   B. The tree was 15 inches tall when it was planted and grows 36 inches each year.

   C. The tree grows 51 inches each year.

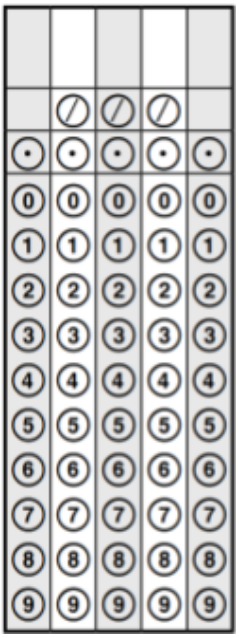
   D. Every five years, the tree grows 111 inches.

10) Brenda and Eddie agreed to save money, consistently adding to their separate savings accounts every month for the same number of months. The amount of money Eddie saved can be determined by the following function, where *x* represents the number of months:

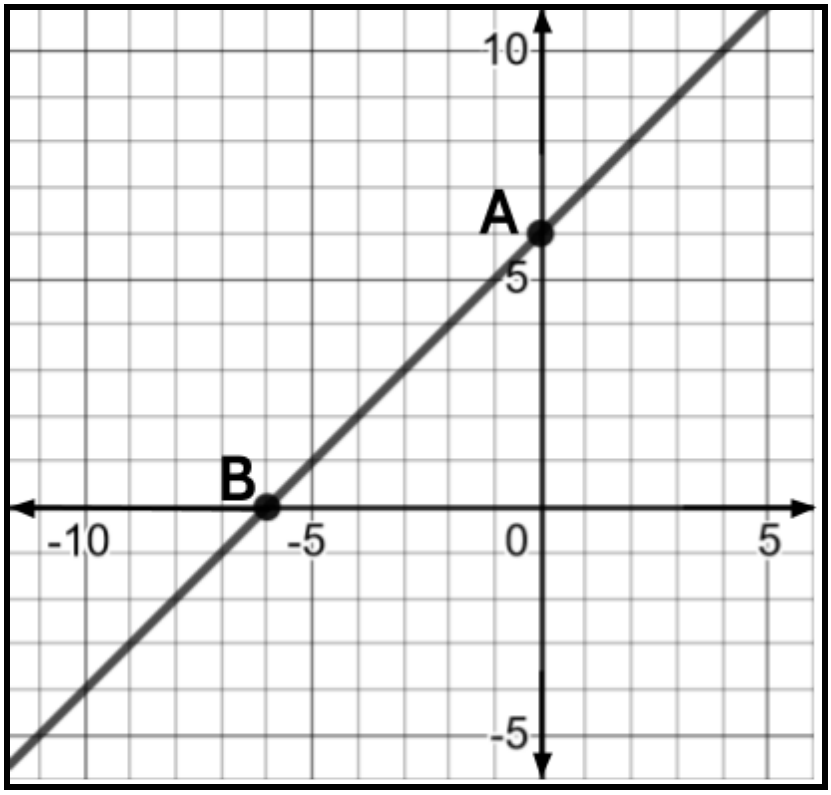
$$f(x) = 200x + 4000$$

Brenda deposited $300 each month into her account.

If Eddie and Brenda had the same amount of money in their accounts after 10 months, how much did Brenda have in her savings account before she and Eddie started the savings plan? Enter your answer in the grid below.



11) Consider the line drawn on the coordinate plane below.



Which of the following can be used to refer to Point A? Choose all possible answers.

A. y-intercept

B. x-intercept

C. the starting amount

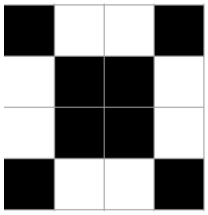
D. the rate of change

E. the slope

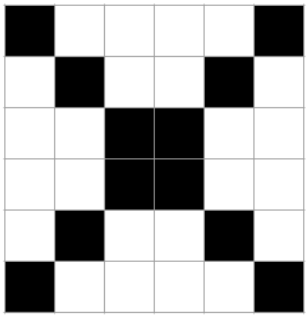
F. (0, 6)

G. (6, 0)

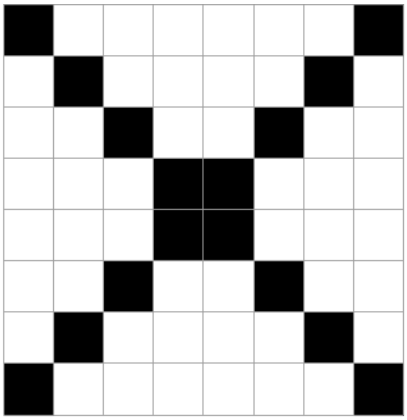
12) The pictures below represent the first three terms of a sequence.



Term 1



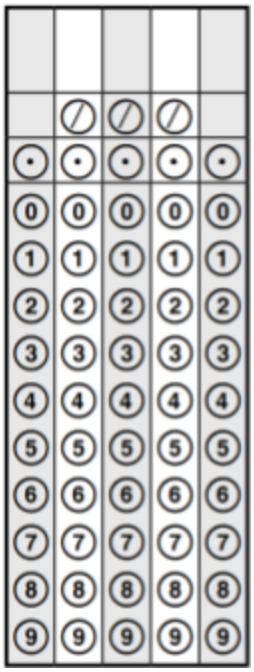
Term 2



Term 3

Assuming the pattern continues, how many shaded squares would there be in the 10th term?

Enter your answer in the grid to the right.



13) Sal has been working as a nutritionist since 2004. She gets paid by the hour and has increased her hourly charges each year since she started.

The equation $y = 2.5x + 16.00$ can be used to model Sal's hourly charge, y, where x represents the number of years since 2004.

Which statement describes the nutritionist's hourly rate?

A. Her hourly charge was $2.50 in 2004, and it is $16.00 now.

B. Her hourly charge was $16.00 in 2004, and it has increased $2.50 each year.

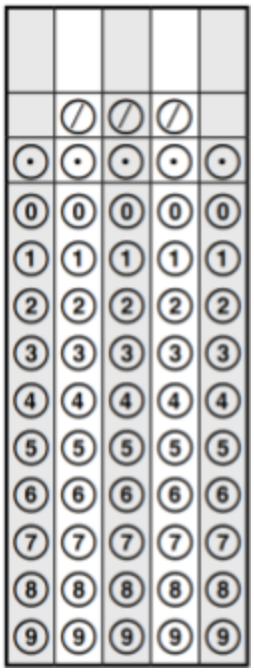
C. Her hourly charge was $2.50 in 2004, and it has increased $16.00 per year.

D. Her hourly charge was $16.00 in 2004, and has gotten 2.5 times bigger each year.

14) The first four numbers in a sequence of numbers are

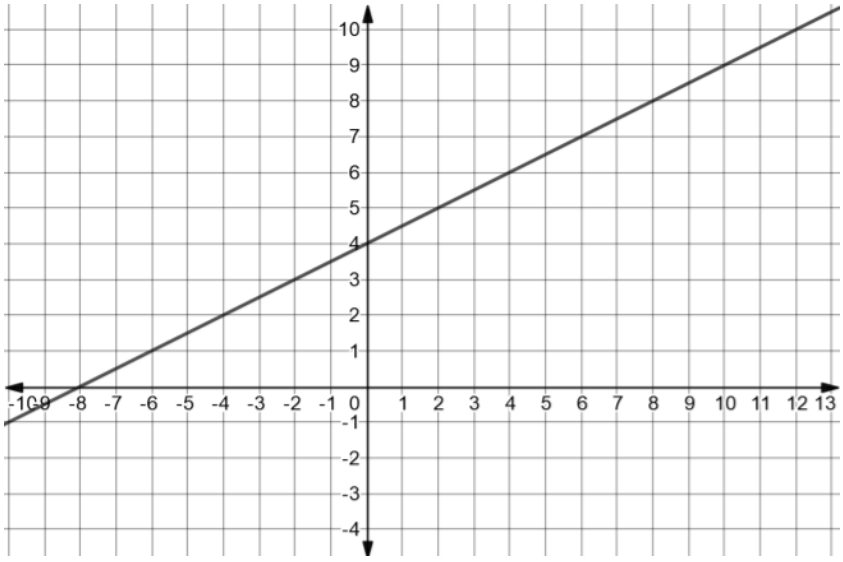
-12, -9, -6, -3,…

What would the 9th number in the sequence be? Enter your answer in the grid.



15) Consider the two functions below.

x	y
0	1
2	1.5
4	2
6	2.5
8	3



Which statement is true?

A. The rate of change of the function on the graph is greater than the rate of change of the function in the table.

B. The rate of change of the function on the graph is less than the rate of change of the function in the table.

C. The rate of change of both functions is the same.

D. There is not enough information given to determine the rate of change of the two functions.

16) A car rental company charges $80 to rent a car, plus 0.20 per mile. They also offer their customers the option of buying insurance for a flat fee of an additional $40. Which function can be used to calculate the total cost of renting a car for a customer who decides to buy the optional insurance?

