



## ALGEBRA

1. What is  $2x - 1$  if  $-4x + 8 = -6 + 3x$ ?

- A. 2
- B. -3
- C. 3
- D. 4
- E. 5

2. What is  $-2x$  if  $\frac{2x-4}{2} - 3 = \frac{-x+3}{3}$ ?

- A. -8
- B. -9
- C.  $4\frac{1}{2}$
- D.  $5\frac{1}{2}$
- E. 9

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3. The solution to the equation  $-0.2(x - 3) - x - 0.9 = 0.4x + 0.5$  is equal to

- A. 0.5
- B. 0.25
- C. -5
- D. 5
- E. -0.5

4. Solve for  $m$  in the equation  $\frac{-4t + m}{3} = 4m$ .

- A.  $-4t$
- B.  $4t$
- C.  $-\frac{4t}{11}$
- D.  $-\frac{11}{4t}$
- E.  $11 + 4t$

5. Solve for  $x$  in the equation  $-2(-x - 6) + 2x = -4(x - 2) + 6$ .

- A.  $\frac{1}{4}$
- B. 0
- C. 4
- D.  $-\frac{1}{4}$
- E.  $\frac{1}{2}$

6. What is  $x + \frac{11}{2}$  if  $x$  is a solution of the equation  $x + 3 = -\frac{2}{5}(2 - x) + 2$ ?

- A.  $2\frac{1}{2}$
- B.  $-2\frac{1}{2}$
- C.  $-\frac{1}{2}$
- D.  $\frac{1}{2}$
- E. -3

7. What is the solution of the equation  $3\frac{1}{2} - 4x = \frac{1}{2}$ ?

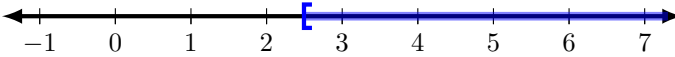
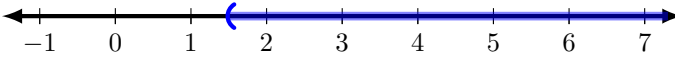
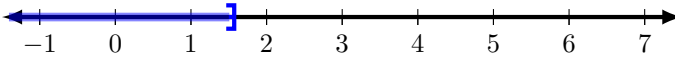
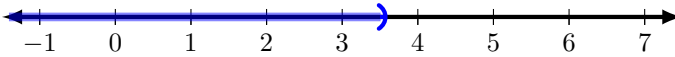
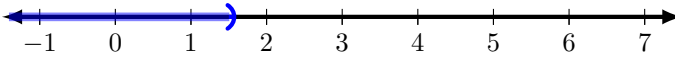
- A.  $-\frac{3}{4}$
- B.  $1\frac{1}{3}$
- C.  $\frac{3}{4}$
- D. -1
- E. 1

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8. Solve the equation  $ax - b = c(1 - x)$  for  $x$ .

- A.  $x = \frac{c - b}{ac}$
- B.  $x = \frac{bc}{a}$
- C.  $x = \frac{b + c}{a + c}$
- D.  $x = \frac{b + c}{a}$
- E.  $x = \frac{a + c}{b + c}$

9. Which of the following graphs represents the solution set to the inequality  $-4x + 2 < 2x - 7$ ?

- A. 
- B. 
- C. 
- D. 
- E. 

10. Which of the following intervals represents the solution set to the inequality  $-2 < \frac{x}{2} + 2 \leq 3$  ?
- A.  $(-8, 2)$
  - B.  $(-8, 2]$
  - C.  $(-4, 1]$
  - D.  $[-8, 2)$
  - E.  $[-6, 4]$
11. What is the solution set of the inequality  $-5 \leq 7 - \frac{2}{3}x < -1$  ?
- A.  $[12, 18)$
  - B.  $(-6, -3]$
  - C.  $[-6, -3)$
  - D.  $\left(\frac{2}{3}, 18\right]$
  - E.  $(12, 18]$
12. What is the solution set of the inequality  $-(3 - 2x) > 4x + 4$  ?
- A.  $x > -3\frac{1}{2}$
  - B.  $x < -3\frac{1}{2}$
  - C.  $x < -\frac{7}{6}$
  - D.  $x > -\frac{7}{6}$
  - E.  $x > 3\frac{1}{2}$
13. The sum of  $3x^3 - 2x^2 + 3x - 8$  and  $-5x^3 - 4x^2 - x - 9$  is
- A.  $8x^3 - 6x^2 + 2x - 17$
  - B.  $-2x^3 + 6x^2 + 2x - 17$
  - C.  $-2x^3 - 6x^2 + 2x - 1$
  - D.  $-2x^3 - 6x^2 + 2x - 17$
  - E.  $-12x^5 + 2x - 17$
14.  $(-6x^2 + 3x - 9) - (x^2 - 3x + 1) = ?$
- A.  $-5x^2 - 10$
  - B.  $-7x^2 + 6x - 8$
  - C.  $7x^2 + 6x - 10$
  - D.  $-42x^3 - 10$
  - E.  $-7x^2 + 6x - 10$
15.  $(2b - 2)^2 - b(2b + 2) = ?$
- A.  $6b^2 + 10b + 4$
  - B.  $4b^2 - 8b + 4$
  - C.  $2b^2 - 10b + 4$
  - D.  $4b^2 + 4$
  - E.  $2b^2 - 12b + 4$

16. Find the value of  $k$  so that  $(x + 2)(x - 3) + 2x - 1 = x^2 - 2kx - 7$ .

- A.  $\frac{3}{2}$
- B.  $-\frac{3}{2}$
- C.  $\frac{1}{2}$
- D.  $-\frac{1}{2}$
- E.  $-1$

17.  $(2 - x^2) - 3(x^2 - 4x) + (x - 1)(2 - x) = ?$

- A.  $-5x^2 + 15x$
- B.  $-5x^2 - 9x$
- C.  $-3x^2 - 3x$
- D.  $-5x^2 + 15x + 4$
- E.  $-5x^2 + 15x - 4$

18. The equation of the line passing through the points  $(-5, -5)$  and  $(1, 3)$  is

- A.  $4x + 3y = 5$
- B.  $-2x + 2y = 5$
- C.  $2x + y = 5$
- D.  $-4x + 3y = 5$
- E.  $-4x + 3y = -5$

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19. Find the value of  $k$  so that the lines with equations  $y = \frac{1}{2}x - 3$  and  $\frac{3}{k}x - y = 1$  are perpendicular.

