

1. Perform the indicated operations on the given matrices.

$$\begin{bmatrix} -3 & 7 \\ -8 & 3 \end{bmatrix} + \begin{bmatrix} 7 & 1 \\ -8 & -4 \end{bmatrix}$$

[A] $\begin{bmatrix} 4 & 8 \\ -16 & -1 \end{bmatrix}$

[B] $\begin{bmatrix} -10 & 6 \\ -16 & -1 \end{bmatrix}$

[C] $\begin{bmatrix} -10 & 6 \\ 0 & 7 \end{bmatrix}$

[D] $\begin{bmatrix} 4 & 8 \\ 0 & 7 \end{bmatrix}$

2. Find $\begin{bmatrix} 12 & 9 & 1 \\ 3 & 1 \\ 7 & 10 \end{bmatrix} \cdot \begin{bmatrix} 180 \\ 90 \\ 17 \end{bmatrix}$.

[A] $\begin{bmatrix} 180 \\ 90 \\ 17 \end{bmatrix}$

[B] $\begin{bmatrix} 144 & 108 \\ 27 & 9 \\ 7 & 10 \end{bmatrix}$

[C] $\begin{bmatrix} 180 & 90 & 17 \end{bmatrix}$

[D] $\begin{bmatrix} 178 & 127 \end{bmatrix}$

3. Find the inverse of the following matrix (if it exists): $\begin{bmatrix} 4 & -4 \\ 0 & 3 \end{bmatrix}$

[A] $\begin{bmatrix} 3 & 4 \\ 0 & 4 \end{bmatrix}$

[B] $\begin{bmatrix} \frac{1}{4} & \frac{1}{3} \\ 0 & \frac{1}{3} \end{bmatrix}$

[C] $\begin{bmatrix} -\frac{1}{3} & 0 \\ \frac{1}{3} & -\frac{1}{4} \end{bmatrix}$

[D] The matrix has no inverse.

4. Find the determinant, and tell whether the matrix has an inverse.

$$\det \begin{bmatrix} -2 & -4 \\ 10 & -7 \end{bmatrix}$$

[A] -15; Yes

[B] 3; Yes

[C] 54; Yes

[D] 0; No

5. Write the augmented matrix for the system of equations.

$$\begin{cases} 4x - 3y - 5z = -3 \\ -8x - 7y - 2z = -8 \\ 6x + 6y + 7z = -1 \end{cases}$$

[A] $\left[\begin{array}{ccc|c} 4 & -3 & -5 & -3 \\ 0 & 0 & -2 & -8 \\ 0 & 0 & 0 & -1 \end{array} \right]$

[B] $\left[\begin{array}{ccc|c} 4 & -8 & 6 & 6 \\ -3 & -7 & 6 & 6 \\ -5 & -2 & 7 & 7 \\ -3 & -8 & -1 & -1 \end{array} \right]$

[C] $\left[\begin{array}{ccc|c} 4 & -3 & -5 & -3 \\ -8 & -7 & -2 & -8 \\ 6 & 6 & 7 & -1 \end{array} \right]$

[D] $\left[\begin{array}{ccc|c} 4 & -3 & -5 & -3 \\ -8 & -7 & -8 & -2 \\ 6 & 7 & 6 & -1 \end{array} \right]$

6. Solve the radical equation. If there is no real solution, write *no solution*.

$$2x = \sqrt{8 - 4x}$$

[A] 1

[B] $\frac{1}{2}$

[C] -1

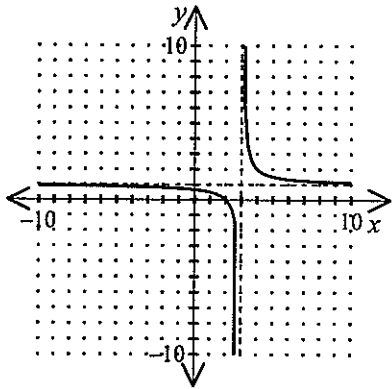
[D] no real solution

7. Determine whether the function is a rational function. If so, find the domain and identify the horizontal and vertical asymptotes, and any holes in the graph. If the function is not rational, state why not.

