



Math

Spring Operational 2016

Algebra 2

Released Items

1.

M40209

Solve  $\frac{\sqrt{x+3.5}}{2} = 1.5$ .

Enter your answer in the box.











$x =$

2.

M41500

Given the expression  $\frac{4n^{2t}-1}{2n^t-1}$ , where  $t$  is an integer greater than or equal to 1, write the expression as a binomial.

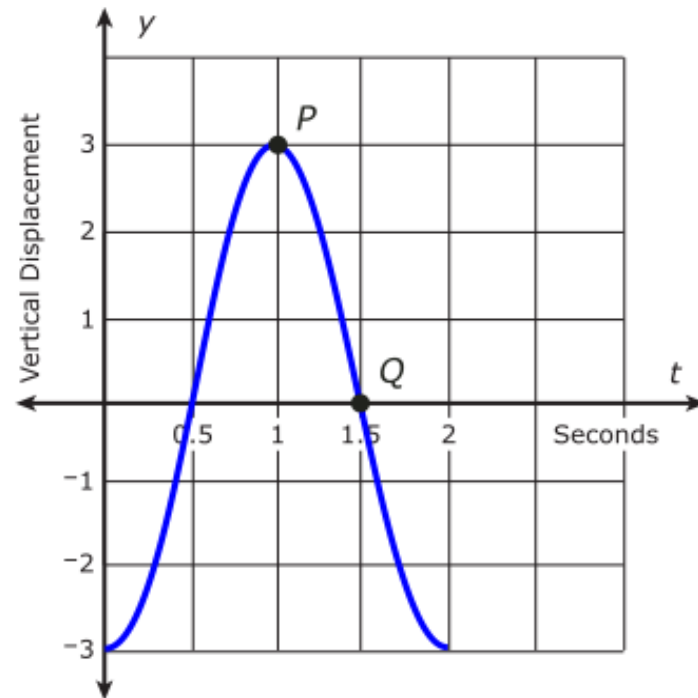
Enter your expression in the space provided. Enter **only** your expression.

						
	$y^x$	$\sqrt{\quad}$	$\sqrt[3]{\quad}$	$=$	$(-)$	$\%$
						

3.

M41917N

Suppose that a weight is attached to a hanging spring. When the weight is pulled down and released, it will bob up and down with vertical displacement from its original resting point. The graph shows a weight pulled down 3 centimeters and allowed to go up and down for 2 seconds.



Determine the average rate of change from point  $P$  to point  $Q$ .

Enter your answer in the box.

4.

M42110

Solve the quadratic equation  $(4x + 5)^2 = -5(5 + 4x)$ .

Select from the drop-down menus to correctly complete the sentence.

The solutions are  and .

-2.5  
-1.5  
-1.25  
-1  
1  
1.25  
1.5  
2.5

-2.5  
-1.5  
-1.25  
-1  
1  
1.25  
1.5  
2.5

5.

VF498521

In the table shown,  $i$  represents the imaginary unit. Select **all** cells in the table for which the product of the row value and the column value is a real number.

Select all appropriate cells in the table.

Value	$-3$	$-2i$	$5$	$i^2$
$i$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
$-4$	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

6.

VF649142

In the numbers listed,  $i$  represents the imaginary unit. For each number, indicate if it is equal to 1, to  $-1$ , or to neither by dragging it to one of the boxes in the appropriate column.

Drag and drop each number into the appropriate box.

$$(2 + i)^2$$

$$i^6$$

$$-1i$$

$$i^2 (i^{10})$$

**Equal to 1**

**Equal to  $-1$**

**Neither**

7.

VF808972

Which of the quadratic equations listed do **not** have any real solutions?

Drag and drop each appropriate equation into the box.

$$x^2 - 10x + 34 = 0$$

$$3x^2 = 4x - 10$$

$$x^2 - 3x = 0$$

$$-7x + 18 = x^2$$

$$6x^2 + 11x - 35 = 0$$

Equations with no real solutions

8.