A. $y = 0.20x + 80$

B. $y = 0.20x + 120$

C. $y = 80x + .20$

D. $y = 120x + .20$

17) The first three figures in a visual pattern can be seen below.

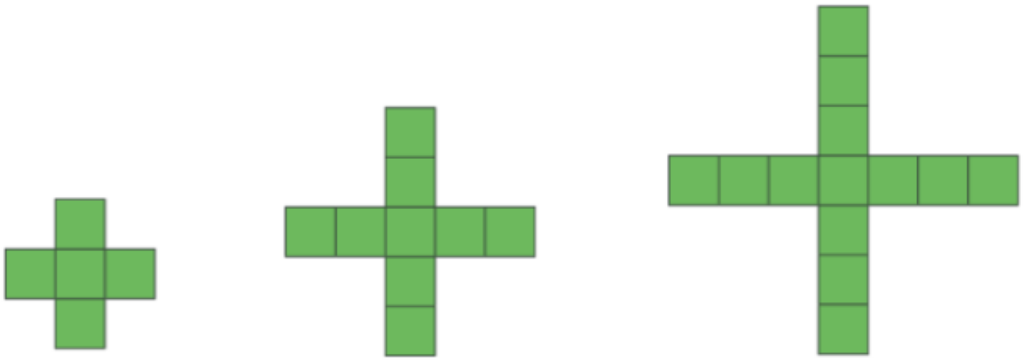
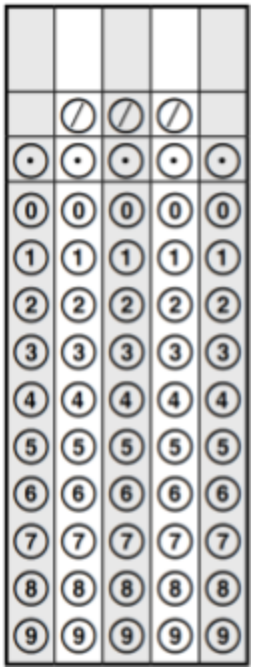


Figure 1 **Figure 2** **Figure 3**

If the pattern continues, which figure would have 89 squares in it?

Please record your answer in the grid to the right.



18) Which equation represents the same function as the table?

A. $d = 1.50c$

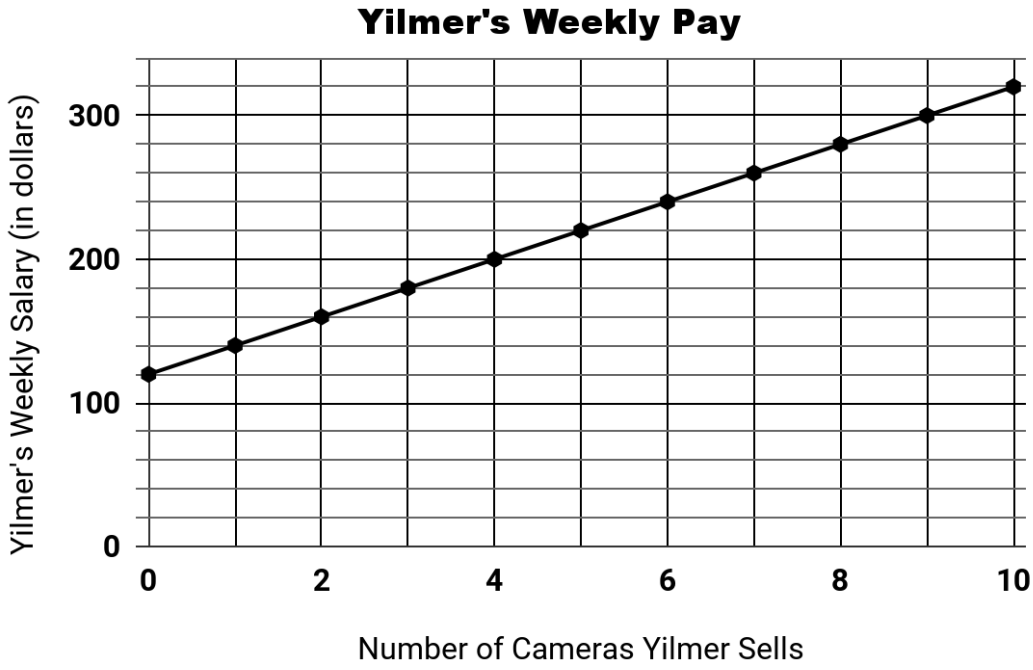
B. $d = 1.50c + 20.00$

C. $d = 20.00c + 1.50$

D. $d = 21.50c$

c	*d*
0	20.00
1	21.50
3	24.50
24	56

19) Yilmer works at a camera store. He earns a guaranteed salary each week. In addition to his guaranteed salary, he earns a commission for each camera he sells. The graph below shows his weekly pay as a function of how many cameras he sells during the week.



Which equation can be used to calculate how much Yilmer earns each week? Let P represent his weekly pay and let c represent the number of cameras he sells.

A. $P = 140c$

B. $P = 120c$

C. $P = 20c + 120$

D. $P = 120c + 20$

20) Which situation does <u>not</u> represent a linear function?

A. An online streaming service charges a membership fee of $50 and $10 per month.

B. A cab company charges $2.50 initially and $3.00 per mile.

C. A restaurant employee earns $12.50 per hour.

D. A population of bacteria doubles every 20 minutes.

21) Which equation expresses the relationship between *x* and *f(x)*, as shown in the table below?

x	1	3	5	7	9
y	5	9	13	17	21

A. $f(x) = 4x + 1$

B. $f(x) = x + 4$

C. $f(x) = 3x - 2$

D. $f(x) = 2x + 3$

22) As time goes by, a car depreciates in value. The value of a car is a function of how many years it has been on the road. An example of this relationship can be seen in the table.

Why is it correct to describe this relationship as linear?

A. The value of the car is increasing at a constant rate.

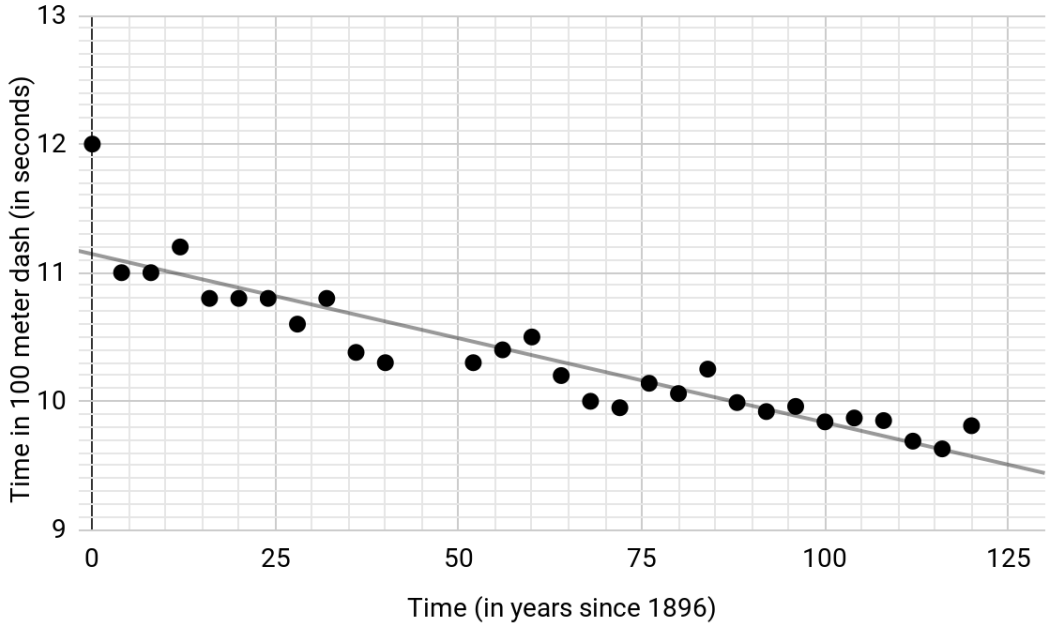
B. The value of the car is decreasing at a constant rate.

C. The value of the car is not increasing at a constant rate.

D. The value of the car is not decreasing at a constant rate.

Years of Ownership	Value of Car
1	$22,500
2	$19,500
3	$16,500
4	$13,500
5	$10,500

23) The scatter plot below shows the winning race times of the Olympic gold medal winners in the 100-meter sprint as a function of time. Tom Burke won the gold medal for the United States at the first ever Olympic Games in 1896. In 2012, Usain Bolt completed the race in 9.63 seconds to win the gold medal for Jamaica.



The equation of the line of best fit is $y = -.013x + 11.14$.

- x represents the number of years after 1896.
- y represents the Olympic Gold medalists times, in seconds, for the 100-meter sprint.

