MATHS

BOOKS - INDEPENDENTLY PUBLISHED MATHS (ENGLISH)

PASSPORT TO ADVANCED MATH

Example

1. If $x > 1$ and $\dfrac{\sqrt{x^3}}{x^2} = x^n$, what is the value of n?

A. $-\dfrac{3}{2}$

B. -1

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

D. $\dfrac{1}{2}$

Answer: C

2. $f(x) = 2x^3 - 5x^2 - 8x + 20$

What are the zeros of function f defined by the above equation?

3. $f(x) = 3x^3 + kx^2 - 32x + 28$

The function f is defined by the equation above where k is a nonzero constant. In the xy-plane the graph of f intersects the x-axis at three points: $(-2, 0)$, $\left(\dfrac{3}{2}, 0\right)$, and $(c, 0)$. What is the value of k?

A. -25

B. -17

C. 7

D. 14

Answer: B

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4. If $x + 3$ is a factor of $f(x) = px^2 + p^2x + 30$ and $p > 0$, what is the value of p?

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5. When $x^{-1} - 1$ is divided by $x - 1$,the quotient is

A. -1

B. $-\dfrac{1}{x}$

C. $\dfrac{1}{x^2}$

D. $\dfrac{1}{(x-1)^2}$

Answer: B

6. $\dfrac{2(n-1)}{3} - \dfrac{3(n+1)}{4} = \dfrac{n+3}{2}$

In the equation above, what is the value of n^2?

7. $\dfrac{9}{y+1} + \dfrac{18}{y^2-1} = 1$

What is the possible solution of the equatio above?

8. Which of the following complex numbers is equivalent to $\dfrac{8 - 4i}{5 + 3i}$? (Note: $i = \sqrt{-1}$)

A. $\dfrac{14}{17} + \dfrac{22}{17}i$

B. $\dfrac{14}{17} - \dfrac{22}{17}i$

C. $\dfrac{13}{17} - \dfrac{24}{17}i$

D. $\dfrac{13}{8} + \dfrac{14}{17}i$

Answer: B

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9. What are the solutions to $y^2 + 6y + 7 = 0$?

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10. Solve $4x^2 - 8x - 3 = 0$ by completing the square.

11. What is the smallest integral value oof k for which the roots $3x^2 + 8x - k = 0$ are real?

   A. -6

   B. -5

   C. 0

   D. 6

Answer: B

12. By the what amount does the product of the solutions of $3x^2 - 10x + 13 = 0$ exceed the sum of its solutions?

13. The graph of the function $f(x) = -\dfrac{1}{2}(x + 4)(x + 8)$ in the xy-plane is a parabola. Which of the following is an equivalent form of function f in which the maximum value of the function appears as a constant?

A. $f(x) = (x + 4)\left(4 - \dfrac{1}{2}x\right)$

B. $f(x) = -\dfrac{1}{2}(x + 6)^2 + 2$

C. $f(x) = -\dfrac{1}{2}x(x + 12) + 16$

D. $f(x) = \dfrac{1}{2}(x + 6)^2 + 20$

Answer: B

14. $y = -x^2 + 120x - 2,000$

the equation above gives the profit in dollars, y, a coat manufacturer earns day where x is the number of coats sold. What is the maximum profit he earns in dollars?

15. Stacy has 30 meters of fencing that she wishes to use to enclose a rectangular garden. If all of the fencing is used, what is the maximum area of the garden, in square meters, that can be enclosed?

A. 48.75
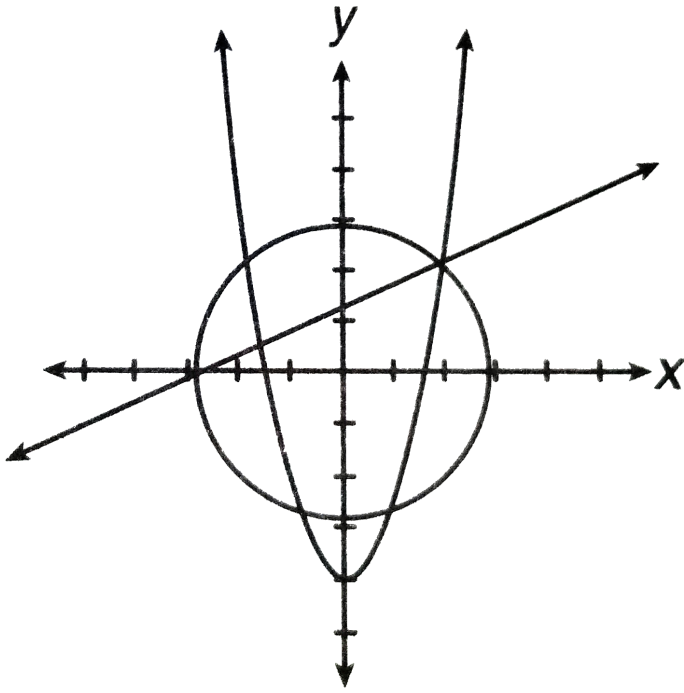
B. 56.25

C. 60.50

D. 168.75

Answer: B

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16. $h(t) = 144t - 16t^2$

The function above represents the height, in feet, a ball reaches t

seconds after it is tossed in the air from groud level.

a. What is the maximum height of the ball?

b. After how many seconds will the ball hit the ground before

rebounding?

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17.

A system of three equations whose graph in the xy-plane are a line, a circle, and a parabola are shown above. How many solutions does the system have?

A. 0

B. 1

C. 2

D. 4

Answer: B

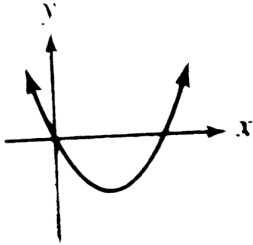**18.** If $x^2 - y^2 = 40$, and x-y=4 , then $x^2 + y^2$ =
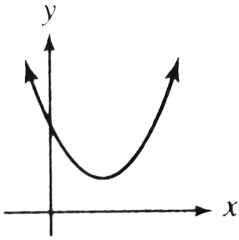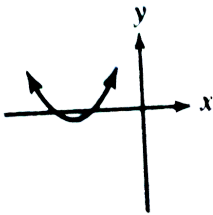
A. 2xy

B. $-2xy$

C. 100+2xy

D. 100-2xy

Answer: D

19. Which could be the graph of $y = x^2 + 3x + k$, where k is an integer ?
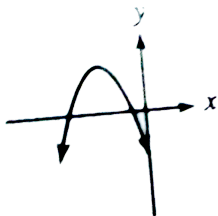

A.

B.

C.

D.

Answer: C

20. Which function has a double root ?

A. $y = x^2 + 4x - 4$

B. $y = x^2 + x + 1$

C. $y = x^2 - 4$

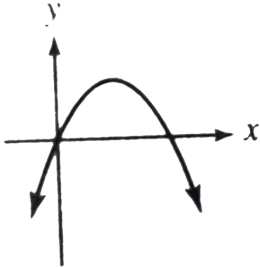D. $y = x^2 + 6x + 9$

Answer: D

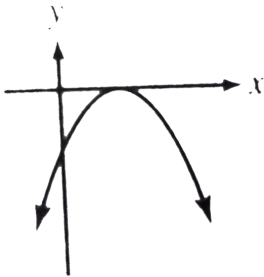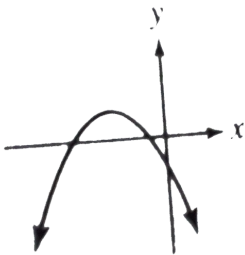**21.** If $f(x) = ax^2 + bx + c$, $a \neq 0$ and a, b , and c are all negative , which could be the graph of f(x) ?
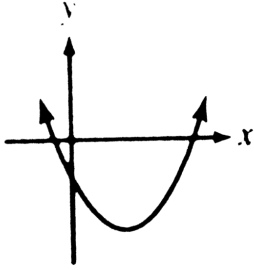

A.

B.

C.

D.

Answer: C

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22. The x-intercepts of a quadratic function are 2 and -4 . Which could be the function ?

$I.y = x^2 + 2x - 8$

$II.y = -2x^2 - 4x + 16$

$III.y = (x + 1)^2 - 9$

A. II and III only

B. I and III only

C. I and II only

D. I , II and III

Answer: D

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23. For the function $f(x) = ax^2 + bx + c, a \neq 0$, the sum of the roots is equal to the product of the roots . Which could be f(x) ?

A. $x^2 - 4x + 4$

B. $x^2 + x + 2$

C. $x^2 - 2x + 1$

D. $x^2 + 3x - 6$

Answer: A

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24. A stone projected vertically upward with initial velocity of 112 feet per second moves according to the equation

$$s = 112t - 16t^2$$

where s is the distance , in feet , from the ground , and t is time , in seconds. What is the maximum height reached by the stone ?

A. 672 feet

B. 196 feet

C. 112 feet

D. 96 feet

Answer: B

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25. Find the larger root of $x^2 - 6x = 10$.

26. $x^3 + 3x^2 - x - 3 = 0$

if the roots of the equation above are p,q, and r, where p < q < r .

Find the product pq.

A. 3

B. -3

C. 1

D. -1

Answer: A

27. Find a root of the equation $\dfrac{x}{x+2} = \dfrac{3}{x} + \dfrac{4}{x(x+2)}$

28. For a large Thanksgiving dinner , Mr. Gonzalez will cook a turkey that weighs at least 12 pounds but no more than 20 pounds. If x represents the weight of a turkey , in pounds, which of the following represents all possible values of x ?

A. $|x\text{-}16| \geq 4$

B. $|x - 12| \leq 20$

C. $|x - 16| \leq 4$

D. $|x - 20| \leq 16$

Answer: C

29. Which of the the solution is $\dfrac{x-5}{x+3} < -1$?

A. x lt -3 or x gt 5

B. x lt -3 or x gt 1

C. -3 lt x lt 5

D. -3 lt x lt 1

Answer: D

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30. A ball is thrown in the air from the top of a 50-foot high building .h(t) is a function that gives the height of the ball from the ground , in feet , in terms of t , the time in seconds. You may assume that t=0 corresponds to the time the ball is thrown .

Which of the following equations for h is consistent with the given information ?

A. $h = 50 + 10t + 16t^2$

B. $h = 50 + 10t - 16t^2$

C. $h = -50 + 10t - 16t^2$

D. $h = -50 + 10t + 16t^2$

Answer: B

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31. A soccer stadium has a seating capacity of 15,000 spectators . With a ticket price of $14, the average attendance is 9,500. A survey suggests that for each dollar the ticket price is lowered , the average attendance will increase by 1,000. A function that models revenue in terms of ticket price is :

A. R(x)=x[15,000+1,000(14-x)]

B. R(x)=x[1,000+9,500(14-x)]

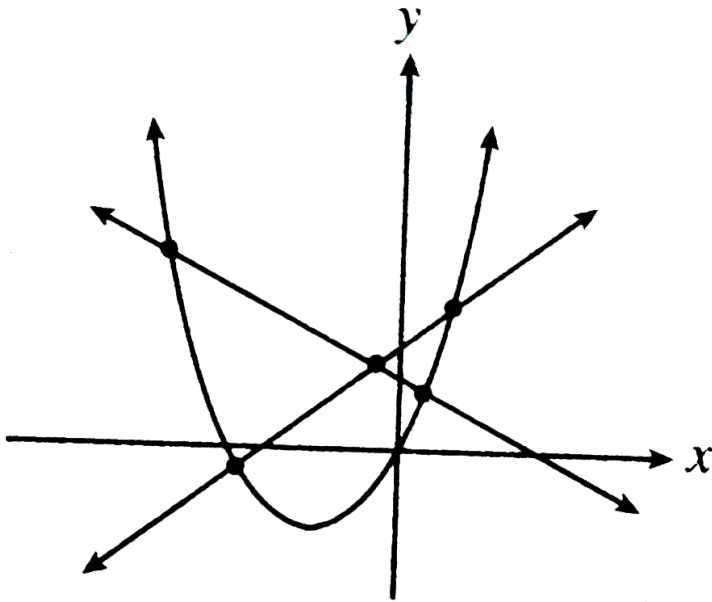C. R(x)=x[9,500+15,000 (14-x)]

D. R(x)=x[9,500 + 1,000 (14-x)]

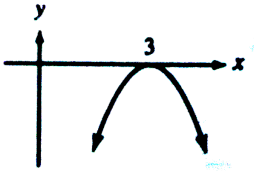**Answer: D**

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32.

A system of three equations is shown graphically in the xy-plane above. How many solutions does the system have ?
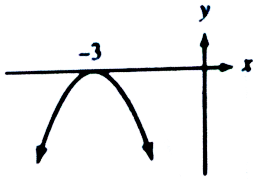
   A. 0
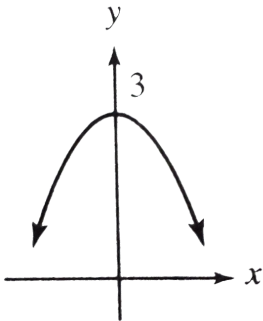
   B. 2

   C. 3

   D. 5

Answer: A

33. If $f(x) = -x^2$, which represents the graph of f(x)+3 ?

A.

B.

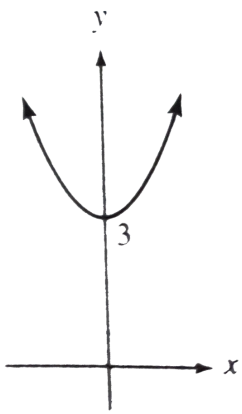

C.
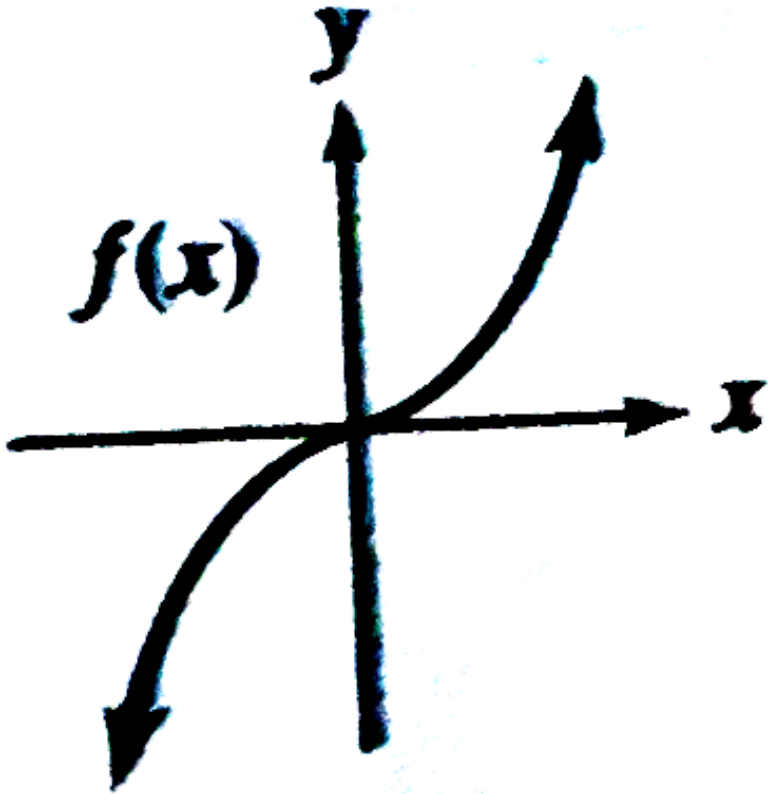
D.

Answer: C

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34.

