1. If A and B are two points on the unit circle corresponding to the arc lengths $\frac{3\pi}{2}$ and $\frac{5\pi}{6}$ respectively, then the distance from A to B is

   (a) $\sqrt{3}$

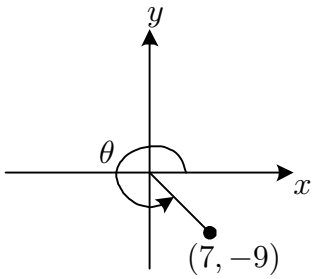
   (b) 1

   (c) $\frac{4\pi}{6}$

   (d) $\frac{14\pi}{6}$

   (e) $\frac{1}{2}$

2. For the angle θ shown at the right, $\tan\theta$ is equal to



   (a) $\frac{-9}{7}$

   (b) $\frac{-9\sqrt{130}}{7}$

   (c) $\frac{\sqrt{130}}{7}$

   (d) $\frac{-7}{9}$

   (e) $\frac{-\sqrt{130}}{9}$

3. The vertex and directrix of the parabola given by $y - 4 = \frac{1}{16}(x+4)^2$ are

(a) vertex: $(-4, 4)$; directrix: $y = 0$

(b) vertex: $(4, -4)$; directrix: $y = -8$

(c) vertex: $(-4, 4)$; directrix: $y = -12$

(d) vertex: $(4, -4)$; directrix: $x = 0$

(e) vertex: $(-4, 4)$; directrix: $y = 8$

4. Which one of the following is FALSE?

(a) $\sin^{-1}(\sin 2) = 2$

(b) $\tan(\tan^{-1}\pi) = \pi$

(c) $\sin^{-1}(\sin 2) = \pi - 2$

(d) $\csc^{-1} 2 = \sin^{-1}\frac{1}{2}$

(e) $\cot^{-1}(-3) = \pi + \tan^{-1}\left(\frac{-1}{3}\right)$

5. If A, B, and C are matrices each of order $n \times n$, then which one of the following is TRUE?

(a) $(AB)C = A(BC)$

(b) $(A+B)^2 = A^2 + 2AB + B^2$

(c) $(A+B) \cdot C = A + (B \cdot C)$

(d) $C(AB) + C(BA) = 2C(AB)$

(e) $(A-B)(A+B) = A^2 - B^2$

6. Given $A = \begin{bmatrix} 0 & -2 & 7 \\ 5 & 4 & 3 \end{bmatrix}$, $B = \begin{bmatrix} 3 & 1 \\ -1 & 5 \\ 6 & 0 \end{bmatrix}$, and $C = \begin{bmatrix} 40 & -10 \\ 28 & 23 \end{bmatrix}$. If $X = AB - C$, then the element in the second row and second column of matrix X is equal to

(a) 2

(b) 48

(c) 0

(d) 28

(e) -10

7. If $2x + 5 = 6x + k = 4x - 7$, then $k =$

(a) -19

(b) -17

(c) -23

(d) -47

(e) -15

8. The magnitude M and the direction angle α of the vector $\mathbf{u} = 2\langle -1, 6\rangle - 3\langle 5, 4\rangle$ is

(a) $M = 17, \quad \alpha = 180^\circ$

(b) $M = 17, \quad \alpha = 0^\circ$

(c) $M = \sqrt{7}, \quad \alpha = 90^\circ$

(d) $M = \sqrt{13}, \quad \alpha = 0^\circ$

(e) $M = 17, \quad \alpha = 270^\circ$

9. The range, in interval notation, of the function $y = 3^{-x^2} + 4$ is equal to

(a) $(4, 5]$

(b) $(4, \infty)$

(c) $(-4, -3]$

(d) $(0, 1]$

(e) $(-\infty, 4)$

10. The eccentricity of the hyperbola given by $9y^2 - 36x^2 - 4 = 0$ is

(a) $\dfrac{\sqrt{5}}{2}$

(b) $\dfrac{\sqrt{3}}{2}$

(c) $\dfrac{\sqrt{17}}{4}$

(d) $\dfrac{1}{2}$

(e) $\dfrac{3}{2}$

11. $\tan\left(2\sin^{-1}\dfrac{\sqrt{3}}{2}\right) =$

(a) $-\sqrt{3}$

(b) $3+\sqrt{3}$

(c) $\dfrac{-\sqrt{3}}{3}$

(d) $\dfrac{1}{2}$

(e) $\sqrt{3}$

12. $\sec x \cos\left(\dfrac{\pi}{2}-x\right)$ is equal to

(a) $\tan x$

(b) 1

(c) $\dfrac{1}{\cos^2 x}$

(d) $\cot x$

(e) $\sec^2 x$

13. If $\mathbf{u} = \langle -2, 7 \rangle$, then a nonzero vector that is perpendicular to $\mathbf{u}$ is

(a) $\langle 14, 4 \rangle$

(b) $\langle -1, 1 \rangle$

(c) $\langle 2, -7 \rangle$

(d) $\langle 1, -1 \rangle$

(e) $\langle 7, -2 \rangle$

14. The value of the determinant $\begin{vmatrix} 2 & -1 & 1 & 0 \\ 1 & 1 & 0 & 1 \\ 0 & -1 & 1 & 1 \\ 1 & 2 & 1 & 2 \end{vmatrix}$ is equal to

