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1. Given  $f(x) = 2x^2 + 4x - 1$  what is  $f(2a - 1)$ ?

- A.  $8a^2 - 16a - 3$
- B.  $4a^2 - 12a - 5$
- C.  $8a^2 - 3$
- D.  $2a^2 + 8a - 2$

2. Given,  $f(x) = -3\sqrt{x+1}$  use your graphing calculator to evaluate  $f(-0.71)$ .

- A. -1.616
- B. -0.94
- C. 3.577
- D. 1.616

For #3-7, consider the polynomial function  $f(x) = 0.5(x - 2)^2(x - 4)(x + 1)$ . You may need a calculator for some parts.

3. What are the roots of  $f$  ?

- A. 0.5, -2, -4, 1
- B. 2, 4, -1
- C. 0.5, 2, 4, -1
- D. -2, -4, 1

4. What is the  $y$  -intercept of  $f$  ?

- A. (0, 8)
- B. (0, 4)
- C. (0, -16)
- D. (0, -8)

5. Solve for  $x$ :  $f(x) \geq 0$

- A.  $[-1, 2] \cup [2, 4]$
- B.  $(-\infty, -1] \cup [2] \cup [4, \infty)$
- C.  $[-1, 4]$
- D.  $(-\infty, -1] \cup [4, \infty)$

6. For how many interval(s) is  $f$  increasing?

- A. 0
- B. 1
- C. 2
- D. 3

7. Choose the appropriate description for  $f(x)$ .

- A. Even polynomial, Even Function
- B. Even Polynomial, Odd Function
- C. Odd Polynomial, Even Function
- D. Odd Polynomial, Odd Function
- E. None of the above

8. The function  $f(x) = \frac{x-5}{x^2+x-6}$  has:

- A. Two vertical asymptotes
- B. A vertical asymptote and a hole
- C. No vertical asymptotes
- D. Not enough information



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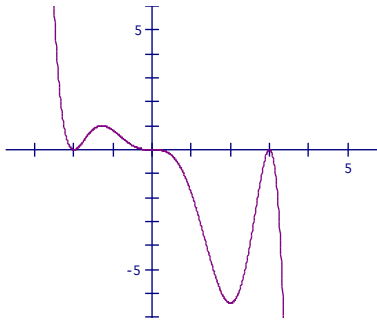
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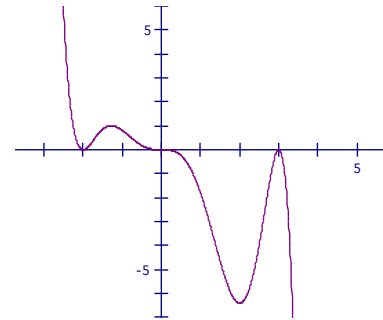
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- 9.** Given the graph of  $P(x) = kx^p(x + 2)^q(x - 3)^r$  below. Which of the following statement(s) are TRUE? Select all that apply.



- A.**  $q = r = 2$
  - B.**  $p = q = 2$
  - C.**  $p = 2$
  - D.**  $q = r = 3$
  - E.**  $p = 3$
  - F.**  $p = q = 3$
- 10.** What is the remainder when  $x^{153} - 5x^{17} + 9$  is divided by  $x + 1$ ?
- A.** 5
  - B.** 3
  - C.** 13
  - D.** Cannot be done

- 11.** The graph of  $P(x) = kx^p(x + 2)^q(x - 3)^r$  is given. Which of the following is TRUE?



- i.  $k$  is positive
  - ii.  $k$  is negative
  - iii.  $p + q + r = 5$
  - iv.  $p + q + r = 7$
- A.** I and III
  - B.** II and IV
  - C.** II and III
  - D.** I and IV

- 12.** Evaluate  $\log_9 102$
- A.** 2.1
  - B.** 0.47
  - C.** 1.6
  - D.** -2.8



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**13.** Which is the correct logarithmic form of  $8^3 = 512$  ?

- A.  $\log_3(512) = 8$
- B.  $\log_8(3) = 512$
- C.  $\log_8(512) = 3$
- D.  $\log_{512}(8) = 3$

For questions 14 – 17, identify if the statement is True or False.