$$f(x) = \frac{3x+10}{x^2+5x+4}$$

- [A] rational; $x \neq 4$ or 1 ; asymptotes at $y=0$, $x=4$ and $x=1$
 [B] rational; $x \neq -4$ or -1 ; asymptotes at $y=0$, $x=-4$ and $x=-1$
 [C] rational; $x \neq -\frac{10}{3}$ or -4 ; asymptotes at $y=3$, $x=-\frac{10}{3}$ and $x=-4$
 [D] not rational; numerator is of lower degree than denominator

8. Which function matches the graph?



- [A] $f(x) = \frac{x-3}{x-2}$ [B] $f(x) = \frac{x-2}{x-3}$ [C] $f(x) = \frac{x-4}{x-1}$ [D] $f(x) = \frac{x-1}{x-4}$

Simplify the rational expression.

9. $\frac{x^2+10x+24}{x^2-16} \div \frac{x+6}{x-6}$ [A] $\frac{x-6}{x-4}$ [B] $\frac{x-8}{x-4}$ [C] $\frac{10x+6}{4}$ [D] $\frac{x+4}{x-6}$

10. $\frac{x^2-1}{10x} \cdot \frac{7x}{x+1}$ [A] $\frac{7(x+1)}{10}$ [B] $\frac{7(x-1)}{10}$ [C] $\frac{(x+1)^2(x-1)}{70x^2}$ [D] $\frac{(x-1)^2(x+1)}{70x^2}$

11. $\frac{\frac{x^2-18x+81}{10x}}{\frac{x-9}{2x}}$ [A] $\frac{x-9}{5}$ [B] $\frac{x+81}{5x}$ [C] $-17x-9$ [D] $\frac{x+9}{5}$

12. Simplify. $\frac{-6x+3}{x^2-49} - \frac{-5x-4}{x^2-49}$ [A] $-\frac{1}{x+7}$ [B] $\frac{-x-1}{x^2-49}$ [C] $\frac{1}{x+7}$ [D] $-\frac{1}{x-7}$

13. Solve the equation or inequality. [A] $x = 7$ [B] $x = -\frac{11}{5}$ [C] $x = -11$ [D] no solution

$$\frac{2}{x-3} - \frac{3}{x-1} = 0$$
14. Evaluate the radical expression: $-5(\sqrt[4]{81})^2$ [A] -45 [B] 225 [C] 75 [D] -15
15. Find the domain of the radical function. [A] $x \leq 7$ [B] $x \geq 7$ [C] $x \geq -7$ [D] $x \leq -7$
 $f(x) = \sqrt{7-x}$
16. Simplify the sum, difference, product, or quotient. Assume that the value of any variable is positive.

$$\frac{\sqrt{9b^2a}}{\sqrt{3ba}}$$

 [A] $\sqrt{3b}$ [B] $\sqrt{9b^2a}$ [C] $\sqrt{3b^2}$ [D] $\frac{\sqrt{3}}{\sqrt{b}}$
17. Rationalize the denominator. [A] $\frac{4\sqrt{5}-\sqrt{35}}{9}$ [B] $\frac{5\sqrt{5}-\sqrt{28}}{18}$ [C] $\frac{4\sqrt{5}-\sqrt{35}}{11}$ [D] $\frac{7\sqrt{5}-\sqrt{20}}{45}$

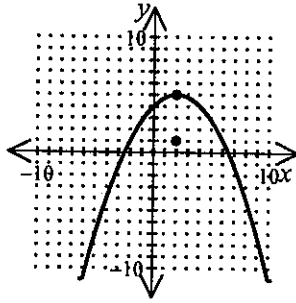
$$\frac{\sqrt{5}}{4+\sqrt{7}}$$
18. Find the distance between points $C(-6, -3)$ and $B(-3, 1)$, and the coordinates of the midpoint of \overline{CB} .
 [A] distance = $5\sqrt{1}$; 5
 midpoint = $\left(-\frac{9}{2}, -1\right)$
 [B] distance = $5\sqrt{1}$; 5
 midpoint = $\left(-\frac{3}{2}, -2\right)$
 [C] distance = $\sqrt{85}$; 9.22
 midpoint = $\left(-\frac{9}{2}, -1\right)$
 [D] distance = $\sqrt{85}$; 9.22
 midpoint = $\left(-\frac{3}{2}, -2\right)$

