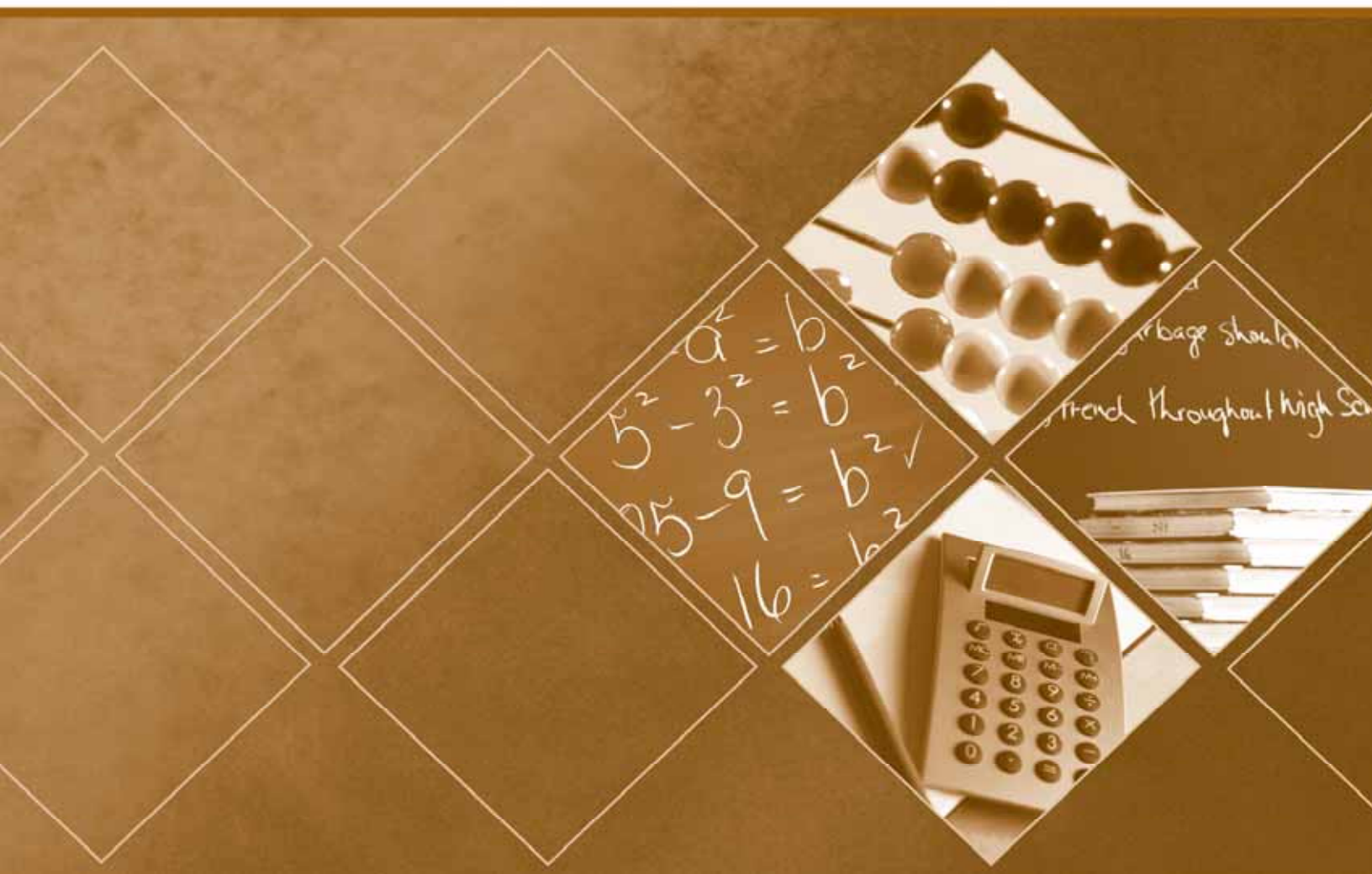


# American Diploma Project

**ALGEBRA II**  
End-of-Course Exam

**RELEASED ITEMS**  
**OCTOBER 2008**



## Released Items

The following released items are intended to offer insight into the notation, format and expectations of this exam. These items are a sample of items that appeared either as operational or field-test items in the Spring 2008 administration. All of the items being released in this document have been reviewed by both a content review committee and a data review committee of professional educators.