- A.  $\frac{3}{2}$
- B.  $-\frac{2}{3}$
- C.  $-\frac{3}{2}$
- D.  $\frac{2}{3}$
- E.  $-1$

20. Which of the following lines are parallel?

- A.  $-x + y = 2$  and  $-x - y = 2$
- B.  $3x = y$  and  $x = -2y + 1$
- C.  $x = 3$  and  $y = -2$
- D.  $y = 4 - 5x$  and  $x = 4 - 5y$
- E.  $3x - y = 5$  and  $-6x = -2y + 1$

21. Find the distance between the  $x$ - and  $y$ -intercepts of the line with equation  $-2x + 5y = -10$ .

- A.  $\sqrt{21}$
- B.  $\sqrt{29}$
- C.  $\sqrt{3}$
- D.  $3$
- E.  $29$

22. What are the roots of the equation  $(2x - 1)(x + 1) = 14$ ?

- A.  $-3, \frac{5}{2}$
- B.  $-1, \frac{1}{2}$
- C.  $-\frac{5}{2}, 3$
- D.  $-\frac{1}{2}, 1$
- E.  $-3, -\frac{5}{2}$

23. For all  $x \neq -3$ ;  $\frac{2x - 3}{x + 3} - 1 = ?$

- A.  $\frac{x}{x + 3}$
- B.  $\frac{3x - 6}{x + 3}$
- C.  $x - 6$
- D.  $-\frac{4}{3}$
- E.  $\frac{x - 6}{x + 3}$

24. For all  $x \neq 2$ ;  $\frac{3x^2 - 11x + 10}{5x - 10} = ?$

- A.  $\frac{3x + 5}{5}$
- B.  $\frac{x}{x - 2}$
- C.  $\frac{3x - 5}{5}$
- D.  $\frac{-x}{x - 2}$
- E.  $\frac{3x + 11}{5}$

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25. For all  $x \neq 2$  and  $x \neq -5$ ;  $\frac{\frac{2x + 10}{x + 5}}{\frac{x + 5}{2x - 4}} = ?$

- A.  $\frac{x - 2}{x + 5}$
- B.  $-\frac{5}{2}$
- C.  $\frac{x + 5}{2}$
- D.  $\frac{-40}{(x + 5)^2}$
- E.  $\frac{x + 5}{x - 2}$

26. A train leaves a train station going east at 72 miles per hour. At the same time, another train leaves the same station going west at 60 miles per hour. How long would it take the two trains to be 792 miles apart?

- A. 6 hr
- B. 3 hr

- C. 6.5 hr
- D. 12 hr
- E. 15 hr

27. What are the solutions to the equation  $|3x - 2| = 7$ ?

- A.  $5/3$  and  $3$
- B.  $-5/3$  and  $3$
- C.  $-5/3$  and  $-3$
- D.  $5/3$  and  $3$
- E.  $-5/3$  and  $-3$

28. Which of the following intervals represents the solution set of the inequality  $|2x + 2| \geq 4$ ?

- A.  $(-\infty, 3] \cup [1, \infty)$
- B.  $(-\infty, -3] \cup [-1, \infty)$
- C.  $[3, \infty)$
- D.  $(-\infty, -3] \cup [1, \infty)$
- E.  $[1, \infty)$

29. Which of the following intervals represents the solution set of the inequality  $|x + 6| < 3$ ?

- A.  $(-9, -3)$
- B.  $(-9, 3)$
- C.  $(-3, 3)$
- D.  $(-3, 9)$
- E.  $(0, 3)$

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30. If  $(x, y)$  is the solution to the linear system of equations

$$\begin{aligned} 2x + 3y &= -4 \\ -x + 2y &= -5 \end{aligned}$$

then  $y = ?$

- A. 0
- B. 2
- C. 3
- D. 6
- E. -2

## COLLEGE ALGEBRA

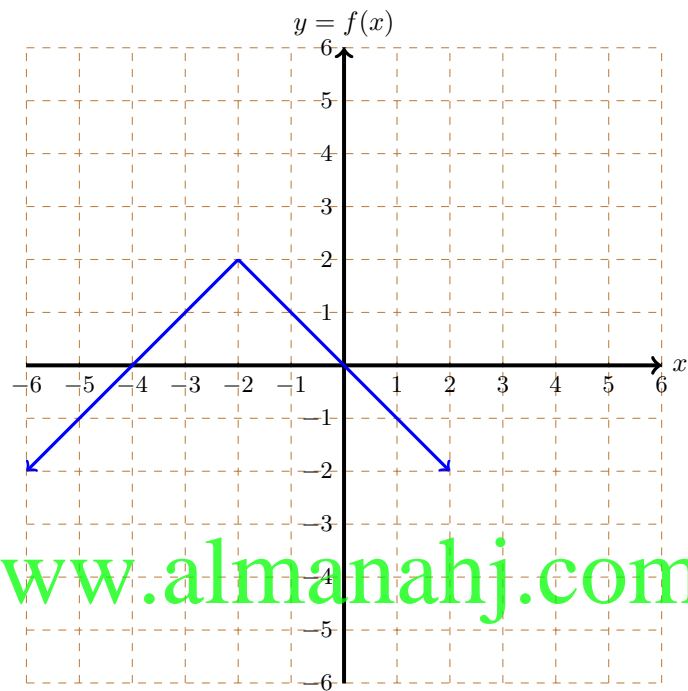
31. For what values of  $x$  is  $\sqrt{3 - 2x}$  defined?

