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# Mid-Year Test

*For use after Chapters 1–7*

## Multiple Choice **Choose the letter of the correct answer.**

**1.** Which number is the largest?

Ⓐ 2.3 Ⓑ $\sqrt{5}$ Ⓒ 2 Ⓓ $\frac{5}{2}$

**2.** Which of the following expressions equals $2(x - y) - 3(y + x)$?

Ⓕ $5y - x$ Ⓖ $-x - 5y$

Ⓗ $x - 5y$ Ⓙ $5x + y$

**3.** What is the solution of $3 \cdot (x - 2) + 5 = 4(x - 1)$?

Ⓐ 3 Ⓑ $-\frac{7}{2}$ Ⓒ 7 Ⓓ $-3$

**4.** John is 6 years old, and his sister Laura is 14. Their mother is 42 years old. In how many years will the sum of the ages of John and Laura equal the age of the mother?

Ⓕ 8 years Ⓖ 28 years

Ⓗ 22 years Ⓙ 64 years

**5.** A car traveled $s$ miles in the city and $t$ miles on the highway and traveled a total distance of 350 miles. The car's fuel efficiency is 30 miles per gallon in the city and 25 miles per gallon on the highway. What expression represents $g$, the number of gallons of gasoline used in the trip?

Ⓐ $g = 30s + 25(350 - s)$

Ⓑ $g = \frac{s}{30} + \frac{350 - s}{25}$

Ⓒ $g = 19{,}250$

Ⓓ $g = \frac{30}{s} + \frac{25}{350 - s}$

**6.** Which compound inequality is graphed below?


Ⓕ $-1 < x < 2$ Ⓖ $-1 < x \leq 2$

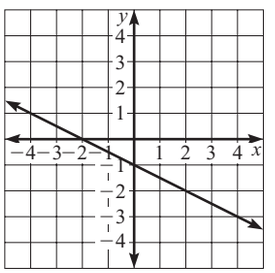
Ⓗ $x \leq -1$ or $x > 2$ Ⓙ $x < -1$ or $x \geq 2$

**7.** The relation given by the ordered pairs $(-5, 2)$, $(-1, 0)$, $(1, 4)$ and $(4, 3)$ is a function. Which ordered pair can be included with this relation to form a new relation that is also a function?

Ⓐ (1, 3) Ⓑ (4, 5)

Ⓒ $(-1, -1)$ Ⓓ (0, 1)

**8.** Which linear equation does this graph represent?




Ⓕ $y = -\frac{1}{2}x - 1$ Ⓖ $y = \frac{1}{2}x + 1$

Ⓗ $y = x - \frac{1}{2}$ Ⓙ $y = -\frac{1}{2}x + 1$

**9.** What is the slope-intercept form of $3x - 4y = 12$?

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

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

**10.** What is the solution of the system?

$4x + y = -2$

$-7x - 2y = 5$

Ⓕ $(-1, 6)$ Ⓖ $(1, -6)$

Ⓗ $(6, 1)$ Ⓙ $(-6, -1)$

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# Mid-Year Test *continued*

*For use after Chapters 1–7*

**11.** How would you classify the system?

$x - 3y = 9$

$2x - 6y = 11$

Ⓐ Consistent and independent

Ⓑ Consistent and dependent

Ⓒ Inconsistent

Ⓓ None of the above

**12.** Five gallons of premium gas plus eight gallons of regular cost $27.74. Five gallons of premium plus two gallons of regular cost $15.86. What is the cost per gallon of the premium gasoline?

Ⓕ $2.38 Ⓖ $1.98

Ⓗ $3.28 Ⓙ $1.19

**13.** Based on the equation below, what is the value of the expression $2x + 3y$?

$$\begin{bmatrix} x & -1 \\ 8 & 7 \end{bmatrix} - 3\begin{bmatrix} 1 & 0 \\ 4 & y \end{bmatrix} = \begin{bmatrix} 2 & -1 \\ -4 & 10 \end{bmatrix}$$