Items 1-14 in this item release document appeared in the non-calculator portion of the exam, and items 15-30 appeared in the calculator portion of the exam. Items of all types—multiple choice (MC), short answer (SA), or extended response (ER)—are represented in this document. However, both ER items in this document are in the calculator section. All three item types will be represented in both the calculator and non-calculator sessions on the actual Algebra II End-of-Course Exam. Students will know whether an item is a short-answer (two-point) item or extended-response (four-point) item by the amount of work space provided in the answer document. The work space provided in the answer document for a short answer item is about one-half page, while work space for an extended-response item is about one full page.

It should be noted that not all items found on the calculator portion of the exam require the use of a calculator. It is important that students learn to assess for themselves whether or not a calculator would be helpful. Students should be able to solve test problems in multiple ways, with and without a calculator, as most of the presented items could have appeared in either section.

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## Non-Calculator Session

### Multiple Choice

1 The numbers  $i\sqrt{3}$  and  $-i\sqrt{3}$  are solutions to which of the following equations?

A.  $p^2 + \sqrt{3} = 0$

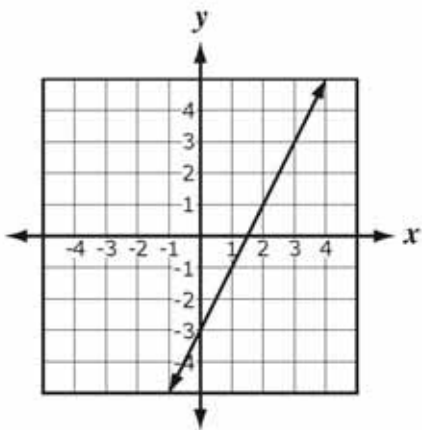
B.  $p^2 + 3 = 0$

C.  $p^2 + 9 = 0$

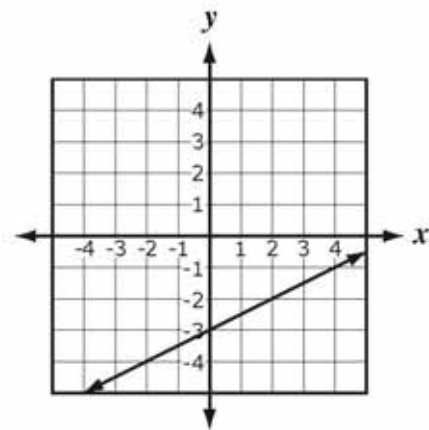
D.  $p^2 - 9 = 0$

2 Which graph represents the inverse of  $f(x) = 2x - 3$ ?

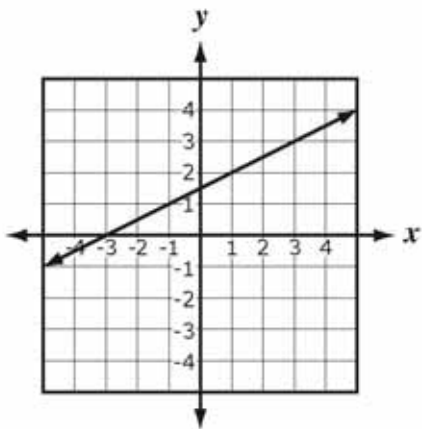
A.



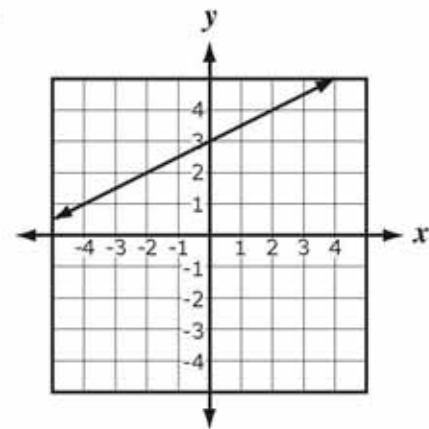
B.



C.



D.



3 Given  $r$ ,  $s$ , and  $t$  are positive integers, which of the following is equivalent to  $r^{\left(\frac{-s}{t}\right)}$ ?