**14.**  $\log\left(\frac{1}{x^3}\right) = 0$

- A. True
- B. False

**15.**  $\ln(3x^6y) = \ln 3 + 6 \ln x + \ln y$

- A. True
- B. False

**16.**  $8 \log_3 x - 2 \log_3 x = \log_3 x^4$

- A. True
- B. False

**17.**  $4 \log_2 x + 2 \log_4 y = \log_8 x^4 y^2$

- A. True
- B. False

**18.** The distance from  $A(3, y + 2)$  to  $B(-3, 2)$  is 10. Find the value of  $y$ .

- A. -8
- B. 10
- C. 8
- D. A and C

**19.**  $M$  is the midpoint of  $\overline{EF}$ . Find  $F$  given  $E(8, 2)$  and  $M(6, -6)$ .

- A.  $(4, -14)$
- B.  $(7, -2)$
- C.  $(10, 10)$
- D.  $(14, -4)$

**20.** What is the vertex of the parabola  $(y + 3)^2 = 4(x - 4)$

- A.  $(4, 3)$
- B.  $(4, -3)$
- C.  $(3, -4)$
- D.  $(3, 4)$

**21.** Write the following equations in standard form  $3y^2 + 24y - x + 30 = 0$

A.  $(y + 4)^2 = \frac{1}{3}(x - 78)$

B.  $(y + 4)^2 = \frac{1}{3}(x - 46)$

C.  $(y + 4)^2 = \frac{1}{3}(x - 14)$



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**D.**  $(y + 4)^2 = \frac{1}{3}(x + 18)$

- 22.** Identify the focus of

$$(x + 4)^2 = 24(y - 7)$$

- A.**  $F(-4, 1)$
- B.**  $F(-4, 13)$
- C.**  $F(-10, 7)$
- D.**  $F(2, 7)$

- 23.** Write the equations of the directrix and axis of symmetry of a parabola with vertex  $(6, 2)$  and focus  $(6, 3)$ .

- A.** Directrix:  $y = 1$ ; Axis of Symmetry:  $x = 6$
- B.** Directrix:  $y = -5$ ; Axis of Symmetry:  $x = 6$
- C.** Directrix:  $x = 6$ ; Axis of Symmetry:  $y = 1$
- D.** Directrix:  $x = 4$ ; Axis of Symmetry:  $y = 1$

- 24.** Write the equation of the parabola with vertex  $(6, 5)$  and focus  $(5, 5)$ .

- A.**  $(x - 6)^2 = 4(y - 5)$
- B.**  $(x - 6)^2 = -4(y - 5)$
- C.**  $(y - 5)^2 = -4(x - 6)$

**D.**  $(y - 5)^2 = 4(x - 6)$

- 25.** Determine the center and the radius of the following circle:

$$(x + 8)^2 + (y - 9)^2 = 16$$

- A.**  $(-8, 9)$ ;  $r = 4$
- B.**  $(-8, 9)$ ;  $r = 256$
- C.**  $(8, -9)$ ;  $r = 8$
- D.**  $(8, -9)$ ;  $r = 2$

- 26.** Write the equation of the circle with center  $(4, 12)$  and point on the circle  $(12, 6)$ .

- A.**  $(x - 8)^2 + (y + 6)^2 = 100$
- B.**  $(x - 4)^2 + (y - 12)^2 = 100$
- C.**  $(x - 8)^2 + (y + 6)^2 = 10$
- D.**  $(x - 4)^2 + (y - 12)^2 = 10$



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**27.** Identify the ellipse's center and foci:

$$\frac{(x+3)^2}{25} + \frac{(y+2)^2}{9} = 1$$

- A.**  $C(3,2)$ ; Foci:  $(7,2)$  and  $(-1,2)$
- B.**  $C(-3, -2)$ ; Foci:  
 $(-7, -2)$  and  $(1, -2)$
- C.**  $C(-3, -2)$ ; Foci:  
 $(-3,2)$  and  $(-3, -6)$
- D.**  $C(3,2)$ ; Foci:  $(3,6)$  and  $(3, -2)$

**28.** State the length of the major and

minor axes of  $\frac{(x+3)^2}{25} + \frac{(y+2)^2}{9} = 1$

- A.** Major: 5; Minor: 3
- B.** Major: 10; Minor: 6
- C.** Major: 25; Minor: 9
- D.** Major: 50; Minor: 18

