Math

Spring Operational 2016

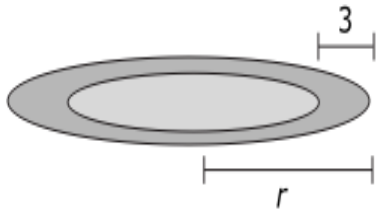
Algebra 1

Released Items

1.

M40236

A circular pool of water is shrinking as it drains. The diagram shows the shrinkage.



A formula for the area, A, of the circular pool is given by the equation $A = \pi(r-3)^2$.

Which is a formula for r?

- A. $r = \sqrt{\frac{A}{\pi}} - 3$
- B. $r = \frac{\sqrt{A}}{\pi} + 3$
- C. $r = \sqrt{\frac{A}{\pi}} + 3$
- D. $r = \sqrt{\frac{A}{\pi} - 3}$

2.

M41081

Determine all real roots of the equation $(x+7)(x^2-49)=0$.

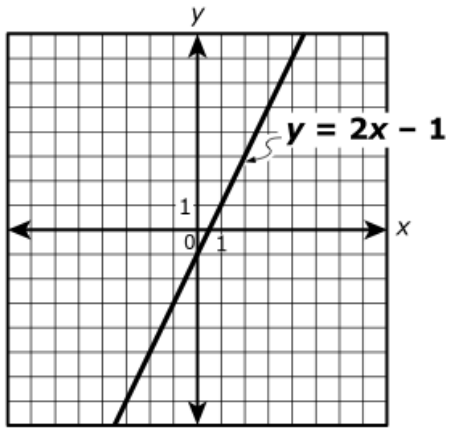
Drag and drop **all** real zeros of the equation into the box.

-49	-14	-7	-4	-3	0	3	4	7	14	49

[ ]

3. VF888002

The graph of the equation $y = 2x - 1$ is shown in the coordinate plane.



Which lists contain only points that lie on the graph of $y = 2x - 1$?

Select **each** correct answer.

- A. $(0, -1), (15, 29), (2, 3)$
- B. $(2000, 1999), (3, 5)$
- C. $(-2, -3), (-5, -9), (0, 0)$
- D. $(-0.5, -2), (0.3, -0.4), (0.5, 0)$
- E. $\left(\frac{1}{4}, -\frac{1}{2}\right), \left(\frac{4}{5}, \frac{3}{5}\right)$

4.

VH002128

The polynomial $(2x-1)(x^2-2)-x(x^2-x-2)$ can be written in the form ax^3+bx^2+cx+d, where a, b, c, and d are constants.

What are the values of a, b, c, and d?

Select from the drop-down menus to correctly complete each value.

$a =$ Choose...

$b =$ Choose...

$c =$ Choose...

$d =$ Choose...

-2
-1
0
1
2

5.

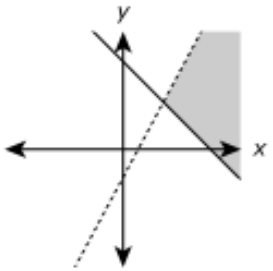
VH018304

Which graph **best** represents the solution to this system of inequalities?

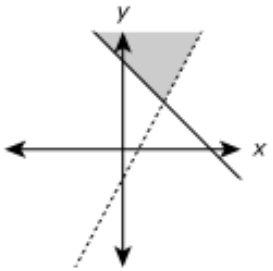
$x + y > 3$

$2x - y \geq 1$

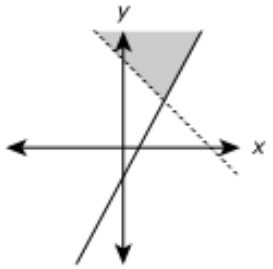
A.



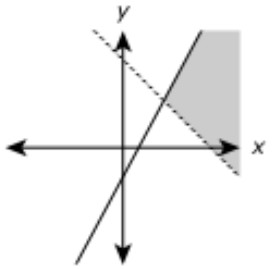
B.



C.



D.



6.

VF905588Y

Ian tosses a bone up in the air for his dog, Spot. The height, h, in feet, that Spot is above the ground at the time t seconds after she jumps for the bone can be represented by the function $h(t) = -16t^2 + 20t$. What is Spot's average rate of ascent, in feet per second, from the time she jumps into the air to the time she catches the bone at $t = \frac{1}{2}$ second?

Enter your answer in the box.

7.

VH002556

The parabola $f(x) = (x-2)^2 + 1$ is graphed in the *xy*-coordinate plane.