(a) -6

(b) 8

(c) 2

(d) -1

(e) 10

15. If $A = \begin{bmatrix} 1 & 0 & 0 \\ 0 & 1 & 1 \\ 1 & 0 & 1 \end{bmatrix}$, then the element in the second row, third column of A^{-1} is equal to

(a) -1

(b) 0

(c) 1

(d) -2

(e) 2

16. If the matrix equation $A^4 = I$ is true and A^{-1} exists, then A^{-1} is equal to

(a) A^3

(b) A

(c) A^4

(d) I

(e) A^8

17. If $A^{-1} = \begin{bmatrix} \frac{1}{2} & 0 \\ \frac{-1}{2} & 1 \end{bmatrix}$, then the matrix A is equal to

(a) $\begin{bmatrix} 2 & 0 \\ 1 & 1 \end{bmatrix}$

(b) $\begin{bmatrix} 1 & 2 \\ 2 & 0 \end{bmatrix}$

(c) $\begin{bmatrix} 2 & 5 \\ 1 & 1 \end{bmatrix}$

(d) $\begin{bmatrix} 2 & 1 \\ 0 & 3 \end{bmatrix}$

(e) $\begin{bmatrix} 2 & 4 \\ 4 & 0 \end{bmatrix}$

18. The solution set of the following system is

$$\begin{cases} \frac{6}{x} + \frac{2}{y} = 8 \\ \frac{9}{x} + \frac{5}{y} = 16 \end{cases}$$

(a) $\left\{\left(\frac{3}{2}, \frac{1}{2}\right)\right\}$

(b) $\left\{\left(\frac{2}{3}, 2\right)\right\}$

(c) $\left\{\left(2, \frac{3}{2}\right)\right\}$

(d) $\left\{\left(\frac{1}{2}, \frac{3}{2}\right)\right\}$

(e) $\left\{\left(\frac{3}{7}, \frac{-1}{4}\right)\right\}$

19. If $\dfrac{\log x}{\log y} = 5$, then $\dfrac{\ln \sqrt{x}}{\ln y^3}$ is equal to

(a) $\dfrac{5}{6}$

(b) $6e^5$

(c) $\dfrac{e^5}{6}$

(d) $\dfrac{10^5}{6}$

(e) $\dfrac{15}{6}$

20. The **maximum** M and the **minimum** N of the function $f(x) = 2 - 3\cos(2x - \pi)$ are

(a) $M = 5, \quad N = -1$

(b) $M = 9, \quad N = 3$

(c) $M = 3, \quad N = 1$

(d) $M = 0, \quad N = 3$

(e) $M = \pi, \quad N = -6$

21. The solution set of the equation $\ln x - \sqrt[3]{\ln x} = 0$ is

(a) $\{1, e, e^3\}$

(b) $\left\{0, e, \frac{1}{e}\right\}$

(c) $\{1, e, -e\}$

(d) $\left\{1, e, \frac{1}{e}\right\}$

(e) $\left\{1, e, \frac{1}{e^3}\right\}$

22. Which of the following is the equation, in standard form, of the ellipse consisting of all points in the plane the sum of whose distances from $(0, 0)$ and $(4, 0)$ is 8

(a) $\frac{(x-2)^2}{16} + \frac{y^2}{12} = 1$

(b) $\frac{x^2}{16} + \frac{(y-2)^2}{12} = 1$

(c) $\frac{(x-4)^2}{64} + \frac{y^2}{16} = 1$

(d) $\frac{x^2}{16} + \frac{(y-4)^2}{64} = 1$

(e) $\frac{(x-2)^2}{8} + \frac{y^2}{64} = 1$

23. Let A and B be 3×3 matrices. Which one of the following statements is FALSE?

(a) $|A^{-1}| = |A|$

(b) $(AB)^{-1} = B^{-1}A^{-1}$

(c) $(|A| + 1)^2 = |A|^2 + 2|A| + 1$

(d) $AA^{-1} = B^{-1}B$

(e) $|3A| = 27|A|$

24. If $\dfrac{1 - \cos 4x}{\sin 4x} = \dfrac{a \tan x}{b + c(\sec^2 x)}$, then $a + b + c$ is equal to

(a) 3

(b) 2

(c) 4

(d) 5

(e) 1

25. The number of zeros of the function $f(x) = \sin x + \cos 2x$ in the interval $[0, 2\pi)$ is

(a) 3

(b) 2

(c) 4

(d) 6

(e) 5

26. By using the **Reduction identity**, the range of the function $f(x) = 3\cos(x) - 4\sin(x) + 1$, in interval notation, is