What is the best interpretation of the slope of the line of best fit?

A. The time it takes to win the gold medal in the 100 meter sprint decreases an average of 0.013 seconds every year.

B. The time it takes to win the gold medal in the 100 meter sprint increases an average of 0.013 seconds every year.

C. The time it takes to win the gold medal in the 100 meter sprint decreases an average of 11.14 seconds every year.

D. The time it takes to win the gold medal in the 100 meter sprint increases an average of 11.14 seconds every year.

24) Which of the following tables shows a linear relationship?

A.

x	*f(x)*
0	-4
1	-2
2	4
3	14
4	28

B.

x	*g(x)*
-1	-3
0	-1
1	1
2	3
3	5

C.

x	*h(x)*
1	-1
2	1
3	5
4	13
5	29

D.

x	*k(x)*
0	8
1	9
2	12
3	17
4	24

25) Find the missing output for the function shown in the table.

x	2	4	6	8	16
y	11	21	31	41	

A. 39

B. 51

C. 81

D. 82

26) Consider the set of related x and y values. {(8, 67), (5, 28), (g, 19), (9, 84)}

Which value of g would make it *impossible* for the set to represent a function?

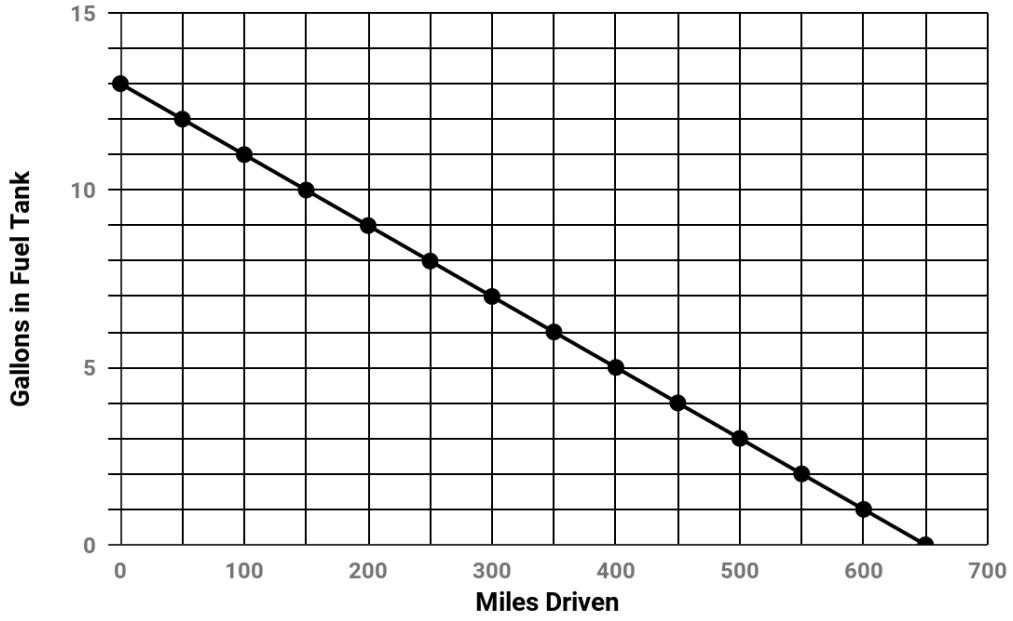
A. 2

B. 3

C. 4

D. 5

27) Shirley wants to see how far she can drive on a single tank of gas in her new hybrid car. She fills up her gas tank completely. The graph shows the number of gallons left in the fuel tank as a function of the number of miles driven for the duration of her trip.



Which <u>two</u> statements can be justified using the graph?

A. Shirley was able to drive 700 miles on one full tank of gas.

B. The total capacity of the fuel tank is 13 gallons.

C. As the gallons of gas in the fuel tank decreases, the number of miles driven also decreases.

D. The car gets 50 miles per gallon.

28) The following function can be used to convert temperatures in Celsius to Fahrenheit:

$$F = 1.8C + 32$$

where C represents a temperature in Celsius and F represents the equivalent temperature in Fahrenheit.

Convert 15°C into Fahrenheit.

A. 32°F

B. 41°F

C. 49°F

D. 59°F

29) We can use the following function to model the exchange rate between the U.S. dollar and the Mexican Peso:

$$f(x) = mx$$

where $f(x)$ is the amount of Mexican Pesos and x is the amount of U.S. dollars. The table shows some values of x and $f(x)$.

x	f(x)
Dollar (US)	Peso (Mexico)
150	2,850
300	5,700
600	11,400
900	17,100

Find m.

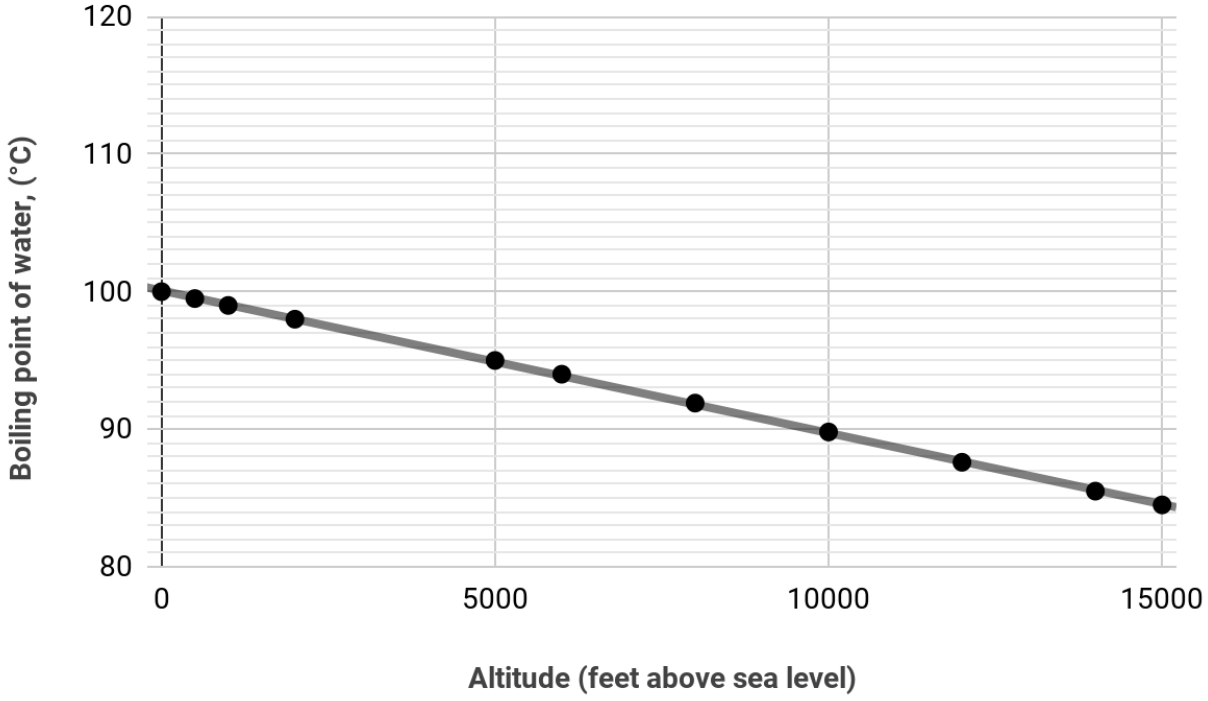
A. 10

B. 13

C. 15

D. 19

30) The graph below represents the boiling point of water as a function of altitude above sea level. The line of best fit can be described with the function $y = 100 - .001x$, where x represents the altitude above sea level and y represents the boiling point of water.



Which three statements are true, based on the line of best fit?

A. 100°C is the boiling point of water at sea level.

B. The boiling temperature of water decreases by 0.001 degrees Celsius for every 1 foot increase in altitude.

C. 100°C represents the rate of change for this function.

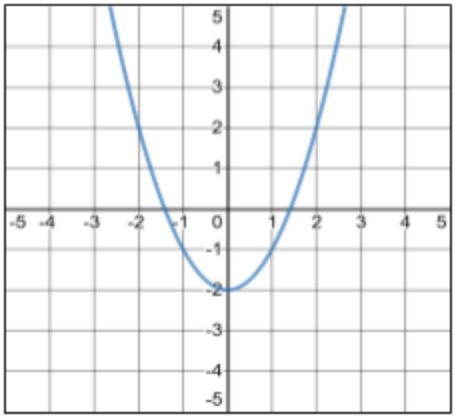
D. For every 5000 feet you go above sea level, the boiling point of water decreases by 5°C.