19. Find the standard equation and graph of a parabola that matches the given set of characteristics.

focus: (2, 1)

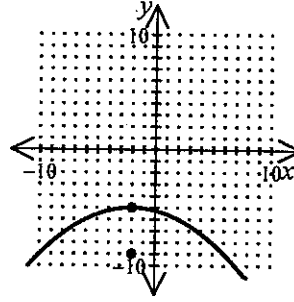
vertex: (2, 5)

[A]



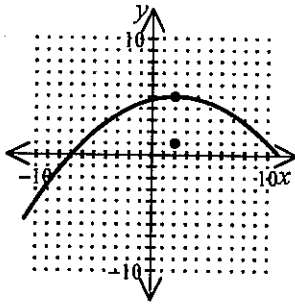
$$y - 5 = -\frac{1}{4}(x - 2)^2$$

[B]



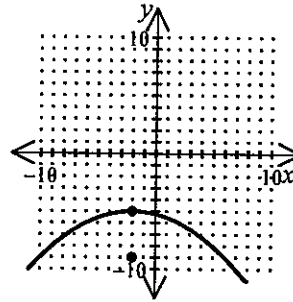
$$y + 5 = -\frac{1}{16}(x + 2)^2$$

[C]



$$y - 5 = -\frac{1}{16}(x - 2)^2$$

[D]



$$y - 5 = \frac{1}{16}(x - 2)^2$$

20. Find the standard equation of a circle with the given radius and center.

radius: 6

center: (-1, -1)

[A] $(x - 1)^2 + (y - 1)^2 = 6$

[B] $(x + 1)^2 + (y - 1)^2 = 36$

[C] $(x - 1)^2 - (y - 1)^2 = 6$

[D] $(x + 1)^2 + (y + 1)^2 = 36$

21. Find the standard equation for the hyperbola with the given characteristics.

vertices: (4, 0) and (-4, 0)

asymptote: $y = \frac{7}{4}x$

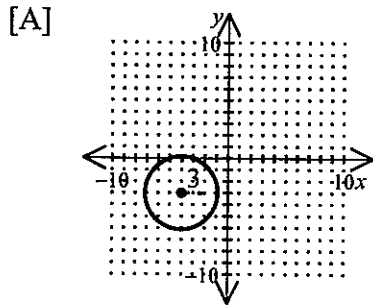
[A] $\frac{x^2}{16} - \frac{y^2}{49} = 1$

[B] $\frac{x^2}{16} - \frac{y^2}{9} = 1$

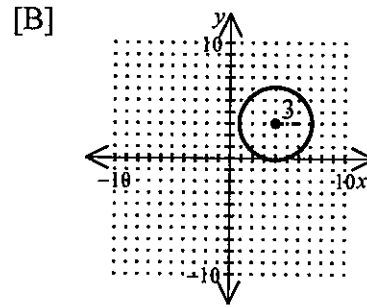
[C] $\frac{x^2}{9} - \frac{y^2}{16} = 1$

[D] $\frac{x^2}{49} - \frac{y^2}{9} = 1$

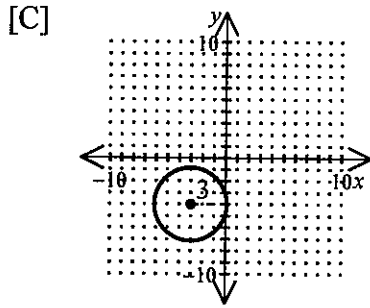
22. Which is the graph of the equation $(x - 4)^2 + (y - 3)^2 = 9$ with the correct center and radius?



