

1. If  $b$  is any positive number and  $n$  is a natural number, then

- A)  $b^{-n} = -b^n$       B)  $b^{-n} = \frac{1}{b^n}$       C)  $b^{-n} = \sqrt[n]{b}$       D)  $b^{-n} = -\frac{1}{b^n}$       E)  $b^{-n} = -\frac{1}{\sqrt[n]{b}}$

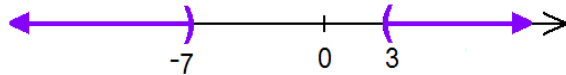
2. Consider the line that passes through the point  $(-2, 3)$  and has slope  $\frac{4}{5}$ . The point-slope form equation of the line is

- A)  $y - 2 = \frac{4}{5}(x - 3)$       C)  $y + 2 = \frac{4}{5}(x + 3)$       E)  $x + 2 = \frac{4}{5}(y - 3)$   
 B)  $y - 3 = \frac{4}{5}(x + 2)$       D)  $x - 2 = \frac{4}{5}(y - 3)$

3. If  $b$  and  $n$  are positive numbers, then

- A)  $b^{\frac{1}{n}} = -b^n$       B)  $b^{\frac{1}{n}} = \frac{1}{b^n}$       C)  $b^{\frac{1}{n}} = \frac{1}{\sqrt[n]{b}}$       D)  $b^{\frac{1}{n}} = -\frac{1}{b^n}$       E)  $b^{\frac{1}{n}} = \sqrt[n]{b}$

4. Which of the following sets is depicted on the picture?



- A)  $(-\infty, -7) \cup (3, \infty)$       C)  $[-7, 3]$       E)  $[-\infty, -7] \cup [3, \infty]$   
 B)  $(-7, 3)$       D)  $(-\infty, -7] \cup [3, \infty)$

5. If a line rises from left to right, the line has a slope that is

- A) positive      B) negative      C) zero      D) undefined      E) parallel

6. The slope  $m$ , of a line through the distinct points  $(x_1, y_1)$  and  $(x_2, y_2)$  is given by the formula

- A)  $m = \frac{x_1 + x_2}{y_1 + y_2}$       C)  $m = \frac{y_2 - y_1}{x_2 - x_1}$       E)  $m = \frac{y_1 - x_1}{y_2 - x_2}$   
 B)  $m = \frac{x_2 - x_1}{y_2 - y_1}$       D)  $m = \frac{y_1 + y_2}{x_1 + x_2}$

7. The degree of the polynomial  $3x^2 + 8x^5 - 3x + 1$  is

- A) 2      B) 3      C) 4      D) 5      E) 8

8. The complex numbers  $2 + 3i$  and  $2 - 3i$  are

- A) reciprocals of each other      C) conjugates of each other  
 B) opposites of each other      D) None of the above

9. If  $a \neq 0$ , the vertex of the parabola  $y = a(x - h)^2 + k$  is the point

- A)  $(k, h)$       B)  $(h, k)$       C)  $(-h, k)$       D)  $(k, -h)$       E)  $(a, h)$