Part A

What is true about the vertex of the parabola?

- A. It is 2 units to the left of the origin and 1 unit down from the origin.
- B. It is 2 units to the right of the origin and 1 unit up from the origin.
- C. It is 2 units up from the origin and 1 unit to the right of the origin.
- D. It is 2 units down from the origin and 1 unit to the left of the origin.

Part B

How does the graph of the function $f(x+3)$ compare to the graph of $f(x)$?

- A. $f(x+3)$ has a vertical shift 3 units up from $f(x)$.
- B. $f(x+3)$ has a vertical shift 3 units down from $f(x)$.
- C. $f(x+3)$ has a horizontal shift 3 units to the right of $f(x)$.
- D. $f(x+3)$ has a horizontal shift 3 units to the left of $f(x)$.

Use the properties of rational and irrational numbers to answer each question.

Assume that only nonzero numbers are used.

Part A

Which of the statements is true?

- A. The sum of two irrational numbers is always irrational.
- B. The product of two irrational numbers is sometimes rational.
- C. The product of a rational number and an irrational number is sometimes rational.
- D. The sum of two rational numbers is sometimes irrational.

Part B

Which of the statements using operations on rational or irrational numbers always results in a rational number?

- A. Irrational + Irrational
- B. Irrational ÷ Irrational
- C. Rational + Irrational
- D. Rational ÷ Rational

9. M40416

In each equation, x represents domain and y represents range. Select **each** equation that represents a function.

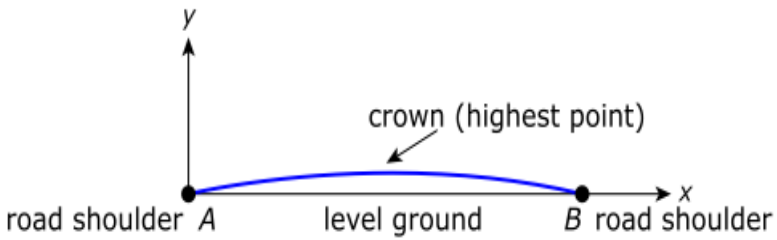
Select **all** that apply.

- [ ] A. $y = 7^x + 1$
- [ ] B. $y = \frac{1}{2}x - 3$
- [ ] C. $|y| = x$
- [ ] D. $y = |x| + 1$
- [ ] E. $y = \sqrt{x}$
- [ ] F. $y = -6^x + 6$

10.

M41815

Roadways are crowned to let rain run off to the shoulders of the road, as illustrated in the diagram.



The width of the roadway, AB, is 18 feet. A function f that models the curved road surface is $f(x) = -0.005x(x - 18)$.

Which of these statements are true?

Select **all** that apply.

- [ ] A. The y-coordinate of the crown occurs at $x = 9$.
- [ ] B. The crown is 9 feet above level ground.
- [ ] C. The y-coordinate of the crown is approximately 0.4.
- [ ] D. The x-intercepts of f are 0 and 18.
- [ ] E. The x-coordinate of the crown is the average of the x-intercepts of f.

11.

M44062P

Which equations have no real solutions?

Select **all** correct answers.

- ☐ A. $2(x-3)^2 = 0$
- ☐ B. $2(x+3)^2 + 4 = 1$
- ☐ C. $(x-1)^2 + 4 = 8$
- ☐ D. $(x+1)^2 + 4 = 2$
- ☐ E. $x^2 + 8x = -15$