The graph of f(x) is shown above , Which of the following represents the graph of f(x-3) ?

A.

B.

C.

D.
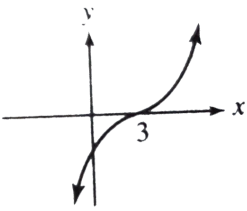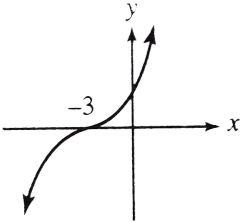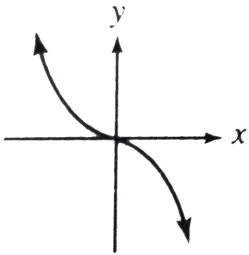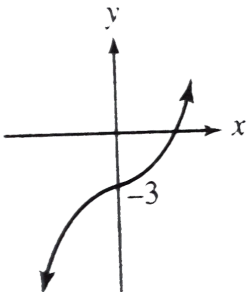
Answer: A

35. For the function $f(x) = x^2 + 2x - 6$, If the graph of f(x) is reflected across the x-axis , the graph of a new function, g(x) , is produced . Find g(3) .

A. -21

B. -9

C. -3

D. 3

Answer: B

36. If $f(x) = x^2 + 1$, and $g(x) = x - 2$, find x such that

$f(g(x)) = g(f(x))$

A. 1

B. $\dfrac{3}{2}$

C. 1.5

D. 2

Answer: B::C

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Multiple Choice

1. Which of the following is equal to $b^{-\frac{1}{2}}$ for all values of b for which the expression is defined?

A. $\dfrac{b}{b^2}$

B. $\dfrac{\sqrt{b}}{b}$

C. $\dfrac{1}{\sqrt{2b}}$

D. $\dfrac{1}{2}b$

Answer: B

2. Which expression is equivalent to $\left(9x^2y^6\right)^{-\frac{1}{2}}$?

A. $\dfrac{1}{3xy^3}$

B. $3xy^3$

C. $\dfrac{3}{xy^3}$

D. $\dfrac{xy^3}{3}$

Answer: A

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3. If $4^y + 4^y + 4^y + 4^y = 16^x$, then y=

    A. $2x - 1$

    B. $2x + 1$

    C. $x - 2$

    D. $x + 2$

Answer: A

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4. If $\sqrt{m} = 2p$, then $m^{\frac{3}{2}} =$

A. $\dfrac{p}{3}$

B. $2p^2$

C. $6p^3$

D. $8p^3$

Answer: D

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5. If $3^x = 81$ and $2^{x+y} = 64,$ then $\dfrac{x}{y} =$

A. 1

B. $\dfrac{3}{2}$

C. 2

D. $\dfrac{5}{2}$

Answer: C

6. Which of the following is equal to $y^{\frac{3}{2}}$ for all values of y for which the expression is defined?

A. $\sqrt[3]{y^2}$

B. $\sqrt{y^3}$

C. $\sqrt{y^{\frac{1}{2}}}$

D. $3\sqrt{y}$

Answer: B

7. Which expression is equivalent to $\dfrac{(2xy)^{-2}}{4y^{-5}}$?

A. $-\dfrac{y^3}{x^2}$

B. $-\dfrac{y^3}{16x^2}$

C. $\dfrac{y^3}{x^2}$

D. $\dfrac{y^3}{16x^2}$

Answer: D

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8. If $10^k = 64$, what is the value of $10^{\frac{k}{2}+1}$?

A. 18

B. 42

C. 80

D. 81

Answer: C

9. If x is a positive integer greater than 1, how much greater than x^2 is $x^{\frac{5}{2}}$?

A. $x^2\left(1 - x^{\frac{1}{2}}\right)$

B. $x^{-\frac{1}{2}}$

C. $x^2\left(x^{\frac{1}{2}} - 1\right)$

D. $x^{\frac{1}{2}}$

Answer: C

10. The expression $\dfrac{x^2}{\sqrt{x^2}}$ is equivalent to

A. $\sqrt[3]{y}$

B. $\dfrac{1}{\sqrt{x}}$

C. $\sqrt{x^2}$

D. $\dfrac{1}{\sqrt[3]{x^2}}$

Answer: C

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11. If n and p are positive integers such that $8(2^p) = 4^n$, what is n in terms of p?

A. $\dfrac{p+2}{3}$

B. $\dfrac{2p}{3}$

C. $\dfrac{p + 3}{2}$

D. $\dfrac{3p}{2}$

Answer: C

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12. $2\sqrt{x - k} = x - 6$

If k=3, what is the solution of the equation above?

    A. $\{4, 12\}$

    B. $\{3\}$

    C. $\{4\}$

    D. $\{12\}$

Answer: D

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13. When $x^{-1} - 1$ is divided by $x - 1$,the quotient is

A. -1

B. $-\dfrac{1}{x}$

C. $\dfrac{1}{x^2}$

D. $\dfrac{1}{(x-1)^2}$

Answer: B

14. If n is a negative integer, which statements is always true?

A. $6n^{-2} < 4n^{-1}$

B. $\dfrac{n}{4} > -6n^{-1}$

C. $6n^{-1} < 4n^{-1}$

D. $4n^{-1} > (6n)^{-1}$

Answer: C

15. If $g(x) = a\sqrt{a(1-x)}$ Function g is defined by the equation above. If $g(-8) = 375$, what is the value of a?

A. 25

B. 75

C. 125

D. 625

Answer: A

16. If $27^x = 9^{y-1}$, then

A. $y = \dfrac{3}{2}x + 1$

B. $y = \dfrac{3}{2}x + 2$

C. $y = \dfrac{3}{2}x + \dfrac{1}{2}$

D. $y = \dfrac{1}{2}x + \dfrac{2}{3}$

Answer: A

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17. The polynomial $x^3 - 2x^2 - 9x + 18$ is equivalent to

A. $(x - 9)(x - 2)^2$

B. $(x - 2)(x - 3)(x + 3)$

C. $(x + 3)(x - 2)^2$

D. $(x - 2)(x + 2)(x - 3)$

Answer: B

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18. When resistors R_1 and R_2 are connected in a parallel electric circuit, the total resistance is $\dfrac{1}{\dfrac{1}{R_1} + \dfrac{1}{R_2}}$. This fraction is equivalent to

A. $R_1 + R_2$

B. $\dfrac{R_1 + R_2}{R_1 R_2}$

C. $\dfrac{R_1}{R_2} + \dfrac{R_2}{R_1}$

D. $\dfrac{R_1 R_2}{R_1 + R_2}$

Answer: D

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19. In how many different points does the graph of the function $f(x) = x^3 - 2x^2 + x - 2$ intersect the x-axis?

    A. 0

    B. 1

    C. 2

    D. 3

Answer: B

20. $\dfrac{x^2 + 9x - 22}{x^2 - 121} \div (2 - x)$

The expression above is equivalent to

    A. $x - 11$

    B. $\dfrac{1}{x - 11}$

    C. $11 - x$

    D. $\dfrac{1}{11 - x}$

Answer: D

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21. If p(x) is a polynomial function and $p(4) = 0$, then which

statement is true?

    A. x+4 is a factor of p(x)

B. x-4 is a factor of p(x)

C. The greatest power of x in p(x) is 4.

D. p(x) is divisible by 4.

Answer: B

22. $\left(\dfrac{9}{4}x^2 - 1\right) - \left(\dfrac{3}{2}x - 1\right)^2$

The expression above is equivalent to

A. $3x - 2$

B. $-3x$

C. $\dfrac{3}{4}x - 2$

D. 0

Answer: A

23. $\dfrac{\dfrac{x-y}{y}}{y^{-1} - x^{-1}}$

The expression above is equivalent to

A. x

B. y

C. $\dfrac{1}{y}$

D. $-\dfrac{x}{y}$

Answer: A

24. $f(x) = 3x^3 - 5x^2 - 48x + 80$

If the zeros of function f defined above are represented by r, s, and t, what is the value of the sum $r + s + t$?

A. $\dfrac{3}{5}$

B. $\dfrac{5}{13}$

C. $\dfrac{17}{3}$

D. 8

Answer: B

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25. $\dfrac{y^3 + 3y^2 - y - 3}{y^2 + 4y + 3}$

The expression above is equivalent to

A. $y - 1$

B. $y + 1$

C. $\dfrac{y - 1}{y + 3}$

D. $y^2 - 1$

Answer: A

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X	f(x)	g(x)
-3	3	0
-1	0	3
0	-4	4
2	0	-2

26.

Several values of x, and the corresponding values for polynomial

functions f and g are shown in the table above. Which of the

following statements is true?

I. $f(0) + g(0) = 0$

II. f(x) is divisible by x+2

III. g(x) is divisible by x+3.
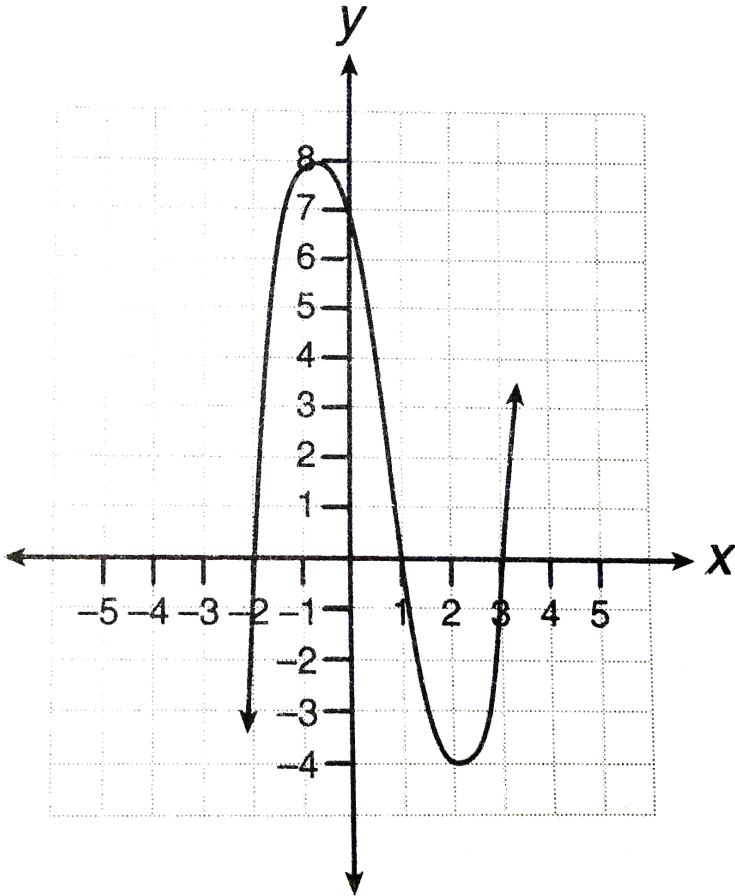
    A. I, II, and III

    B. I and II, only

C. II and III, only

D. I and III, only

Answer: D

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27.

Which equation(s) represent(s) the graph above?

I. $y = (x + 2)(x^2 - 4x - 12)$

II. $y = (x - 3)(x^2 + x - 2)$

III. $y = (x - 1)(x^2 - 5x - 6)$

    A. I only

B. II only

C. I and II

D. II and III

Answer: B

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28. Which of the following functions have zeros -1, 1, and 4?

A. $f(x) = (x - 4)(1 + x^2)$

B. $f(x) = (x + 4)(1 - x^2)$

C. $f(x) = (x - 1)(x^2 - 3x - 4)$

D. $f(x) = (x - 1)(x^2 + 3x - 4)$

Answer: C

29. $\left(\dfrac{10x^2y}{x^2 + xy} \right) \times \left(\dfrac{(x + y)^2}{2xy} \right) \div \left(\dfrac{x^2 - y^2}{y^2} \right)$

Which of the following is equivalent to the expression above?

A. $\dfrac{5y^2}{x - y}$

B. $\dfrac{y^2}{x - y}$

C. $\dfrac{xy}{x - y}$

D. $\dfrac{x + y}{xy}$

Answer: A

30. $f(x) = (2 - 3x)(x + 3) + 4(x^2 - 6)$

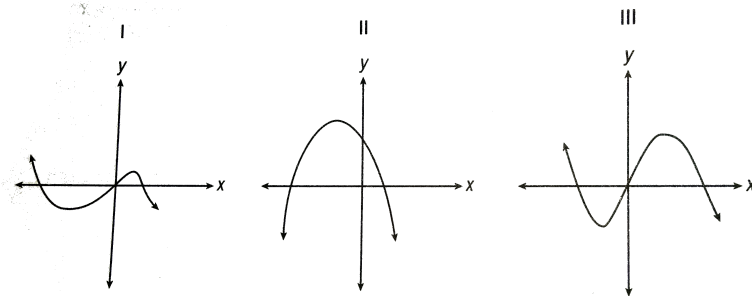What is the sum of the zeros of function f defined by the equation

above?

A. 3

B. 6

C. 7

D. 11

Answer: C

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31.

A polynomial function contains the factors x, $x - 2$, and $x + 5$.

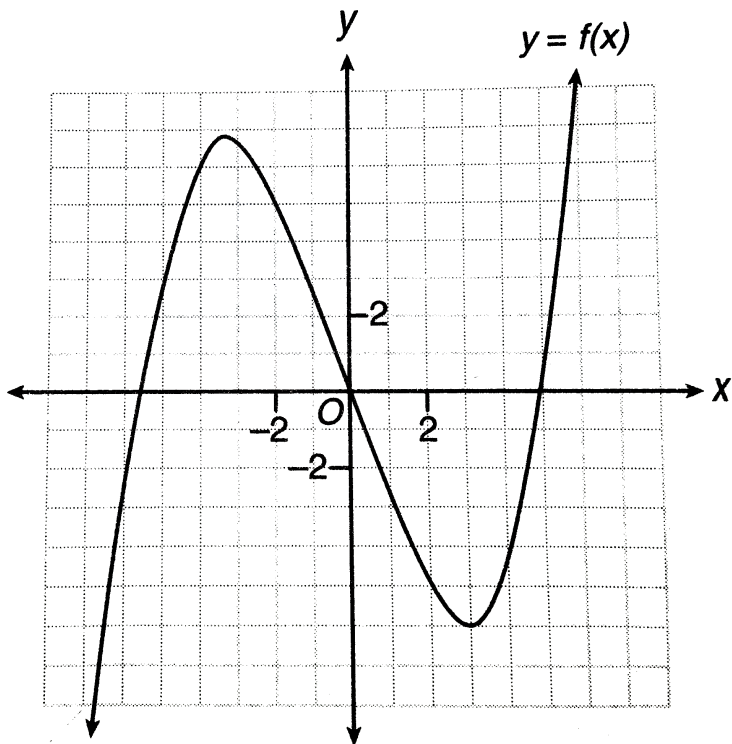Which of the graph(x) above could represents the graph of this function?