Ⓐ $-9$ Ⓑ 10 Ⓒ 5 Ⓓ 7

**14.** If $A$ is a $3 \times 4$ matrix and $B$ is a $4 \times 3$ matrix, what are the dimensions of $AB$?

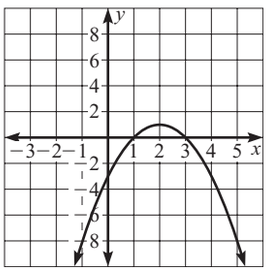
Ⓕ $3 \times 4$ Ⓖ $4 \times 3$

Ⓗ $3 \times 3$ Ⓙ $4 \times 4$

**15.** What is the determinant of the 2 by 2 matrix $\begin{bmatrix} 3 & -1 \\ -1 & 5 \end{bmatrix}$?

Ⓐ 14 Ⓑ $-6$ Ⓒ 16 Ⓓ $-14$

**16.** Which of the following is the equation of the parabola?




Ⓕ $y = -x^2 + 1$

Ⓖ $y = -x^2 + 4x - 3$

Ⓗ $y = (x - 2)^2 + 1$

Ⓙ $y = x^2 + 4x + 3$

**17.** A coffee store sells about 40 cappuccinos per day at $3.00 per cup. For each $0.15 decrease in price, about 4 more cappuccinos per day are sold. What quadratic formula models this situation?

Ⓐ $(40 + 4x)(3 + 0.15x)$

Ⓑ $(40 + 4x)(3 - 0.15x)$

Ⓒ $(40 - 4x)(3 - 0.15x)$

Ⓓ $(3 + 4x)(40 - 0.15x)$

**18.** What are the roots of the equation $-5x^2 + 7x + 6 = 0$?

Ⓕ 2, 0.6 Ⓖ $-2$, 0.6

Ⓗ 2, $-0.6$ Ⓙ $-2$, $-0.6$

**19.** If you know that the quadratic equation $ax^2 + bx + c = 0$ has two real solutions, what can you conclude?

Ⓐ $b^2 - 4ac = 0$ Ⓑ $b^2 - 4ac < 0$

Ⓒ $b^2 - 4ac > 0$ Ⓓ None of these

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# Mid-Year Test *continued*

*For use after Chapters 1–7*

**20.** How many solutions does the quadratic equation $x^2 + 6x + 9 = 0$ have?

Ⓕ 0 Ⓖ 3 Ⓗ 2 Ⓙ 1

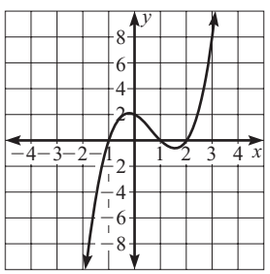
**21.** What is the simplified form of $\frac{(a^5 \cdot a^{-3})^4}{a^7}$?