E. For every 5000 feet you go below sea level, the boiling point of water decreases by 5°C.

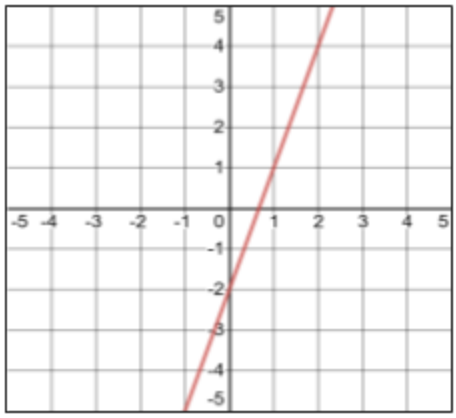
31) Which of the following graphs represents the equation $y = 3x - 2$?

A.

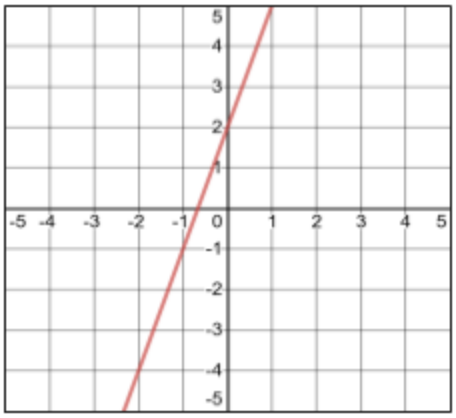
B.



C.



D.



32) Consider the inputs and outputs in the table.

Which replacement for a makes this *not* a function?

A. 4

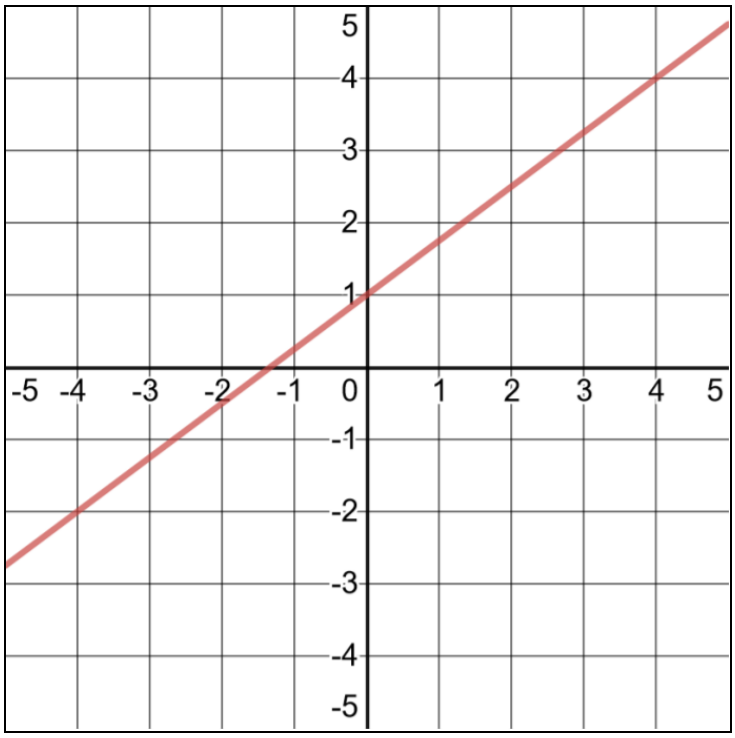
B. 5

C. 6

D. 7

x	*f(x)*
4	7
a	12
9	17
12	26

33) Consider the following graph.



Which of the following function equations represents the line on the graph?

A. $y = \frac{4}{3}x + 1$

B. $y = -\frac{4}{3}x + 1$

C. $y = \frac{3}{4}x + 1$

D. $y = -\frac{3}{4}x + 1$

34) Which of the following functions could be graphed as a line parallel to $y = 3x + 8$?

A. $y = 3x - 2$

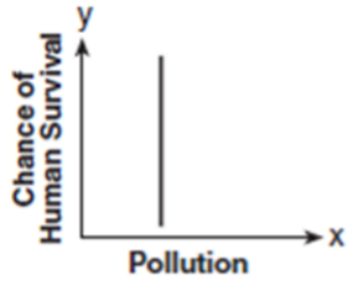
B. $y = 5x + 8$

C. $y = 8x + 3$

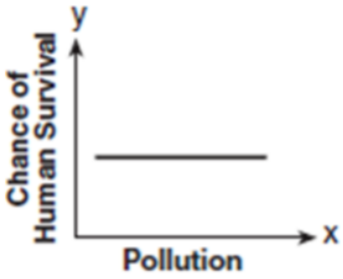
D. $y = 4x - 2$

35) Which of these graphs does *not* represent a function of *x*?

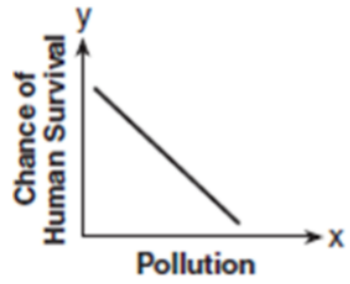
A.



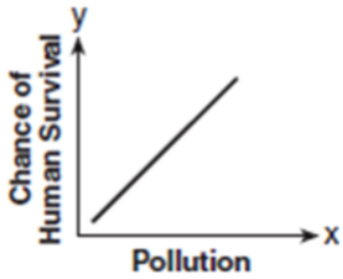
B.



C.



D.



36) A plumber has a set fee for a house call and then charges by the hour for work done. The total cost of her services can be modeled by the function $c(t) = 125t + 95$. When working for friends, she reduces her hourly rate by $35. Which function can be used to calculate the total cost of her services for work done for friends?

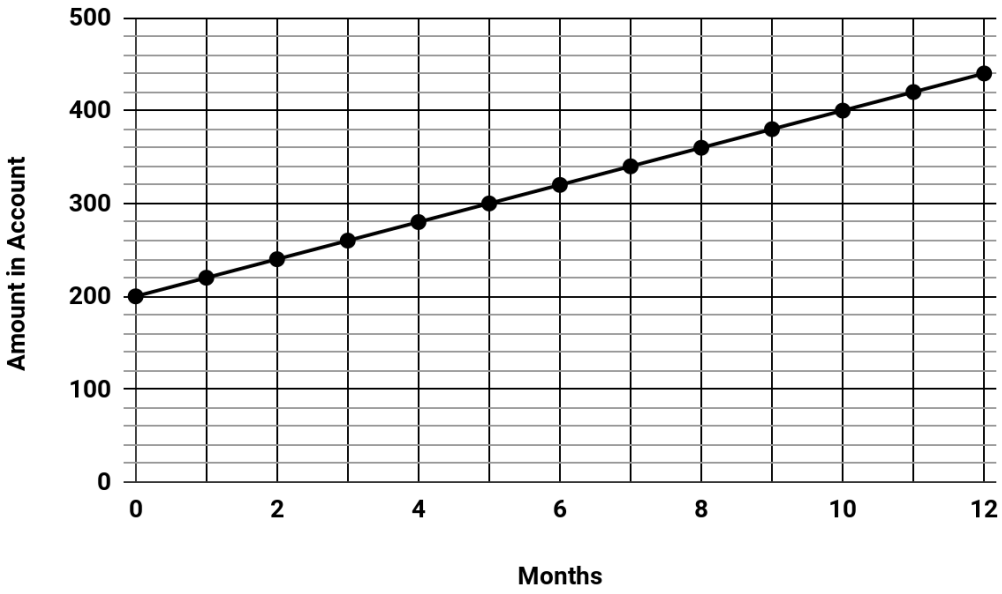
A. $c(t) = 125t$

B. $c(t) = 90t + 95$

C. $c(t) = 125t + 60$

D. $c(t) = 90t + 60$

37) Alex had some money in a savings account and decided to save $20 a month for 12 months.



How much money did Alex have in the account at the start of the year?

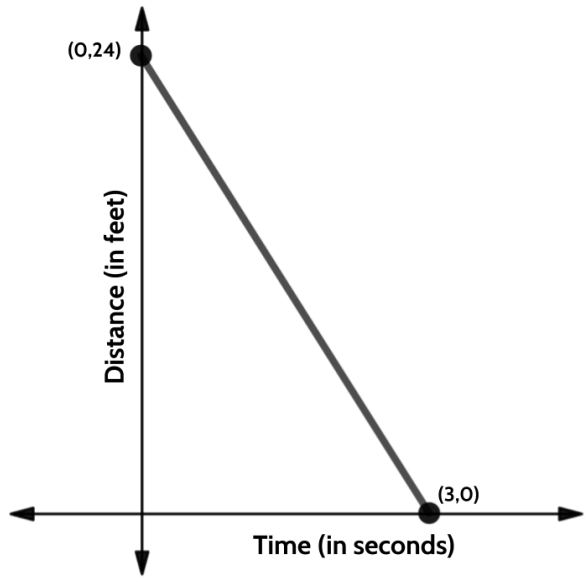
A. $20

B. $200

C. $220

D. $460

38) Which table is the best match for the graph?



A.

Time (in seconds)	*Distance (in feet)*
0	24
1	16
2	8
3	0

B.