A. I only

B. II only

C. II only

D. I and III

Answer: A

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32.

16-18 The graph of polynomial function f is shown above.

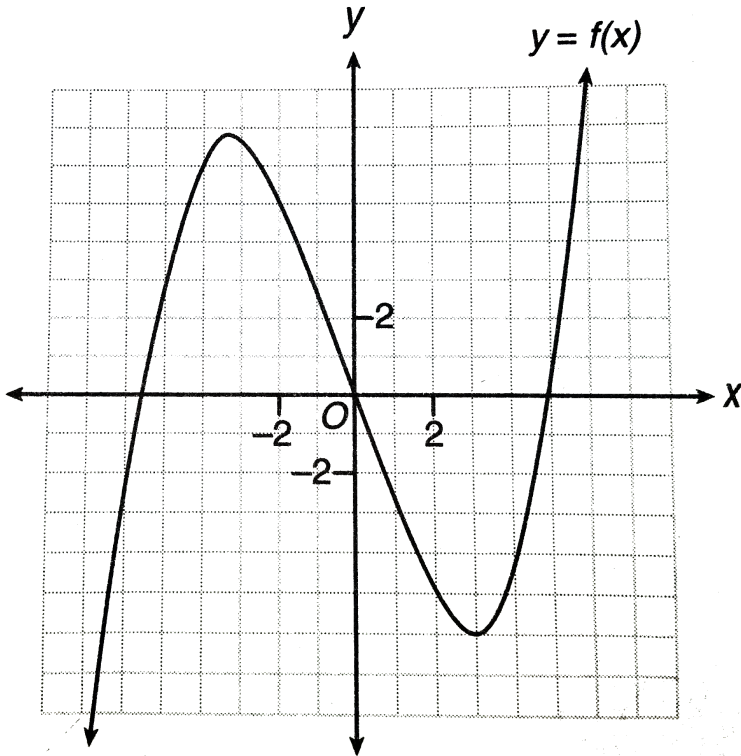Q.What is the greatest integer value of k for which f(x)=k has exactly 3 real solutions?

A. -5

B. 0

C. 6

D. 7

Answer: C

33.

16-18 The graph of polynomial function f is shown above.

Q. What is the best estimate of the remainder when f(x) is divided by x+3?

A. -6.0

B. 0

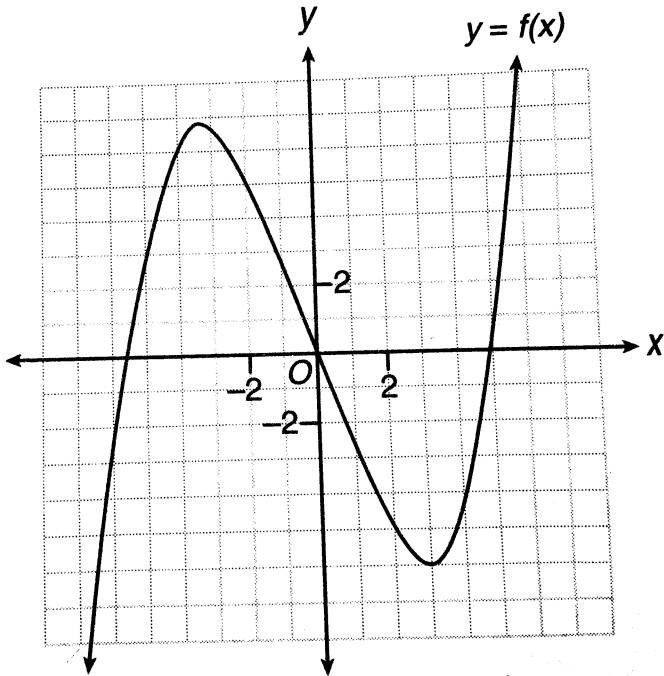C. 6.5

D. It cannot be determined.

Answer: C

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34.

16-18 The graph of polynomial function f is shown above.

Q. What is the maximum number of points a circle whose center is

at the origin can intersect the graph of $y = f(x)$?

A. 2

B. 3

C. 4

D. 6

Answer: D

35. $\left(y^2 + ky - 3\right)(y - 4) = y^3 + by^2 + 5y + 12$

In the equation above, k is a nonzero constant. If the equation is true for all values of y, what is the value of k?

A. $-\dfrac{1}{2}$

B. -2

C. 4

D. 6

Answer: B

36. $$\dfrac{16a^4 - 81b^4}{8a^3 + 12a^2b + 18ab^2 + 27b^3}$$

Which of the following expresssion is equivalent to the expression above?

A. $4a^2b + 9ab^2 - a^2b^2$

B. $4a^2b - 9ab^2$

C. $2a + 3b$

D. $2a - 3b$

Answer: D

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37. Which of the following is equal to $i^{50} + i^0$?

A. 1

B. 2

C. -1

D. 0

Answer: D

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38. Which of the following is equivalent to $2i^2 + 3i^3$?

A. $-2 - 3i$

B. $2 - 3i$

C. $-2 + 3i$

D. $2 + 3i$

Answer: A

39. Expressed in simplest form, $2\sqrt{-50} - 3\sqrt{-8}$ is

A. $16i\sqrt{2}$

B. $3i\sqrt{2}$

C. $4i\sqrt{2}$

D. $-i\sqrt{2}$

Answer: C

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40. If x=3i, y=2i, z=m+I, and i=sqrt(-1), $then the\; \exp ression x y^(2) z=$

A. $-12 - 12mi$

B. $-6 - 6mi$

C. $12 - 12mi$

D. $6 - 6mi$

Answer: C

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41. If $g(x) = \left(x\left(\sqrt{1-x}\right)\right)^2$, what is g(10)?

A. -30

B. -900

C. $30i$

D. $900i$

Answer: B

42. Which of the following is equal to $(x + i)^2 - (x - i)^2$?

A. 0

B. -2

C. $-2 + 4xi$

D. $4xi$

Answer: D

43. $i^{13} + i^{18} + i^{31} + n = 0$

In the equation above, what is the value of n in simplest form?

A. $-i$

B. -1

C. 1

D. i

Answer: C

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44. Which of the following is equivalent to $2i\left(\xi - 4i^2\right)$?

A. $2x - 8i$

B. $-2 + 8i$

C. $-6i$

D. $-8i$

Answer: B

45. If $x = 2i, y = -4, z = 3i,$ and $i = \sqrt{-1},$ then $\sqrt{x^3 yz} =$

A. $4\sqrt{6}i$

B. $24i$

C. $-4\sqrt{6}$

D. -24

Answer: A

46. Which of the following is equal to $(13 + 17i)(4 - 9i)$?

A. -12

B. 116

C. $115 - 89i$

D. $52 - 126i$

Answer: C

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47. If $(x - yi) + (a + bi) = 2x$ and $i = \sqrt{-1}$, then $(x + yi)(a + bi) =$

A. $x^2 + y^2$

B. $x^2 - y^2$

C. $4x^2 + y^2$

D. $5x^2$

48. Which of the following complex numbers is equivalent to $\dfrac{3+i}{4-7i}$?

A. $\dfrac{17}{28}$

B. $-\dfrac{19}{33} - \dfrac{25}{33}i$

C. $\dfrac{1}{13} - \dfrac{5}{13}i$

D. $\dfrac{1}{13} + \dfrac{5}{13}i$

Answer: D

49. In an electrical circuits, the voltage, E, in volts, the current, I, in amps, and the opposition to the flow of current, called impedance, Z, in ohms, are related by the equation, $E = IZ$. What is the impedance, in ohms, of an electrical circuit that has a current of (3+i) amps and a voltage of $(-7+i)$ volts?

A. $-2 + i$

B. $1 - 2i$

C. $\dfrac{-11}{25} - \dfrac{1}{5}i$

D. $-\dfrac{16}{25}i$

Answer: A

50. $(9 + 2i)(4 - 3i) - (5 - i)(4 - 3i)$

The expression above is equivalent to which of the following?

A. 7

B. $14 - 18i$

C. 25

D. $16 + 18i$

Answer: C

51. What are the solutions to $3x^2 - 33 = 18x$?

A. $x = 3 \pm 2\sqrt{3}$

B. $x = \dfrac{3 \pm \sqrt{5}}{2}$

C. $x = 3 \pm 4\sqrt{5}$

D. $x = 3 \pm \dfrac{\sqrt{5}}{2}$

Answer: A

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52. If the solution to $2x^2 - 8x - 5 = 0$ are p and q with $p > q$, what is the value of p-q?

A. $\sqrt{26}$

B. $\dfrac{7}{2}$

C. $2\sqrt{13}$

D. $\dfrac{11}{2}$

Answer: A

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53. $\dfrac{x+5}{4} = \dfrac{1-x}{3x-4}$

If the solutions to the equation above are r and s with $r > s$, what is the value of r-s?

A. $\sqrt{7}$

B. $\dfrac{5}{2}$

C. $\sqrt{57}$

D. 5

Answer: C

54. If the equation $y = 3x^2 + 18x - 13$ is written in the form $y = a(x-h)^2 + k$, what are the values of h and k?

A. $h = 3, k = 14$

B. $h = -3, k = -40$

C. $h = 3, k = -13$

D. $h = -3, k = -22$

Answer: B

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55. $x^2 + 6x + y^2 - 8y = 56$

If the above equation is written in the form $(x - h)^2 + (y - k)^2 = r^2$, what is the value of r?

A. 6

B. 8

C. 9

D. $\sqrt{31}$

Answer: A

56. $\dfrac{4}{x-3} + \dfrac{2}{x-2} = 2$

If the solution of the equation above in simplest radical form are

$x = a \pm \sqrt{b}$, what are the values of a and b?

A. $a = 4, b = 3$

B. $a = -4, b = 5$

C. $a = 3, b = 5$

D. $a = -3, b = 5$

Answer: C

57. Which quadratic has $2 + 3i$ and $2 - 3i$ as its solutions?

A. $x^2 + 4x - 13 = 0$

B. $x^2 - 4x + 13 = 0$

C. $x^2 + 13x - 4 = 0$

D. $x^2 - 13x - 4 = 0$

Answer: B

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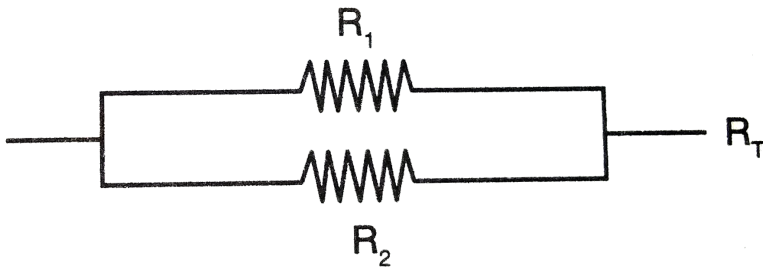**58.** The equation $ax^2 + 6x - 9 = 0$ will have imaginary roots if

A. $a > -1$

B. $a \geq -1$

C. $a \leq 1$

D. $-1 < a < 1$

Answer: A

59.

If electrical circuits are hooked up in parallel, the reciprocal of the total resistance in the series is found by adding the reciprocals of each resistance as shown inn the diagram above. In a certain circuits, R_2 exceeds the resistance of R_1 by 2 ohms, and the total resistance, R_1, is 1.5 ohms. Which expression represents the number of ohms in R_1?

A. $\sqrt{13} - 1$

B. $\sqrt{11} - 1$

C. $\dfrac{1 + \sqrt{11}}{2}$

D. $\dfrac{1 + \sqrt{13}}{2}$

Answer: D

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60. The amount of water remaining in a certain bathtub as it drains when the plug is pulled is represented by the equation, $L = -4t^2 - 8t + 128$, where L represents the number of liters of water in the bathtub and t represents the amount of time, in minutes, since the plug was pulled. Which expression represents the number of minutes it takes for half of the water that was in the bathtub before the plug was pulled to drain?

A. $-1 + \sqrt{33}$

B. $-1 + \sqrt{17}$

C. $\dfrac{-1 + \sqrt{33}}{2}$

D. $\dfrac{-1 + 2\sqrt{17}}{2}$

Answer: B

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61. An archer shoots an arrow into the air such that its height at any time, t, given by the function $h(t) = -16t^2 + kt + 3$. If the maximum height of the arrow occurs at 4 seconds after it is launched, what is the value of k?

A. 128

B. 64

C. 8

D. 4

Answer: A

62. A model rocket is launched vertically into the air such that its height at any time, t, is given by the function $h(t) = -16t^2 + 80t + 10$. What is the maximum height attained by the model rocket?

A. 140

B. 110

C. 85

D. 10

Answer: B

63. When a ball is thrown straight up at an initial velocity of 54 feet per second. The height of the ball t seconds after it is thrown is given by the function $h(t) = 54t - 12t^2$. How many seconds after the ball is thrown will it return to the ground?

A. 9.2

B. 6

C. 4.5

D. 4

Answer: C

64. The graph of $y + 3 = (x - 4)^2 - 6$ is a parabola in the xy-plane. What are the x-intercepts of the parabola?

    A. 1 and 7

    B. -1 and -7

    C. 4 and -6

    D. 4 and -9

Answer: A

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65. The graph of $y = (2x - 4)(x - 8)$ in the xy-plane is a parabola. Which of the following are true?

I. The graph's line of symmetry is x=5

II. The minimum value of y is -7

III. The y-intercept of the graph is 32.

    A. I and II only

    B. I and III only

    C. II and III only

    D. I, II, and III

Answer: B

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y

P(a,b)

y = f(x)

(−1,0)

(6,0)

O

x
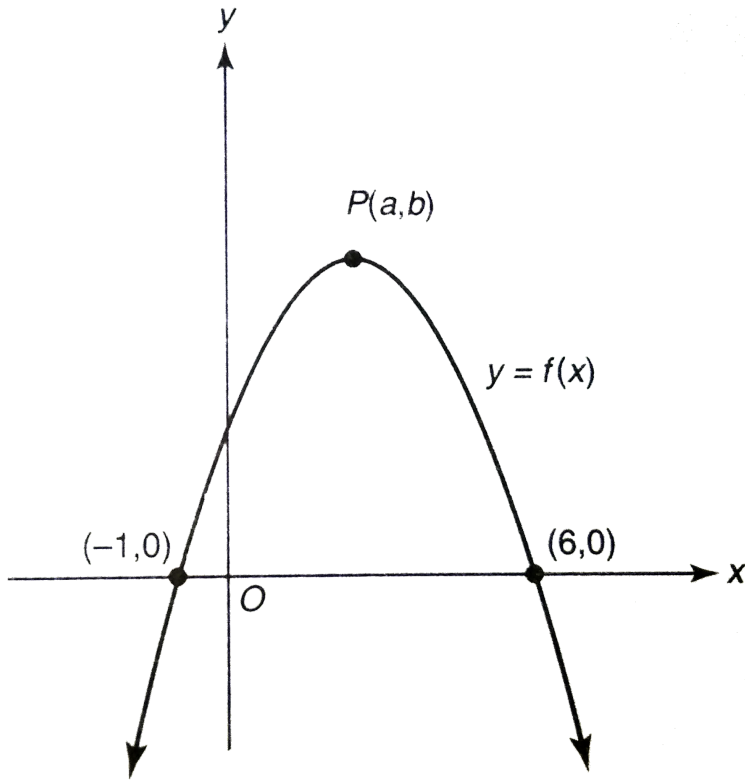
Note: Figure not drawn to scale

66.