A.  $-\sqrt[t]{r^s}$

B.  $\sqrt[s]{r^t}$

C.  $-\frac{1}{\sqrt[s]{r^t}}$

D.  $\frac{1}{\sqrt[t]{r^s}}$

4 How many solutions does the equation  $|-1 + 3x| - 5x = 9$  have?

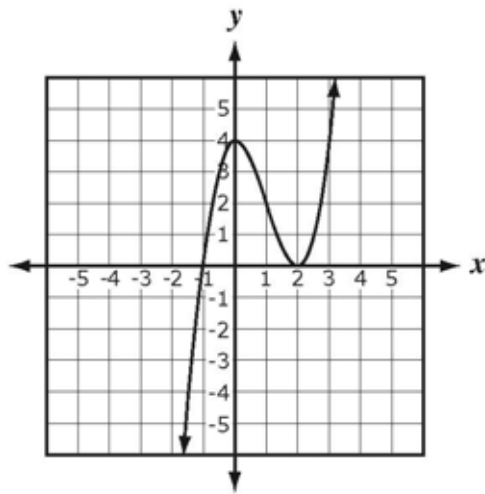
A. 0

B. 1

C. 2

D. 3

- 5 The graph of a polynomial function  $f(x)$  is shown below.

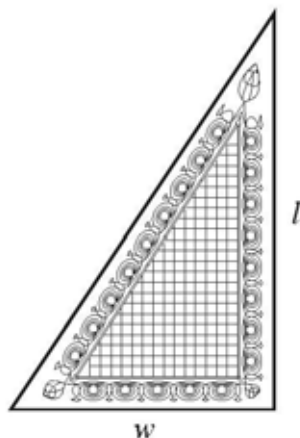


What could be the factorization of the polynomial  $f(x)$ ?

- A.  $(x - 1)(x + 4)(x + 2)$
- B.  $(x + 1)(x - 4)(x - 2)$
- C.  $(x + 1)(x - 2)(x - 2)$
- D.  $(x)(x + 1)(x - 2)$

Short Answer

- 6 The area of a right triangular rug is 12 square feet. The length ( $l$ ) of the rug is 2 feet more than the width ( $w$ ) of the rug.



Find the width of the right triangular rug. Show or explain your work.

- 7 Graph  $f(x) = \frac{4}{x^2}$ . Label the axes and scales used to construct the graph.

Multiple Choice

- 8 Consider the table below.

**Function Characteristics**

Characteristic	$f(x)$
Domain	all real numbers
Range	$y > 1$
Intercept	$(0, 2)$
Asymptote	$y = 1$
As $x$ approaches $+\infty$	$y$ approaches $+\infty$
As $x$ approaches $-\infty$	$y$ approaches 1

Which function has the characteristics described in this table?

- A.  $f(x) = 2^x$
- B.  $f(x) = -2^x$
- C.  $f(x) = 3^x + 1$
- D.  $f(x) = -3^x + 1$
- 9 What is the slope of the graph of  $f(x) = -\frac{1}{2}|x - 1| + 4$  when  $x < 1$ ?

- A. -2
- B.  $-\frac{1}{2}$
- C.  $\frac{1}{2}$
- D. 2

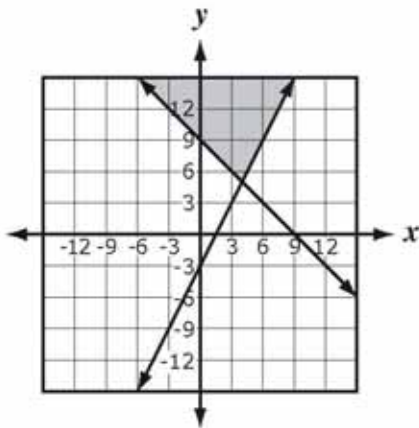
10 Consider the system of inequalities below.

$$y \geq 2x - 3$$

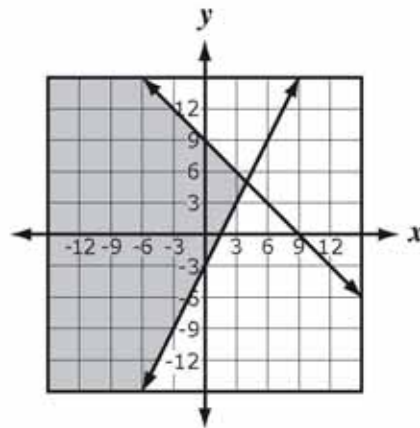
$$y \leq -x + 9$$

Which graph represents this system?