**29.** Write the equation in standard form

$$3y^2 - 24y - 5x^2 + 20x = 17$$

- A.**  $\frac{(y-4)^2}{15} - \frac{(x-2)^2}{9} = 1$
- B.**  $\frac{(y-4)^2}{15} - \frac{(x+2)^2}{9} = 1$
- C.**  $\frac{(y-4)^2}{9} - \frac{(x-2)^2}{15} = 1$
- D.**  $\frac{(y-4)^2}{9} - \frac{(x+2)^2}{15} = 1$

**30.** What is the slope of the asymptotes for the hyperbola

$$\frac{(y+4)^2}{36} - \frac{(x+2)^2}{16} = 1$$

- A.**  $y = \pm \frac{2}{3}$
- B.**  $y = \pm \frac{4}{9}$
- C.**  $y = \pm \frac{3}{2}$
- D.**  $y = \pm \frac{9}{4}$

**31.** Write the equation in standard form  $x^2 + 14x + y^2 - 12y = -1$

- A.**  $(x + 7)^2 + (y - 6)^2 = 84$
- B.**  $\frac{(x+7)^2}{84} + \frac{(y-6)^2}{84} = 12$
- C.**  $(x + 7)^2 + (y - 6)^2 = 2\sqrt{21}$
- D.**  $\frac{(x+7)^2}{12} + \frac{(y-6)^2}{12} = 1$

**32.** Identify the type of conic section:

$$y^2 - 4y - 3x^2 + 6x = 12$$

- A.** Parabola
- B.** Circle
- C.** Ellipse
- D.** Hyperbola

**33.** Identify the type of conic section.

$$4y^2 + 16y + 4x^2 - 24x = 2x^2 + 12$$

- A.** Parabola
- B.** Circle
- C.** Ellipse
- D.** Hyperbola



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34. What angle measure corresponds to  $\frac{7\pi}{4}$  radians?

- A.  $51.43^\circ$
- B.  $102.86^\circ$
- C.  $157.5^\circ$
- D.  $315^\circ$

35. We are given  $\cos x = -\frac{5}{9}$  and the terminal point is in quadrant III. Find  $\cot x$ .

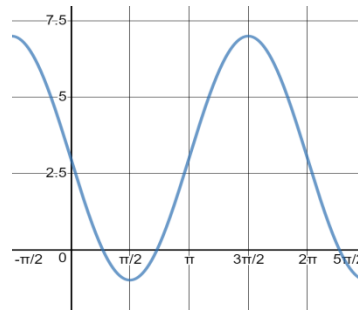
- A.  $\frac{5\sqrt{14}}{14}$
- B.  $\frac{5\sqrt{14}}{28}$
- C.  $\frac{\sqrt{14}}{14}$
- D.  $\frac{5\sqrt{2}}{14}$

36. If  $\cos k = -0.75$  and  $\sin k > 0$ , what is the exact value of  $\sin(k + \pi)$ ?

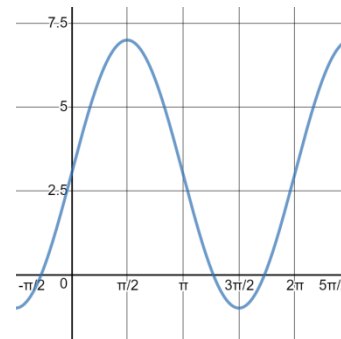
- A.  $-\frac{3}{5}$
- B.  $-\frac{\sqrt{7}}{4}$
- C.  $\frac{3}{5}$
- D.  $\frac{\sqrt{7}}{4}$

37. Which graph represents  $y = 4 \sin(-x) + 3$ ?

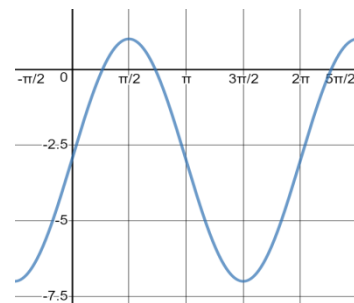
A.