Ⓐ $a^2$ Ⓑ $a^{-2}$ Ⓒ $a^9$ Ⓓ $a$

**22.** What is the value of $f(x) = x^4 + 5x^3 - 4x + 1$ when $x = -1$?

Ⓕ 1 Ⓖ $-2$ Ⓗ 3 Ⓙ $-4$

**23.** What is true about the degree and leading coefficient of the polynomial function whose graph is shown?




Ⓐ Degree is odd; leading coefficient is negative

Ⓑ Degree is odd; leading coefficient is positive

Ⓒ Degree is even; leading coefficient is negative

Ⓓ Degree is even; leading coefficient is positive

**24.** What is the result when $2x^4 + 8x^2 - x + 1$ is added to $-2x^4 + x^3 + x + 3$?

Ⓕ $x^3 + 8x^2 + 4$ Ⓖ $x^4 + 8x^2 + 4$

Ⓗ $4x^3 + 8x^2 + 4$ Ⓙ $4x^4 + 8x^2 + 4$

**25.** Which expression is equivalent to $s^4 - 9t^6$?

Ⓐ $(s^2 - 3t^3)^2$

Ⓑ $(s^2 - 3t^3)(s^2 + 3t^3)$

Ⓒ $(s - 3t^3)(s + 3t^3)$

Ⓓ $(s^2 - 2t^3)(s^2 + 2t^2)$

**26.** What are the real-number solutions of the expression $x^3 + 7x^2 - 9x - 63$?

Ⓕ 3, 7, $-3$ Ⓖ 0, 3, 7

Ⓗ 3, $-7$, $-3$ Ⓙ 7, 9, 1

**27.** What is the simplest form of the expression $8^{1/4} \cdot \frac{1}{2}\sqrt[4]{6}$?

Ⓐ $\sqrt{3}$ Ⓑ $\frac{1}{2}\sqrt[4]{3}$ Ⓒ $\sqrt[4]{2}$ Ⓓ $\sqrt[4]{3}$

**28.** What is the simplified form of $5\sqrt{4x} - 3\sqrt{9x}$?

Ⓕ $\sqrt{x}$ Ⓖ $2\sqrt{x}$ Ⓗ $-7\sqrt{x}$ Ⓙ $\sqrt{2x}$

**29.** What is the product $f(x) \cdot g(x)$ if $f(x) = -2x^{-1/3}$ and $g(x) = x^{2/3}$?

Ⓐ $-2x^{2/9}$ Ⓑ $x^{2/3}$

Ⓒ $-2x^{-1/3}$ Ⓓ $-2x^{1/3}$

**30.** Let $f(x) = (x^2 + 3)$ and $g(x) = x^{-1}$. What is the value of $f(g(1))$?

Ⓕ 10 Ⓖ 4 Ⓗ $\frac{1}{4}$ Ⓙ $\frac{1}{10}$

**31.** Which is the equation for the inverse of the relation $y = \frac{3}{2}x - 1$?

Ⓐ $y = \frac{2}{3}x + 1$ Ⓑ $y = \frac{3}{2}(x - 1)$

Ⓒ $y = x - \frac{3}{2}$ Ⓓ $y = \frac{2}{3}(x + 1)$

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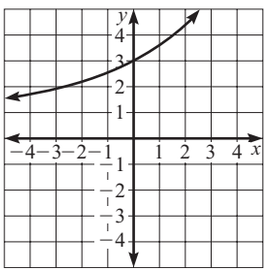
# Mid-Year Test *continued*

*For use after Chapters 1–7*

**32.** What is the solution of $x + 1 = 2\sqrt{x + 5} - 1$?

Ⓕ 4 Ⓖ 3 Ⓗ $-4$ Ⓙ 5

**33.** The graph of which function is shown?




Ⓐ $y = (1.3)^x$ Ⓑ $y = 2(1.3)^x - 1$

Ⓒ $y = (1.3)^x - 1$ Ⓓ $y = 2(1.3)^x + 1$

**34.** An initial capital of \$1000 is invested at 3% interest rate, compounded annually. What is the value of the investment after 5 years?

Ⓕ \$115,000 Ⓖ \$103,027

Ⓗ \$115,927 Ⓙ \$135,927

**35.** What is $\log_3\left(\frac{1}{81}\right)$?

Ⓐ 4 Ⓑ $\frac{1}{4}$ Ⓒ $-4$ Ⓓ $-\frac{1}{4}$

**36.** Which of the following is equivalent to $\frac{1}{2}\log a + \frac{3}{2}\log b - \frac{1}{2}\log c$?

Ⓕ $\log\left(\sqrt{\frac{ab}{c}}\right)$ Ⓖ $\log\left(b\sqrt{\frac{ab}{c}}\right)$

Ⓗ $\log\sqrt{\frac{a}{bc}}$ Ⓙ $\log\left(\sqrt{\frac{a}{b^3c}}\right)$

**37.** What is the domain of the function $y = 3\ln(x + 4) - 2$?

Ⓐ $x > -4$ Ⓑ $x < 4$

Ⓒ $x > 2$ Ⓓ $x < -2$

**38.** Which expression is equivalent to $\log 1000^x$?

Ⓕ $10^{3x}$ Ⓖ $3^x$ Ⓗ $3 + x$ Ⓙ $3x$

**39.** Which of the following statements is *not* correct?

Ⓐ $\log_2 24 = 3 + \log_2 3$

Ⓑ $\log_2 24 = \log_2 4 + \log_2 6$

Ⓒ $\log_2 24 = (\log_2 4)(\log_2 6)$

Ⓓ $\log_2 24 = 2 + \log_2 6$

Mid-Year Test

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# Mid-Year Test *continued*

*For use after Chapters 1–7*

## Short Response

**40.** Evaluate $(2m - 1)^2 + m - 7$ for $m = -2$.

**41.** In an elementary school, students have the option to prepay for lunch by the month. The plan consists of 20 meals at a cost of \$37. Write an expression for the balance on the account after buying $x$ lunches. For which values of $x$ does your expression make sense in the context of this problem?