Time (in seconds)	*Distance (in feet)*
0	24
1	12
2	6
3	0

C.

Time (in seconds)	*Distance (in feet)*
0	24
1	18
2	12
3	0

D.

Time (in seconds)	*Distance (in feet)*
0	24
1	20
2	16
3	0

39) For the function $f(x) = 6x - 8$, what is $f(3)$?

A. 10

B. 26

C. 30

D. 42

40) An apple orchard charges an entrance fee of $15 for visitors to go apple picking. Any apples they pick can be purchased for $1.50 a pound.

Part One: Choose the word that best completes the following statement.

In this situation, the $15 can best be described as the _____ .

A. rate of change

B. slope

C. input

D. starting amount

Part Two: If a visitor spent $24, how many pounds of apples did they buy?

A. 3

B. 6

C. 8

D. 16

41) Find the rate of change for this function.

A. 8

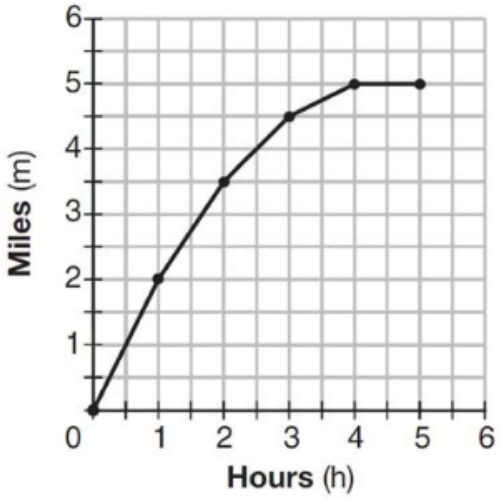
B. 24

C. 32

D. 104

x	f(x)
16	134
20	166
45	366
19	158
3	30

42) The graph below shows the distance in miles, m, hiked from a camp in h hours.



Which hourly interval had the greatest rate of change?

A. hour 0 to hour 1
B. hour 1 to hour 2
C. hour 2 to hour 3
D. hour 3 to hour 4

Linear Functions - Answer Key

1. Part One: **Choice A.** This function is showing us the relationship between Samantha's profit and the number of cups of iced tea she sells. Her profit is a function of how many cups she sells. In the function $P(c) = .75c - 9.46$, the .75 represents the price of each cup of iced tea. Multiplying that number by c, the number of cups she sold, tells us the amount of money she made. Since profit is determined by taking the amount of money earned and subtracting the cost of what we produced, the 9.46 represents the $9.46 it must have cost to make the iced tea.

   Part Two: **Choice B**. In the function $P(c) = .75c - 9.46$, the .75 represents the price of each cup of iced tea. If Samantha raises the price of each cup by 50 cents, then the new price would be $1.25.

2. **Choice D.** In the function $C(m) = 50m + 75$, the rate of change is 50 and the starting amount is 75. We can think of the starting amount as a flat fee that we only pay once and we can think of the rate of change as a monthly cost. We can assume that the variable m represents the number of months. If you put a 2 (for two months) into the function, you get 50(2) + 75, which is $175. If you put a 3 in, you get 50(3) + 75, which is $225. That reflects the written description in Choice D of paying $75 to join and then $50 each month.

3. **Choice C.** The rate of change for this function is 16. One way to calculate that is to look at the two consecutive inputs, 6 and 7. The change in the outputs between those two consecutive inputs is 16. Evaluating all of the answer choices, choice C is the only one that does not equal 16.

4. **Choice D.** Choice B is a compelling answer choice because it has the correct rate of change (0.21) and the correct starting amount (0.50). A good strategy when you are given a written description to match an equation is to try a few numbers.

$y = .21x + .50$	
Ounces	Cost
x	y
1	0.71
2	0.92
3	1.13

$y = .21(x-1) + .50$	
Ounces	Cost
x	y
1	0.50
2	0.71
3	0.92

The function table on the right is the one that matches the written description of the function. The USPS charges 0.50 for a letter weighing up to 1 ounce.

5. **Choice D.** Making a quick table can also be helpful when you are asked to evaluate statements like this. The table below allows us to see that statements A, B, and C are all true. Since Melvin is adding $15 a week the rate of change of the function describing his saving would be 15. The rate of change for Alexis' saving is 5, which is a smaller growth.

Week	Alexis	Melvin
1	$55	$25
2	$60	$40
3	$65	$55
4	$70	$70

6. **Choice C** has an input of 3 and an output of 42. The chart already has an output of 39 for an input of 3. A function can not have the same input resulting in different outputs, therefore including (3, 42) in the table would mean that the table doesn't represent a function

7. **Choice D.** A rate of 2 gallons per minute is equivalent to 32 cups of water per minute. If the rate is 32 cups per minute, it would be 32 × 15 or 480 cups of drinking water used in a 15 minute shower,

8. **Choice B** is the only choice that does not have two different outputs for the same input.

   A. {(1,9), (**2,15**), (3,21), (**2,13**), (4,27)}

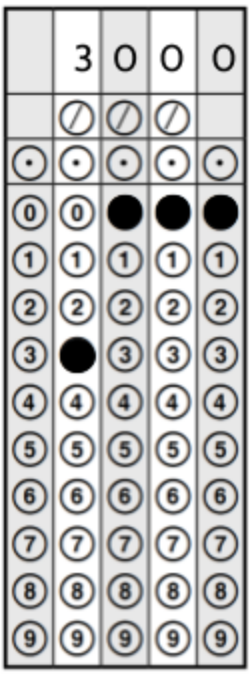
   B. {(5,31), (2,13), (0,1), (4,25), (1,7)}

   C. {(**7,25**), (1,7), (9,31), (3,13), (**7,21**)}

   D. {(0,2), (4,22), (**2,12**), (**2,17**), (5,27)}

9. **Choice A.** The function gives the starting height of the tree as 36 inches, which is equivalent to 3 feet. Choice B reverses the rate of change and the starting amount—you are likely to see this kind of misleading answer on the high school equivalency exam. Choices C and D are also common misleading answers. They are both *almost* true. Choice C is almost true - the tree does grow 51 inches in its first year, but the statement says it grows 51 inches <u>each</u> year, which is not true. Choice D is also almost true - in 5 years, the tree grows 111 inches, but the statement says <u>every</u> five years the tree grows 111 inches, which is not true.

10.



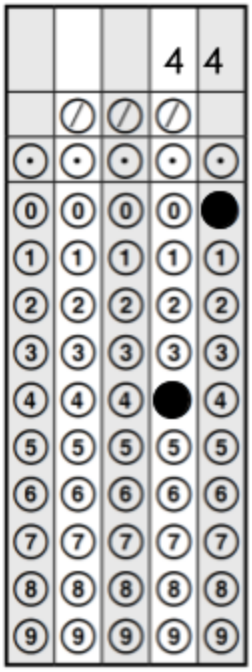
The function describing Eddie's savings is $f(x) = 20x + 4000$. The problem tells us that their accounts had the same amount of money after 10 months.

After ten months, Eddie has 20(10) + 4000, which equals $6000.

Brenda has been saving $300 a month. After ten months, she will have saved $3000. Since the problem tells us they had the same amount of money after the ten months, Brenda must have started with a starting amount of $3000.

11. Choices A, C, F.

12.



Term	Shaded Squares
1	8
2	12
3	16
4	20
5	24
6	28
7	32
8	36
9	40
10	44

One strategy is to make a table and continue the pattern.

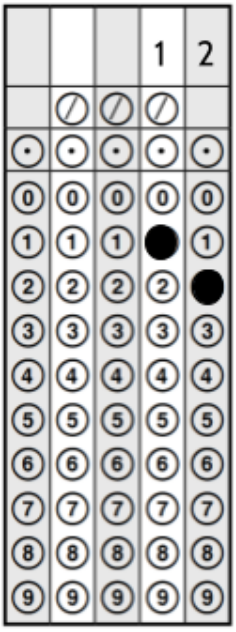
Another strategy is to determine the function equation. The change in the number of shaded squares can be represented by the function $f(n) = 4n + 4$ where n represents the term number. 4(10) + 4 is equal to 44.

If you count the number of shaded squares in the 3 terms given, you can see the rate of change is 4.

13. **Choice B.** It is not necessary, but using the equation to make a quick table can help when a question asks you to evaluate statements.

Years since 2004	Hourly Rate
0	$16
1	$18.50
2	$21
3	$23.50

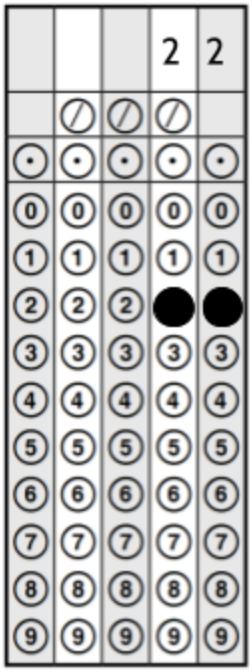
14. The numbers in this sequence are increasing by 3. If the sequence continued until the 9th term, the sequence would be -12, -9, -6, -3, 0, 3, 6, 9, 12.