(a) $[-4, 6]$

(b) $[0, 1]$

(c) $[-4, 4]$

(d) $[-4, 3]$

(e) $[-5, 5]$

27. The solution set of the following system is

$$(x-2)^2+(y+3)^2=20$$
$$(x-3)^2+(y+2)^2=10$$

(a) $\{(4,1),\ (6,-1)\}$

(b) $\{(-4,1),\ (6,1)\}$

(c) $\{(2,1),\ (3,-1)\}$

(d) $\{(-2,1),\ (-3,1)\}$

(e) $\{(3,-1),\ (5,-2)\}$

28. The solution set, in interval notation, of the inequality $\log_{\frac{1}{3}} x \geq \log_{\frac{1}{9}} x$ is

(a) $(0,1]$

(b) $(0,1)$

(c) $\left[\frac{1}{9},\frac{1}{3}\right]$

(d) $[1,\infty)$

(e) $\left[\frac{1}{3},\infty\right)$

29. Given that $g(x) = 4\sin\left(2x - \frac{\pi}{3}\right)$ and $f(x) = 4\sin(2x)$. How is f shifted horizontally to get g?

(a) $\frac{\pi}{6}$ units to the right

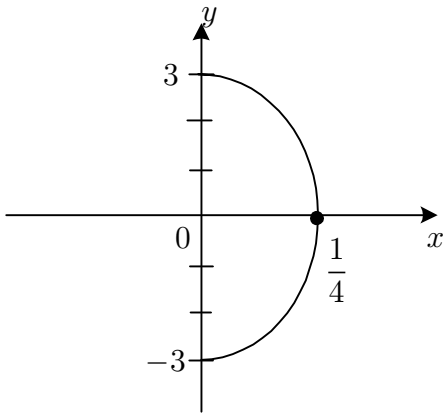
(b) $\frac{2\pi}{3}$ units to the left

(c) $\frac{\pi}{3}$ units to the right

(d) $\frac{2\pi}{3}$ units to the right

(e) $\frac{\pi}{6}$ units to the left

30. The equation, whose graph is shown on the right, is equal to



(a) $4x = \sqrt{1 - \frac{y^2}{9}}$

(b) $2x = \sqrt{1 - \frac{y^2}{9}}$

(c) $\frac{x}{4} = \sqrt{1 - \frac{y^2}{9}}$

(d) $\frac{x}{4} = \sqrt{1 - 9y^2}$

(e) $4x = \sqrt{1 - 9y^2}$

31. When the augmented matrix $\left[\begin{array}{ccc|c} 1 & 1 & 1 & 2 \\ 3 & 2 & 4 & 5 \\ 2 & 1 & 1 & 6 \end{array}\right]$ of a given system of linear equations is written in the echelon form

$$\left[\begin{array}{ccc|c} 1 & m & n & 2 \\ 0 & 1 & k & 1 \\ 0 & 0 & 1 & -3/2 \end{array}\right],$$

then the product mnk is equal to

(a) -1

(b) 0

(c) 1

(d) 2

(e) -2

32. The range of the function $f(x) = 1 - 3\csc\left(\frac{\pi}{2}x - 1\right)$ is

(a) $(-\infty, -2] \cup [4, \infty)$

(b) $(-\infty, -4] \cup [2, \infty)$

(c) $[-2, 4]$

(d) $(-\infty, -2] \cup [2, \infty)$

(e) $[-4, 2]$

33. $\sqrt{\dfrac{1-\sin 310^\circ}{1-\cos 400^\circ}}$ is equal to

(a) $\tan 20^\circ$

(b) $\cot 80^\circ$

(c) $\tan 70^\circ$

(d) $\sin 310^\circ \sec 400^\circ$

(e) a real number between $\tan 50^\circ$ and $\tan 55^\circ$

34. The degree measure of a central angle that cuts off an arc of length $\dfrac{\pi}{2}$ inches on a circle of diameter 10 inches is equal to

(a) 18°

(b) $\left(\dfrac{\pi}{10}\right)^\circ$

(c) $\left(\dfrac{10}{\pi}\right)^\circ$

(d) 9°

(e) 90°

35. $\dfrac{\cot^2\theta}{\csc\theta+1}+1$ is equal to

(a) $\dfrac{1}{\sin\theta}$

(b) $\sin^2\theta-\cos\theta$

(c) $\dfrac{1+\sin\theta}{\sin\theta}$

(d) $\dfrac{\cos^2\theta-(1+\sin\theta)}{\sin^3\theta}$

(e) $\dfrac{\cot^2\theta}{\sec\theta}+1$

36. If $\begin{vmatrix} 1 & 1 & 1 \\ x & y & z \\ 2 & 3 & 4 \end{vmatrix} = -3$, then the value of $\begin{vmatrix} 2 & 3 & 4 \\ x-4 & y-6 & z-8 \\ \frac{-1}{3} & \frac{-1}{3} & \frac{-1}{3} \end{vmatrix}$ is equal to

(a) -1

(b) $\dfrac{1}{9}$

(c) -3

(d) 3

(e) 1