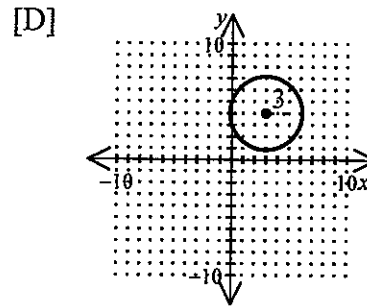
center: $(-4, -3)$; radius: 3



center: $(4, 3)$; radius: 3

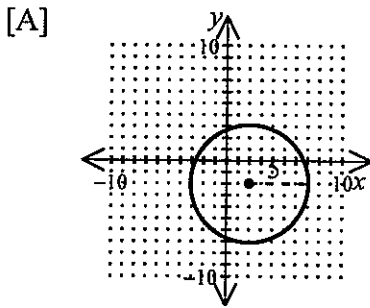


center: $(-3, -4)$; radius: 3



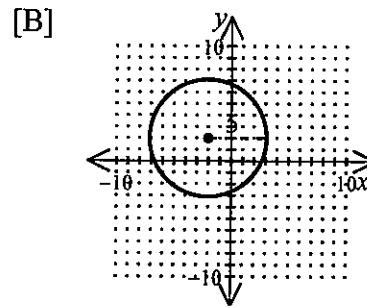
center: $(3, 4)$; radius: 3

23. Which is the graph and the standard form of the equation $x^2 + y^2 - 4x - 4y - 17 = 0$?



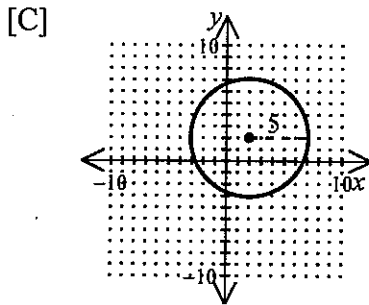
$$(x - 2)^2 + (y + 2)^2 = 25$$

center: $(2, -2)$; radius: 5



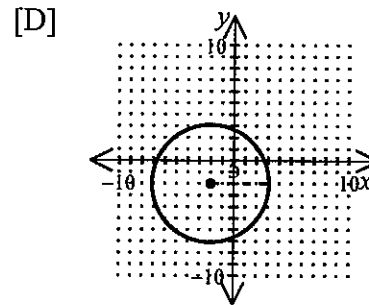
$$(x + 2)^2 + (y - 2)^2 = 25$$

center: $(-2, 2)$; radius: 5



$$(x - 2)^2 + (y - 2)^2 = 25$$

center: $(2, 2)$; radius: 5



$$(x + 2)^2 + (y + 2)^2 = 25$$

center: $(-2, -2)$; radius: 5

24. Find the standard equation for the ellipse, using either the given characteristics, or characteristics taken from the graph.

vertices: $(\pm 5, 0)$; foci: $(\pm 3, 0)$

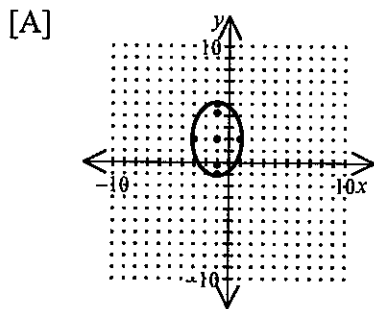
[A] $\frac{x^2}{9} + \frac{y^2}{16} = 1$