10. Simplify the expression  $\sqrt[3]{\frac{x^{11}y^5}{x^2y^2}}$
- A)  $\sqrt{x^{11}}\sqrt{y^3}$       B)  $x^3y$       C)  $x^4y\sqrt[3]{xy}$       D)  $x^2$       E)  $\sqrt{x^{11}}\sqrt{y^5}$
11. Simplify the expression  $\frac{x^2 + 2x - 15}{x^2 - 8x + 15}$
- A)  $-\frac{1}{4}$       B)  $\frac{x+3}{x-3}$       C)  $-1$       D)  $\frac{x+1}{x-4}$       E)  $\frac{x+5}{x-5}$
12. Simplify the expression  $\sqrt{12} - 2\sqrt{75} + \sqrt{48}$
- A)  $-4\sqrt{3}$       B)  $9\sqrt{3} + \sqrt{10}$       C)  $\sqrt{3}$       D)  $-3\sqrt{10}$       E)  $-5\sqrt{3}$
13. A boat's crew rowed 36 kilometers downstream, with the current, in three hours. The return trip upstream, against the current, covered the same distance, and it took six hours. Find the crew's rowing rate in still water.
- A) 4 kilometers per hour      C) 6 kilometers per hour      E) 12 kilometers per hour  
 B) 4.5 kilometers per hour      D) 9 kilometers per hour
14. Solve the equation  $2(x-1)^2 = 8 - (x+2)(3-x)$  over the complex numbers. The solution set is:
- A)  $\left\{\frac{-1-\sqrt{17}}{2}, \frac{-1+\sqrt{17}}{2}\right\}$       C)  $\left\{\frac{-1-\sqrt{193}}{6}, \frac{-1+\sqrt{193}}{6}\right\}$       E)  $\left\{\frac{1}{3}, 2\right\}$   
 B)  $\{3\}$       D)  $\{0, 3\}$
15. Solve the system of equations given below. What is the  $x$ -value of the solution?
- $$\begin{cases} 2x - 3y = 16 \\ x + 8y = -87 \end{cases}$$
- A)  $-4$       C)  $-7$       E) There are infinitely many solutions.  
 B)  $-10$       D) There is no solution.
16. Perform the indicated operations and simplify.  $(3 - 2\sqrt{5})(\sqrt{5} - 1)$
- A)  $-8\sqrt{5}$       B)  $\sqrt{5} + 7$       C)  $\sqrt{5} - 7$       D)  $5\sqrt{5} - 17$       E)  $5\sqrt{5} - 13$
17. Find the **exact value** of the expression  $27^{-2/3}$ .
- A)  $-18$       B)  $\frac{1}{9}$       C)  $\frac{\sqrt{3}}{243}$       D)  $0.11$       E)  $-9$
18. Find all solutions of the equation  $x^2 = 6x + 1$  over the complex numbers. The solution set is:
- A)  $\{3 - \sqrt{10}, 3 + \sqrt{10}\}$       C)  $\{3 - 2\sqrt{10}, 3 + 2\sqrt{10}\}$       E)  $\{-3 + 2\sqrt{2}, -3 - 2\sqrt{2}\}$   
 B)  $\{3 - 4\sqrt{10}, 3 + 4\sqrt{10}\}$       D)  $\{6 - 2\sqrt{10}, 6 - 2\sqrt{10}\}$

19. Solve the equation  $(x - 3)^2 + 2x = 4$  over the complex numbers. The solution set is:

- A)  $\{-1, 5\}$                       C)  $\{2 - 2i, 2 + 2i\}$                       E)  $\{2 - 3i, 2 + 3i\}$   
 B)  $\{-4, 8\}$                       D)  $\{2 - i, 2 + i\}$

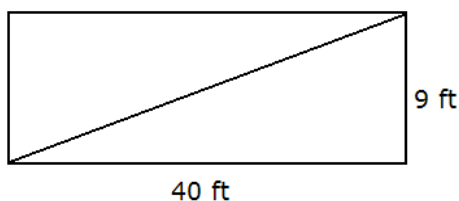
20. The following expressions are all equal to each other except for one. Which one?

- A)  $\sqrt{50} - \sqrt{8}$       B)  $\sqrt{2} + \sqrt{12}$       C)  $3\sqrt{2}$       D)  $\sqrt{18}$       E)  $\frac{\sqrt{72}}{2}$

21. Solve the equation  $\frac{2x + 3}{5} - \frac{x - 5}{3} = 1$ . The solution set is:

- A)  $\{4\}$       B)  $\{31\}$       C)  $\{-33\}$       D)  $\{17\}$       E)  $\{-19\}$

22. Find the length of the diagonal of the rectangle shown on the picture below.



- A)  $7\sqrt{31}$  ft      B) 41 ft      C) 49 ft      D)  $6\sqrt{10}$  ft      E)  $\sqrt{1519}$  ft

23. Solve the equation  $|2x - 5| + 2 = 11$  over the real numbers. The solution set is:

- A)  $\{-2, 7\}$       B)  $\{-4, 7\}$       C)  $\{-2, 2\}$       D)  $\{2\}$       E)  $\{7\}$

24. Rationalize the denominator in the expression  $\frac{3}{\sqrt{10} + 1}$ .

- A)  $\frac{\sqrt{10} - 1}{3}$       B)  $\sqrt{10} + 3$       C)  $\frac{\sqrt{10} + 1}{3}$       D)  $\sqrt{10} - 3$       E)  $\frac{\sqrt{10} - 3}{9}$

25. Solve  $-2 \leq \frac{1}{3}x - 1 \leq 5$ . The solution set is:

- A)  $[-9, 12]$       B)  $[-9, 18]$       C)  $[-5, 16]$       D)  $[-3, 18]$       E)  $[-9, 16]$

26. How many liters of a 17% acid solution should be mixed with 8 liters of an 11% acid solution to obtain a mixture that is 15%?