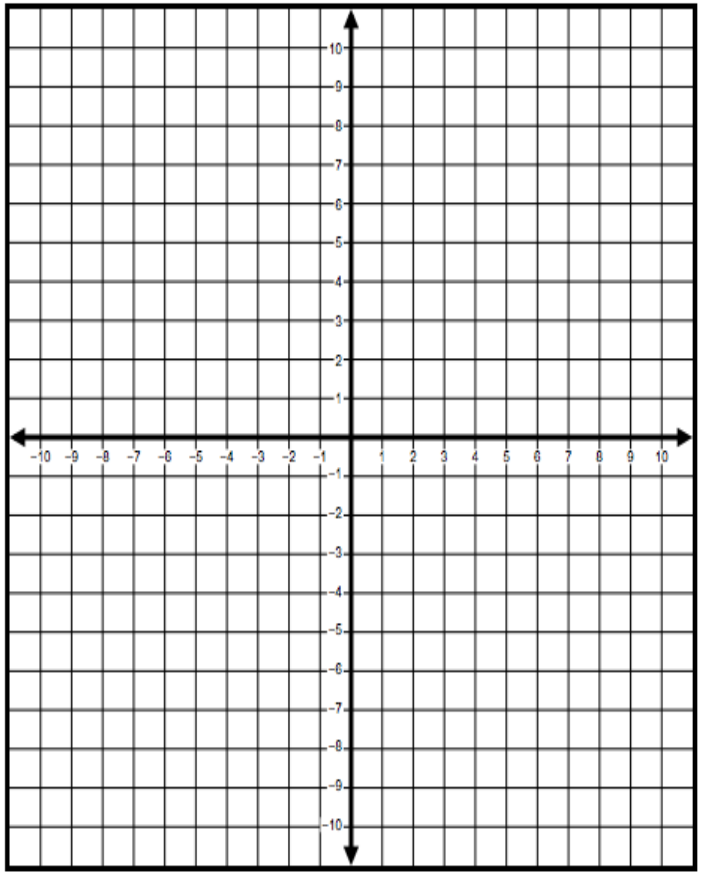
12.

VF799741

An absolute value function in the form $f(x) = a|x + b| + c$ is graphed in the *xy*-coordinate plane, where a, b, and c are constants.

Select the Absolute Value button and then drag the points to show the graph $f(x) = |6 - 3x| + 6$.

Absolute Value



13. VF814812

The vertex form of the equation of a quadratic function is $f(x) = a(x-h)^2 + k$, where a, h, and k are constants. Write the function $f(x) = -3x^2 + 18x - 21$ in vertex form.

Fill in the missing numbers of the vertex form of the function.

Enter your answers in the boxes.

$f(x) = \square\,(x - \square)^2 + \square$

14. VF820976

Use the quadratic equation $y = -2x^2 + 4x + 5$ to complete the statements.

Enter your answers in the boxes.

The equation can be rewritten as $y = -2(x + \square)^2 + \square$.

Therefore, the vertex of the graph of the function $y = -2x^2 + 4x + 5$ in the *xy*-coordinate plane is located at the point $(\square, \square)$.

15.

VF821048

For the equation $ax + c = bx + d$, where $a \neq b$ and $c \neq d$, what is x expressed in terms of a, b, c, and d?

Complete the expression for the value of x using the choices shown.

Drag and drop correct choices to the boxes.

$a + b$	$c + d$	$a - b$	$c - d$
$b - a$	$d - c$		

$$x = \frac{\square}{\square}$$

16.

VH000046

The expression $150\left(1.02^{h}\right)$ represents the number of bacteria in a laboratory experiment at time h, in hours. Which parts of the expression correspond to the number of bacteria at the start of the experiment, the hourly rate of growth, and the number of bacteria when $h = 1$?

Drag and drop the parts into the corresponding box. Not all the parts will be used.

$150(1.02)$	150	0.02	1.02	*h*

The number of bacteria at the start of the experiment	The rate of growth per hour	The number of bacteria when $h = 1$

17.

VH004225

The food service company at Central High School surveyed a sample of students about their lunch menu preferences. The results of the survey are shown in the two-way table.

	Sandwich	Pizza	Salad Bar	Total
Girls	4	5	7	16
Boys	6	8	1	15
Total	10	13	8	31

Let the quantities *A*, *B*, *C*, and *D* be defined as follows:

A: Of the students surveyed, the proportion who are girls
B: Of the students surveyed, the proportion who prefer pizza
C: Of the girls surveyed, the proportion who prefer pizza
D: Of the students surveyed who prefer pizza, the proportion who are girls

Which list orders the 4 quantities from least to greatest?

A. *B*, *A*, *D*, *C*

B. *B*, *C*, *A*, *D*

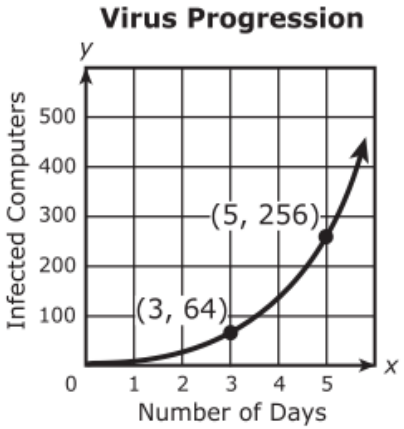
C. *C*, *B*, *A*, *D*

D. *C*, *D*, *B*, *A*

18.