[B] $\frac{x^2}{25} + \frac{y^2}{16} = 1$

[C] $\frac{x^2}{16} + \frac{y^2}{9} = 1$

[D] $\frac{x^2}{16} + \frac{y^2}{25} = 1$

25. Which is the graph of the ellipse represented by the equation $\frac{(x+1)^2}{4} + \frac{(y-2)^2}{9} = 1$?

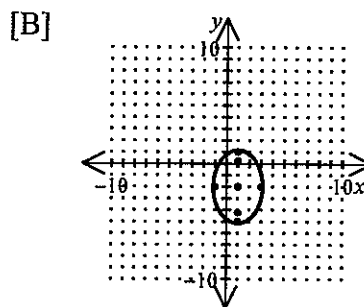


center: $(-1, 2)$

foci: $(-1, -0.24), (-1, 4.24)$

vertices: $(-1, -1), (-1, 5)$

co-vert.: $(-3, 2), (1, 2)$

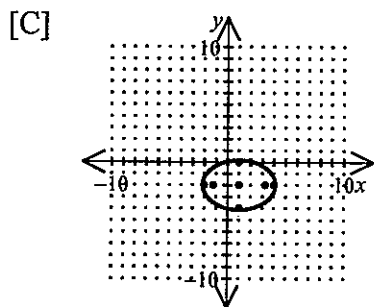


center: $(1, -2)$

foci: $(1, -4.24), (1, 0.24)$

vertices: $(1, -5), (1, 1)$

co-vert.: $(-1, -2), (3, -2)$

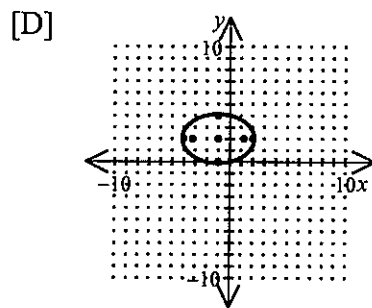


center: $(1, -2)$

foci: $(-1.24, -2), (3.24, -2)$

vertices: $(-2, -2), (4, -2)$

co-vert.: $(1, -4), (1, 0)$



center: $(-1, 2)$

foci: $(-3.24, 2), (1.24, 2)$

vertices: $(-4, 2), (2, 2)$

co-vert.: $(-1, 0), (-1, 4)$

26. Solve the nonlinear system of equations.

$$\begin{cases} x^2 + y^2 = 144 \\ x + y = 12 \end{cases}$$

[A] one solution: $(6\sqrt{2}, 6\sqrt{2})$

[B] two solutions: $(0, 12)$ and $(12, 0)$

[C] two solutions: $(6\sqrt{2}, 6\sqrt{2})$ and $(-6\sqrt{2}, -6\sqrt{2})$

[D] four solutions: $(0, \pm 12)$ and $(\pm 12, 0)$

27. For the equation of a hyperbola, find the standard equation, vertices, foci, asymptotes, and correct graph.

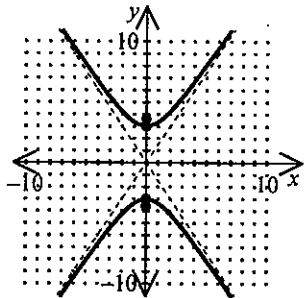
$$9x^2 - 4y^2 - 36 = 0$$

[A] $\frac{y^2}{9} - \frac{x^2}{4} = 1$

vertices: $(0, 3), (0, -3)$

foci: $(0, -\sqrt{13}), (0, \sqrt{13})$

asymptotes: $y = \frac{3}{2}x, y = -\frac{3}{2}x$

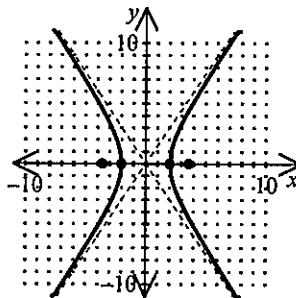


[B] $\frac{x^2}{4} - \frac{y^2}{9} = 1$

vertices: $(2, 0), (-2, 0)$

foci: $(-\sqrt{13}, 0), (\sqrt{13}, 0)$

asymptotes: $y = \frac{3}{2}x, y = -\frac{3}{2}x$

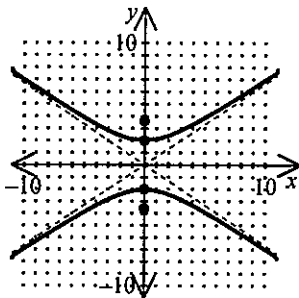


[C] $\frac{y^2}{4} - \frac{x^2}{9} = 1$

vertices: $(0, 2), (0, -2)$

foci: $(0, -\sqrt{13}), (0, \sqrt{13})$

asymptotes: $y = \frac{2}{3}x, y = -\frac{2}{3}x$

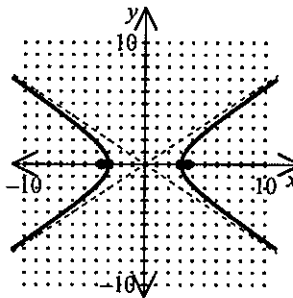


[D] $\frac{x^2}{9} - \frac{y^2}{4} = 1$

vertices: $(3, 0), (-3, 0)$

foci: $(-\sqrt{13}, 0), (\sqrt{13}, 0)$

asymptotes: $y = \frac{2}{3}x, y = -\frac{2}{3}x$



28. A spinner is evenly divided into 8 equal areas and numbered from 1 through 8. What is the probability of spinning a number less than 4 in a single spin?