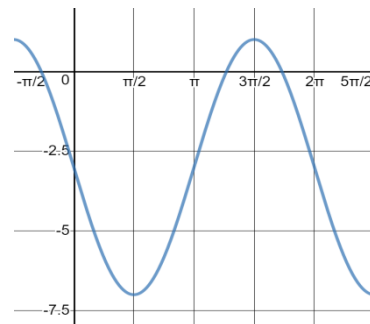
B.



C.



D.





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**38.** Evaluate the expression

$$\cos(\alpha + \beta) \text{ given that } \cos \alpha = -\frac{\sqrt{3}}{2}$$

where  $\alpha$  is in Quadrant II and

$$\sin \beta = \frac{\sqrt{2}}{2} \text{ where } \beta \text{ is in Quadrant I.}$$

**A.**  $\frac{\sqrt{6}-\sqrt{2}}{4}$

**B.**  $-\frac{\sqrt{3}}{4}$

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

**D.**  $\frac{\sqrt{2}}{4}$

**39.** Given  $\triangle ABC$ , with  $m\angle A = 20^\circ$ ,

$$a = 12, \text{ \& } c = 31, \quad \text{find } m\angle B.$$

**A.**  $42.074^\circ$

**B.**  $62.074^\circ$

**C.**  $97.926^\circ$

**D.** both a and c

**40.** Evaluate  $\tan x + \cot x$

**A.**  $\sec x + \csc x$

**B.**  $\sec x \csc x$

**C.**  $\frac{\cos x + \sin x}{\cos x \sin x}$

**D.**  $\frac{\cos^2 x + \sin^2 x}{\cos^2 x \sin^2 x}$

**41.** Find the exact value of  $\cos 165^\circ$

**A.**  $\frac{-\sqrt{6}-\sqrt{2}}{4}$

**B.**  $\frac{-\sqrt{6}+\sqrt{2}}{4}$

**C.**  $\frac{\sqrt{6}+\sqrt{2}}{-2}$

**D.**  $\frac{\sqrt{6}-\sqrt{2}}{-2}$

**42.** On the interval  $[0, 2\pi)$ ,  $\sin 2x - \sin x = 0$

**A.** 0 and  $\pi$

**B.**  $\frac{\pi}{3}$

**C.**  $\frac{5\pi}{3}$

**D.** all of the above

**43.**  $\cos^4 x =$

**A.**  $\frac{1}{8}(3 - \cos 2x + \cos 4x)$

**B.**  $\frac{1}{8}(3 + 4\cos 2x + \cos 4x)$

**C.**  $\frac{1}{8}(3 + 2\cos 2x + \cos 4x)$

**D.**  $\frac{1}{8}(3 - 2\cos 2x + \cos 4x)$

**44.** Rewrite  $\cos 6x \cos 4x$  as a sum or difference.

**A.**  $\frac{1}{2} \cos 2x - \frac{1}{2} \cos 10x$

**B.**  $\frac{1}{2} \cos 2x + \frac{1}{2} \cos 10x$

**C.**  $\frac{1}{2} \sin 2x - \frac{1}{2} \sin 10x$

**D.**  $\frac{1}{2} \sin 2x + \frac{1}{2} \sin 10x$



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- 45.** On the interval  $[0, 2\pi)$ ,  $\sin 6x + \sin 2x = 0$
- A.**  $\frac{k\pi}{4}$ , where  $k \in \{0,1,3\}$
- B.**  $\frac{\pi}{4}$
- C.**  $\frac{k\pi}{4}$ , where  $k \in \{0,1,2,3,4,5,6,7\}$
- D.** no solution on the interval given

- 46.** On the interval  $[0, \pi)$ , solve  $\tan^2 x + 3 \sec x = -3$
- I. 0    II.  $\frac{2\pi}{3}$     III.  $\frac{3\pi}{4}$
- A.** I only
- B.** II and III
- C.** II only
- D.** I, II, and III

- 47.**  $\sin^{-1}\left(\sin \frac{-2\pi}{3}\right) =$
- A.**  $\frac{\pi}{3}$
- B.**  $-\frac{\pi}{3}$
- C.** both a and b
- D.** undefined

- 48.** Given  $\triangle ABC$ , with  $m\angle A = 115^\circ$ ,  $b = 15$ , &  $c = 10$ , find the area of  $\triangle ABC$ .
- A.** 22.658 units<sup>2</sup>
- B.** 67.973 units<sup>2</sup>
- C.** 72.444 units<sup>2</sup>
- D.** 135.946 units<sup>2</sup>

- 49.** Convert  $(6, 90^\circ)$  to rectangular form.