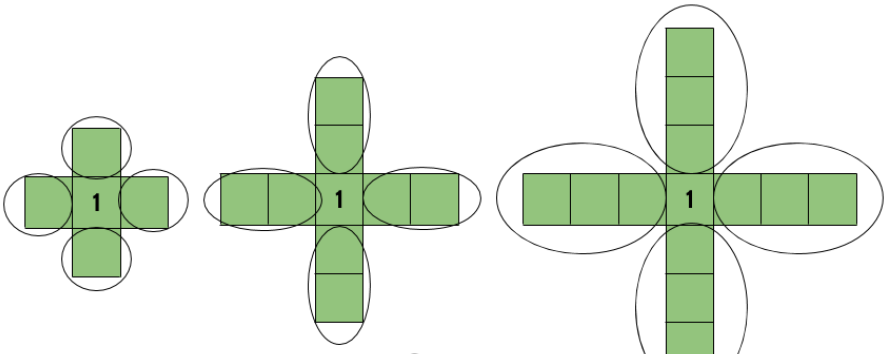
15. **Choice A.** The rate of change for the function represented by the graph is 0.5 or ½. The rate of change for the function in the table is 0.25. The rate of change on the table appears to be 0.5, making Choice C a compelling misleading choice. But the inputs in the table are not consecutive, they are going up by 2.

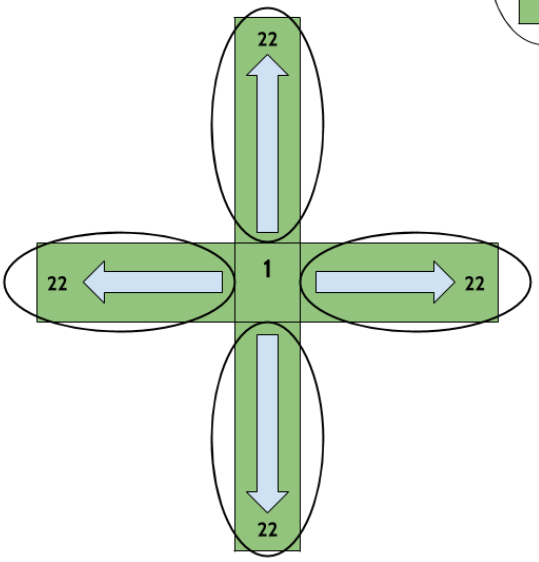
16. **Choice B.** A $80 flat fee charge plus a $40 flat fee insurance charge would result in a starting amount of $120.

17. The function equation that describes the relationship between the figure number and the number of squares in this sequence is $y = 4x + 1$, where x is the figure number and y is the number of squares. The problem gives us the number of squares, so we can set up the equation $89 = 4x + 1$.



Another strategy is to think about thow the figure grows and ask what is changing and what is staying the same.





There is always 1 square in the middle. There are always 4 "arms" coming out of the center square. The number of squares in each arm is equal to the figure number. If we imagine 89 squares, we can put 1 in the middle, which leaves us with 88 squares, If we have 88 squares left and divide them into 4 equal groups, each group would have 22 squares. Figure 22 is the one that has 22 squares in each arm. 89 = 22 + 22 + 22 + 22 + 1

18. **Choice B.** According to the table, when the input is zero, the output is 20. That means we are looking for an equation with a starting amount of 20.

19. **Choice C.** Based on the graph, the starting amount of this function is 120. That only matches one answer choice. Another strategy is to pick a point and put it into each answer choice. Point (4, 200) appears on the line of this function. 20(4)+120= 200.

20. **Choice D.** Making a quick table for each situation allows you to see that only one of them does not have a constant rate of change.

21. **Choice D.** Be careful of Choice A. The difference in the outputs shown in the table is 4, but the inputs are not consecutive.

22. **Choice B.** A key feature of linear functions is a constant rate of change, even if the outputs are decreasing in value..

23. **Choice A.** Usain Bolt won a gold medal in 2012 with a time of 9.63. Tom Burke won in 1896 with a time over 11 seconds.

24. **Choice B** is the only choice with a constant rate of change.

25. **Choice C.** The rate of change for this function is 5 and the starting amount is 1, so we can use the function $y = 5x + 1$. When the input is 16, the output is 81.

26. **Choice D.** Since one of the ordered pairs given has an input of 5 and an output of 28, the function cannot have another solution with an input of 5 and an output of 19.

27. **Choice B and Choice D.** A table based on the points on the graph allows us to identify the rate of change (-50) and the starting amount (13)

Number of Gallons in tank	Miles Driven
13	0
12	50
11	100
10	150

28. **Choice D.** 1.8(15) + 32 = 59

29. **Choice D.** The currency of the United States is the US dollar. When we talk about foreign currency, we are talking about the money that is used in other countries. We use exchange rates to determine the equivalent value between different currencies. There are different strategies you might use to answer a question like this. We are given inputs and outputs and possible rates of change. One method is to multiply each of the inputs by the given possible values of *m* and see which one results in the given outputs. Another method might be to use the information in the table to determine the rate of change, looking at the change in the inputs and the change in the outputs.

30. **Choice A, B, D.** High altitude cooking is cooking that is done at altitudes well above sea level. The higher you go, the less air pressure there is. A decrease in air pressure causes a decrease in the temperature required to make water boil. So basically, the higher your altitude, the lower the boiling point of water!

31. **Choice C.** When answering questions like these, eliminating choices can help. We can tell by the function equation given that the function is linear, so we can eliminate choice B. Choice A can also be eliminated because it has a negative slope. The main difference between choices C and D are the *y*-intercepts. The function equation has a *y*-intercept of -2, so we can eliminate choice D.

32. **Choice A.** Since the table already has an input of 4 with an output of 7, having another input of 4 and an output of 12 would make this not a function. This type of question is often used to test whether students understand that every input has exactly one output. If the same input results in two different outputs, then the relationship is not a function.

33. **Choice C.**

34. **Choice A**. Linear functions that have the same rate of change will have graphs that are parallel to each other.

35. **Choice A.** In this graph there are multiple *y* values for the same *x* value.

36. **Choice B.** The hourly rate is the rate of change in the function. If her standard rate, $125, is reduced by $35, then her "Friends and Family" hourly rate would be $90. The problem does not mention a discount in the house call fee.

37. **Choice B.** The *y*-intercept on the graph represents the starting amount of $200.

38. **Choice A** is the only table that represents a linear function with a constant rate of change between each of the outputs. If you were to graph the other tables, you would not get a straight line all the way from (0,24) to (3,0).

39. **Choice A.** With an input of 3, the function would produce an output of 10.

40. Part One: **Choice D.**

    Part Two: **Choice B**.

41. **Choice A.** You can use any of the input/output pairs in the table to calculate the rate of change. There are two consecutive inputs of 19 and 20. If you use those, and find the difference in their outputs, you can see the rate of change is 8.

42. **Choice A.** Between hour 0 and 1, the rate of change is 4. Between hour 1 and 2, the rate of change is 3. Between hours 2 and 3, the rate of change is 2. Between hours 3 and 4, the rate of change is 0.

Nonlinear Functions

1) These are the first four terms in a number sequence: 1, 3, 6, 10.
If you continue the sequence, what is the 7th term?

A. 26

B. 27

C. 28

D. 29

2) The input/output table on the right represents a quadratic function.

Part I: What is the missing value for y?

x	y
0	1
1	2
2	5
3	10
4	17
5	

A. 24

B. 26

C. 27

D. 34

Part II: Which equation matches the table?

A. $2x^2 - 1 = y$

B. $2x^2 + 1 = y$

C. $x^2 - 1 = y$

D. $x^2 + 1 = y$

3) These are the first four terms in a number sequence: 3, 6, 12, 24. If you continue the sequence, what is the 5th term?

A. 30

B. 36

C. 42

D. 48

4) Which ordered pair is <u>not</u> a solution to $y = x^2 + 2x + 1$?

A. $(-1, 0)$

B. $(0, 1)$

C. $(3, 12)$

D. $(5, 36)$

5) The table shows values of a function $f(x)$.

x	$f(x)$
1	4
2	7
3	
4	13
5	16

Part I: What is the value for $f(3)$?

A. 8

B. 9

C. 10

D. 11

Part II: What kind of function is $f(x)$?