[A] $\frac{3}{8}$

[B] $\frac{5}{8}$

[C] $\frac{1}{2}$

[D] $\frac{1}{4}$

29. Hiro is in the bowling club. There are 23 students in the club. Three of them will be picked at random to attend an awards banquet. What is the probability that Hiro will *not* be randomly chosen to attend the banquet?

[A] $\frac{20}{23}$

[B] $\frac{3}{23}$

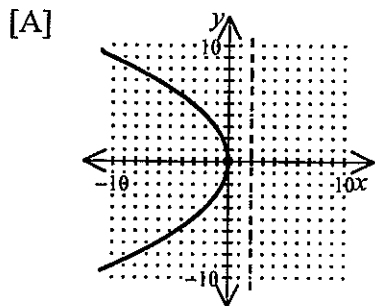
[C] $\frac{23}{20}$

[D] $\frac{23}{3}$

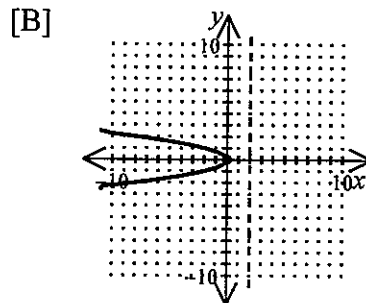
30. Find the standard equation and graph of a parabola that matches the given set of characteristics.

vertex: $(0, 0)$

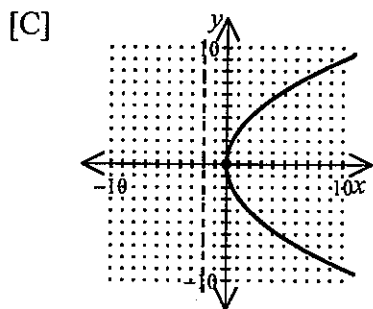
directrix: $x = -2$



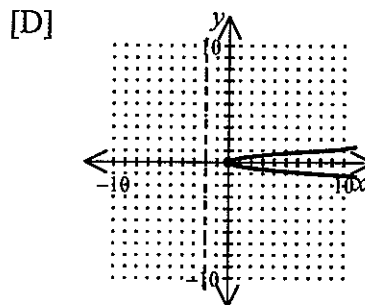
$$x = -\frac{1}{8}y^2$$



$$x = -2y^2$$



$$x = \frac{1}{8}y^2$$



$$x = 8y^2$$

31. A lunch menu consists of 5 different kinds of sandwiches, 3 different kinds of soup, and 4 different drinks. How many choices are there for ordering a sandwich, a bowl of soup, and a drink?

[A] 60

[B] 12

[C] 3

[D] 17,280

32. How many different arrangements can be made using all of the letters in the word GRAPHICS?

[A] 40,320

[B] 784

[C] 64

[D] 8

33. Find: ${}_9P_4$

[A] 6048

[B] 3024

[C] 13

[D] 36

34. A circular, rotating, serving tray has 7 different desserts placed around its circumference. How many different ways can all of the desserts be arranged on the circular tray?

[A] 40,320

[B] 720

[C] 5040

[D] 362,880

35. Evaluate: ${}_{10}C_4$

[A] 3

[B] 5040

[C] 210

[D] 3,628,800

36. Three cards are drawn in succession and without replacement from a standard deck of 52 cards. How many sets of three cards are possible?

[A] 132,600

[B] 66,300

[C] 22,100

[D] 5525

37. How many distinct committees of 9 people can be formed if the people are drawn from a pool of 21 people? Use factorials to express the answer.