VF902791

In the equation  $\left(5^{\frac{1}{3}}\right)\left(5^{\frac{2}{3}}\right)^4 = 5^x$ , what is the value of  $x$ ?

Enter your answer in the box.

$x =$

9.

VH002299

$$f(x) = \frac{(x^{-2})^3}{\left(x^{\frac{1}{4}}\right)^8}$$

Which of the listed functions is equivalent to  $f(x)$  for all positive values of  $x$ ?

- A.  $g(x) = x^4$
- B.  $g(x) = x^8$
- C.  $g(x) = \frac{1}{x^4}$
- D.  $g(x) = \frac{1}{x^8}$

10.

M40311

For an unknown polynomial function  $p(x)$ ,  $p(4) + 2 = 2$ . Which binomial is a factor of  $p(x)$ ?

- A.  $x - 2$
- B.  $x + 2$
- C.  $x - 4$
- D.  $x + 4$

The amount of a certain element that remains after  $t$  hours can be determined using the expression  $5(0.5)^{\frac{t}{64}}$ . Which expression can be used to find the approximate amount of the element that remains after  $m$  minutes?

- A.  $5(0.5)^{\frac{60m}{64}}$
- B.  $5(0.5)^{\frac{64m}{60}}$
- C.  $5(0.5)^{\frac{m}{64}}$
- D.  $5(0.5)^{\frac{m}{60-64}}$



12.

M42267P

Given:  $y = f(x) = |x - 3|$

and  $y = g(x) = x^2 - 5x + 6$

At what points do  $f(x)$  and  $g(x)$  intersect?

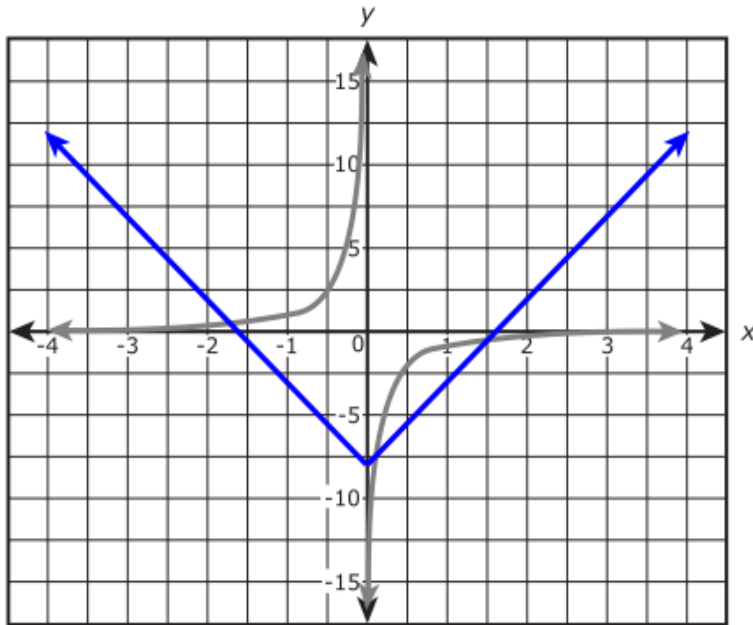
Select **all** that apply.

- A.  $(-3, 6)$
- B.  $(-1, 4)$
- C.  $(1, 2)$
- D.  $(1, 4)$
- E.  $(3, 0)$

13.

M42285

The graph of the system  $\begin{cases} y = |5x| - 8 \\ y = -x^{-1} \end{cases}$  is shown.



Shown are several ordered pairs that could be solutions to the system.

Drag and drop each correct solution into the box.

(0.14, -7.32)	(0.14, 7.32)	(-1.46, -0.68)
(1.46, -0.68)	(-0.14, -7.32)	(-1.72, 0.58)

The rational expression  $\frac{x^3-4x^2+6}{x^2+2x}$  can be written as  $ax + b + \frac{cx+d}{x^2+2x}$ ,  
where  $a$ ,  $b$ ,  $c$ , and  $d$  are constants.

What are the values of  $c$  and  $d$ ?

Enter your answers in the boxes.