- A.  $x > 5\frac{1}{2}$
- B.  $x > 3\frac{1}{2}$
- C.  $x \geq 2\frac{1}{2}$
- D.  $x \leq 1\frac{1}{2}$
- E.  $x > 1\frac{1}{2}$

32. What is the domain of  $f(x) = \frac{-3}{\sqrt{16-x^2}}$  ?

- A.  $[-4, 4]$
- B.  $(-4, 4)$
- C.  $(-\infty, -4) \cup (4, +\infty)$
- D.  $(-\infty, -4] \cup [4, +\infty)$
- E.  $(-\infty, +\infty)$

33. What is the range of function  $f$  whose graph is shown below?



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- A.  $[-6, 2]$
- B.  $(-\infty, 0)$
- C.  $(-\infty, 2]$
- D.  $[2, +\infty)$
- E.  $(-\infty, +\infty)$

34. If  $h(x) = \sqrt{-x+2} + x^2$ , what is  $h(-2)$ ?

- A. not a real number
- B. 6
- C. 4
- D. -4
- E. 2

35. If  $h(x) = (-x + 1)^2 - 5$  and  $g(x) = -x - 2$ , then  $(h \circ g)(x) = ?$

- A.  $-x^3 + 8x + 8$
- B.  $-x^2 + 2x + 2$
- C.  $-x^2$
- D.  $-x^2 + 6x + 4$
- E.  $x^2 + 6x + 4$

36. If  $f(x) = -x^2 - 9$  and  $g(x) = x - 4$ , then  $(f \circ g)(2) = ?$

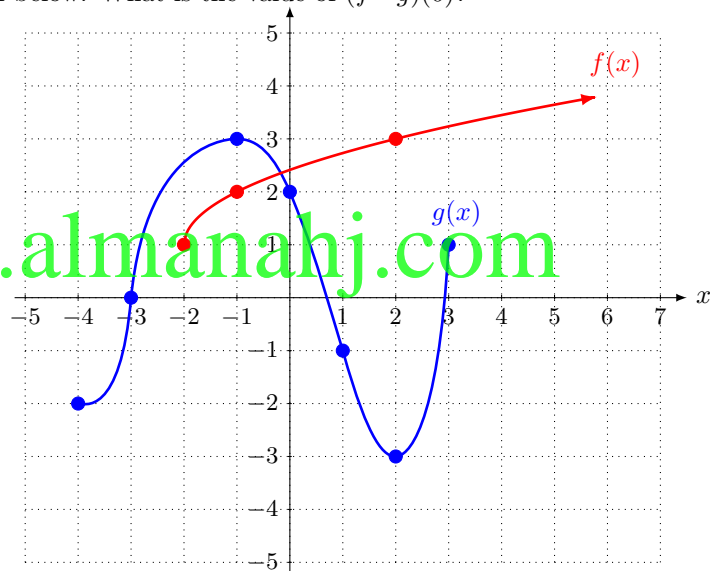
- A. -17
- B. -13
- C. 26
- D. 13
- E. 17

37. If  $g(x) = 3x + 1$  and  $(f \circ g)(x) = \frac{3}{\sqrt{3x+1}}$ , then  $f(x) = ?$

- A.  $\frac{3}{\sqrt{x}}$
- B.  $\sqrt{3x+1}$
- C. 3
- D.  $\frac{3}{x}$
- E.  $\frac{1}{\sqrt{3x+1}}$

38. The graphs of  $f(x)$  and  $g(x)$  are given below. What is the value of  $(f \circ g)(0)$ ?

- A.  $-\frac{1}{2}$
- B. 0
- C. 3
- D.  $-\frac{2}{3}$
- E. -3



39. If  $f(x) = \sqrt{-2x - 4}$  and  $g(x) = 3x^2 + 4x - 4$ , then the domain of  $f + g$  is

- A.  $(-2, +\infty)$
- B.  $[-2, +\infty)$
- C.  $(-\infty, +\infty)$
- D.  $(-\infty, -2]$
- E.  $(-\infty, -2)$

40. If  $f(x) = \frac{x+3}{x-4}$ , what is the range of  $f^{-1}$ ?

- A.  $(-\infty, 4) \cup (4, +\infty)$
- B.  $(-\infty, +\infty)$
- C.  $(-\infty, -3) \cup (-3, +\infty)$
- D.  $(-\infty, 4)$
- E.  $(-\infty, -3)$



41. For what value of  $x$  does the function  $f(x) = -x^2 + 3x - 5$  attain its maximum ?

- A. 5
- B.  $2\frac{1}{2}$
- C. 3
- D.  $1\frac{1}{2}$
- E.  $-1\frac{1}{2}$

42. Which of the following is the vertex of the graph of the quadratic function  $y = -2x^2 - 8x + 1$ ?

- A.  $(-2, -23)$
- B.  $(-2, 9)$
- C.  $(-2, 25)$
- D.  $(2, -23)$
- E.  $(2, 9)$

43. If  $f(x) = \sqrt{x-1}$ , what is the value of  $f^{-1}(2)$ ?

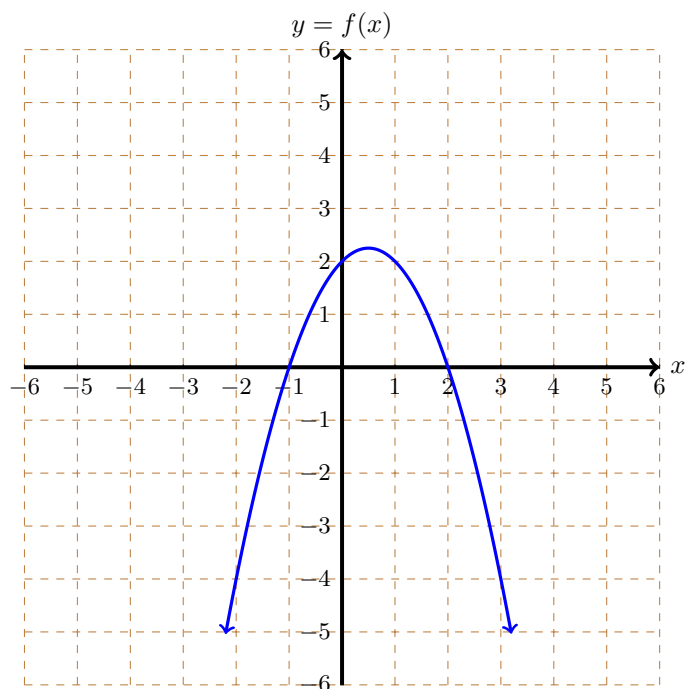
- A. 5
- B. -1
- C. 1
- D.  $\sqrt{5}$
- E. 2