The graph of a quadratic function f is shown in the above figure. If

$f(x) \le b$ for all values of x, which of the following could be the
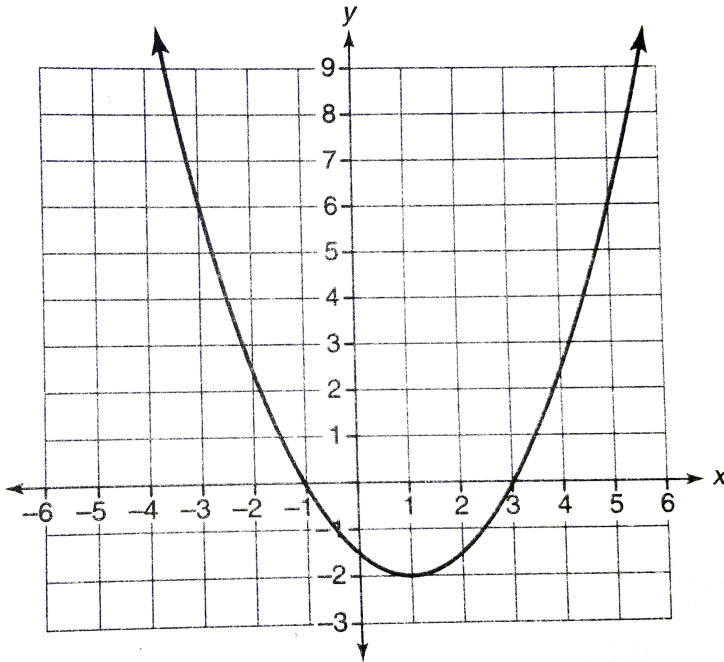
coordinates of point P?

A. $(1.5, 2)$

B. $(2.25. 3.5)$

C. $(2.5, 4)$

D. $(2.75, 5)$

Answer: C

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67.

The figure above shows the graph of the quadratic function f with

a minimum point at $(1, -2)$. If $f(5) = f(c)$, then which of the following could be the values of c?

   A. -5

   B. -3

   C. 0

   D. 6

Answer: B

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68. The graph of a quadratic function f intersects the x-axis at $x = -2$ and $x = 6$. If $f(8) = f(p)$, which could be the value of p?

   A. -6

B. -4

C. -2

D. 0

Answer: B

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69. If in the quadratic function $f(x) = ax^2 + bx + c$, a and c are both negative constant, which of the following could be the graph of function f?
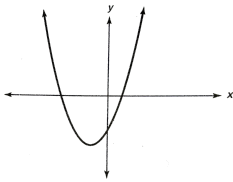
(A)

A.

(B)

B.

(C)

C.

(D)

D.
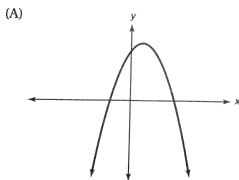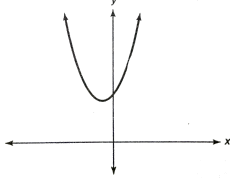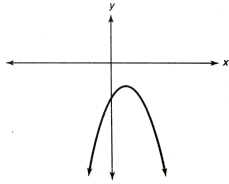
Answer: C

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70. A parabola passes through the points (0, 0) and (6, 0). If the turning point of the parabola is $T(h, 4)$, which statement must be true?

I. h=2

II. If the parabola passes through (1, 2), then it must also pass through (5, 2).

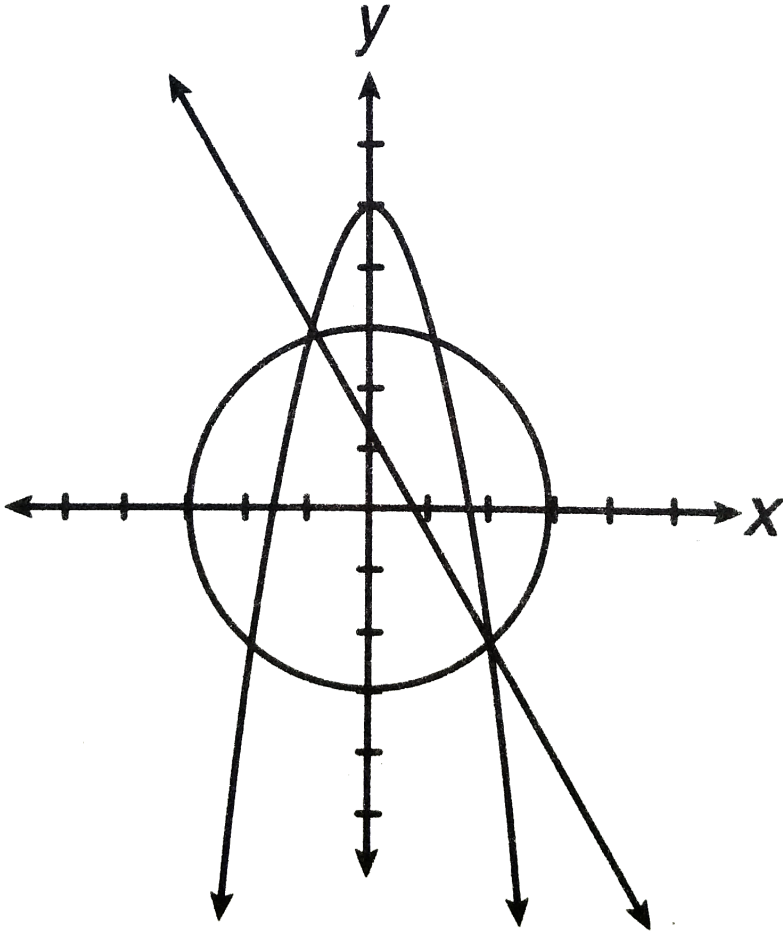III. Point T is the highest point of the parabola

A. II only

B. III only

C. I and II only

D. II and III only

Answer: D

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71.

A system of three equations whose graphs in the xy-plane are a line, a circle, and a parabola is shown above. How many solutions does the system have?
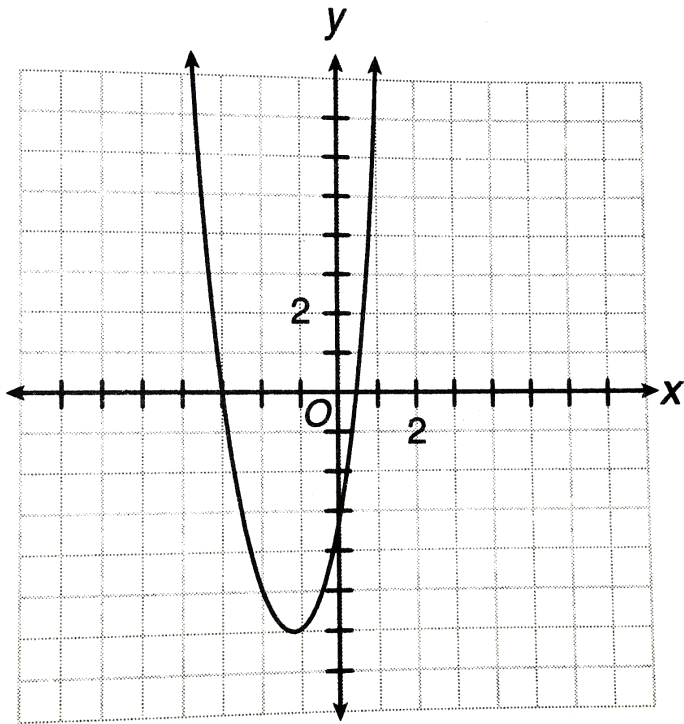
A. 1

B. 2

C. 3

D. 4

Answer: B

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72.

Which of the following could be the equation of the graph above?

A. $y = (x - 3)(2x + 1)$

B. $y = (x + 3)(2x - 1)$

C. $y = -(x - 3)(1 + 2x)$

D. $y = \dfrac{1}{2}(x + 3)(x - 1)$

Answer: B

73. $y = 2x^2 - 12x + 11$

The graph of the equation above is a parabola in the xy-plane. What is the distance between the vertex of the parabola and the point $(3, 1)$?

   A. 1

   B. 8

   C. 10

   D. 12

Answer: B

74. $f(x) = ax^2 + bx + c, a > 0$

The coordinates of the lowest point on the graph of the function defined by the equation above is $(3, 2)$. If $f(-1) = p$, then which of the following represents the value of p?

    A. $f(-5)$

    B. $f(-4)$

    C. $f(6)$

    D. $f(7)$

Answer: D

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75. The parabola whose equation is $y = ax^2 + bx + c$ passes through the points $(-3, -40), (0, 29),$ and $(-1, 10)$. What is an equation of the line of symmetry?

A. $x = \dfrac{17}{4}$

B. $x = \dfrac{9}{2}$

C. $x = 5$

D. $x = 6$

Answer: A

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76. $x^2 + y^2 = 416$

$y + 5x = 0$

If (x, y) is a solution to the system of equations above and $x > 0$, what is the value of the difference $x - y$?

A. 4

B. 16

C. 20

D. 24

Answer: D

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77. $h(t) = -4.9t^2 + 68.6t$

The function above gives the height of a model rocket, in meters, t seconds after it is launched from ground level. What is the maximum height, to the nearest meter, attained by the model rocket?

A. 90

B. 120

C. 180

D. 240

Answer: D

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78. The graph of the equation above is a parabola in the xy-plane.

If $k > 0$, what is the minimum value of y expressed in terms of k?

A. $-7k$

B. $-16k$

C. $-25k$

D. $-73k$

Answer: C

79. The graph of $y = 2^{x-3}$ can obtained by shifting the graph of $y = 2^x$?

    A. 3 units to the right

    B. 3 units to the left

    C. 3 units up

    D. 3 units down

Answer: B

80. Which equation represents the line that is the reflection of the line $y = 2x - 3$ in the y-axis?

A. $y = -2x - 3$

B. $y = -2x + 3$

C. $y = 2x + 3$

D. $y = 3x - 2$

Answer: A

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$y = f(x)$
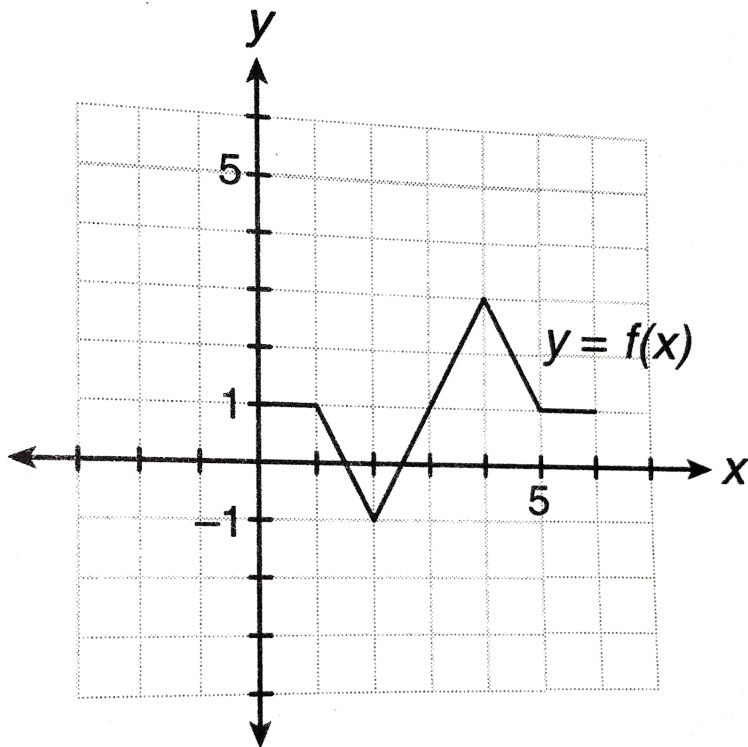
81.

The figure above shows part of the graph of function f. If $f(x - 5) = f(x)$ for all values of x, what is the value of f(19)?

A. -1

B. 0

C. 1

D. 3

Answer: D

82. The endpoints of $\overline{AB}$ are A(0, 0) and B(9, -6). What is an equation of the line that contains the reflection of $\overline{AB}$ in the y-axis?

A. $y = -\dfrac{3}{2}x$

B. $y = -\dfrac{2}{3}x$
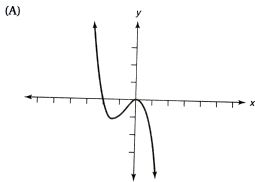
C. $y = -x + 3$
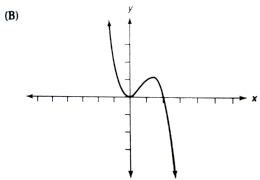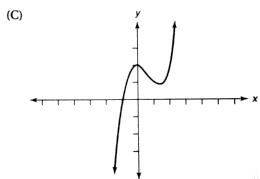
D. $y = \dfrac{2}{3}x$

Answer: D
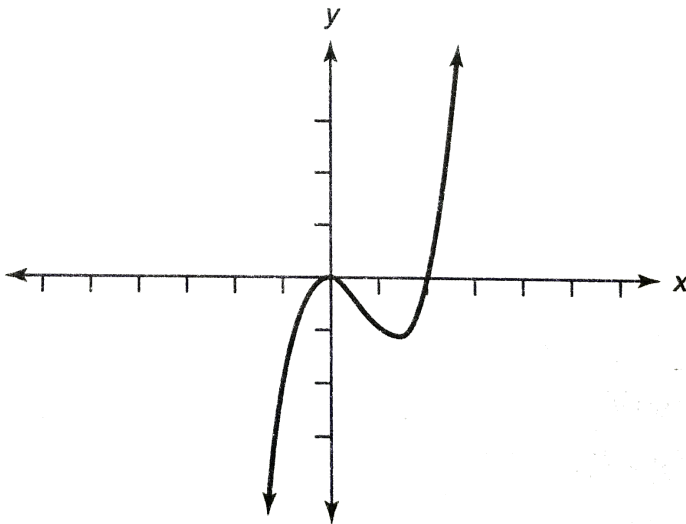
83.

The figure above shows the graph of function f. If $g(x) = -f(x)$, which graph represents function g?
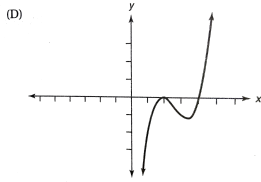

A.

B.

C.

D.