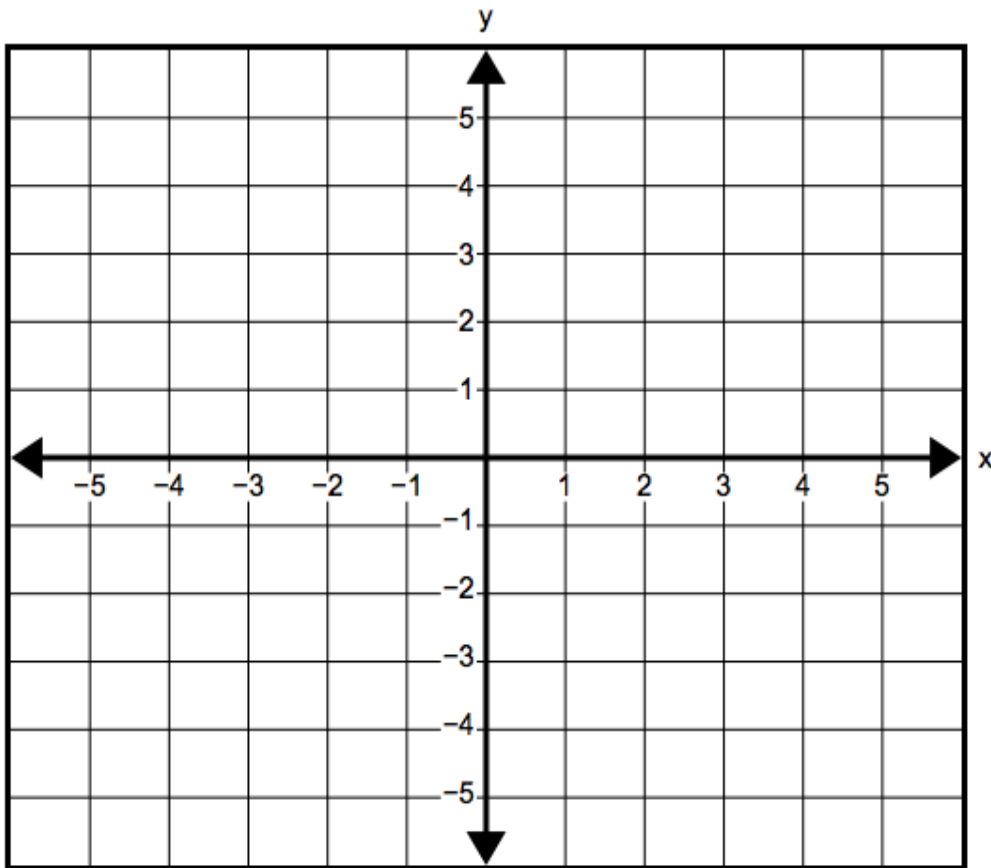
$$c = \boxed{\phantom{00}}$$

$$d = \boxed{\phantom{00}}$$

15.

VF811773

Plot two points on the  $xy$ -coordinate plane to represent the  $x$ - and  $y$ -intercepts for the function  $f(x) = \log_2(x + 2)$ .



Jim is starting a new company and decides to send a promotional e-mail offering a free sample of his product to anyone who receives the e-mail. His plan is to send the promotional e-mail to 128 contacts with a request to forward the e-mail to 3 different people.

**Part A**

Suppose that Jim sends the initial e-mail to 128 contacts on day 1. On day 2, each recipient sends the e-mail to 3 different people. On day 3, each of the **new** recipients sends the e-mail to 3 different people. If the process continues, how many e-mails will be sent on day 7?

Enter your answer in the box.

The number of e-mails sent on day 7 will be  .

**Part B**

If the process continues, what is the total number of Jim's promotional e-mails that would have been sent by day 7?

Enter your answer in the box.

The total number of e-mails sent by the end of day 7 will be  .

The population of a certain city was 25,000 in 2010 and decreased by 4% each year afterward.