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44. If  $f(x) = \frac{6-x}{-2x+1}$ , then  $f^{-1}(x) = ?$

- A.  $\frac{-2x+1}{6-x}$
- B.  $\frac{6-x}{-2x+1}$
- C.  $\frac{x+3}{2x+1}$
- D.  $\frac{-6+x}{-2x+1}$
- E.  $\frac{6-x}{2x-1}$

45. Which of the following is an appropriate expression for function  $f$  whose graph is given below?



- A.  $f(x) = x + 2$
- B.  $f(x) = -x^2 - 2$
- C.  $f(x) = -x^2 + 3$
- D.  $f(x) = -x^2 + 2$
- E.  $f(x) = -(x + 1)(x - 2)$

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46. Which of the following is the solution set to the logarithmic equation  $\log_4(x + 5) + \log_4(x - 1) = 2$ ?

- A.  $\{-7, 3\}$
- B.  $\{4\}$
- C.  $\{-7\}$
- D.  $\{3\}$
- E.  $\{-3, 7\}$

47. If  $27^{4x+5} = \left(\frac{1}{9}\right)^{x-3}$ , then  $x = ?$

- A.  $-\frac{21}{14}$
- B.  $-\frac{9}{14}$
- C.  $-\frac{21}{10}$
- D.  $\frac{21}{24}$
- E.  $-\frac{9}{10}$

48. If  $\log_5(4x) = -2$ , then what is the value of  $x$ ?

- A. 100
- B.  $\frac{1}{100}$
- C.  $-\frac{1}{50}$

- D.  $\frac{1}{50}$
- E.  $\frac{1}{25}$

49. If  $2\log_4(x) = \log_4(64)$ , then  $x =$ ?

- A. 16
- B. 62
- C. 32
- D.  $\sqrt{8}$
- E. 8

50. If  $5^{3x+2} = 12$ , then  $x \approx$ ?

- A. -0.261
- B. 2.648
- C. -0.340
- D. -0.152
- E. -0.523

51. For all  $x > 0$  and  $y > 0$ ,  $\log_7(x^4\sqrt{y}) =$ ?

- A.  $4\log_7(x) + \frac{1}{2}\log_7(y)$
- B.  $4\log_7(x) - \frac{1}{2}\log_7(y)$
- C.  $\log_4(x) + \log_7(y) - \log_7\left(\frac{1}{2}\right) - \log_7(x)$
- D.  $\log_4(x) + \log_7(x) + \log_7\left(\frac{1}{2}\right) - \log_7(x)$
- E.  $\log_4(x) + \log_7(x) - \log_7\left(\frac{1}{2}\right) + \log_7(x)$

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52. If  $i = \sqrt{-1}$  and  $x + yi = \frac{5 + 3i}{2 - i}$ , which of the following is the value of the real number  $y$ ?

- A.  $-\frac{11}{5}i$
- B.  $\frac{11}{5}i$
- C.  $-\frac{11}{5}$
- D.  $\frac{11}{5}$
- E.  $\frac{7}{5}$

53. If  $f(x) = 2x^2 - px - 6$  and  $f(2) = -14$ , then  $p =$ ?

- A. -8
- B. 14
- C. 0
- D. 8
- E. 6

54. If  $i = \sqrt{-1}$ , then  $i^3 + i^5 + i^7 + i^9 = ?$

- A.  $-2i$
- B.  $2i$
- C.  $0$
- D.  $1$
- E.  $-4i$

55. If  $i = \sqrt{-1}$ , then  $(5 + 2i)^2 = ?$

- A.  $21 + 20i$
- B.  $21 - 20i$
- C.  $-21 + 20i$
- D.  $29 - 20i$
- E.  $29 + 20i$

56. If  $10! = 7! \cdot m$ , then  $m = ?$

- A.  $\frac{720}{7}$
- B.  $3$
- C.  $720$
- D.  $\frac{10}{7}$
- E.  $\frac{1}{720}$

57. If  $\frac{3}{4}, x, \frac{1}{12}, \dots$  is an arithmetic sequence, then  $x = ?$

- A.  $-\frac{5}{12}$
- B.  $-\frac{12}{5}$
- C.  $\frac{13}{12}$
- D.  $\frac{5}{12}$
- E.  $\frac{12}{5}$

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58. Which of the following is not a one-to-one function?

- A.  $(x - 1)^2 - 7, x \geq 1$
- B.  $(x - 2)^3 + 4$
- C.  $x + 6$
- D.  $x^2 + 5$
- E.  $-\sqrt{x + 3}$

59. What is the sum of the first 18 terms of the arithmetic sequence  $\frac{1}{4}, 1, \frac{7}{4}, \dots$ ?

- A.  $\frac{477}{4}$
- B.  $230$
- C.  $\frac{953}{4}$
- D.  $-\frac{451}{4}$

E.  $-\frac{4}{477}$

60. What is the tenth term of the geometric sequence 4, -12, 36, ...?

- A. -120
- B. 236, 196
- C. -78, 732
- D. -59, 045
- E. 78, 732

61. If the domain of the function  $f$  is  $[-2, 5)$ , what is the domain of the function  $g$  defined by  $g(x) = f(x + 3) - 6$ ?