Answer: B

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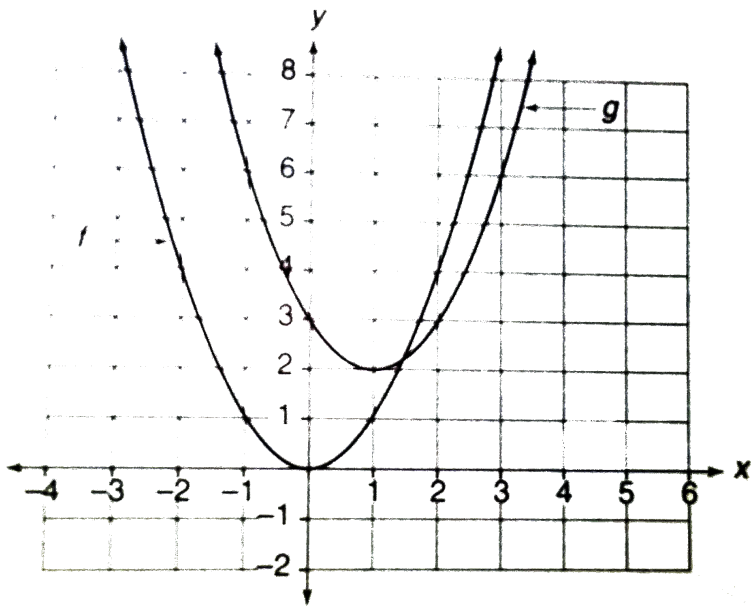**84.** The point $(2, -1)$ on the graph y=f(x) is shifted to which point on the graph of y=f(x+2)?

A. $(4, 1)$

B. $(4, -1)$

C. $(0, -1)$

D. $(0, -3)$

Answer: C

85.

The accompanying figure shows the graphs of functions f and g. If

f is defined by $f(x) = x^2$ and g is defined by

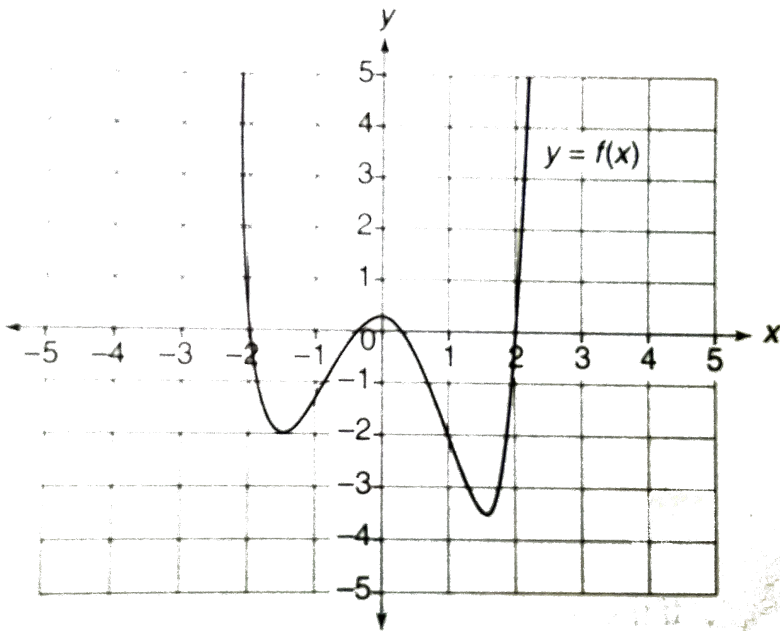$g(x) = f(x + h) + k$, where h and k are constants, what is the

value of h+k?

A. -3

B. -2

C. -1

D. 1

Answer: D

86.

If $g(x) = -2$ intersects the graph of $y = f(x) + k$ at one point, which of these choices could be the value of k?
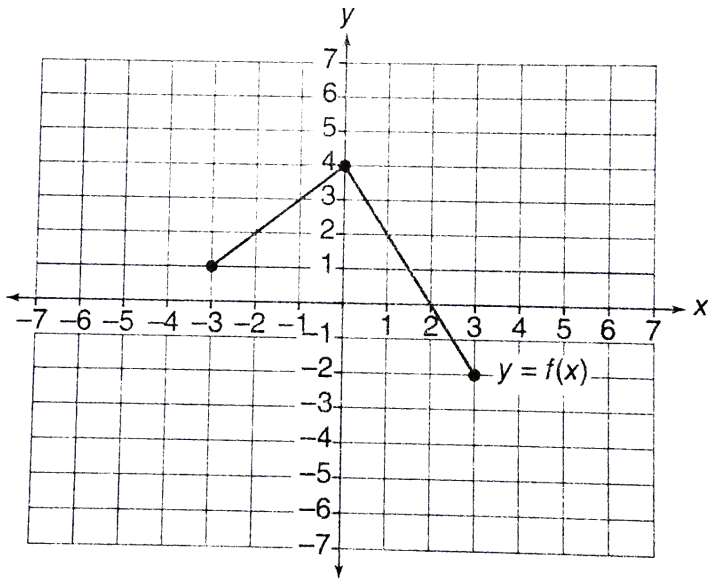
A. -1.5

B. -0.5

C. 0

D. 1.5

Answer: D

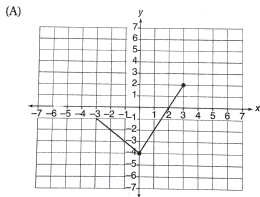▶ Watch Video Solution
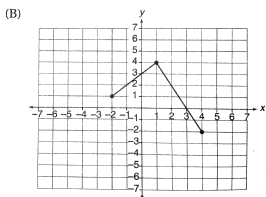
87.

If the accomanying figure above shows the graph of function f, which of the following could represent the graph of $y = f(x + 1)$?

(A)

A.

(B)

B.

(C)

C.

(D)
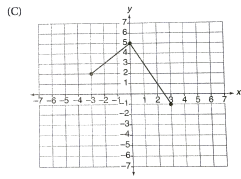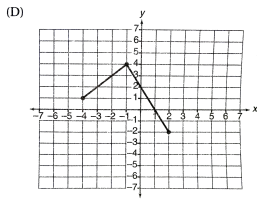
D.

Answer: D

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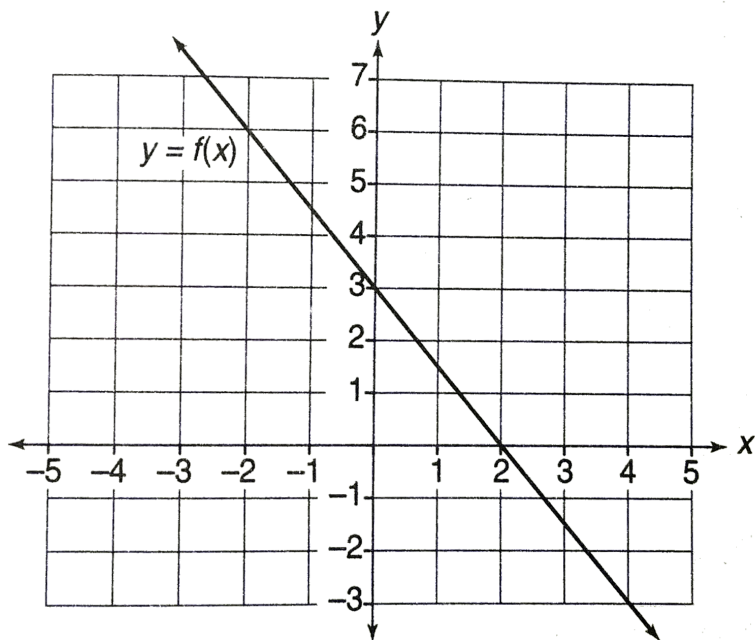
88.

A linear function f is shown in the accompanying figure. If function g in the reflection of function f in the x-axis (not shown), what is the slope of the graph of function g?

A. $-\dfrac{3}{2}$

B. $-\dfrac{2}{3}$

C. $\dfrac{2}{3}$

D. $\dfrac{3}{2}$

Answer: D

89. The graph of $y = f(x)$ is shown below.
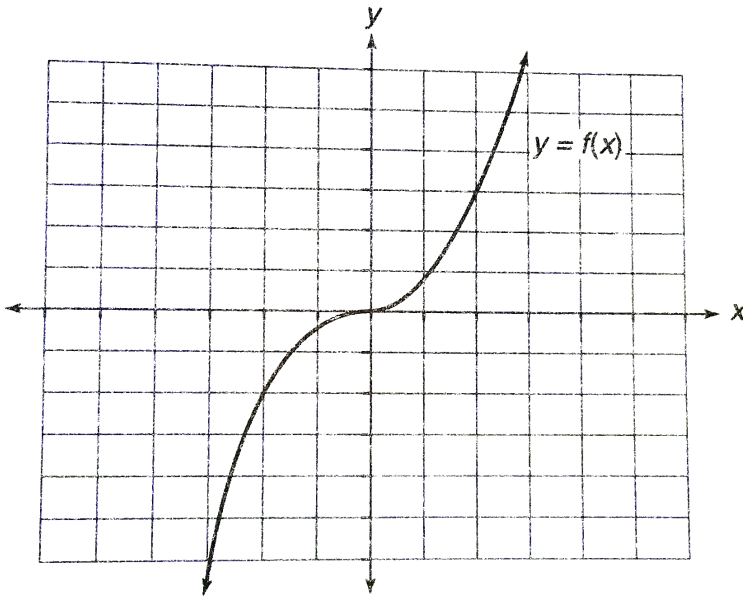
Which of the following could represents the graph of

$y = f(x - 2) + 1?$

(A)

A.

(B)

B.

(C)

C.

(D)

D.
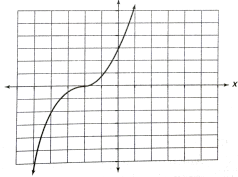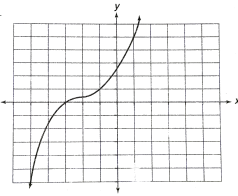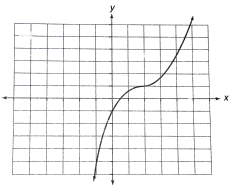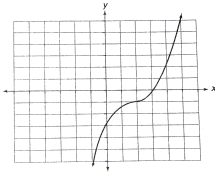
Answer: C

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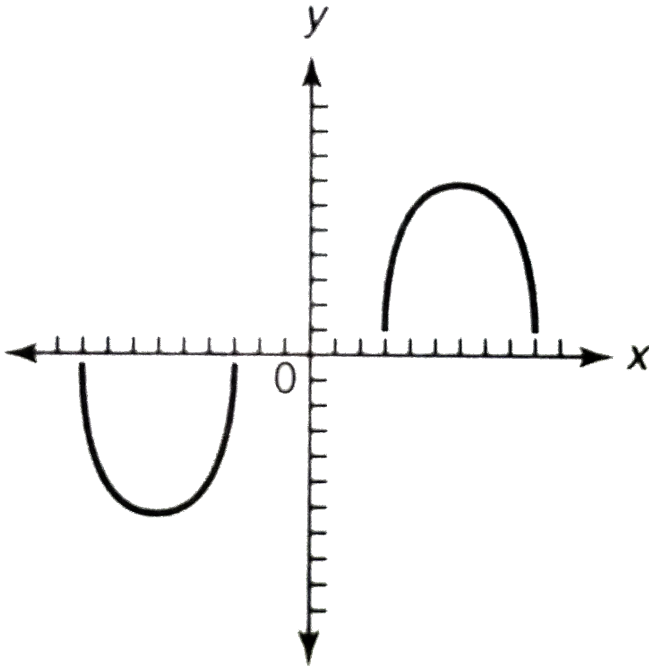
90.

The graph of the function f is shown above. Which of the following could represent the graph of $y = |f(x)|$?

(A)

A.

(B)

B.

(C)

C.

(D)

D.
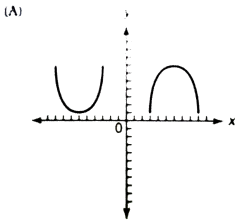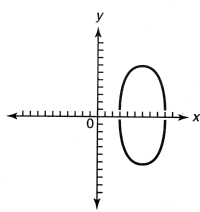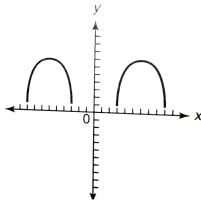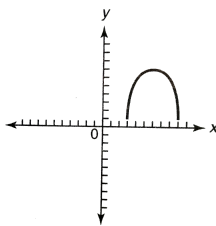
Answer: C

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Grib In

1. $\sqrt{3p^2 - 11} - x = 0$

If $p > 0$ and $x = 8$ in the equation above, what is the value of p?

2. If $x^{-\frac{1}{2}} = \dfrac{1}{8}$, what is the value of $x^{\frac{2}{3}}$?

3. If x is not equal to 0, what is the value of $\dfrac{6(2x)^{-2}}{(3x)^{-2}}$?

4. If $(2rs)^{-1} = 3s^{-2}$, what is the value of $\dfrac{r}{s}$?

5. If m and p are positive integer and $\left(2\sqrt{2}\right)^m = 32^n$, what is the value of $\dfrac{p}{m}$?

6. If a, b, and c are positive numbers such that $\sqrt{\dfrac{a}{b}} = 8c$ and $ac = b$, what is the value of c?

7. If $k = 8\sqrt{2}$ and $\dfrac{1}{2}k = \sqrt{3h}$, what is the value of h?

8. If $64^{2n+1} = 16^{4n-1}$, what is the value of n?

9. $\dfrac{\sqrt[3]{a^8}}{\sqrt{a^3}} = a^x$ where $a > 1$

In the equation above, what is the value of x?

10. A meteorologist estimates how long a passing storm will last by using the function $t(d) = 0.08d^{\frac{3}{2}}$, where d is the diameter of the storm, in miles, and t is the time, in hours. If the storm lasts 16.2 minutes, find its diameter, in miles.

11. $\dfrac{k}{6} + \dfrac{3(1 - k)}{4} = \dfrac{k - 5}{2}$

What is the solution for k in the equation above?

12. $\dfrac{3}{2} = \dfrac{-(5m - 3)}{3m} + \dfrac{7}{12m}$

What is the solution for m in the equation above?

13. $f(x) = x^3 + 5x^2 - 4x - 20$

How many of the zeros of funtion f defined by the equation above are located in the interval $-4 \le x \le 4$?

14. $\dfrac{t}{t-3} - \dfrac{t-2}{2} = \dfrac{5t-3}{4t-12}$

If x and y are solutions of the equation above and $y > x$, what is the value of $y - x$?

15. $x^3 + 150 = 6x^2 + 25x$

What is the sum of all values of x that satisfy the equation above?

16. $p(t) = t^5 - 3t^4 - kt + 7t^2$

In the polynomial function above, k is a nonzero constant. If p(t) is divisible by t-3, what is the value of k?

17. What is the value of $\left(\frac{1}{2} + i\sqrt{5} \right) \left(\frac{1}{2} - i\sqrt{5} \right)$?

18. $\left(2 - \sqrt{-25} \right) \left(-7 + \sqrt{-4} \right) = x + yi$

In the equation above, what is the value of y?

19. If $\left(1 - 3i \right) \left(7 + 5i + i^2 \right) = a + bi$, what is the value of $a + b$?

20. If $\dfrac{6 + 4i}{1 - 3i} = a + bi$, what is the value of $a + b$?

21. $g(x) = a\sqrt{41 - x^2}$

Function g is defined by the equation above where a is a nonzero real constant. If $g(2i) = \sqrt{5}$, where $i = \sqrt{-1}$, what is the value of a?

22. $x^2 - y^2 = 18$

$y = x - 4$

In the above system of the equations, what is the value of x+y?