### Part A

The population can be modeled by an exponential function of the form  $y = ab^x$ , where  $x$  represents the number of years since 2010. What are the values of  $a$  and  $b$ ?

Enter your answers in the boxes.

$a =$

$b =$

### Part B

Select the appropriate option from each drop-down menu to complete the sentence about the graph of the function.

Select from the drop-down menus to correctly complete the sentence.

The  is indicated by the

In electronics, a capacitor stores electrical energy for future use. As a capacitor is charging, the current across the capacitor decreases exponentially. Suppose that the current across a capacitor decreases from 10 milliamperes (mA) to 2.5 mA in 120 milliseconds (ms) as the capacitor is charging.

Enter your answers in the boxes.

From the information provided, the half-life of the current is  ms.

The amount of current across the capacitor 180 ms after the capacitor begins charging is  mA.

**Part A**

Diane owns a store that sells computers. Her profit, in dollars, is represented by the function  $P(x) = x^3 - 22x^2 - 240x$ , where  $x$  is the number of computers sold.

Diane hopes to make a profit of at least \$10,000 by the time she sells 36 computers. Explain whether or not Diane will meet her goal. Justify your reasoning.

Enter your explanation and your justification in the space provided.



▶ Math symbols

▶ Relations

▶ Geometry

▶ Groups

▶ Trigonometry

▶ Statistics

▶ Greek

**Part B**

Diane states that there are three possible values of  $x$  for which she will have a profit of \$0. Find the values of  $x$  that produce a zero profit to show whether Diane is correct or not. Justify your reasoning.

Enter your answer and your justification in the space provided.



▶ Math symbols

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A medical test is often used to determine if a person has an allergy. If the test detects the allergy, the result is positive; if the test does not detect the allergy, the result is negative. However, results are not always accurate. Sometimes the result is positive when the person does not have the allergy. Such results are called false positives. Sometimes the result is negative when the person does have the allergy. Such results are called false negatives. Consider the described situation.

It is estimated that 5 percent of the population has a certain allergy. There are two medical tests, R and S, available to determine if a person has the allergy. If a person does have the allergy, the probability that test R will be positive is 0.9, and the probability that test S will be positive is 0.8. However, if the person does **not** have the allergy, the probability that test R will be negative is 0.7 and the probability that test S will be negative is 0.8.

### Part A

Suppose a group of 200 randomly selected people are to be given test R, and a different group of 200 randomly selected people are to be given test S. Assume that the percent of people with the allergy in each group reflects that of the population. Complete the tables to show the expected number of people for each result based on the probabilities of the tests.

Enter your answers in the boxes.

**Results of Test R**

	Positive Result	Negative Result	Total
Number with Allergy	9	1	10
Number without Allergy	<input type="text"/>	<input type="text"/>	190
Total	<input type="text"/>	<input type="text"/>	200

**Results of Test S**

	Positive Result	Negative Result	Total
Number with Allergy	<input type="text"/>	<input type="text"/>	10
Number without Allergy	<input type="text"/>	<input type="text"/>	190
Total	<input type="text"/>	<input type="text"/>	200

### Part B

Find the estimated percent of false positives and false negatives for **each** of the two tests.

Enter your answers in the space provided. Enter **only** your answers.



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### Part C

Suppose you are a doctor who must decide which test to administer to a patient. Which test, R or S, would you choose? Justify your decision by using data from the tables and by discussing the consequences of error.

Enter your answer and your justification in the space provided.



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An analyst studying the population of a town determines that the population can be modeled by the formula  $f(t) = 120,000(1.015)^t$ , where  $f(t)$  represents the population after  $t$  years.

A city council member makes this claim:

“Based on the formula, after 1 year the population will have increased by 1,800. Since 1,800 divided by 12 is 150, we can use the fact that the population increases by 150 people per month to predict the future population of the town.”

Explain why the city council member’s claim is or is not a valid way to predict the population.

Modify the initial given formula such that it represents the predicted population after  $m$  months, and use the modified formula to predict the population after 50 months.

Enter your explanation, your work, and your answer in the space provided.



▶ Math symbols

▶ Relations

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