- A.  $[-5, 2)$
- B.  $[1, 2]$
- C.  $[1, 8)$
- D.  $[2, -5)$
- E.  $(8, -5]$

62. If  $A = \begin{bmatrix} 3 & -4 \\ 8 & -1 \end{bmatrix}$  and  $B = \begin{bmatrix} -8 & -4 \\ 3 & 5 \end{bmatrix}$ , then  $-2A + 3B = ?$

- A.  $\begin{bmatrix} -13 & 18 \\ -4 & 7 \end{bmatrix}$
- B.  $\begin{bmatrix} 25 & -4 \\ 18 & -13 \end{bmatrix}$
- C.  $\begin{bmatrix} -7 & -20 \\ 30 & 7 \end{bmatrix}$
- D.  $\begin{bmatrix} 18 & 20 \\ -25 & -13 \end{bmatrix}$
- E.  $\begin{bmatrix} -30 & -4 \\ -7 & 17 \end{bmatrix}$

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63. If  $\begin{vmatrix} a & b \\ c & d \end{vmatrix} = ad - bc$ , which of the following is equivalent to  $\begin{vmatrix} 9 & -7 \\ 2 & -1 \end{vmatrix} - \begin{vmatrix} 8 & \sqrt{7} \\ -\sqrt{7} & 6 \end{vmatrix}$ ?

- A. 102
- B. -120
- C. -14
- D. -50
- E. -12

64. If  $i = \sqrt{-1}$ , then  $i^{18} = ?$

- A. -1
- B.  $i$
- C. 1
- D.  $-i$
- E. 0

65. If  $n \geq 1$ , which of the following expressions is equivalent to  $\frac{n!(n+6)!}{(n+7)!(n-1)!}$ ?

- A.  $\frac{n}{n+7}$
- B.  $\frac{n}{n+6}$
- C.  $\frac{n^2+6n}{n^2+6n-7}$
- D.  $\frac{6n}{7n-7}$
- E.  $\frac{n+7}{n}$

66. What is the 205<sup>th</sup> term of the arithmetic sequence 15, 8, 1, -6, ...?

- A. 1420
- B. -1413
- C. 1413
- D. -1420
- E. 1443

67. What is the ninth term of the geometric sequence whose first term is 6 and whose fourth term is  $\frac{16}{9}$ ?

- A.  $\frac{19683}{128}$
- B.  $\frac{512}{2187}$
- C.  $\frac{2187}{512}$
- D.  $\frac{128}{729}$
- E.  $\frac{243}{64}$

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68. For  $x \neq -1$ ,  $\frac{3x^2+2x+3}{x+1} = ?$

- A.  $3x+1+\frac{4}{x+1}$
- B.  $x-1+\frac{4}{x+1}$
- C.  $3x-1+\frac{4}{x+1}$
- D.  $3x+3+\frac{4}{x+1}$
- E.  $3x-1-\frac{4}{x+1}$

69. For  $x \neq -1$ ,  $x \neq -4$  and if  $\frac{5x+14}{(x+1)(x+4)} = \frac{A}{x+4} + \frac{B}{x+1}$ , then

- A.  $A = 2$  and  $B = -3$
- B.  $A = 2$  and  $B = 4$
- C.  $A = -2$  and  $B = 3$
- D.  $A = 2$  and  $B = 3$
- E.  $A = 2$  and  $B = 5$

70. Which of the intervals below is the solution set of the inequality  $x^2 - 7x + 12 \leq 0$  ?

- A.  $[3, 4)$
- B.  $(3, 4]$
- C.  $(-\infty, 3] \cup [4, \infty)$
- D.  $(-\infty, 3) \cup (4, \infty)$
- E.  $[3, 4]$

71. Which of the intervals below is the solution set of the inequality  $\frac{2x-5}{x+3} \geq 0$  ?

- A.  $(-\infty, -3] \cup [5/2, \infty)$
- B.  $(-\infty, -3) \cup (5/2, \infty)$
- C.  $(-\infty, -3) \cup [5/2, \infty)$
- D.  $[5/2, \infty)$
- E.  $(-\infty, -3)$

72. If  $\sqrt{2x-1} = 3$ , then  $-3x = ?$

- A. 5
- B. 3
- C. 12
- D. 15
- E. -15

## TRIGONOMETRY

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73. What is the degree measure of  $\theta = -\frac{3\pi}{20}$  ?

- A. -27
- B. -16
- C. 0
- D. -4
- E. 2

74. What is the radian measure of  $\theta = 216^\circ$  ?

- A.  $108\pi$
- B.  $\frac{5\pi}{6}$
- C.  $\frac{6\pi}{5}$
- D.  $\frac{8\pi}{9}$
- E.  $\frac{4\pi}{9}$

75. The angles  $-11^\circ$  and  $101^\circ$  are

- A. complementary
- B. supplementary
- C. both acute
- D. both obtuse
- E. none of the above

76. Find the smallest positive angle coterminal with  $-980^\circ$ .

- A.  $100^\circ$
- B.  $820^\circ$
- C.  $460^\circ$
- D.  $-260^\circ$
- E.  $-620^\circ$

77. Convert  $\frac{5\pi}{6}$  to degree measure.

- A.  $210^\circ$
- B.  $150^\circ$
- C.  $120^\circ$
- D.  $240^\circ$
- E.  $500^\circ$

78. Convert  $-300^\circ$  to radian measure.

- A.  $\frac{11\pi}{4}$
- B.  $\frac{5\pi}{6}$
- C.  $-\frac{5\pi}{3}$
- D.  $\frac{7\pi}{3}$
- E.  $\frac{7\pi}{4}$

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79. Which of the following angles is coterminal with  $\frac{5\pi}{4}$ ?