23. $d(t) = -16t^2 + 40t + 24$

A swimmer dives from a diving board that is 24 feet above the

water. The distance, in feet, that the diver travels after t seconds have elapsed is given by the function above. What is the maximum height above the water, in feet, the swimmer reaches during the dive?

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24. The mark department at Sports Stuff found that approximately 600 pairs of running shoes will be sold monthly when the average price of each pair of running shoes is $90. It was observed that for each $5 reduction in price, an additional 50 pairs of running shoes will be monthly. What price per pair of running shoes will maximize the store's monthly revenue from the sale of running shoes?

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25. Question refer to the equation below.

h(x)=-(1)/(225)x^(2)+(2)/(3)x`

The function h above models the path of a football when it is kicked during an attempt to make a field goal where x is the horizontal distance, in feet, from the kick, and h(x) is the corresponding height of the football, in feet above the ground.

Q. After the ball is kicked, what is the number of feet the football travels horizontally before it hits the ground?

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26. Question refer to the equation below.

h(x)=-(1)/(225)x^(2)+(2)/(3)x`

The function h above models the path of a football when it is kicked during an attempt to make a field goal where x is the horizontal distance, in feet, from the kick, and h(x) is the

corresponding height of the football, in feet above the ground.

Q. What is the number of feet in the maximum height of the football?

27. Question refer to the equation below.

$$h(x) = -\frac{1}{225}x^2 + \frac{2}{3}x$$

The function h above models the path of a football when it is kicked during an attempt to make a field goal where x is the horizontal distance, in feet, from the kick, and h(x) is the corresponding height of the football, in feet above the ground.

Q. The goal post is 10 feet high and a horizontal distance of 45 yards from the point at which the ball is kicked. By how many feet will be football fail to pass over the goal post?

28. Question 1 and 2 refer to the information and graph below.

Let function f be defined by the graph in the accompanying figure.
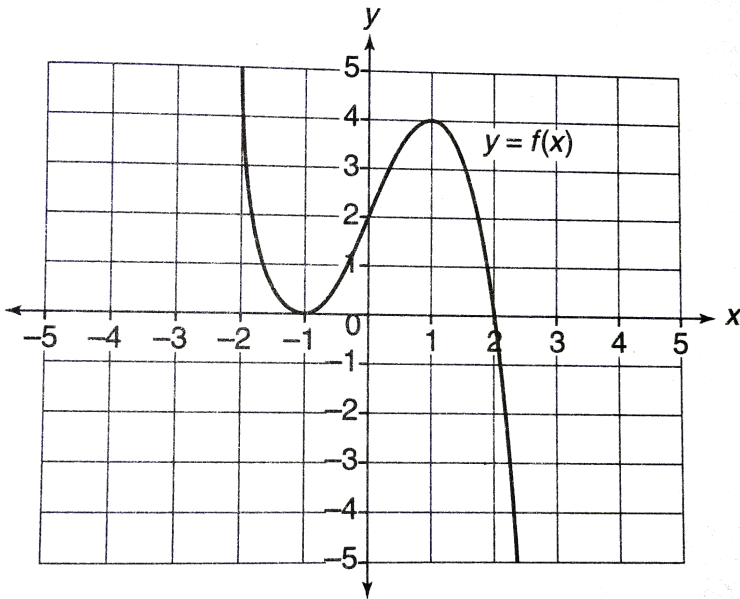
Q. For what positive integer k is (1, 0) an x-intercept of the graph

of $y = f(x - k)$?

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29. Question 1 and 2 refer to the information and graph below.

Let function f be defined by the graph in the accompanying figure.
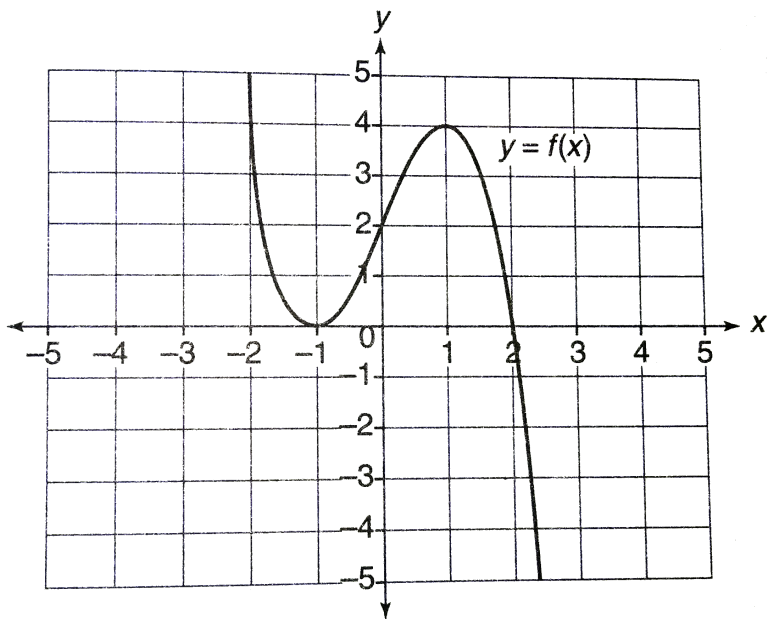
Q. Let m represents the number of points at which the graphs of $y = f(x)$ and $g(x) = 3$ intersect. Let n represents the number of points at which the graphs of $y = f(x) - 1$ and $g(x) = 3$ intersect. What is the value of m+n?

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Practice Test

1. If $p + 2\sqrt{x-1} = q$, and q > p , what is x-1 in terms of p and q ?

A. $\dfrac{\sqrt{q-p}}{2}$

B. $\sqrt{\dfrac{q-p}{2}}$

C. $\dfrac{(q-p)^2}{2}$

D. $\dfrac{(q-p)^2}{4}$

Answer: D

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2. The function f is defined by $f(x) = x^4 - 4x^4 - x^2 + cx - 12$, where c is a constant.In the xy-plane, the graph of f intersects the x-axis in the four points (-2,0), (1,0), (p,0), and (q,0). What is the value of c ?

A. 16

B. -16

C. $\dfrac{p}{q}$

D. $\dfrac{q}{p}$

Answer: A

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3. Consider the inequality $y \geq ax^2 + bx + c$, where a , b and c are all positive . Which of the following regions could be the solution set of the inequality ?
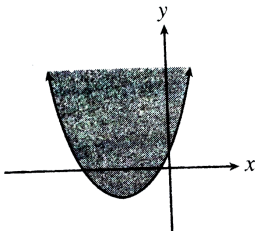
A.
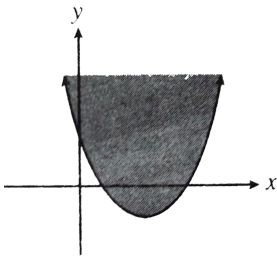
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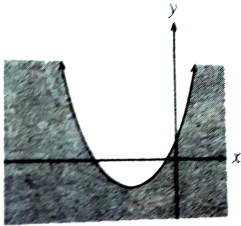
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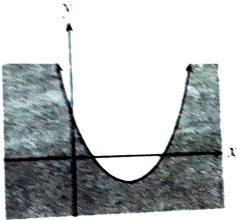
D.

Answer: A

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4. $y = x^3 - 2x + 1, y = 2x + 1$

The graphs in the system of equations shown above have three

points of intersection . $(x_1, y_1), (x_2, y_2)$ and (x_3, y_3) . Find the product $x_1 . x_2 . x_3$.

A. 4

B. $\dfrac{5}{2}$

C. 1

D. 0

Answer: D

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5. $y = x^2 - 4,\ x + y = 2$

Based on the system of equations above , what is the minimum value of the product xy ?

A. 2

B. 0

C. -5

D. -15

Answer: D

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6. If an object is dropped from a tall building , then the distance it has fallen after t seconds is given by $d(t) = 16t^2$. Find its average speed , in feet per second, between t=1 second and t=5 seconds.

A. 198

B. 192

C. 96

D. 80

Answer: C

7. A group of students go on a field trip to a play . The cost of the bus is $450 , to be shared equally among the students . The ticket cost is discounted as follows : Tickets usually cost $50 each , but are reduced by 10 cents per ticket ,up to the maximum capacity of the bus. The goal is for the total cost per student to be less than $54. If x is the number of students in the group , which of the following correctly models the situation described ?

A. $\dfrac{450}{x} + (0.10)(50) < 54$

B. $\dfrac{450}{x} + (50 - 0.10x) < 54$

C. $\dfrac{450}{x} + (50 - 10x) < 5,400$

D. $\dfrac{450}{x} + (50)(0.10x) < 54$

Answer: B

8. The equation $\left(1 + \dfrac{1}{x}\right)^2 - 6\left(1 + \dfrac{1}{x}\right) + 8 = 0$ has two roots

, a and b. What is a + b ?

A. $\dfrac{2}{3}$

B. $\dfrac{4}{3}$

C. 4

D. 6

Answer: B

9. If the recommended adult dosage for a drug is D , in milligrams, then to determine the appropriate dosage c for a child of a age a, where a > 1 , pharmacists use the equation c =0.0417D(a+1). The formula , rewritten to express a in terms of c and D , is

A. $a = \dfrac{c - 1}{0.0417D}$

B. $a = \dfrac{c}{0.0417D} - 1$

C. a=0.0417D(c+1)

D. a=0.0417D(c-1)

Answer: B

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10. Which is equivalent to $\left(x - \dfrac{1}{x} \right) \left(1 + \dfrac{1}{x - 1} \right)$?

A. x+1

B. x-1

C. 1

D. $\dfrac{x}{x+1}$

Answer: A
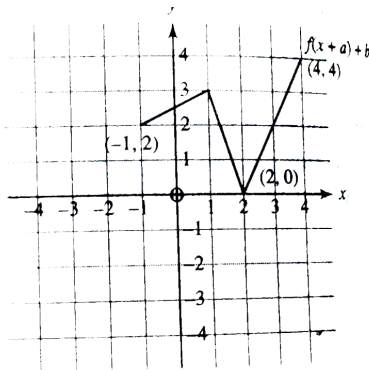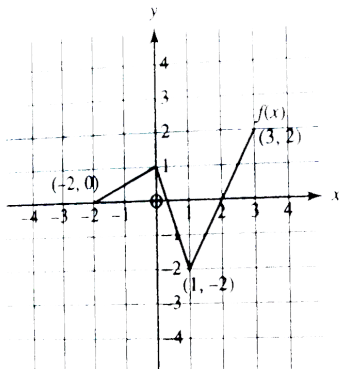
11.

The graphs shown above represent f(x) and f(x+a) + b, where a and b are constants. Which of the following is the ordered pair (a,b) ?

A. (1,2)

B. (2,1)

C. (-1,2)

D. (2,-1)

Answer: C

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12. If $3^{2x} + 3^{2x} + 3^{2x} = \left(\dfrac{1}{3}\right)^x$. What is the value of x ?

A. -1

B. $-\dfrac{1}{2}$

C. $-\dfrac{1}{3}$

D. $-\dfrac{1}{6}$

Answer: C

---

13. Find an integer value of x that satisfies both of the inequalities below :

|3x-5| < 20 and |x +2| > 8

---

14. Let $f(x) = x^2 - 5x + 2$ and g(x)=f(x-4). Find the positive root of the equation

f(x)=g(2)

15. A statistics class investigated the cost of cheesecakes at different bakeries around town . Given that P(x) was the cost , in dollars, of a cheesecake with diameter x, the function that best fit the data collected by the class was

$$P(x) = \frac{1}{2}x^2 - 5x + 20$$

According to this model , what was the least amount , in dollars , that a town resident could pay for a cheesecake ?

16. If $f(x) = x^2 + x - 42$ and f(p-1)=0. what is a positive value of p ?

17. If $\left(\frac{1}{3}\right)^x = (81)^{x-1}$, find the value of x .

18. The height h , in feet , of a ball shot upward from a ground level spring gun is described by the formula $h = -16t^2 + 48t$. Where t is the time in seconds. What is the maximum height , in feet , reached by the ball ?

19. The drama department at a middle school wants to determine the price to charge for tickets to a show . If the price is too low, there won't be enough money to cover expenses. If its too high, they may not get a big enough audience. The teacher estimates that the profit, P, in dollars per show, can be represented by $P = -(t - 12)^2 + 100$, where t is the price of a ticket in dollars

. When the profit is 0, the drama department breaks even . What is the lowest ticket price for which the department breaks even ?

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1. Let $\leftrightarrow$ be an operation on p and q defined as p $\leftrightarrow$ q = $(2^p - q)$. If p $\leftrightarrow$ 12 = p, then find the value of p.

A. 2

B. 4

C. 8

D. 12

Answer: B

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2. The number of units sold, N, of a product follows the realtion

N= 120-C, where $C is the selling price per unit. The cost to setup

the manufacturing facility is $150 and the cost per unit is $5. If all

units are sold, what should be the least selling price, in dollars,

per unit to have a profit of $400?
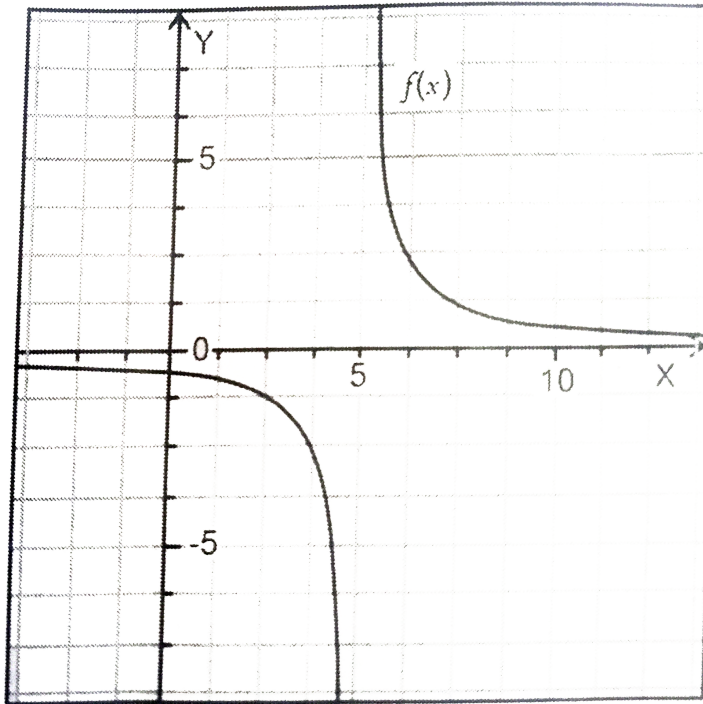
3.

The graph of $f(x) = \dfrac{3}{x - 5}$ is shown above:

`(##VIB_343_SAT_MAT_C04_E01_003_Q02.png" width="80%">

Which option gives the correct expression for g(x) as shown below?

A. $|f(x)|$

B. $-|f(x)|$

C. $-f(x)$

D. $f(|x|)$

Answer: B

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4. For all non-negative x, let f(x)=$x^3 - 8$ and g(x)=x-2. For how many integer values of x is f(x)=g(x)? NC

A. 0

B. 1

C. 2

D. 3

Answer: B

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5. If a^6b^3=4816 and $\dfrac{a^{10}}{b}$=301, what is the value of $\dfrac{a^2}{b^2}$?