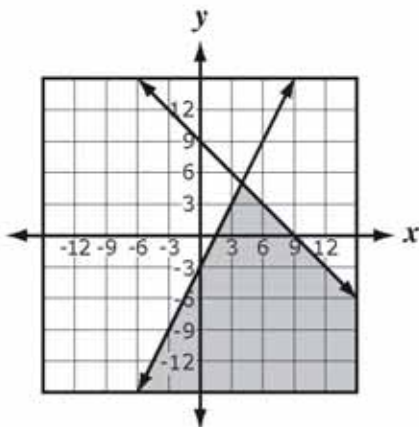
A.



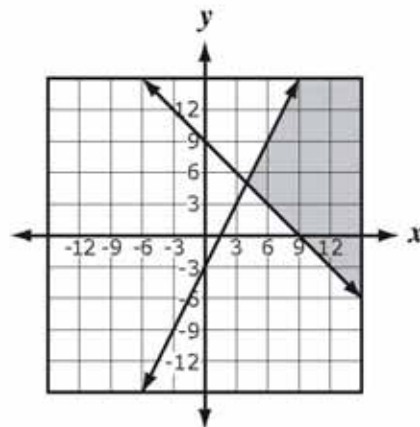
B.



C.



D.



- 11 A website uses the following table to calculate the shipping charge ( $S$ ) of an order based on the order's total cost ( $c$ ).

**Shipping Charges**

Order Total Cost ( $c$ )	Shipping Charges ( $S$ )
Up to \$14.99	\$5.00
\$15.00–24.99	\$7.00
\$25.00–34.99	\$9.00
\$35.00–44.99	\$11.00
\$45.00–54.99	\$13.00

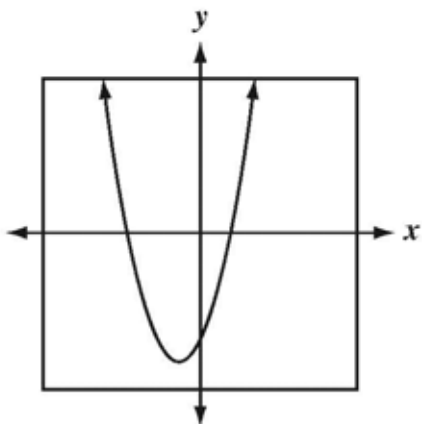
Which greatest integer function can be used to compute the accurate shipping charges based on the information in this table?

- A.  $S(c) = 5 + 2[c - 15]$
- B.  $S(c) = 5 + 2\left[\frac{c}{15}\right]$
- C.  $S(c) = \begin{cases} 5, & 0 < c < 15 \\ 5 + 2\left[\frac{c-5}{10}\right], & c \geq 15 \end{cases}$
- D.  $S(c) = \begin{cases} 5, & 0 < c < 15 \\ 5 + 2\left[\frac{c-15}{10}\right], & c \geq 15 \end{cases}$
- 12 A quadratic equation in the form  $ax^2 + bx + c = 0$ , where  $a$ ,  $b$ , and  $c$  are non-zero real numbers, has a negative discriminant. What are the solutions to this equation if  $m$  and  $n$  are non-zero real numbers?
- A.  $x = m$  and  $x = n$
- B.  $x = m + ni$  and  $x = m - ni$
- C.  $x = m + n$  and  $x = m - n$
- D.  $x = m + ni$  and  $x = -m - ni$

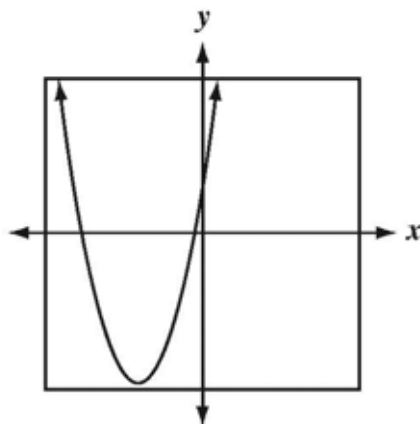


- 13 Which graph could represent the function  $f(x) = -ax^2 + bx + c$ , where  $a$ ,  $b$ , and  $c$  are positive integers?