- A.  $-\frac{7\pi}{4}$
- B.  $\frac{7\pi}{4}$
- C.  $\frac{3\pi}{4}$
- D.  $-\frac{\pi}{4}$
- E.  $\frac{13\pi}{4}$

80. Given  $\sin \alpha = \frac{\sqrt{10}}{10}$ , find the exact value of  $\sec \alpha$ .

- A. 3
- B.  $\frac{\sqrt{110}}{10}$
- C.  $\frac{3\sqrt{10}}{10}$
- D.  $\frac{10}{3}$
- E.  $\frac{\sqrt{10}}{3}$



81. Find the exact value of  $\frac{1}{\sec^2 32^\circ} + \frac{1}{\csc^2 32^\circ}$ .

- A. 2
- B. 1
- C.  $\frac{1}{16}$
- D.  $\frac{1}{2}$
- E. 0

82. Find the exact value of  $\cos \frac{\pi}{3} - \cot \frac{\pi}{4}$ .

- A.  $\frac{3}{2}$
- B.  $-\frac{3}{2}$
- C.  $\frac{1}{2}$
- D.  $-\frac{1}{2}$
- E. 0

83. Find the exact value of  $\csc(-420^\circ)$ .

- A.  $-\frac{2\sqrt{3}}{3}$
- B.  $\frac{2\sqrt{3}}{3}$
- C. 2
- D. -2
- E.  $2\sqrt{3}$

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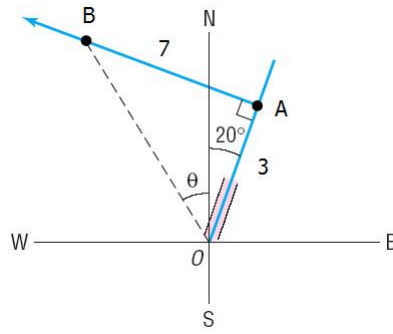
84. An observer standing 50 meters away from a building notices a flagpole on the top of the building. If the angle of elevation to the base of the flagpole is  $46.2^\circ$  and the angle of elevation to the top of the flagpole is  $50.1^\circ$ , what is the height of the flagpole?

- A. 2.3 m
- B. 2.5 m
- C. 59.8 m
- D. 7.7 m
- E. 3.4 m

85. Find the reference angle of  $600^\circ$ .

- A.  $25^\circ$
- B.  $15^\circ$
- C.  $60^\circ$
- D.  $30^\circ$
- E.  $45^\circ$

86. An aircraft takes off from an airport which has a bearing of NorthEast  $20^\circ$ . After flying 3 miles, the pilot turns the plane  $90^\circ$  heading NorthWest. After the plane goes 7 miles in this direction, what is the bearing of the aircraft from the due North of the airport tower? (that is, what is the angle  $\theta$ )? See graph below.



- A.  $66.8^\circ$
- B.  $5.4^\circ$
- C.  $44.6^\circ$
- D.  $23.2^\circ$
- E.  $46.8^\circ$

87. If  $\cos \theta = -\frac{2}{3}$  and  $\frac{\pi}{2} < \theta < \pi$ , find the exact value of  $\cot \theta$ .

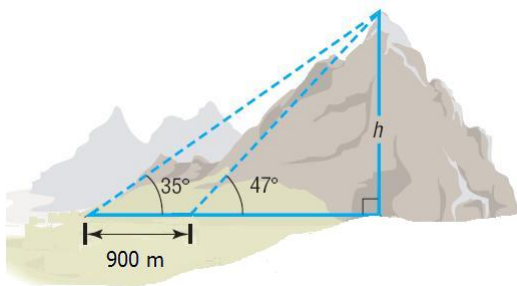
- A.  $\frac{3\sqrt{5}}{5}$
- B.  $-\frac{2\sqrt{5}}{5}$
- C.  $-\frac{\sqrt{5}}{2}$
- D.  $\frac{2\sqrt{5}}{5}$
- E.  $-\frac{3}{2}$

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88. If  $\tan \theta = -4$  and  $\sin \theta < 0$ , find the exact value of  $\cos \theta$ .

- A.  $-\frac{1}{4}$
- B.  $\sqrt{17}$
- C.  $\frac{\sqrt{17}}{17}$
- D.  $-\frac{4\sqrt{17}}{17}$
- E.  $-\frac{3}{2}$

89. From a distance, an observer estimated that the angle of elevation to the top of the mountain is  $35^\circ$ . The observer moved 900 meters closer to the mountain and estimated the angle of elevation to be  $47^\circ$ . How tall is the mountain? See figure below.



- A. 2595 m  
 B. 1816 m  
 C. 381 m  
 D. 6404 m  
 E. 630 m
90. If  $\left(-\frac{\sqrt{5}}{5}, \frac{2\sqrt{5}}{5}\right)$  is a point on the unit circle corresponding to angle  $t$ , find  $\cot t$ .

- A.  $-\frac{1}{2}$   
 B.  $-\sqrt{5}$   
 C.  $-\frac{\sqrt{5}}{5}$   
 D.  $-\frac{2}{5}$   
 E.  $-2$

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91. If  $(-5, 11)$  is a point on the terminal side of an angle  $\theta$  in standard position, find the exact value of  $\sec \theta$ .

- A.  $-\frac{5}{11}$   
 B.  $-\frac{4\sqrt{6}}{5}$   
 C.  $-\frac{\sqrt{146}}{11}$   
 D.  $-\frac{11}{5}$   
 E.  $-\frac{\sqrt{146}}{5}$

92. Name the quadrant in which the angle  $\theta$  lies if  $\csc \theta < 0$  and  $\cot \theta > 0$ .

- A. *I*  
 B. *II*  
 C. *III*  
 D. *IV*  
 E. *V*

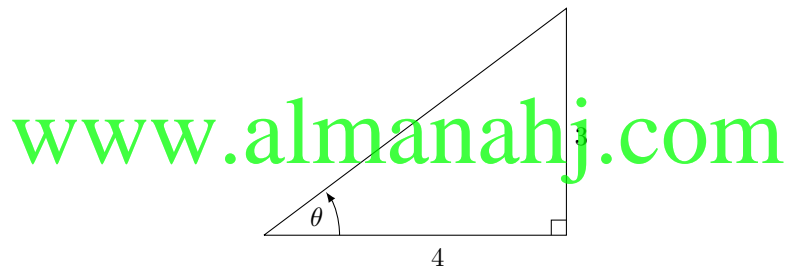
93. Find the point on the unit circle associated with the angle  $-\frac{5\pi}{6}$ .