M40009

The graph shows the number of computers that have been infected with a virus in the days since the computer virus was first reported.



Let *d* represent the number of days since the computer virus was first reported, and let $c(d)$ represent the number of computers infected. Which equations model this situation?

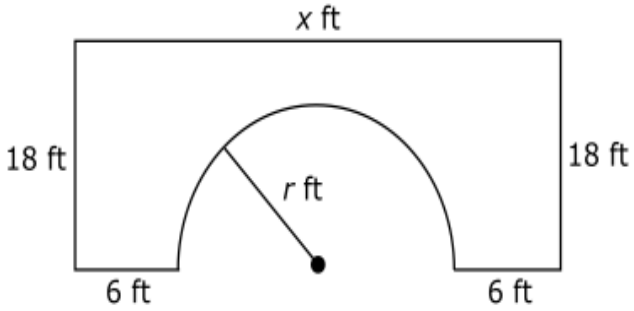
Select **each** correct equation.

- ☐ A. $c(d) = 2d + 246$
- ☐ B. $c(d) = 96d - 224$
- ☐ C. $c(d) = 2^{d+3}$
- ☐ D. $c(d) = (8)2^d$
- ☐ E. $c(d) = 4^d$
- ☐ F. $c(d) = 4^{d-1}$

19.

M40237P

The diagram represents a bridge over a river with an opening for boats to pass under the bridge.



The area, A, of the side view is given by $A = 18x - 0.5\pi r^2$. Which equation, in terms of A and x, represents the radius, r, of the bridge opening?

A. $r = \sqrt{\frac{18x - A}{2\pi}}$

B. $r = \sqrt{\frac{A - 18x}{0.5\pi}}$

C. $r = \sqrt{\frac{18x}{0.5\pi} - A}$

D. $r = \sqrt{\frac{2(18x - A)}{\pi}}$

20. VF441625

Matthew has a job where his daily pay P, in dollars, is given by the function $P(h) = 15h$, where h represents the number of hours worked that day. Last week, he worked 2 hours more on Tuesday than he did on Wednesday. If he worked c hours on Tuesday, which statements are true?

Select **all** that apply.

- ☐ A. $P(c)$ represents Matthew's pay, in dollars, on Tuesday.
- ☐ B. $15c$ represents Matthew's pay, in dollars, on Tuesday.
- ☐ C. $P(c-2)$ represents Matthew's pay, in dollars, on Wednesday.
- ☐ D. $15c-2$ represents Matthew's pay, in dollars, on Wednesday.
- ☐ E. $P(c)-P(c-2)$ represents how much more Matthew's pay was on Tuesday than on Wednesday.

21. VF580101

Enter your answers in the boxes to show the complete factorization of the expression $-5x^3+30x^2+35x$.

Enter your answers in the boxes.

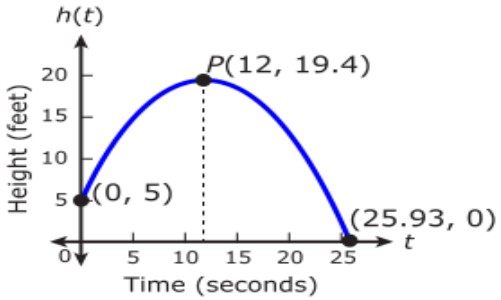
$-5x^3+30x^2+35x$

$-5x(x^2+\square x+\square)$

$-5x(x+\square)(x+1)$

Part A

A projectile is shot into the air. The altitude of the projectile after t seconds is modeled by the function graphed. Time t is measured in seconds and altitude $h(t)$ is measured in feet.



Which of these statements is true?

- A. The projectile reaches a maximum altitude of 12 feet.
- B. The projectile reaches its maximum altitude after 12 seconds of flight.
- C. The projectile is launched from the ground.
- D. The altitude of the projectile is increasing on the interval $5 < t < 20$.

Part B

The table models the flight of the projectile from Part A.

t	0	4	8	12	16	20	24
$h(t)$	5	13	17.8	19.4	17.8	13	5

Which of these statements is true?

- A. $h(4) < h(20)$
- B. The flight is symmetric about the line $t = 10$.
- C. The projectile will hit the ground at some value of t less than 24.
- D. If $0 < a < 12$, then $h(12 - a) = h(12 + a)$.

Part A

The slope Z of a line parallel to the line containing $(-3, 5)$ and $(7, n)$ is a function of n. Which equation(s) define(s) function Z?