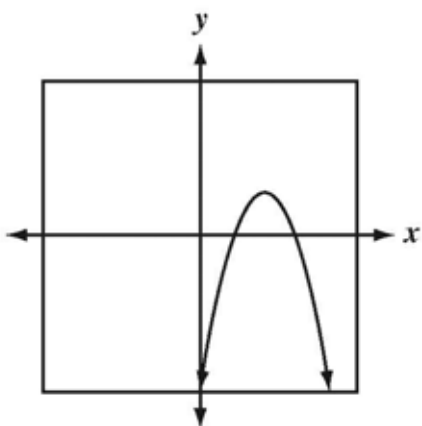
A.



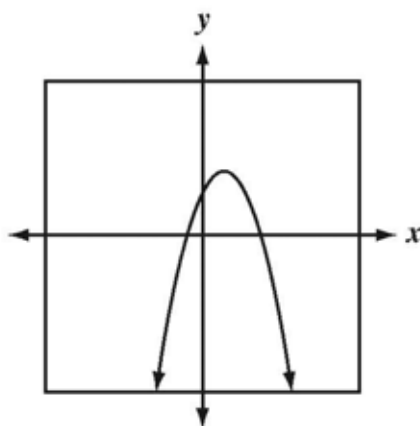
B.



C.



D.



Short Answer

- 14 A cube that measures 4 inches on each side is increased by  $m$  inches on each side.

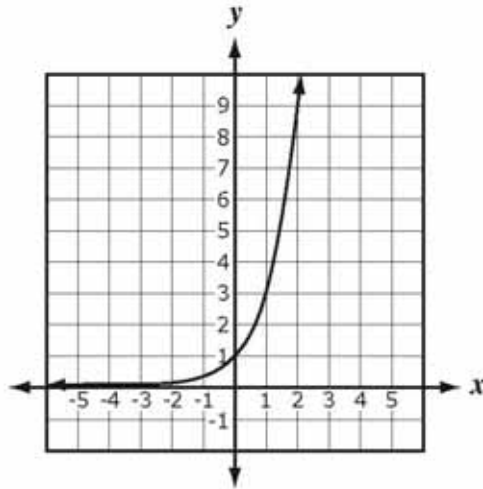
**Part A** Determine the expression for the volume of the new cube in terms of its side.

**Part B** Expand the expression for the volume of the new cube in terms of its side. Show or explain your work.

## Calculator Session

Multiple Choice

- 15 The graph of  $f(x) = 3^x$  is shown below.



The graph of which of the following functions intersects the  $x$ -axis?

- A.  $f(x) = -3^x$
- B.  $f(x) = 3^{-x}$
- C.  $f(x) = 3^{x-4}$
- D.  $f(x) = 3^x - 4$

- 16 The formula below can be used to determine the period ( $T$ ) of a pendulum in seconds, given the pendulum's length ( $L$ ) in meters.

$$T = 2\pi\sqrt{\frac{L}{9.8}}$$

Which expression can be used to determine the length ( $L$ ) of a pendulum given its period ( $T$ )?

- A.  $L = 2\pi\frac{T^2}{9.8}$
- B.  $L = 4\pi^2\frac{T^2}{9.8}$
- C.  $L = 9.8\frac{T^2}{2\pi}$
- D.  $L = 9.8\frac{T^2}{4\pi^2}$
- 17 At an amusement park Lisa rides The Plunger and The Skydiver. These rides take people up to a certain height and then let them drop to experience free-fall. As Lisa starts her drop for either ride, the function  $h(t) = -16t^2 + h_0$  describes her height in feet as a function of time in seconds, where  $h_0$  is her initial height. She reaches the bottom of The Plunger's 144-foot drop 1.5 seconds faster than she reaches the bottom of The Skydiver's drop. What is the height of The Skydiver's drop in feet?
- A. 180
- B. 216
- C. 324
- D. 468

18 Consider the functions below.

$$k(x) = \frac{1}{\sqrt{x-6}}$$

$$m(x) = 3x$$

What is the domain of  $k(m(x))$  over the set of real numbers?