A. rational

B. exponential

C. linear

D. quadratic

6) The table shows values of a function $g(x)$. What kind of function is $g(x)$?

x	$g(x)$
0	0
1	2
2	8
3	18
4	32

A. rational

B. exponential

C. linear

D. quadratic

7) The table shows values of a function $h(x)$. Which type of function best models the given data?

x	$h(x)$
0	1
1	3
2	9
3	27
4	81

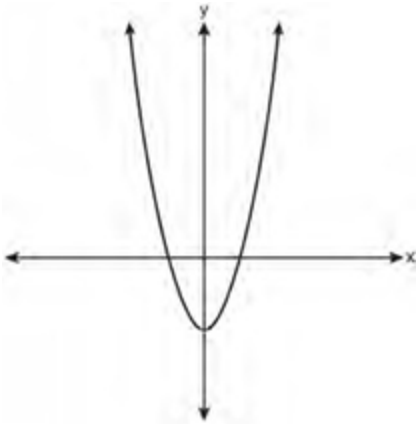
A. linear function with negative rate of change

B. linear function with positive rate of change

C. exponential growth function

D. exponential decay function

8) Which type of function is represented by the graph shown to the right?



A. rational

B. exponential

C. linear

D. quadratic

9) If $f(x) = 3x^2 - 2x + 1$, what is $f(2)$?

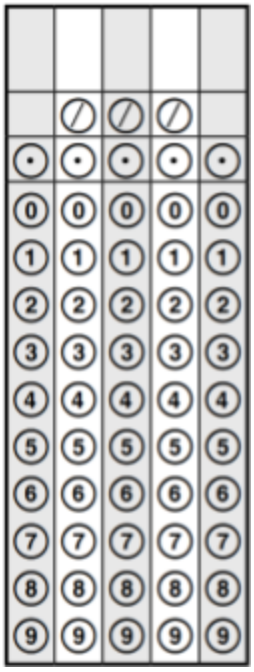
A. 1

B. 2

C. 6

D. 9

10) Consider the equation $x^2 = 25$. For $x \geq 0$, what is the value of x? Enter your answer in the grid to the right.



11) The table shows values of a function $f(x)$.

Determine the average rate of change of the function from $f(3)$ to $f(6)$.

A. -1

B. 5

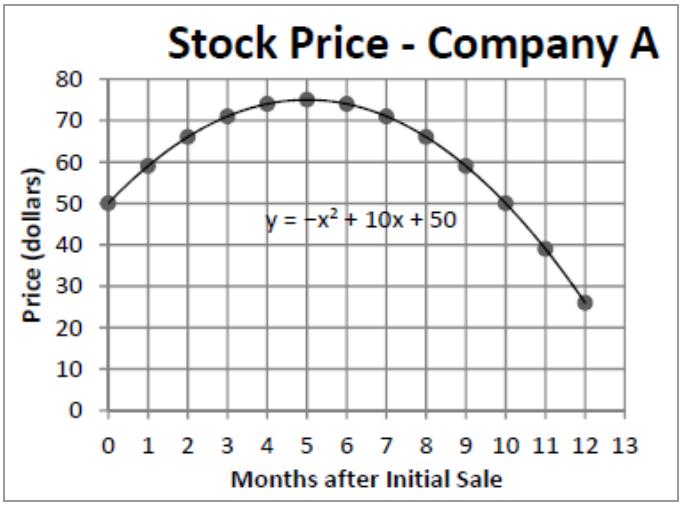
C. 7

D. 14

x	$f(x)$
2	-2
3	-1
4	2
5	7
6	14
7	23

12) An economist recorded the stock price of Company A after the initial stock sale.

What was the value of the stock price of Company A 10 months after the initial stock sale?



A. 25

B. 40

C. 50

D. 75

13) Which expression is the product of $(x + 4)$ and $(x - 2)$?

A. $x^2 + 6x - 8$

B. $x^2 - 6x - 8$

C. $x^2 + 2x - 8$

D. $x^2 + 2x + 8$

14) Which of the following is the factored form of $x^2 + 4x + 3$?

A. $(x + 1)(x + 3)$

B. $(x + 1)(x - 3)$

C. $(x - 1)(x + 3)$

D. $(x - 1)(x - 3)$

15) Which equation can be used to find the solutions of $y = x^2 - 3x - 10$?

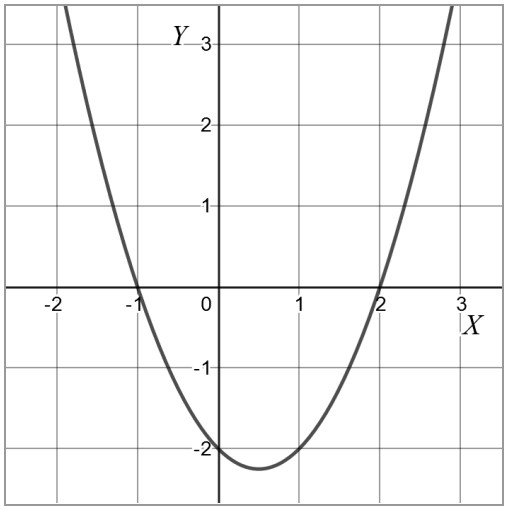
A. $(x - 2)(x + 5) = 0$

B. $(x + 2)(x - 5) = 0$

C. $(x + 3)(x - 10) = 0$

D. $(x + 3)(x + 10) = 0$

16) What are the zeros in the graph of the function $f(x) = (x + 1)(x - 2)$?



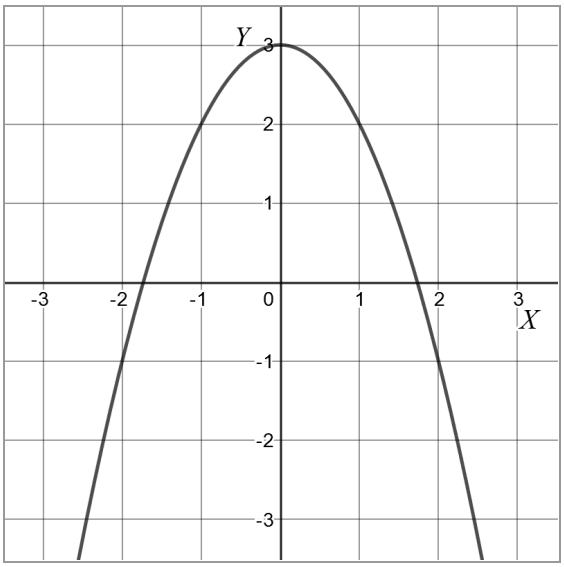
A. x= 1 or x= -2

B. x= -1 or x= -2

C. x= 1 or x= 2

D. x= -1 or x= 2

17) Which equation best matches the graph?



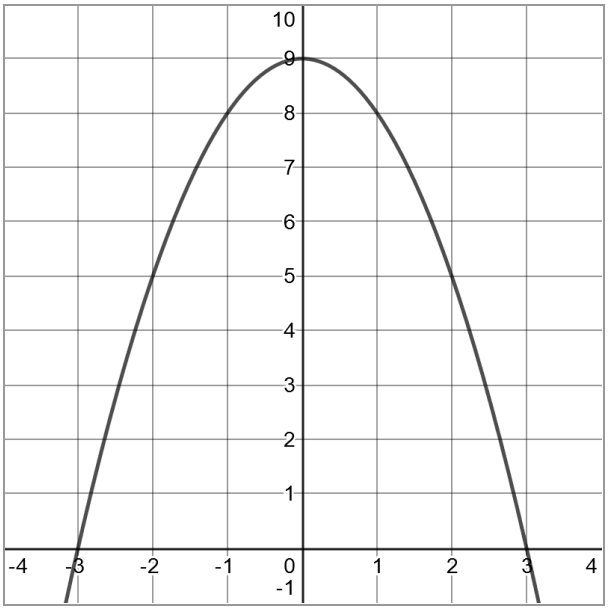
A. $y = -x^2 + 3$

B. $y = x^2 + 3$

C. $y = -x^2 + 2$

D. $y = x^2 + 2$

18) Consider the graph of the polynomial function $y = -x^2 + 9$ as shown.



What is the positive zero of this polynomial function?

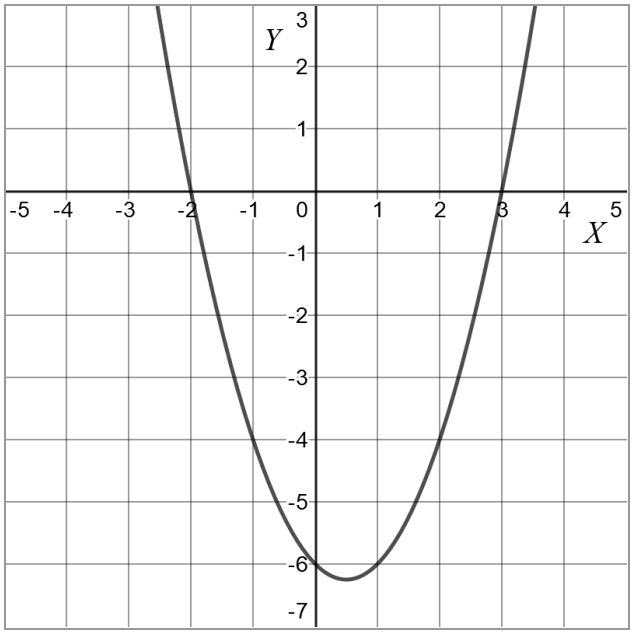
A. -3

B. 0

C. 3

D. 9

19) What are the roots of the quadratic equation associated with the graph?