Drag and drop **each** correct letter into the box.

A B C D E

A $Z(n) = \frac{n-5}{-10}$

B $Z(n) = \frac{n-5}{10}$

C $Z(n) = 0.1n - 5$

D $Z(n) = 0.1n - 0.5$

E $Z(n) = -\frac{1}{2} + \frac{1}{10}n$

Part B

Select any statement about Z and its graph that is true.

Drag and drop the letter of **each** correct statement into the answer box.

A B C D E F

A The domain of Z excludes the set of all negative numbers.

B Z is an increasing function for any interval in the domain of Z.

C The rate of change in Z, with respect to n, as n varies from 2 to 4, is 0.1.

D $Z(n)$ is a rational number for each value of n that is a natural number.

E The domain of Z is the set of all positive real numbers.

F Z is a linear function.

Consider the equation $y = x^2 + bx + 9$.

Part A

For each value of b, indicate if the quadratic equation will have 1 real root, 2 unique rational roots, 2 unique non-rational real roots, or no real roots when $y = 0$.

Select all appropriate cells in the table.

b	1 real root	2 unique rational roots	2 unique non-rational real roots	no real roots
-7	☐	☐	☐	☐
0	☐	☐	☐	☐
6	☐	☐	☐	☐
10	☐	☐	☐	☐

Part B

For what value of b will the graph of the quadratic equation have a vertex at $(1, 8)$?

Enter your answer in the box.

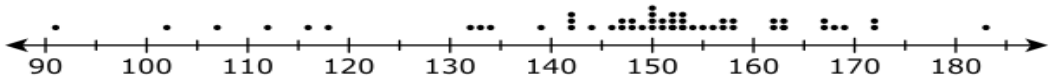
☐

25.

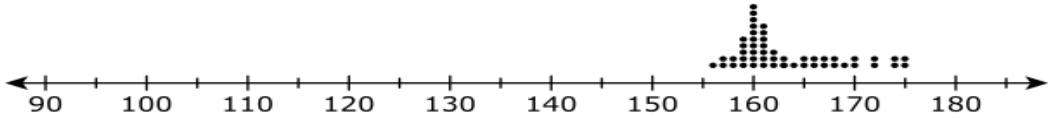
VH017862

A real estate agent recorded the home prices, in thousands of dollars, for 50 randomly selected homes in two communities, A and B. The dot plots display the recorded data.

Community A Home Prices, in Thousands of Dollars



Community B Home Prices, in Thousands of Dollars



Part A

Which statement **best** describes the relationship between the home prices in community A and community B?

- A. The homes in community A are typically more expensive and more consistent in price than those in community B.
- B. The homes in community A are typically more expensive and less consistent in price than those in community B.
- C. The homes in community A are typically less expensive and more consistent in price than those in community B.
- D. The homes in community A are typically less expensive and less consistent in price than those in community B.

Part B

Which of the listed home prices **most likely** represents the third quartile for the 50 home prices in community B?

- A. $160,000
- B. $165,000
- C. $167,000
- D. $170,000

Part A

The table shows the temperature t in degrees Fahrenheit recorded at a weather station h hours after midnight yesterday. If t is a function of h, what is the value of $t(2)$?

h	0	1	2	3
t	45	43	39	40

Enter your answer in the box.

$t(2) =$ ☐

Part B

Which statement is true based on the table in Part A?

Select the correct symbol.

$t(2)$ Choose... > < = $t(1)$

Students in a statistics class will perform the following experiment and then model it mathematically. They begin with a bag of 256 pennies and complete these steps:

1. Pour the pennies from the bag onto the floor.
2. Count the number of pennies that land heads up and record the number.
3. Put the pennies that landed heads up back into the bag and leave the rest on the floor.

Steps 1 to 3 constitute one trial of the experiment. Repeat trials until no pennies land heads up.

Part A

The students are asked to write functions that will model the number of pennies in the bag and on the floor throughout the experiment. The models will be best related to what type of function?

- A. linear
- B. quadratic
- C. exponential
- D. square root

Part B

Which of the equations best represents $f(n)$, the number of pennies put into the bag at the end of trial n, where $n \geq 1$?

- A. $f(n) = \sqrt{256 - n}$
- B. $f(n) = 256\left(\frac{1}{2}\right)^n$
- C. $f(n) = 256 - \frac{1}{2}n$
- D. $f(n) = \frac{(256-n)n}{2}$

Part C

What number of trials would the students **most likely** need to run until no pennies land heads up?