- A.  $x > 0$
- B.  $x > 2$
- C.  $x > 6$
- D. all real numbers

19

Simplify  $\frac{\frac{a-b}{b^2}}{\frac{a^2-b^2}{b}}$ .

A.  $\frac{1}{ab-b^2}$

B.  $\frac{1}{ab+b^2}$

C.  $\frac{a^2-2ab+b^2}{b^2}$

D.  $\frac{a^3-a^2b-ab^2+b^4}{b^3}$

- 20 The characteristics of  $p(x) = ax^b$  are listed in the table below.

**Characteristics of  $p(x)$**

Characteristic	$p(x)$
Domain	All real numbers except 0
Range	All real numbers except 0
As $x$ approaches $+\infty$	$y < 0$ and approaches 0
As $x$ approaches $-\infty$	$y > 0$ and approaches 0

What must be true about the values of  $a$  and  $b$ ?

- A.  $a < 0$ ,  $b < 0$ , and  $b$  must be even
- B.  $a < 0$ ,  $b > 0$ , and  $b$  must be even
- C.  $a < 0$ ,  $b < 0$ , and  $b$  must be odd
- D.  $a > 0$ ,  $b < 0$ , and  $b$  must be odd

Short Answer

- 21 The amount of federal income tax a single person with a taxable income of \$77,100 or less must pay is listed below.
- 10% of taxable income up to \$7,825
  - 15% of taxable income more than \$7,825 up to \$31,850
  - 25% of taxable income more than \$31,850 up to \$77,100

Write a piecewise function to give the total amount of federal income tax a single person owes with a taxable income of  $x$ .

Extended Response

- 22 A cell phone company predicts monthly profit using the equation

$P(x) = -0.6x^2 + 30x + 150$  where  $P(x)$  is the monthly profit in thousands of dollars, and  $x$  is the amount spent on advertising in thousands of dollars.

**Part A** What amount should the company spend on advertising to maximize the monthly profit? Show or explain your work.

**Part B** Predict the maximum monthly profit. Show or explain your work.

**Part C** To the nearest dollar, what is the maximum amount the company can spend on advertising and still have a positive profit? Show or explain your work.

Multiple Choice

- 23 Which expression shows  $\frac{-4x^3 + 14x^2 - 6x}{-6x^2 + 36x - 54}$  in simplest form?

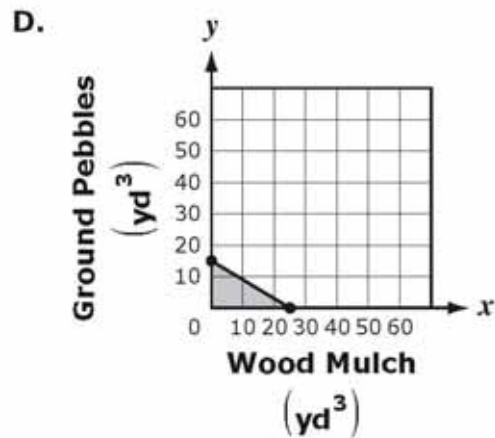
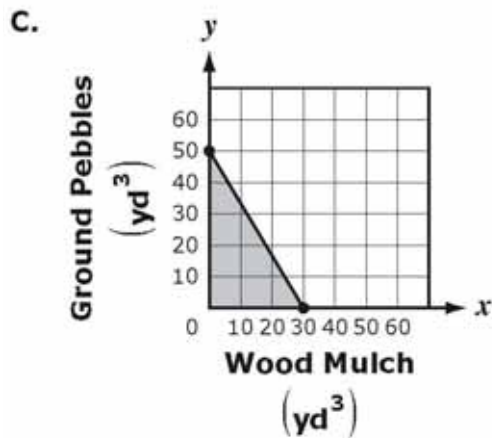
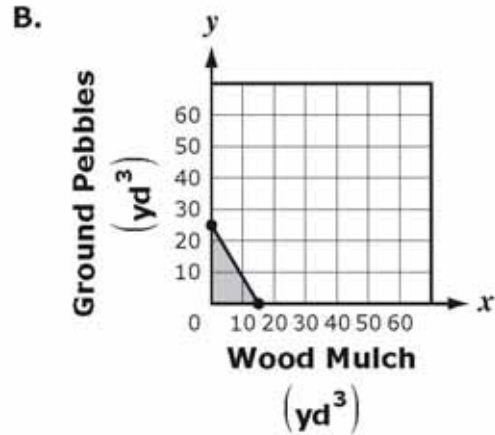
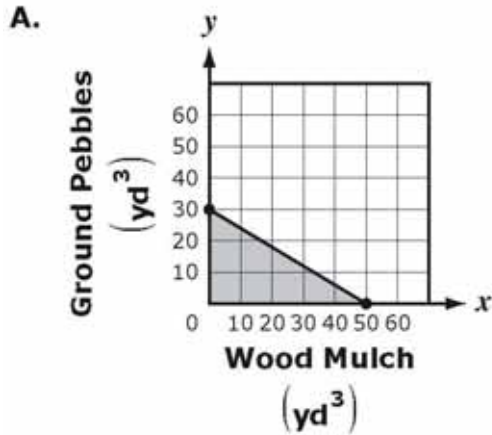
A.  $-4x^3 - \frac{58}{27}$