- A) 11 liters      B) 12 liters      C) 13 liters      D) 16 liters      E) 19 liters

27. Find all solutions of the equation  $\sqrt{2x - 1} = 5$  over the complex numbers. The solution set is:

- A)  $\{-2, 3\}$       B)  $\{-12, 13\}$       C)  $\emptyset$       D)  $\{18\}$       E)  $\{13\}$



38. Simplify:  $\frac{2m-1}{m^2-m-2} - \frac{1}{m+1}$
- A)  $\frac{m-3}{m^2-m-2}$       B)  $\frac{2}{m+1}$       C)  $\frac{1}{m-2}$       D)  $\frac{2(m-1)}{m^2-2m-1}$       E)  $\frac{-m-3}{2m+2}$
39. Solve the equation  $|x+1| = |3x-1|$  over the real numbers. The solution set is:
- A)  $\{1\}$       B)  $\{0, 1\}$       C)  $\{0\}$       D)  $\{-1\}$       E)  $\{-1, 1\}$
40. Simplify:  $\frac{\frac{3}{x-1} - 1}{\frac{2}{x-1} + 1}$
- A)  $\frac{-x+2}{x+1}$       B)  $\frac{3}{2}$       C)  $\frac{-x+2}{x-1}$       D)  $\frac{2}{3}$       E)  $\frac{-x+4}{x+1}$
41. Find all real solutions of the equation  $\frac{3}{p-7} + \frac{p+7}{p} = \frac{7p-28}{p(p-7)}$ . The solution set is:
- A)  $\{14\}$       B)  $\{-11, 7\}$       C)  $\{-3, 7\}$       D)  $\{-3\}$       E)  $\{-7\}$
42. Suppose that  $f$  is a function given by  $f(x) = -x^2 - x + 2$ . Compute the value of  $f(-3)$ .
- A)  $-4$       B)  $14$       C)  $8$       D)  $-10$       E)  $-14$
43. The graph of which equation given below is a parabola with its vertex at  $(3, -4)$ ?
- A)  $y = x^2 - 3x - 4$       C)  $y = x^2 - 6x + 5$       E)  $y = x^2 + 3x - 4$   
 B)  $y = x^2 + 3x - 22$       D)  $y = x^2 + 6x - 31$
44. Solve the compound inequality given below.
- $$3 - x \geq -2x + 5 \quad \text{and} \quad 2(x - 7) < x + 4$$
- A)  $[2, 18)$       C)  $(-\infty, 2]$       E)  $[2, \infty)$   
 B)  $(-\infty, 2] \cup (18, \infty)$       D)  $(-\infty, \infty)$
45. Solve the compound inequality given below.
- $$3 - x \geq -2x + 5 \quad \text{or} \quad 2(x - 7) < x + 4$$
- A)  $[2, 18)$       C)  $(-\infty, 2]$       E)  $[2, \infty)$   
 B)  $(-\infty, 2] \cup (18, \infty)$       D)  $(-\infty, \infty)$
46. Find the coordinates of the vertex of the parabola given by  $y = 2x^2 - 20x + 18$ .
- A)  $(5, -32)$       B)  $(5, -16)$       C)  $(-5, -32)$       D)  $(-5, -16)$       E)  $(5, 18)$

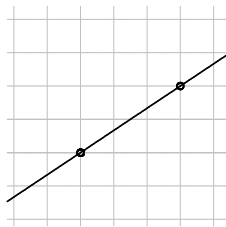
47. One factor of  $2x^3 + 3x^2 - 2x - 3$  is

- A)  $2x - 3$       B)  $2x - 1$       C)  $x + 1$       D)  $x - 3$       E)  $x^2 - 3$

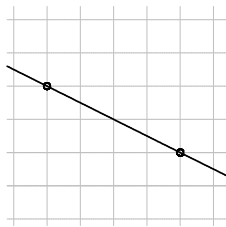
48. Simplify completely  $\frac{x^2 - 9}{x^2 - 3x} \div \frac{x^2 + 8x + 15}{2x + 10}$

- A)  $\frac{(x + 3)^2}{2x}$       B)  $\frac{2}{x}$       C)  $\frac{2(x + 5)}{(x - 3)^2}$       D)  $\frac{2(x + 5)}{x - 5}$       E)  $\frac{(x + 3)(x - 3)}{2x}$

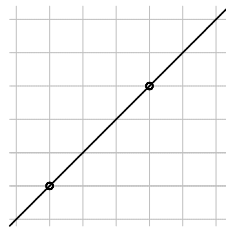
49. Assume that the spacing is the same on both axes. Which of the lines shown below has a slope of  $-\frac{1}{2}$ ?