A. -6 and 3

B. -6 and 0

C. -3 and 2

D. -2 and 3

20) The function $P(t) = 50,000 \cdot 1.01^{t}$ models the change in a population over time, starting with an initial population of 50,000. *P*(*t*) is the size of the population after *t* years.

Which total is closest to the predicted population after 10 years?

A. 45,000

B. 50,500

C. 55,000

D. 505,000

21) Which function equation matches the table on the right?

x	y
0	0
1	5
2	12
3	21
4	32
5	45

A. $y = x^2 + 8$

B. $y = x^2 - x$

C. $y = x^2 + 4x$

D. $y = x^2 + 8x + 16$

22) Which table displays an exponential function?

A.

x	1	2	3	4	5
y	2	4	6	8	10

B.

x	1	2	3	4	5
y	4	16	32	48	64

C.

x	1	2	3	4	5
y	3	6	9	12	15

D.

x	1	2	3	4	5
y	2	4	8	16	32

23) Consider the equations below.

$y = x^2 - 1$

$y = 2x + 7$

Part I: Which ordered pair is a solution to the system of equations?

A. (4, 15)

B. (1, 0)

C. (15, 4)

D. (0, 7)

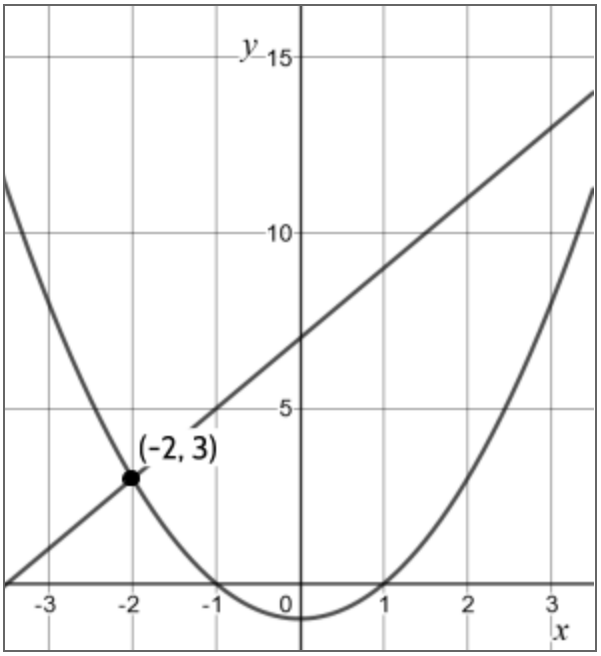
Part II: Why is the coordinate pair (-2, 3) important?

A. It isn't considered a solution because x is negative.

B. It is the only solution to the system of equations.

C. It shows the 2nd solution to the system of equations.

D. It is the only place where the line and the parabola intersect.



24) What are the factors of the expression $x^2 + x - 20$?

A. $(x + 5)$ and $(x + 4)$

B. $(x + 5)$ and $(x - 4)$

C. $(x - 5)$ and $(x + 4)$

D. $(x - 5)$ and $(x - 4)$

25) The height of a water-powered rocket at time t seconds is given by $h(t) = -6t^2 + 96t$.

$t = time$
$h = height\ in\ feet$

How high will the rocket be after 2 seconds?

A. 6 feet high

B. 96 feet high

C. 132 feet high

D. 168 feet high

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

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

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

C. a population of bacteria that doubles every 4.5 hours

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

27) Which scenario represents exponential growth?

A. A water tank is filled at a rate of 2 gallons/minute.

B. A species of fly doubles its population every month during the summer.

C. A vine grows 6 inches every week.

D. A car increases its distance from a garage as it travels at a constant speed of 25 miles per hour.

28) Lacey is saving up to buy a new phone. Every week she puts $20 into a jar. Which type of function best models the total amount of money in the jar after a given number of months?

A. linear

B. quadratic

C. exponential

D. square root

29) What is the percent change in the population modeled by $P(t) = 5,000 \cdot 1.01^{t}$, and is this exponential growth or decay?

A. 1%; exponential decay

B. 1%, exponential growth

C. 101%, exponential decay

D. 101%, exponential growth

30) The table below shows the end of the year balance in an investment account where interest is compounded annually. No money is deposited or withdrawn after the initial amount is deposited.

Year	Balance in dollars
0	$500.00
1	$525.00
2	$551.25
3	$578.81
4	$607.75
5	$638.14

Which type of function best models the given data?

A. linear function with negative rate of change

B. linear function with positive rate of change

C. exponential growth function

D. exponential decay function

31) The length of a rectangular window is 5 feet more than its width, w. The area of the window is 36 square feet. Which equation could be used to find the dimensions of the window?

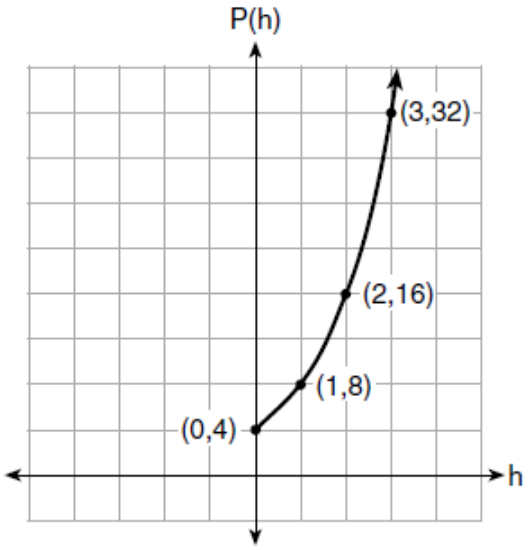
A. $w + 5w = 36$

B. $5w^2 + w = 36$

C. $w^2 + 5 = 36$

D. $w^2 + 5w = 36$

32) Liz collected population data, $P(h)$, from a colony of E. coli bacteria over time in hours, h, as shown in the graph.



Part I: Which equation matches the data in the graph?

A. $P(h) = 4h + 4$

B. $P(h) = 4h^2$

C. $P(h) = 4 \cdot 2^h$

D. $P(h) = 2 \cdot 4^h$

Part II: Over how many hours did Liz collect population data?

A. 3

B. 4

C. 16

D. 32

33) The highest possible grade for a book report is 100. The teacher deducts 10 points for each day the report is late. Which kind of function describes this situation?

A. linear

B. exponential growth

C. quadratic

D. exponential decay

34) Look at the graphs and then answer the questions below.

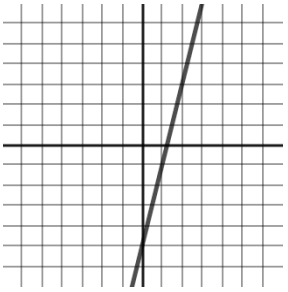
Part I: Which statement describing these graphs is false?

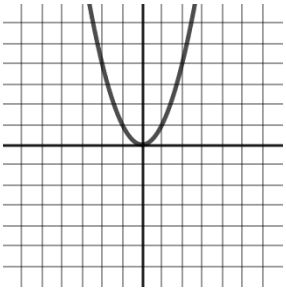
A. Graphs 1 and 4 represent linear functions.

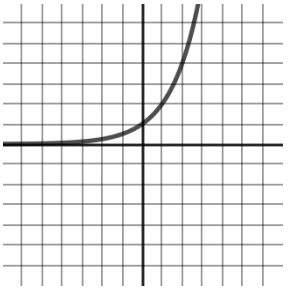
B. Graphs 2 and 3 represent nonlinear functions.

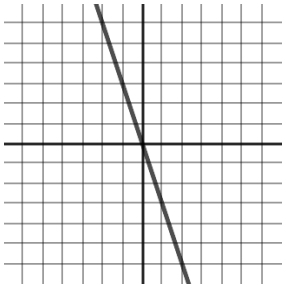
C. Graph 2 is a quadratic function.

D. Graph 3 shows a constant rate of change.

1. 

2. 

3. 

4. 

Part II: Which graph shows exponential growth?

A. 1

B. 2

C. 3

D. 4

Nonlinear Functions - Answer Key

1) C
2) Part I: B, Part II: D
3) D
4) C
5) Part I: C, Part II: C
6) D
7) C
8) D
9) D
10) 5
11) B
12) C
13) C
14) A
15) B
16) D
17) A
18) C
19) D
20) C
21) C
22) D
23) Part I: A, Part II: C
24) B
25) D
26) B
27) B
28) A
29) B
30) C
31) D
32) Part I: C, Part II: A
33) A
34) Part I: D, Part II: C