- A.** (-6, 0)
- B.** (0, -6)
- C.** (0, 6)
- D.** (6, 0)

- 50.** Convert  $\left(\frac{3}{8}, -\frac{3\sqrt{3}}{8}\right)$  to polar form.

- A.**  $\left(\frac{3}{4}, 60^\circ\right)$
- B.**  $\left(\frac{3}{4}, 300^\circ\right)$
- C.**  $\left(\frac{8}{9}, 60^\circ\right)$
- D.**  $\left(\frac{8}{9}, 300^\circ\right)$

- 51.** Convert  $x = 3y^2$  to polar form.

- A.**  $r = \frac{1}{3} \cot\theta \csc\theta$
- B.**  $r = \frac{1}{3} \tan\theta \cos\theta$
- C.**  $r = 3 \cot\theta \csc\theta$
- D.**  $r = 3 \tan\theta \cos\theta$

- 52.** Convert  $(x + 2)^2 = 13 - (y + 3)^2$  to polar form.

- A.**  $r = -6\cos\theta - 4\sin\theta$
- B.**  $r = -4\cos\theta - 6\sin\theta$
- C.**  $r = -4\cos\theta + 6\sin\theta$
- D.**  $r = 6\cos\theta + 4\sin\theta$





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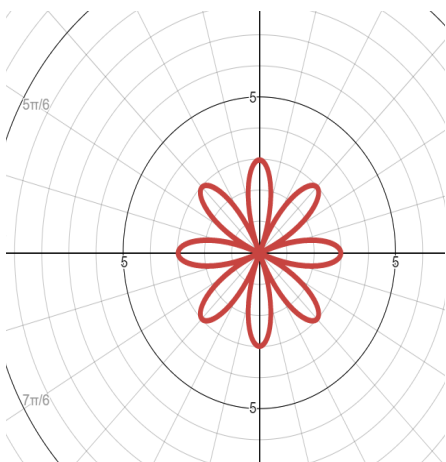
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**53.** Convert  $r = \frac{4}{1-\sin\theta}$  to rectangular form.

- A.**  $y^2 + 4y = x^2$
- B.**  $y^2 = x^2 - 4x$
- C.**  $(y + 4)^2 = x^2 + y^2$
- D.**  $(4 - y)^2 = x^2 + y^2$

**54.** Which polar equation does the provided graph represent?



- A.**  $r = 3\cos(4\theta)$
- B.**  $r = 4\cos(3\theta)$
- C.**  $r = 3\sin(4\theta)$
- D.**  $r = 4\sin(3\theta)$

**55.** What are the dimensions of the given matrix?  $A = \begin{bmatrix} 2 & 3 & -1 \\ 0 & 4 & 5 \end{bmatrix}$

- A.** 3x3
- B.** 2x3
- C.** 3x2
- D.** 2x2

**56.** Which operation(s) can be performed using the matrices?

$$A = \begin{bmatrix} 2 & 3 & -1 \\ 0 & 4 & 5 \end{bmatrix} \quad B = \begin{bmatrix} 6 & 7 & 3 \\ 1 & 4 & 7 \end{bmatrix}$$

- I. Multiplication
- II. Addition
- III. Subtraction

- A.** I only
- B.** I and II
- C.** II and III
- D.** I, II and III

**57.** Which of the following matrices does NOT have an inverse?

- A.**  $\begin{bmatrix} 3 & 2 \\ -4 & 0 \end{bmatrix}$
- B.**  $\begin{bmatrix} 1 & -6 \\ 1 & -5 \end{bmatrix}$
- C.**  $\begin{bmatrix} 4 & -2 \\ 10 & 5 \end{bmatrix}$
- D.**  $\begin{bmatrix} -6 & 3 \\ 8 & -4 \end{bmatrix}$