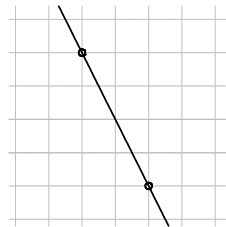
A)



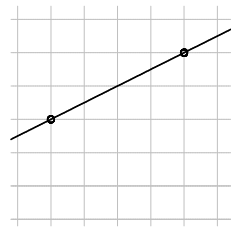
B)



C)



D)



E)

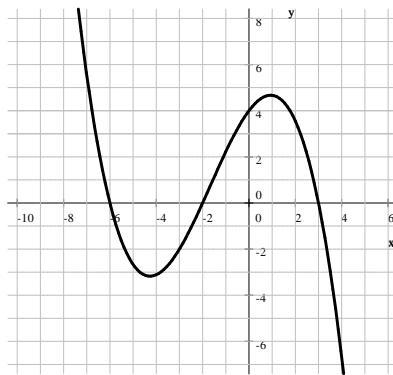
50. Ann invested \$20,000 in two accounts. She took a 4% loss on one of the accounts and made a 12% profit on the other investment, but ended up breaking even. How much money did she lose in the first investment?

- A) \$600      B) \$800      C) \$1000      D) \$1200      E) \$20,000

51. Solve the inequality  $3(x - 2) \leq -2(x - 1) - 5$ .

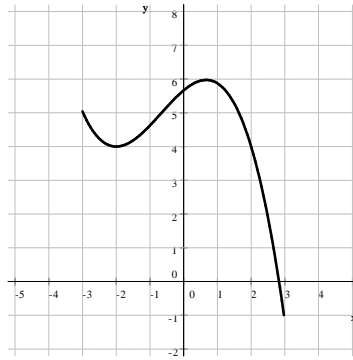
- A)  $\left(-\infty, \frac{3}{5}\right]$       B)  $(-\infty, 0]$       C)  $\left(-\infty, -\frac{1}{5}\right]$       D)  $\left(-\infty, -\frac{4}{5}\right]$       E)  $\left(-\infty, -\frac{2}{5}\right]$

52. Which of the following is NOT an intercept of the function graphed below?



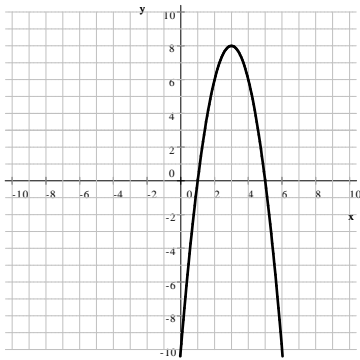
- A)  $(-6, 0)$       B)  $(-2, 0)$       C)  $(0, 3)$       D)  $(3, 0)$       E)  $(0, 4)$

53. The picture shows the graph of a function,  $f(x)$ . Based on its graph, determine the domain of  $f$ .

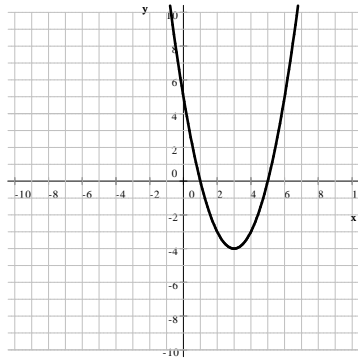


- A)  $[-3, 3]$       B)  $[-1, 6]$       C)  $(-1, 6)$       D)  $[1, 5]$       E)  $[-3, -1]$
54. The picture above shows the graph of a function,  $f(x)$ . Based on its graph, determine the range of  $f$ .
- A)  $[-3, 3]$       B)  $[-1, 6]$       C)  $(-1, 6)$       D)  $[1, 5]$       E)  $[-3, -1]$
55. Compute the slope of the line that passes through the points  $(3, 1)$  and  $(6, -3)$ .
- A)  $\frac{3}{4}$       B)  $\frac{4}{3}$       C) 5      D)  $-\frac{3}{4}$       E)  $-\frac{4}{3}$
56. Perform the division and simplify:  $\frac{7+i}{2+i}$
- A)  $3-i$       B)  $3+i$       C)  $\frac{7}{2}$       D)  $\frac{13+9i}{3}$       E)  $5-2i$
57. Which of the following is NOT equivalent to  $x^{-8/3}$ ?
- A)  $\frac{1}{(\sqrt[3]{x})^8}$       B)  $\frac{1}{\sqrt[3]{x^8}}$       C)  $\frac{1}{x^2\sqrt[3]{x^2}}$       D)  $\frac{\sqrt[3]{x}}{x^3}$       E)  $\sqrt[3]{-x^8}$
58. Simplify the expression  $\frac{x^2-36}{x^2+2x-48}$
- A)  $\frac{x+6}{x+8}$       B)  $-\frac{18}{x-48}$       C)  $\frac{3}{4}$       D)  $\frac{x-6}{x-8}$       E)  $\frac{18}{-x+24}$
59. Simplify  $\frac{t^2-t-2}{3t-6} \cdot \frac{6t+30}{t^2+6t+5}$
- A) 1      B)  $\frac{t+1}{t-2}$       C) undefined      D) 2      E) 4
60. Compute the exact value of  $-p^2+4p-1$  if  $p = -1+2\sqrt{3}$
- A)  $2+4\sqrt{3}$       B)  $8+4\sqrt{3}$       C)  $2-4\sqrt{3}$       D)  $8+8\sqrt{3}$       E)  $-18+12\sqrt{3}$