A. 301

B. 64

C. 16

D. $\dfrac{1}{4}$

Answer: D

6. Let $\cong$ be an operation on a and b defined as a $\cong$ b=ab+b^2. If p $\cong$ q=0 where p and q are non-zero integers, which of the following options is true?

A. p+q=1

B. p+2q=0

C. p+3q=2p

D. p-2q= -3q

Answer: D

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7. If $x^2 > x^3 > x$, which of the following statements must be correct?

I. $x^6 > x^7$

II. x can take any value between 0 and 1

III. $-1 < x < 0$

A. Only I

B. Only II

C. Only III

D. Both I and III

Answer: D

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8. A man puts $P in a bank which offers n% interest compounded annually. After 2 years , the amount of money in the bank is $M. Which of the following ist the value of r if M =$1728 and P=1200?

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9. After multiplying by 5, each of the following numbers will have the same number of perfect square factors EXCEPT

A. 350

B. 290

C. 250

D. 12

Answer: C

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10. How many two-digit numbers exist such that the difference of the squares of its digits is 24?

A. 2

B. 4

C. 6

D. 8

11. If p and q are the roots of $x^2 - 4x + 1 = 0$, choose from the options below, the correct equation whose roots are given by $(p + q)^2$ and $(p - q)^2$.

A. $x^2 - 12x + 168 = 0$

B. $x^2 - 10x + 90 = 0$

C. $x^2 - 28x + 192 = 0$

D. $x^2 - 36x + 320 = 0$
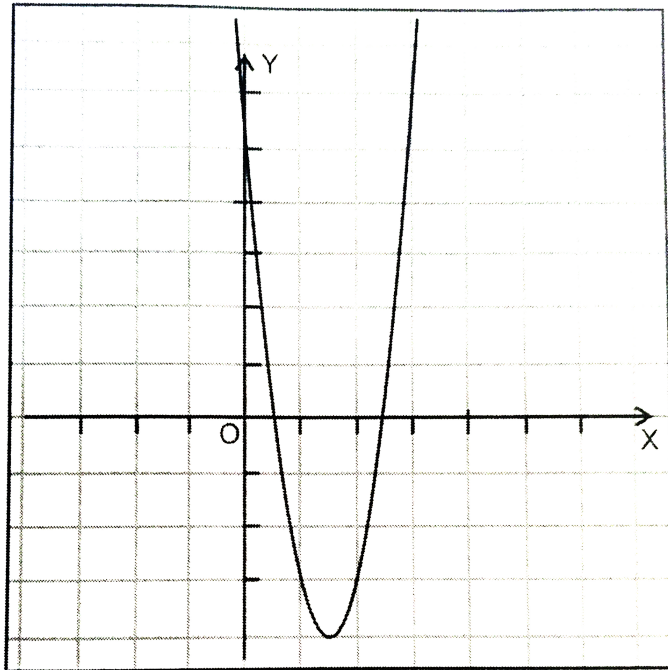
12.

The graph of a quadratic expression $ax^2 + bx + c$ is shown beside. Which of the following is correct?

A. $ab > 0$, $bc < 0$, $ac > 0$

B. $ab > 0$, $bc > 0$, $ac > 0$

C. $ab > 0$, $bc > 0$, $ac < 0$

D. $ab < 0$, $bc < 0$, $ac > 0$

Answer: D

13. If f(x)=$x^3 - kx^2 + 2x$ and f(-x)= -f(x), the value of k is_

    A. -2

    B. 0

    C. 1

    D. 2

Answer: B

14. Joe throws a ball upwards from a height of 12 feet from ground level. The height of the ball above the ground after time t second from when the ball was thrown is given by the expression h(t)= $-t^2 + at + b$. The ball comes back to the ground after 8 second. What is the value of (a+b)?

A. 6.5

B. 12

C. 18.5

D. 19

Answer: C

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15. Which of the following correctly shows the range of the function $f(x)=\sqrt{-x^2 + 4x + 12}$?

A. $0 < y < 4$

B. $-1 \le y \le 4$

C. $-1 < y < 5$

D. $0 \le y \le 4$

Answer: D

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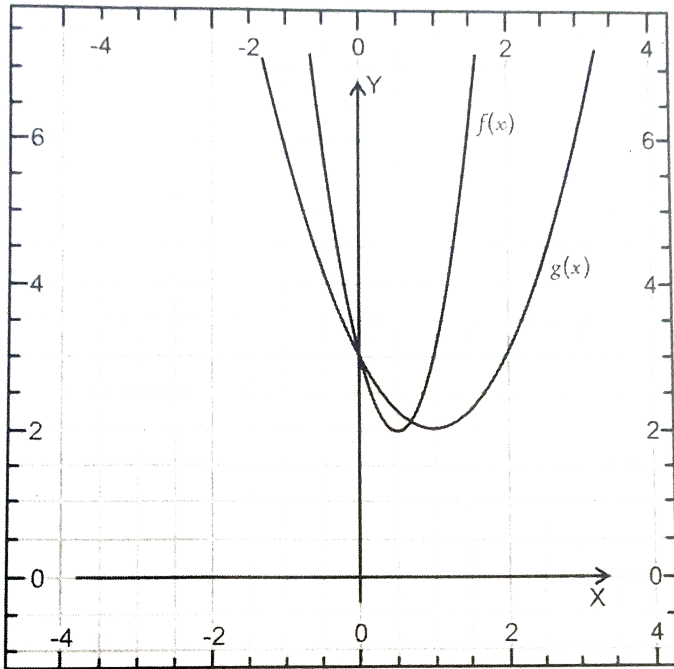
16.

The graphs of f(x) and g(x) are shown below. Which option is true?

A. f(x)=g(x+1)

B. f(x)=g(x)+1

C. f(x)=2g(x)

D. f(x)=g(2x)

Answer: D

17. If f(x+2)=3x+11 and g(f(x))=2x, find the value of g(5).

A. 0

B. 1

C. 3

D. 5

Answer: A

18. If a and b are positive integers satisfying $(a+3)^2 + (b+1)^2 = 85$, what is the minimum value of (2a+b)?

A. 6

B. 7

C. 11

D. 12

Answer: D

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19. Joe throws a ball upwards from a certain height above the ground level. The height of the ball above the ground after time t seconds from when the ball was thrown is given by the expression $h(t) = -(t-a)^2 + b.$ The ball reaches a maximum height of 25 feet after 4 seconds. After how much time [in seconds] will the ball reach the ground level?

A. 6

B. 7

C. 8

D. 9

Answer: D

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20. If $f(x) = ax^2 + bx + c$ and $f(x + 1) = f(x) + x + 1$, then

the value of (a+b) is __

A. -2

B. -1

C. 0

D. 1

Answer: D

21. After multiplying by 2, each of the following numbers becomes

a perfect square EXCEPT

A. 72

B. 162

C. 392

D. 500

Answer: D

22. $f(x) = x^2 + 16.$ For what value of k is $f(2k + 1) = 2f(k) + 1$ if k is a positive integer?

23. Which of the following statemens are true regarding the expression $f(x) = x^2 - 6x + 11$?

I. The expression has a least value of 11

II. The value of the expression is always positive for any value of x

III. The roots of f(x) =0 are real

   A. Only I

   B. Only II

   C. Both I and II

   D. BothII and III

Answer: B

---

24. Let $\emptyset$ be an operation on x and y defined as $x \emptyset y = \dfrac{x^{-2} + y^{-2}}{x^{-1} + y^{-1}}$. Find the value of $(1\emptyset 1)\emptyset 3$?

A. 0.83

B. 1.00

C. 2.50

D. 2.67

Answer: A

25. If $9^x - 2.3^x - 3 = 0$, what is the value of x?

26. Find the sum of the first 20 terms of the sequence shown below:

$$\frac{1}{1(1+1)} + \frac{1}{2(2+1)} + \frac{1}{3(3+1)} + \frac{1}{4(4+1)} + \dots + \frac{1}{20(20+1)}$$

A. $\dfrac{1}{2}$

B. $\dfrac{3}{4}$

C. $\dfrac{9}{10}$

D. $\dfrac{20}{21}$

Answer: D

27. Let $\angle$ be an operation on a and b defined as $a \angle b = a^b$. If $p = 4 \angle a$, $q = 4 \angle b$, $r = 2 \angle (2c)$ and $a + b + c = 4$, find the value of pqr.

A. 4

B. 16

C. 64

D. 256

Answer: D

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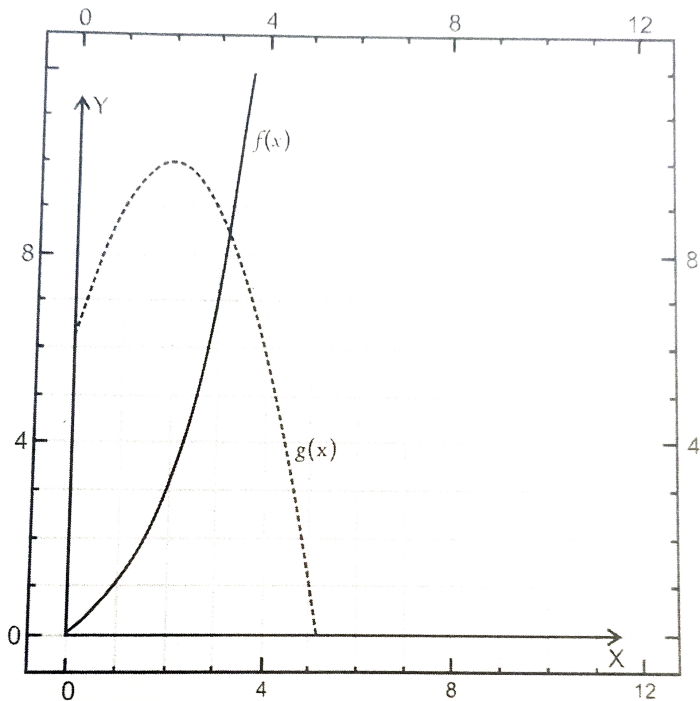
28.

The graph of f(x) and g(x) are shown below. If

$3f(g(k) + 1) + g(f(m))$, where k and m are positive integers

from 1 to 5, what is the maximum value of (K+m)?

29. What is the value of x that satisfies the equation: $\sqrt{x-3} = \sqrt{2x+2} - 2$?

A. 4

B. 7

C. 9

D. 12

Answer: A

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30. It was observed in an experiment that the number of bacteria doubles evey hour. It was found that the number of bacteria twelve hours from the start of observation was 40960. After how

many hours from the start of the experiment would the number of bacteria has been one-fourth the final number of bacteria?

A. 11

B. 10

C. 8

D. 6

Answer: B

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31. Let $\forall$ be an operation on a defined as $\forall a = \left(a^2 - 3a - 4\right)$. If $\forall$ k also equals (k-4),find the positive value of k.

A. -5

B.

C. 4

D. 1

Answer: C

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32. If $x > x^3$, then all the options may be correct EXCEPT

A. $x^3 > x^5$

B. $x^2 > x$

C. $x^2 > x^3$

D. $\dfrac{1}{x} > \dfrac{1}{x^2}$

Answer: D

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33. A sequence is defined as: $t_{n+1} = t_n - t_{n-1}$, where t_n denotes the nth term of the sequence. If t_1=1 and $t_2 = 5$, find the sum of the first 100 terms of the above sequence.

A. 1

B. 9

C. 10

D. 20

Answer: B

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34. Let ! "-be" an opertion on p and q defined as $q!p = p^2 - 4pq + q^2$. If x!1= -3, what is the value of x!(x+1)?

A. -11

B. -11

C. 2

D. 61

Answer: A

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35. What is the positive value of x that satisfies the equation:
$$\frac{6}{x+1} = \frac{3}{x-1} = 1?$$

A. 1

B. 2

C. 3

D. 4

Answer: B

36. Let □ be on operation on p defined as $\Box p = p^2 - 3$. Which of the following correctly represents the value of

$$\blacksquare\Big(\blacksquare\big(\blacksquare 2\big)\Big)?$$

A. (A) $\blacksquare\big(\blacksquare(\blacksquare 1)\big)$

B. (B) $\blacksquare\Big(\blacksquare(\blacksquare(\blacksquare(-2)))\Big)$

C. (C) $\blacksquare\Big(\blacksquare(\blacksquare(-1))\Big)$

D. (D) $\blacksquare\Big(\blacksquare(\blacksquare(\blacksquare 1))\Big)$

Answer: D

37. How many solutions exists for the equation $2|x - 1|^2 + 4 = 0$?

38. Let n be the value of the least integer $(0 > n > 5)$ so that $3^{2n} + 4$ is not prime. What is the value of the remainder when $3^{2n} + 4$ is divided by n?

A. 1

B. 2

C. 3

D. 4

Answer: A

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39. In the quadratic equation $ax^2 + bx + 2 = 0$, both a and b belong to the set $P = \{3, 4, 5\}$. How many different quadratic equations can be formed using the values from the set P for a and b so that the roots of the equation are real?

A. 3

B. 5

C. 6

D. 8

Answer: B

40. Which of the following statements are true regarding the expression f(x)=$2x^2 + 4x + 9$?

I. The expression has a least value of 7

II. The value of the expression is always positive for any value of x

III. The roots of f(x)=0 are irrational

A. Only I

B. Only II

C. Only III

D. Both I and II

Answer: D

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41. If x+2y=2   and $x^2 - y^2 = 9$, what   is   the   value   of $\left(x^3 - 2y^3 - xy^2 + 2x^2y\right)$?

42. In   the   formula $\dfrac{2}{3a} - \dfrac{4}{5b} = \dfrac{5}{4c}$,   what   is   the   correct

expression of a in terms of b and c?

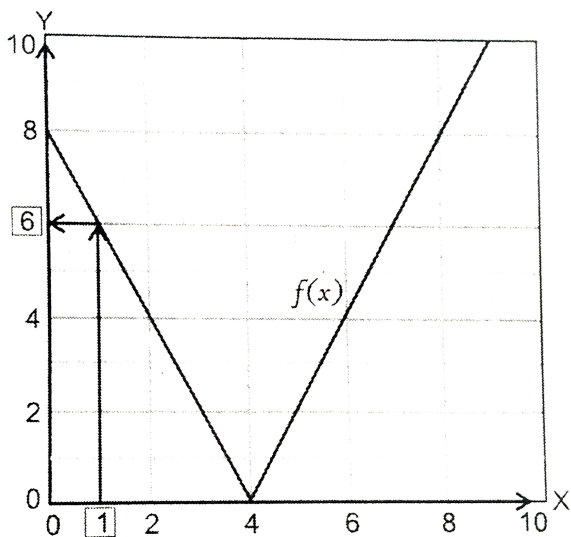A. $\dfrac{40bc}{3(16b + 25c)}$

B. $\dfrac{40bc}{3(16b + 25c)}$
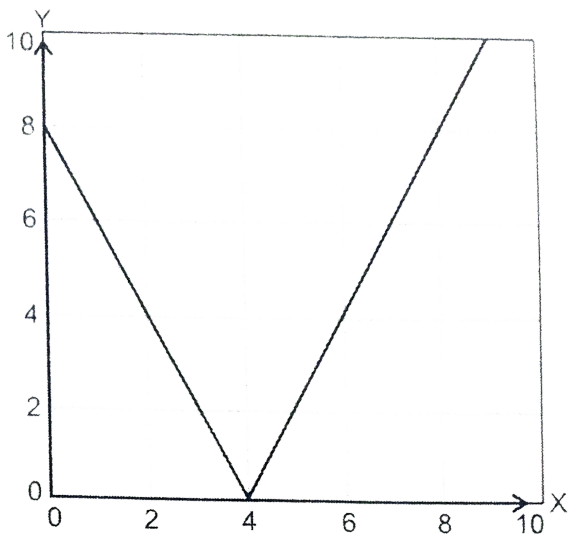
C. $\dfrac{40bc}{3(25b + 16c)}$

D. $\dfrac{40bc}{3(25b - 16c)}$

Answer: C

43.