B.  $\frac{2x^2 - x}{3x - 9}$

C.  $\frac{2}{3}x + \frac{7}{18}x + \frac{1}{9}x$

D.  $\frac{2x^3 - 7x^2 + 3x}{3x^2 - 18x + 27}$

- 24 Halley wants to buy two different types of ground coverings for her yard. She plans to spend no more than \$750 in all. She found wood mulch for \$30 per cubic yard and ground pebbles for \$50 per cubic yard, taxes included. Which of these graphs best represents the numbers of cubic yards of each type of ground covering Halley can buy?



- 25 The roots of a quadratic function are  $x = -2 \pm \sqrt{7}$ . Find the  $x$ -value of the vertex of the corresponding parabola.

- A. -4  
 B. -2  
 C. -1  
 D. 0

- 26 The function listed below describes a family of exponential functions.

$$f(x) = 3^x + c$$

Which table corresponds to this family function?

A.

$x$	0	1	2	3	4
$f(x)$	1	4	7	10	13

B.

$x$	0	1	2	3	4
$f(x)$	2	4	10	28	82

C.

$x$	0	1	2	3	4
$f(x)$	1	2	9	28	65

D.

$x$	0	1	2	3	4
$f(x)$	2	3	5	9	17

- 27 Given non-zero real numbers  $a$  and  $b$ , for which of the following values of  $x$  is  $x(a+bi)$  a real number?

- A.  $i^2$
- B.  $-bi$
- C.  $a-bi$
- D.  $-(a+bi)$



- 28 The number of cells in a bacteria culture doubles every hour. If there were 500 bacteria cells in a culture at the start of an observation, how many hours will it take to have 50,000 cells in the culture?
- A. 1.70
  - B. 2.35
  - C. 6.64
  - D. 9.97
- 29 A quadratic function is represented by  $f(x) = a(x - h)^2 + k$ , where  $a$ ,  $h$ , and  $k$  are non-zero real numbers. Which of the following changes will have no effect on the values of the real zeros for a function in this form?
- A. adding 2 to  $k$
  - B. adding  $-1$  to  $h$
  - C. multiplying  $a$  by  $-1$
  - D. multiplying the function by 2

Extended Response

- 30 The average price of a gallon of gasoline in the United States on January 1, 2006, was \$2.238. On January 1, 2007, the average price of a gallon of gasoline was \$2.334.
- Part A** By what percent did the price increase from January 1, 2006, to January 1, 2007?
- Part B** Write a formula giving the price of a gallon of gasoline in terms of the number of years following 2006 if gasoline prices continue to increase exponentially at the annual rate found in Part A.
- Part C** Use your formula to predict the year when the price of a gallon of gasoline in the United States will reach \$10. Show or explain your work.