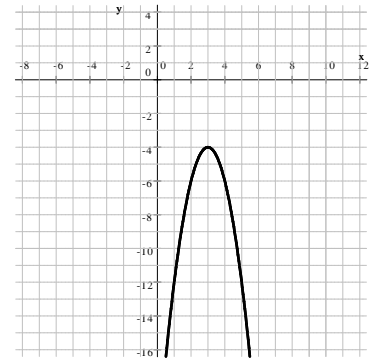
61. Compute the exact value of  $-p^2 + 4p - 1$  if  $p = -1 + 2i$
- A)  $-8 + 4i$       B)  $-2 + 12i$       C)  $-8 - 2i$       D)  $-4i$       E)  $-2 - 4i$
62. Solve the equation  $-x^2 = -7x + 6$  over the complex numbers.
- A)  $\{-1, -6\}$       B)  $\{2, 3\}$       C)  $\{1, 6\}$       D) no real solution      E)  $\{-2, -3\}$
63. If a ramp is 7 feet long and has a height of 2 feet, how much horizontal space will the ramp need? Round your answer to the nearest thousandths.
- A) 6.708 ft      B) 7.28 ft      C) 6.71 ft      D) 7.280 ft      E) 3 ft
64. Find the surface area of a rectangular solid with width 2 centimeters, height 9 centimeters, and length 4.5 centimeters.
- A)  $67.5 \text{ cm}^2$       B) 15.5 cm      C)  $81 \text{ cm}^3$       D) 31 cm      E)  $135 \text{ cm}^2$
65. Sketch the graph of  $y = -2x^2 + 12x - 10$



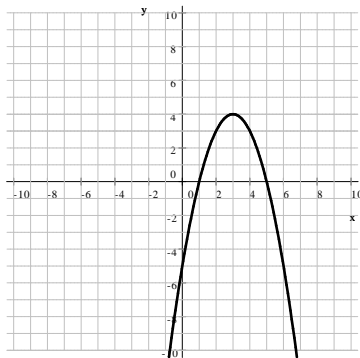
A)



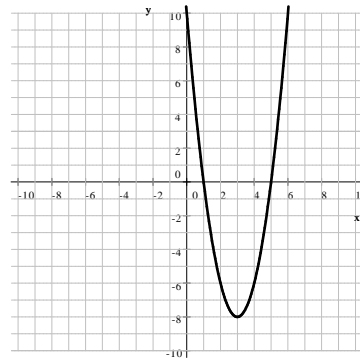
B)



C)



D)



E)



66. Which of the following is the equation of the parabola graphed?

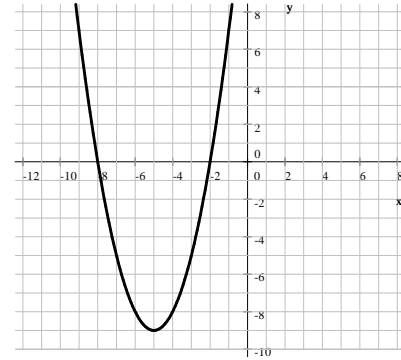
A)  $y = (x - 2)(x - 8)$

B)  $y = x^2 - 10x + 16$

C)  $y = x^2 + 10x + 16$

D)  $y = (x - 5)^2$

E)  $y = x^2 - 5x - 9$



### Answers

1. B	10. B	19. D	28. D	37. C	46. A	55. E	64. E
2. B	11. E	20. B	29. A	38. C	47. C	56. A	65. A
3. E	12. A	21. E	30. B	39. B	48. B	57. E	66. C
4. A	13. D	22. B	31. D	40. E	49. B	58. A	
5. A	14. D	23. A	32. C	41. D	50. A	59. D	
6. C	15. C	24. A	33. E	42. A	51. A	60. E	
7. D	16. E	25. D	34. A	43. C	52. C	61. B	
8. C	17. B	26. D	35. E	44. A	53. A	62. C	
9. B	18. A	27. E	36. A	45. D	54. B	63. A	