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- 58.** Find the inverse  $C = \begin{bmatrix} 0 & 3 \\ 1 & -2 \end{bmatrix}$
- A.**  $\begin{bmatrix} 0 & -1 \\ -\frac{1}{3} & \frac{2}{3} \end{bmatrix}$
- B.**  $\begin{bmatrix} \frac{2}{3} & -1 \\ -\frac{1}{3} & 0 \end{bmatrix}$
- C.**  $\begin{bmatrix} \frac{2}{3} & 1 \\ \frac{1}{3} & 0 \end{bmatrix}$
- D.**  $\begin{bmatrix} 0 & 1 \\ \frac{1}{3} & -\frac{2}{3} \end{bmatrix}$
- 59.** A vector has component forces of  $A_x = 6.3$  and  $A_y = 3.2$ , what is  $|\vec{A}|$ ?
- A.** 7.07
- B.** 9.5
- C.** 20.16
- D.** 49.93
- 60.** Find the component form of the vector  $\vec{v} = QR$ , where  $Q = (-8, 2)$  and  $R = (5, 7)$ .
- A.**  $(-3, 9)$
- B.**  $(-3, 5)$
- C.**  $(13, 5)$
- D.**  $(-13, -5)$

- 61.** Find the magnitude of the vector  $\vec{v} = QR$ , where  $Q = (-8, 2)$  and  $R = (5, 7)$ .
- A.** 9.45
- B.** 5.83
- C.** 12
- D.** 13.93
- 62.**  $\vec{a} = (4, -6)$  and  $\vec{b} = (-2, 5)$ ,  
find  $\vec{b} - \vec{a}$ .
- A.**  $(-6, 11)$
- B.**  $(-2, 11)$
- C.**  $(-6, -1)$
- D.**  $(-2, -1)$
- 63.**  $\vec{a} = (3, -7)$  and  $\vec{b} = (-4, 6)$ ,  
find  $2\vec{b} + \vec{a}$ .
- A.**  $(5, -19)$
- B.**  $(11, -5)$
- C.**  $(-5, 5)$
- D.**  $(-11, -19)$
- 64.** Which of the following is the vector equation of the line through  $(3, -7)$  and parallel to  $\vec{u} = (-2, 5)$ ?
- A.**  $(x + 3, y + 7) = t(-2, 5)$
- B.**  $(x - 3, y + 7) = t(-2, 5)$
- C.**  $(x + 3, y - 7) = t(-2, 5)$
- D.**  $(x - 3, y - 7) = t(-2, 5)$



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**65.** Which of the following is the parametric equation of the line through  $(3, -7)$  and parallel to  $\vec{u} = (-2, 5)$ ?

- A.**  $\begin{cases} x = 3 - 2t \\ y = 7 + 5t \end{cases}$   
**B.**  $\begin{cases} x = -3 - 2t \\ y = -7 + 5t \end{cases}$   
**C.**  $\begin{cases} x = -3 - 2t \\ y = 7 + 5t \end{cases}$   
**D.**  $\begin{cases} x = 3 - 2t \\ y = -7 + 5t \end{cases}$

**66.**  $\vec{a} = (7, -6)$  and  $\vec{b} = (-3, 5)$ , find  $\vec{b} \cdot \vec{a}$ .

- A.** -9  
**B.** -51  
**C.** 9  
**D.** 51

**67.** Are the vectors parallel, perpendicular or neither?

$$\vec{m} = (4, -6) \text{ and } \vec{n} = (-8, 12)$$

- A.** Parallel  
**B.** Perpendicular  
**C.** Neither

**68.** The angle between  $\vec{a} = (4, -6)$  and  $\vec{b} = (-2, 5)$  is

- A.** .979  
**B.** 2.934  
**C.** 152.345  
**D.** 168.111

**69.** Use  $a_1 = -15$  and  $d = 6$  to write the first 4 terms of the sequence.

- A.** -15, -21, -27, -31  
**B.** 15, 21, 27, 31  
**C.** -15, -9, -3, 3, 9  
**D.** -15, 9, 3, -3

**70.** If  $a_1 = 7$ ,  $a_n = 143$ , and  $d = 8$ , what is  $n$ ?

- A.** 12  
**B.** 14  
**C.** 16  
**D.** 18

**71.**  $a_1 = 6$ ,  $a_{12} = 42$ , find  $S_{12}$ .

- A.** 288  
**B.** 188  
**C.** 144  
**D.** 36

**72.**  $\sum_{b=4}^7 3b - 2$

- A.** 65  
**B.** 60  
**C.** 58  
**D.** 50