[A] ${}_{21}C_{10} = \frac{21!}{11! 10!}$

[B] ${}_{21}C_8 = \frac{21!}{12! 8!}$

[C] ${}_{21}C_9 = \frac{21!}{11! 9!}$

[D] ${}_{21}C_9 = \frac{21!}{12! 9!}$

38. If the number cards below were shuffled and a card were drawn at random, what is the probability of drawing an 8 or a 4?

9	4	9	8	2	9	1	8
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[A] $\frac{1}{2}$

[B] $\frac{3}{8}$

[C] $\frac{1}{8}$

[D] $\frac{1}{32}$

39. A coin is tossed and a number cube is rolled. What is the probability that the coin shows tails and the die shows 4?

[A] $\frac{2}{3}$

[B] $\frac{1}{6}$

[C] $\frac{1}{12}$

[D] $\frac{1}{4}$

40. In a bag there are 3 green jelly beans, 5 black jelly beans, and 5 yellow jelly beans. Once a jelly bean is drawn, it is not replaced. Find the probability of randomly drawing a green jelly bean and then a black jelly bean in two consecutive draws.

[A] $\frac{5}{52}$

[B] $\frac{4}{39}$

[C] $\frac{15}{169}$

[D] $\frac{2}{39}$

41. Write the next two terms in the sequence 4, 8, 12, 16, ...

[A] 19, 23

[B] 20, 24

[C] 28, 32

[D] 21, 25

42. Evaluate the sum: $\sum_{k=3}^9 (3k + 2)$

[A] 62

[B] 140

[C] 153

[D] 129

43. Write the terms of the series. Then evaluate the sum.

$$\sum_{k=0}^3 (3k - 3)$$

[A] $-3 + 0 + 3; 0$

[B] $-3 + 0 + 3 + 6; 0$

[C] $-3 + 0 + 3; 6$

[D] $-3 + 0 + 3 + 6; 6$

44. Use the given formula to find the first four terms of the arithmetic sequence.

$$t_n = -7 + 3n$$

[A] $-1, 2, 5, 8$

[B] $-4, -7, -10, -13$

[C] $-4, -12, -36, -108$

[D] $-4, -1, 2, 5$

45. Evaluate the sum.

[A] -594

[B] -84

[C] -698.5

[D] -649

$$\sum_{k=1}^{11} (-9k - 5)$$

46. Write the first five terms of the geometric sequence using the given explicit formula.

$$t_n = 2 \cdot \left(\frac{1}{2}\right)^n$$

[A] $1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}, \frac{1}{16}$

[B] $2, 1, \frac{4}{3}, 2, \frac{16}{5}$

[C] $2, 1, \frac{3}{4}, \frac{2}{3}, \frac{5}{8}$

[D] $2, 1, \frac{1}{2}, \frac{1}{4}, \frac{1}{8}$

47. Find the sum of the geometric series $0.4 + 0.04 + 0.004 + \dots$ given the formula $S = \frac{a}{1-r}$, where a is the first term, r is the common ratio, and S is the sum.

[A] $\frac{4}{9}$

[B] 0.444

[C] 0.012

[D] $\frac{2}{5}$

48. Find the sum of the infinite geometric series, if it exists.

[A] -2

[B] $-\frac{6}{5}$

[C] $-\frac{2}{3}$

[D] none

$$\sum_{k=1}^{\infty} -3 \left(-\frac{1}{2}\right)^{k-1}$$

49. Find the 4th and 8th entries in the row 12 of Pascal's triangle.

[A] 220; 792

[B] 55; 462

[C] 66; 924

[D] 78; 1716

50. Expand the binomial raised to a power.

$$(a - 3b)^5$$

[A] $a^5 - 15a^4b + 90a^3b^2 - 270a^2b^3 + 405ab^4 - 243b^5$

[B] $a^5 - 12a^4b + 90a^3b^2 - 270a^2b^3 + 405ab^4 - 243b^5$

[C] $a^5 + 5a^4b + 10a^3b^2 + 10a^2b^3 + 5b^4 + b^5$

[D] $a^5 - 5a^4b - 10a^3b^2 - 10a^2b^3 - 5b^4 + b^5$