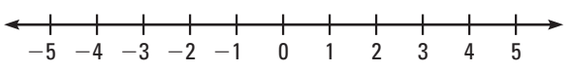
**42.** In a grocery store there are strawberries and blueberries. The strawberries cost \$4 per pound, and the blueberries \$6 per pound. Mary buys a certain quantity of each, weighing 8 pounds in total, at a cost of \$5.25 per pound. Let $s$ denote how many pounds of strawberries Mary bought.

**a.** Write an equation in the variable $s$ that models this situation.

**b.** Solve the equation for $s$ to find how many pounds of strawberries Mary bought.

**c.** How many pounds of blueberries did Mary buy?

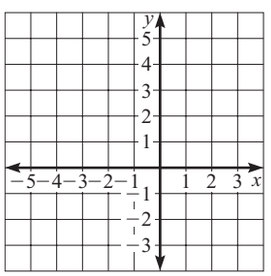
**43.** Solve $3x - 1 < -5x + 7$. Then graph the solution.




**44.** Consider the relation given by the ordered pairs $(-5, -2)$, $(-1, 3)$, $(-1, 5)$, $(0, 0)$, $(1, 2)$, $(2, -3)$.

**a.** Identify the domain and the range of the relation.

**b.** Graph the relation.




**c.** Tell whether the relation is a function. Explain.

***Answers***

**40.** _____

**41.** _____

_____

**42a.** _____

**42b.** _____

**42c.** _____

**43.** _____

See graph.

**44a.** _____

**44b.** See graph.

**44c.** _____

_____

_____

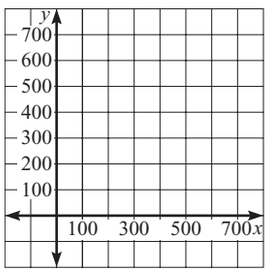
Mid-Year Test

Name _____ Date _____

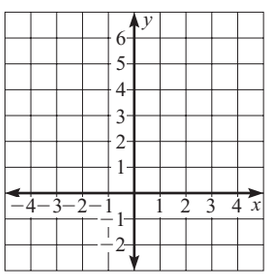
# Mid-Year Test *continued*

*For use after Chapters 1–7*

**45.** Tickets for a school play cost \$5 for adults and \$3 for children up to 12 years old. Ticket sales total \$1500. Write and graph an equation that models this situation. Explain how to use your graph to find out how many children's tickets were sold if 210 adult tickets were sold.




**46.** Write the equation of the line that passes through points (1, 3) and (3, 4). Graph the line in the provided grid.




**47.** The price of furnace $A$ is \$600 and the price of furnace $B$ is \$700. The cost of electricity needed to operate the furnace is \$50 per year for furnace $A$ and \$30 per year for furnace $B$.

**a.** Write an equation for the cost of owning furnace $A$ and an equation for the cost of owning furnace $B$.

**b.** After how many years is the total cost of owning the furnaces equal?

**48.** Use the substitution or elimination method to solve the system.

$\frac{5}{2}x + 3y = 1$

$3x - 6y = 30$

**49.** Use Cramer's rule to solve the system.

$2x - 4y = 2$

$7x + 14y = 35$

**50.** For what value of $a$ is the system consistent and dependent? Explain.

$2x + y = 6$

$x + ay = 3$

***Answers***

**45.** See graph.

**46.** _____

See graph.

**47a.** _____

**47b.** _____

**48.** _____

**49.** _____

**50.** _____

Mid-Year Test

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# Mid-Year Test *continued*

*For use after Chapters 1–7*

**51.** Let $S = \begin{bmatrix} 3 & 7 \\ 0 & -1 \\ 5 & -2 \end{bmatrix}$ and $T = \begin{bmatrix} -3 & 0 \\ -6 & 4 \end{bmatrix}$.