- A. 2
- B. 8
- C. 16
- D. 128

Part D

If $g(n)$ is a function that models the number of pennies on the floor at the end of trial n, where $n \geq 1$, which equation should be true?

- A. $f(n) \cdot g(n) = 1$
- B. $\frac{g(n)}{f(n)} = 2$
- C. $g(n) - f(n) = 128$
- D. $f(n) + g(n) = 256$

A local salsa company makes two types of salsa, tomato and corn. **Each** batch of tomato salsa takes 2 hours to prepare and 4 hours to package. **Each** batch of corn salsa takes 2.5 hours to prepare and 3 hours to package. There are 4 preparation workers and 7 packaging workers in the company. **Each** of them works 40 hours per week.

Part A

Create a system of two inequalities that relates the number of batches of tomato salsa, t, and the number of batches of corn salsa, c, that can be made by the 4 preparation workers and the 7 packaging workers each week. Assume $t \geq 0$ and $c \geq 0$. You must select **two** inequalities.

Select **two** inequalities.

- ☐ A. $2t + 2.5c \leq 160$
- ☐ B. $2t + 4c \leq 160$
- ☐ C. $2t + 4c \leq 280$
- ☐ D. $2.5t + 3c \leq 160$
- ☐ E. $4t + 3c \leq 160$
- ☐ F. $4t + 3c \leq 280$

Part B

Which combinations of batches of salsa could be made in one week based on the constraints?

Select **all** that apply.

- ☐ A. 20 tomato and 45 corn
- ☐ B. 30 tomato and 40 corn
- ☐ C. 45 tomato and 30 corn
- ☐ D. 50 tomato and 25 corn
- ☐ E. 60 tomato and 10 corn

Part C

In order to maximize productivity, how many batches of salsa should be made if the company owner wants 20 batches of corn salsa?

Enter your answer in the box.

[ ] batches of tomato salsa and 20 batches of corn salsa

Part D

The company owner decides to only make corn salsa one week prior to a local festival. Given the same constraints, what is the maximum number of batches of corn salsa that can be made in one week?

Enter your answer in the box.

[ ] batches of corn salsa

29.

VF648815

A set of points in the *xy*-coordinate plane meets two conditions, as described.

- Condition 1: The *y*-coordinate is positive.
- Condition 2: The sum of the coordinates is greater than -2 .

Part A

Create a system of inequalities described by the two conditions.

Enter your answer in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

Part B

A graph of the solution of the system includes points in different quadrants of the *xy*-coordinate plane. Explain why **all** points in the first quadrant are part of the solution.

Enter your explanation in the space provided.

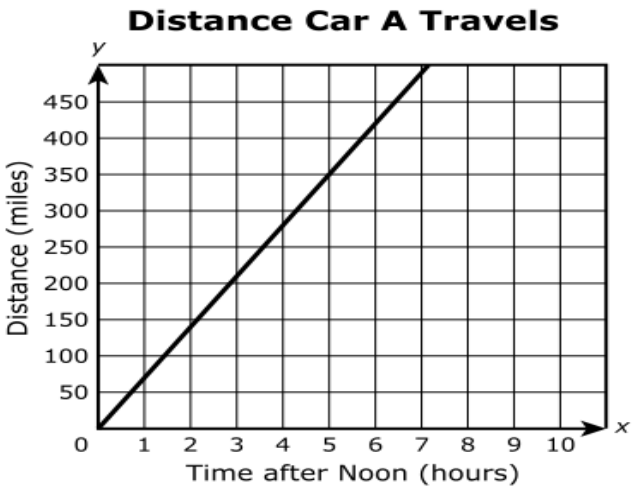
- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek

30.

VH000834

Three cars are traveling to the same campground along the same route. The cars began at the same place but at different times. Car A began the trip at noon, and cars B and C began the trip at different times before noon. The miles traveled by Cars A, B, and C are represented respectively, by the following graph, table, and equation.

Car A



Car B

Distance Car B Travels

Time after Noon (hours)	Total Distance
1	110
2	175
3	240
4	305
5	370

Car C

$$D = 68t + 20$$

where D is the total distance, in miles, traveled by car C, and t is the number of hours after noon.

At what time, if ever, will car A pass each of the other cars? Describe any assumptions you made and justify your answer.

Enter your answer, your description, and your justification in the space provided.

- Math symbols
- Relations
- Geometry
- Groups
- Trigonometry
- Statistics
- Greek