The graph of y=f(x) is shown below. If f(k)=6, then what is the minimum value of m so that f(m)=k?

44. How many values of x exist if $4^x - 12.2^x - 64 = 0$?

A. 8

B. 4

C. 2

D. 1

Answer: D

45. If $(x) = \dfrac{a^x - 1}{a^x + 1}$, choose the correct statement.

I. f(-x)=f(x)
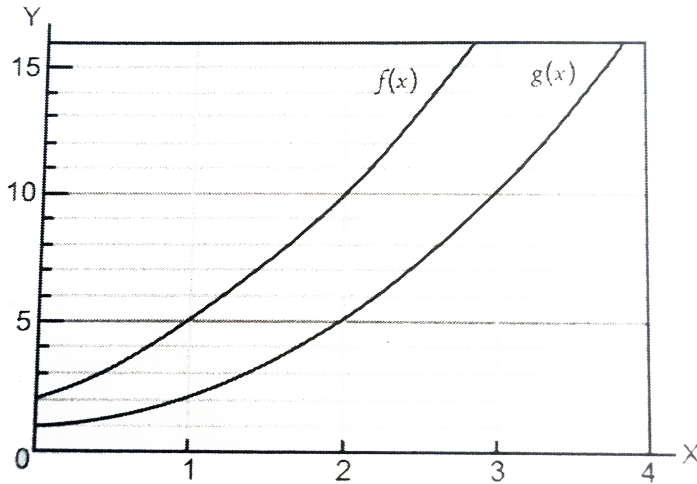
II. F(-x)=-f(x)

III. F(2x)=2f(x)

A. Only I

B. Only II

C. Only III

D. Both II and III

Answer: B

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46.

The graph of f(x) and g(x) are shown below. Which option is true?

A. $f(x) = (x + 2)^2$

B. $f(x) = x^2 + 1$

C. $g(x) = x^2$

D. $g(x) = x^2 + 1$

Answer: D

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47. The function f(x) is defined as follows:

$$f(x) = x^2 - 1 \quad \text{if} \ \ x \le 3$$
$$f(x) = 2x + 2 \quad \text{if} \ \ 3 < x \le 9$$
$$f(x) = 4x - 8 \quad \text{if} \ \ x > 9$$

What is the value of k if $f(f(f(3))) = (k+1)^2$ where k is positive integer ?

48. If $\dfrac{2x + 3}{(x+1)(x+2)} = \dfrac{A}{x+1} + \dfrac{B}{x+2}$ for all real values of $x (\ne -1, \ -2)$, what is the value of (A+B)?

A. 1

B. 2

C. 3

D. 4

Answer: B
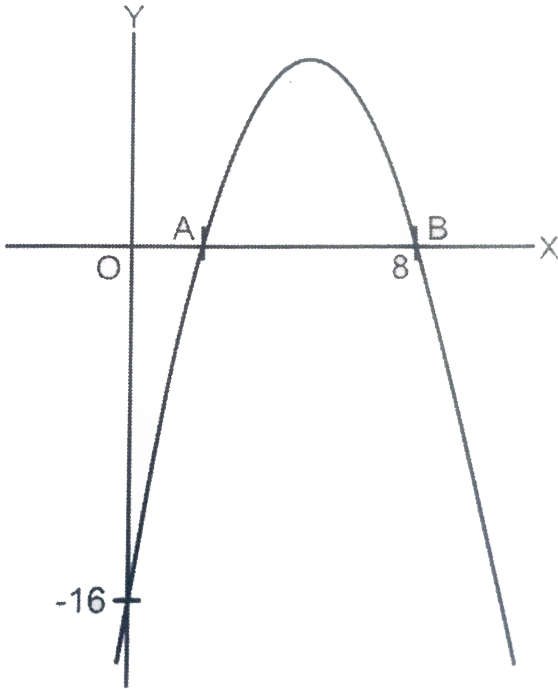
49.

The graph of $f(x) = -x^2 + ax + b$ is shown below. What is the area of the square constructed with side AB?

50. $f(x) = \dfrac{x - k}{5}$ and $g(x) = 5x + 7$. If $f(g(x)) = g(f(x))$, what is the value of k?

A. 2

B. 4

C. 5

D. 7

Answer: D

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51. Choose the correct option if it is known that one root of the quadratic equation $ax^2 + bx + c = 0$ is three times the other root?

A. $b^2 = 3ac$

B. $3b^2 = 16ac$

C. $a^2 = 9b^2c$

D. $4c^2 = 9ab$

Answer: B

52. $f(x) = 2|x| + x$. Which of the options is the correct value of $f(-2) + f(-4)$?

A. f(-3)

B. f(-1)

C. f(2)

D. f(0)

Answer: C

---

53. If $f(x) = x^2 + 1$ and $f(g(2)) = 1$, then which of the following could be a possible expression for g(x)?C

A. 5x-1

B. 2x-4

C. 6x+3

D. x-1

Answer: B

54. If $x = 4 + \dfrac{1}{a}$ and $y = 2 - \dfrac{1}{2a}$, what is the value of $(x^3 + 6x^2y + 12xy^2 + 8y^3)$?

55. If the quadratic equation $2x^2 + 5x + 1 = 0$ has roots p and q,what is the value of the expression (2-p)(2-q)?
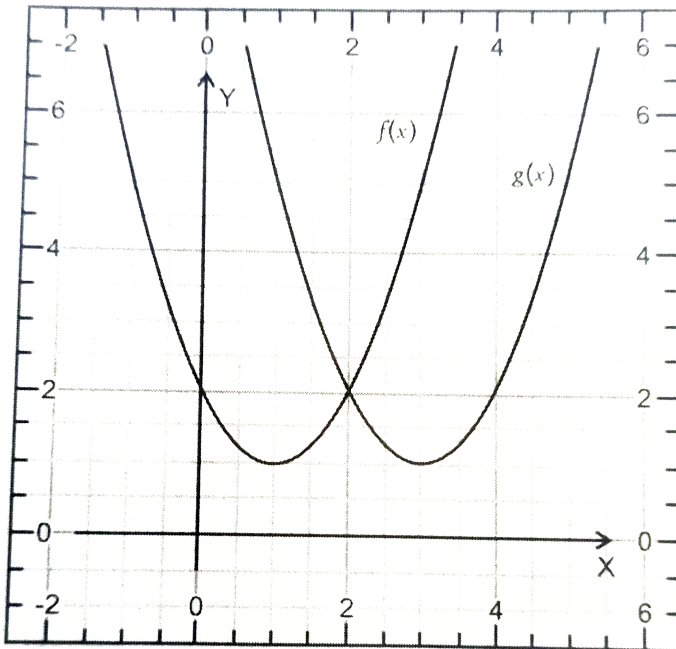
A. 0

B. -2

C. $\sqrt{17}$

D. 9.5

Answer: D

56. If $9^x - 2.3^x - 3 = 0$, what is the value of x?

57.

The graph of f(x) and g(x) are shown below. Which option is true?

A. g(x)=f(x-2)

B. g(x)-f(x)+1

C. g(x)=f(x-1)

D. g(x)=f(x)-2

Answer: A

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58. f(x) is defined to be the sum of all the digits in a number x. If x is a three-digit number, what is the difference between the largest and the smallest values of x such that f(x)=11?

A. 81

B. 101

C. 791

D. 801

Answer: D

59. A symbol is defined below:
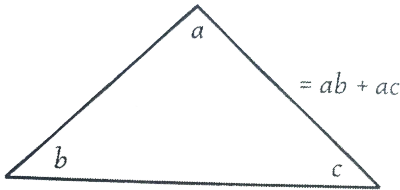
For what value of |r| is

$$= ab + ac$$
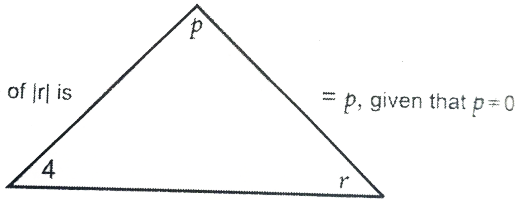
$$= p, \text{ given that } p \neq 0$$

Find the value of $|r|$ given that $p \neq 0$?

Find the value of |r| given that $p \neq 0$?

60. If the quadratic equation

$x^2 - ax + 30 = 0$ and $x^2 - 12x + 20 = 0$ have exactly one root

common, find the sum of the possible values of a.

A. 3

B. 10

C. 13

D. 17

Answer: C

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61. $f(x) = 3^3 \sqrt{x} - 5$ and $g(x) = 2px + q^2$. If $f(g(2)) = 7$, what is the minimum value of $(p + q)$ if p is a positive integer?

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62.

The graph of f(x) and g(x) are shown below. Which option is true?

A. $f(x) = g(x + 2)$
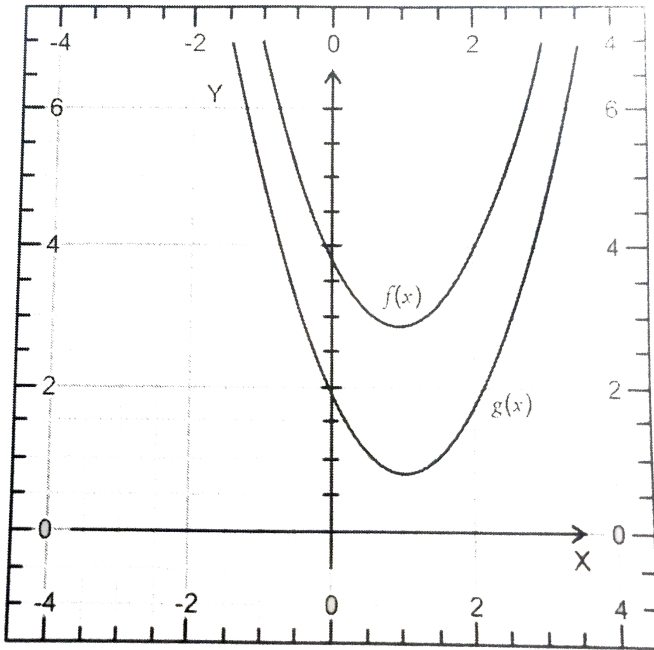
B. $f(x) = g(x) + 2$

C. $f(x) = g(x - 2)$

D. $f(x) = g(x) - 2$

Answer: B

63. The product of three consecutive positive integers is 8 times the sum of the three numbers. What is the sum of the three integers?

64. The harmonic mean of two quantities a and b is defined as $\frac{2ab}{a+b}$. If the harmonic mean of the quantities x and 12 is one less than the average of the same two quantities, which of the following can be the value of the sum of digits in x?

A. 1

B. 2

C. 4

D. 5

Answer: B

---

65. If $2x = a - \dfrac{1}{a}$, where $a > 0$, what is the value of $\sqrt{(x^2 + 1)} + x$?

A. 1

B. $\dfrac{1}{a}$

C. a

D. $\dfrac{1}{2}\left(a + \dfrac{1}{a}\right)$

Answer: C

66.

$$P = \left(1 + \frac{1}{x}\right)\left(1 + \frac{1}{x+1}\right)\left(1 + \frac{1}{x+2}\right)...\left(1 + \frac{1}{x+20}\right).$$

What is the value of P if x=9?

A. 1.5

B. 2.25

C. 2.75

D. 3.33

Answer: D

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67. If $(x-3)^2 < 25$ and $(y-5)^2 < 4$, what is sum of the maximum and minimum possible values of $\frac{x}{y}$ given that x and y are integers?

A. 2.67

B. 2

C. 1.5

D. 1.2

Answer: C

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68. At how many points does the line y=2x-1 intersect the circle $(x - 4)^2 + (y - 6)^2 = 2$?

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69. If $h(x) = 2^{kx - 1}$, what is the value of $\dfrac{h(a)h(b)}{h(a + b)}$?

A. 4

B. 2

C. 1

D. 0.5

Answer: D

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70. It is observed that the number of ants living in a colony increase by 25% every week. After four weeks of observation, total ants were found to be 6250. How many ants were found when the observation was first made?

A. 1250

B. 2560

C. 3125

D. 3250

Answer: B

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71. If $N = a^2 b^4$ is divisible by 8 and 27. If a and b are positive integers not having any common factors except one,what is the minimum value of the least multiple of a and b?

A. 6

B. 8

C. 9

D. 12

Answer: D

72. Find the sum of the possible integer values of m:

$$2m + n = 10$$

$$m(n - 1) = 9$$

73. In a series, the first term is k. Each term thereafter is three times the preceding term. The sum of the first six terms is 728. What is the sum of the first three terms of the series ?

A. 2

B. 13

C. 26

D. 80

Answer: C

---

74. In formula $s = ut - \dfrac{a}{2}t^2$, which of the following is NOT the correct expression of a in terms of s,u and t?

A. $\dfrac{2u}{t} - \dfrac{2s}{t^2}$

B. $\dfrac{2(ut - s)}{t^2}$

C. $\dfrac{u - st}{2t}$

D. $\dfrac{1}{t}\left(2u - \dfrac{2s}{t}\right)$

Answer: C

75. If $f(x) = 8 - x^2$ where $-3 < x < 3$, what is the range of values of $f(x)$?

    A. $0 < y < 7$

    B. $-1 \leq y \leq 8$

    C. $8 < y < 17$

    D. $-1 < y \leq 8$

Answer: D

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76. A quadratic function f(x) intersects the X-axis at points (6,0) and (8,0). If $f(a) = f(2) = 24$, what is the value of $a[a \neq 2]$?

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77. In a sequence of terms, the first term is (-1). Each term thereafter is obtained by multiplying the previous number with (-2). How many of the first 50 terms of the series are less than 50?

A. 3

B. 25

C. 28

D. 32

Answer: C

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78. If $f(x)$ be a function such that $f(-x) = -f(x), g(x)$ be a function such that $g(-x) = -g(x)$ and $h(x)$ be a function such that $h(-x) = h(x)$, then choose the correct statement:

I. $h(f(g(-x))) = -h(f(g(x)))$

II. $f(g(h(-x))) = f(g(h(x)))$

III. $g(f(-x)) = g(f(x))$

    A. Only I

    B. Only II

    C. Only III

    D. Both I and II

Answer: B

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79. If $\sqrt{x+3} + \sqrt{7-x} = 4$, what is the positive value of x^3?

    A. 1

    B. 8

C. 27

D. 216

Answer: D

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80. If $f(x) = |x - 2| + x^2 - 1$ and $g(x) + f(x) = x^2 + 3$, find

the maximum value of $g(x)$.

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