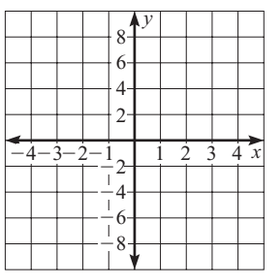
**a.** Write the dimensions of the two matrices.

**b.** Decide which matrix is defined, $ST$ or $TS$? Find this matrix and give its dimensions.

**52.** The quadratic function $y = ax^2 - 6x - 4$ has its maximum value when $x = -3$. Can you conclude if $a$ is positive or negative? If you are now told that the maximum value of the parabola is $y = 5$, what is the value of $a$?

**53.** Let $y = 2x^2 + 4x - 6$.

**a.** Graph the function.




**b.** Find the vertex and write the equation of the axis of symmetry.

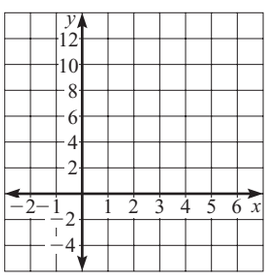
**c.** Find the minimum value of the function.

**d.** Find the zeros of the parabola and show their location on the graph.

**54.** Express $35x^2 - 11x - 6$ as the product of two linear factors.

**55.** A cubic polynomial function has leading coefficient 2 and constant term $-3$. If $f(1) = 0$ and $f(2) = 21$, what is $f(-1)$? Explain.

**56.** Graph the polynomial function $f(x) = x^4 - 2x^2 + 4x$. Describe the end behavior of the graph as $x \to -\infty$ and $x \to +\infty$.




***Answers***

**51a.** _____

_____

**51b.** _____

_____

**52.** _____

_____

_____

**53a.** See graph.

**53b.** _____

_____

**53c.** _____

**53d.** _____

**54.** _____

**55.** _____

_____

_____

**56.** See graph.

_____

Mid-Year Test

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# Mid-Year Test *continued*

*For use after Chapters 1–7*

**57.** If a polynomial function has the following end behavior:

$f(x) \to +\infty$ as $x \to +\infty$, $f(x) \to +\infty$ as $x \to -\infty$.

Can you determine if the degree of $f(x)$ is odd or even? Explain.

**58.** Let $f(x) = x^{-1}$ and $g(x) = x^3 - 8$.

**a.** Find $f(g(x))$ and $g(f(x))$.

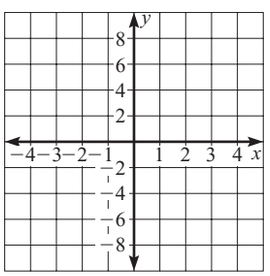
**b.** Find the domain of each composition.

**c.** Find the inverse function of $g(x)$.

**59.** Find all solutions of the equation $\sqrt{x - 5} + 1 = \frac{x}{7} + 2$.

**60.** Let $y = 2^{x-1} - 1$.

**a.** Graph the function.

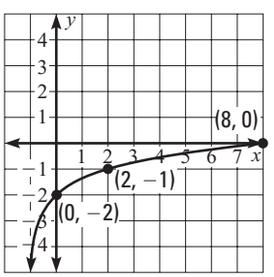



**b.** State the domain and range of the function.

**c.** Write the equation of the horizontal asymptote.

**d.** Solve the equation $7 = 2^{x-1} - 1$.

**61.** The graph shown is a translation of the graph of $y = \log_3 x$.




**a.** Write an equation of the function represented in the graph.

**b.** State the domain and range of the function.

**c.** Graph the inverse of the graphed function.

**62.** Solve the logarithmic equation $2\log_3 x + 3\log_{27} x = 15$.

***Answers***

**57.** _____

_____

_____

**58a.** _____

_____

**58b.** _____

_____

**58c.** _____

**59.** _____

**60a.** See graph.

**60b.** _____

_____

**60c.** _____

**60d.** _____

**61a.** _____

**61b.** _____

_____

**61c.** See graph.

**62.** _____

Mid-Year Test