- A.  $\left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
- B.  $\left(-\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
- C.  $\left(\frac{\sqrt{3}}{2}, -\frac{1}{2}\right)$
- D.  $\left(-\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$
- E.  $\left(-\frac{1}{2}, -\frac{\sqrt{3}}{2}\right)$

94. What is the maximum value of  $f(x) = -3 \sin(5x - 4)$ ?

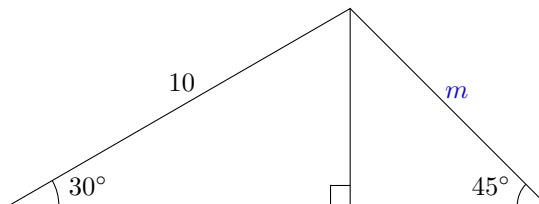
- A. 5
- B. 3
- C. 4
- D. 1.5
- E. 15

95. In the right triangle below, what is  $\sin \theta$ ?



- A.  $\frac{4}{5}$
- B.  $\frac{3}{5}$
- C.  $\frac{3}{4}$
- D.  $\frac{4}{3}$
- E.  $\frac{4}{7}$

96. In the triangle below,  $m = ?$



- A.  $3\sqrt{5}$
- B.  $4\sqrt{3}$
- C.  $5\sqrt{2}$
- D.  $6\sqrt{3}$

E.  $2\sqrt{3}$

97. If  $0^\circ < \theta < 90^\circ$  and  $\sin \theta = 0.5$ , what is the value of  $\sec \theta$ ?

A.  $\frac{2}{\sqrt{3}}$

B.  $\frac{\sqrt{3}}{2}$

C.  $-\frac{1}{2}$

D.  $-\frac{\sqrt{3}}{2}$

E.  $\frac{1}{2}$

98. If  $\sin(\theta + 2\pi) = 0.4$ ,  $\sin(\theta - 12\pi) = ?$

A.  $-0.4$

B.  $0.6$

C.  $0.4$

D.  $\sqrt{0.84}$

E.  $\sqrt{0.48}$

99. If  $\cos \theta = 0.7$ ,  $\cos(\theta + \pi) = ?$

A.  $0.7$

B.  $\sqrt{0.51}$

C.  $-0.3$

D.  $-0.7$

E.  $\sqrt{0.15}$

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100. If  $f(x) = -4 \sin(x + \pi/2)$  and  $g(x) = \frac{x}{3}$ , then  $f(g(\pi/2)) = ?$

A.  $\sqrt{3}/4$

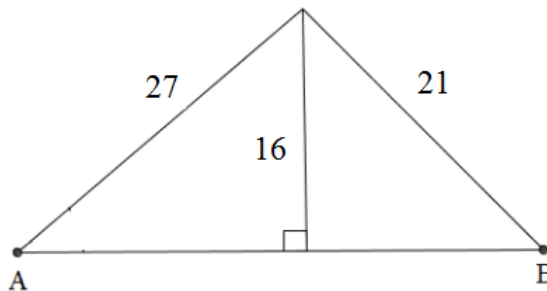
B.  $3\sqrt{3}$

C.  $2\sqrt{3}$

D.  $-2/\sqrt{3}$

E.  $-2\sqrt{3}$

101. Which of the following is closest to the length of segment AB in the figure below?



A. 24

B. 48

C. 37

- D. 34
- E. 53

102. A person standing 150 meters away from the base of a building measures the angle of elevation to the top of the building to be  $35^\circ$ . Approximately how tall is the building.

- A. 105 meters
- B. 123 meters
- C. 86 meters
- D. 214 meters
- E. 155 meters

103. If  $\tan \theta = 3$  and  $\sin \theta < 0$ , what is the value of  $\cos \theta$ ?

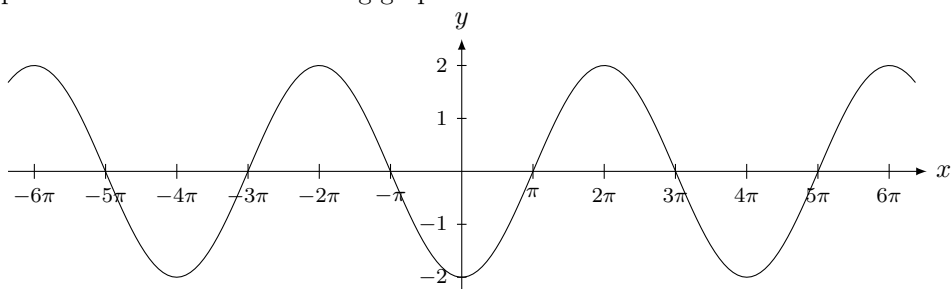
- A.  $\frac{1}{\sqrt{2}}$
- B.  $\frac{1}{\sqrt{10}}$
- C.  $-\frac{1}{2\sqrt{2}}$
- D.  $\frac{1}{2\sqrt{2}}$
- E.  $-\frac{1}{\sqrt{10}}$

104. What is the period of the function  $y = \cos\left(\frac{3\pi x}{2}\right)$ ?

- A.  $\frac{2}{3}$
- B.  $\frac{4\pi}{3}$
- C.  $\frac{3\pi}{2}$
- D.  $\frac{4}{3}$
- E.  $\frac{2}{3}$

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105. Find an appropriate function for the following graph:



- A.  $y = -2 \cos\left(\frac{\pi x}{2}\right)$
- B.  $y = -2 \cos\left(\frac{x}{2}\right)$
- C.  $y = -2 \sin\left(\frac{x}{4}\right)$
- D.  $y = 2 \sin(2x)$
- E.  $y = -\cos(2x)$

106. Which of the following is not an identity?

- A.  $1 + \tan^2 \theta = \sec^2 \theta$
- B.  $\sin^2 \theta + \cos^2 \theta = 1$
- C.  $\tan(2\theta) = 2 \tan \theta$
- D.  $\cos(-\theta) = \cos \theta$
- E.  $\sin(-\theta) = -\sin \theta$

107. If  $180^\circ < \theta < 270^\circ$  and  $\tan \theta = \sqrt{3}$ , what is the value of  $\sin(2\theta)$ ?

- A.  $\frac{1}{\sqrt{3}}$
- B.  $\frac{\sqrt{3}}{2}$
- C.  $-\frac{1}{4}$
- D.  $\frac{1}{2}$
- E. 0.25

108. If  $0 < \theta < \frac{\pi}{2}$  and  $\cos \theta = 0.4$ , then  $\sin\left(\frac{\theta}{2}\right) = ?$

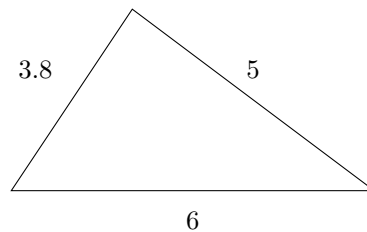
- A.  $-\sqrt{0.7}$
- B.  $-\sqrt{0.3}$
- C.  $\sqrt{0.7}$
- D.  $\sqrt{0.3}$
- E.  $-\sqrt{0.4}$

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109. For what values of  $x$  is the graph of  $y = -\sin(x)$  always increasing?

- A.  $[\pi/2, 3\pi/2]$
- B.  $[0, \pi]$
- C.  $[\pi, 2\pi]$
- D.  $[0, 2\pi]$
- E.  $[-\pi/2, \pi/2]$

110. Which of the following is closest to the measure of the angle opposite the side whose length is 6 in the triangle below?



- A.  $56^\circ$
- B.  $39^\circ$
- C.  $85^\circ$
- D.  $45^\circ$
- E.  $67^\circ$

111. What is the exact value of  $\cos(\arctan(1/4))$ ?

- A.  $\frac{4}{17}$
- B.  $\frac{4\sqrt{17}}{17}$
- C.  $\frac{1}{16}$
- D.  $\frac{\sqrt{17}}{17}$
- E.  $\frac{4\sqrt{15}}{15}$

112. What are all the solutions of the equation  $\sin(x - \frac{\pi}{4}) + \sin(x + \frac{\pi}{4}) = -1$  in the interval  $[0, 2\pi)$ ?

- A.  $x = \frac{7\pi}{4}$  and  $x = \frac{5\pi}{4}$
- B.  $x = \frac{7\pi}{4}$
- C.  $x = \frac{5\pi}{4}$
- D.  $x = \frac{9\pi}{4}$  and  $x = \frac{7\pi}{4}$
- E.  $x = \frac{11\pi}{4}$  and  $x = \frac{3\pi}{4}$

113. What are all the solution set of the equation  $2\sin^2 x + 3\sin x = -1$ , in the interval  $[0, 2\pi)$ ?

- A.  $x = \frac{7\pi}{6}$  and  $x = \frac{5\pi}{4}$
- B.  $x = \frac{11\pi}{6}$  and  $x = \frac{3\pi}{2}$
- C.  $x = \frac{7\pi}{6}$  and  $x = \frac{11\pi}{6}$
- D.  $x = \frac{7\pi}{6}$ ,  $x = \frac{11\pi}{6}$  and  $x = \frac{3\pi}{2}$
- E.  $x = \frac{3\pi}{2}$

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114. The measurement of an angle of a right triangle is  $40^\circ$  and the leg opposite to this angle is 5cm long. What is the length, in cm, of the other leg?

- A.  $\frac{\tan 40^\circ}{5}$
- B.  $\frac{\tan 50^\circ}{5}$
- C.  $\frac{5}{\tan 40^\circ}$
- D.  $\frac{5}{\tan 50^\circ}$
- E. 5

115. Find a point on the unit circle such that its y-coordinate is  $-\frac{3}{5}$  and is located in quadrant III.

- A.  $(\frac{4}{5}, -\frac{3}{5})$
- B.  $(\frac{3}{5}, -\frac{3}{5})$
- C.  $(-\frac{3}{5}, -\frac{3}{5})$



- D.**  $(-\frac{4}{5}, -\frac{3}{5})$
- E.**  $(-\frac{4}{25}, -\frac{3}{5})$

116. Find  $x$  if  $0 < x < 3\pi/2$  and  $\sin(x) = -\frac{\sqrt{3}}{2}$ .

- A.**  $\frac{4\pi}{3}$
- B.**  $\frac{7\pi}{6}$
- C.**  $\frac{5\pi}{3}$
- D.**  $\frac{2\pi}{3}$
- E.**  $\frac{7\pi}{3}$

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117. Find the rotation  $t \in [0, 2\pi)$  associated with the point  $(-\frac{\sqrt{2}}{2}, -\frac{\sqrt{2}}{2})$  on the unit circle.

- A.**  $\frac{3\pi}{4}$
- B.**  $\frac{7\pi}{4}$
- C.**  $\frac{\pi}{4}$
- D.**  $\frac{2\pi}{3}$
- E.**  $\frac{5\pi}{4}$

Answers

1. C
2. B
3. E
4. C
5. A
6. A
7. C
8. C
9. B
10. B
11. E
12. B
13. D
14. E
15. C
16. D
17. A
18. D
19. C
20. E
21. B
22. A
23. E
24. C
25. E
26. A
27. B
28. D
29. A
30. E
31. D
32. B
33. C
34. B
35. E

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- 36. B
- 37. A
- 38. C
- 39. D
- 40. A
- 41. D
- 42. B
- 43. A
- 44. B
- 45. E
- 46. D
- 47. B
- 48. B
- 49. E
- 50. D
- 51. A
- 52. D
- 53. D
- 54. C
- 55. A
- 56. C
- 57. D
- 58. D
- 59. A
- 60. C
- 61. A
- 62. E
- 63. D
- 64. A
- 65. A
- 66. B
- 67. B
- 68. C
- 69. D
- 70. E
- 71. C
- 72. E

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- 73. A
- 74. C
- 75. E
- 76. A
- 77. B
- 78. C
- 79. E
- 80. E
- 81. B
- 82. D
- 83. A
- 84. D
- 85. C
- 86. E
- 87. B
- 88. C
- 89. B
- 90. A
- 91. E
- 92. C
- 93. B
- 94. B
- 95. B
- 96. C
- 97. A
- 98. C
- 99. D
- 100. E
- 101. D
- 102. A
- 103. E
- 104. D
- 105. B
- 106. C
- 107. B
- 108. D
- 109. A

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110. C

111. B

112. A

113. D

114. C

115. D

116. A

117. E

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