

1. Evaluate $\sin(46.7^\circ)$ to four decimal places.

- A. 0.4113
- B. -0.9115
- ☒ C. 0.7278
- D. 0.6858
- E. 0.5642

2. Convert $\theta = \frac{13\pi}{14}$ to degrees, minutes, seconds. Give your answer to the nearest second.

- ☒ A. $167^\circ 8' 34''$
- B. $167^\circ 14' 29''$
- C. $167^\circ 10' 28''$
- D. $167^\circ 16' 53''$
- E. $167^\circ 10' 10''$

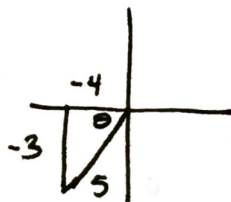
$$\frac{13\pi}{14} \cdot \frac{180^\circ}{\pi} = \frac{13 \cdot 180}{14} \approx 167.142857^\circ$$

[2nd] DD ▶ DMS

$\rightarrow 167^\circ 8' 34''$

3. Given $\tan \theta = \frac{3}{4}$ and $\sin \theta < 0$, find the exact value of $\sec \theta$.

- A. $\sec \theta = \frac{4}{5}$
- ☒ B. $\sec \theta = -\frac{5}{4}$
- C. $\sec \theta = -\frac{4}{5}$
- D. $\sec \theta = \frac{5}{4}$
- E. None of the above



$$\sec \theta = \frac{1}{\cos \theta} = \frac{h}{x} = \frac{5}{-4}$$

4. A radioactive element has a half-life of 45 years. How long will it take for a sample to decay to 35% of its original mass?

- ☒ A. 68 years
- B. 93 years
- C. 83 years
- D. 23 years
- E. 28 years

$$A(t) = A_0 e^{kt}$$

$$\frac{A(45)}{A_0} = \frac{1}{2} = e^{k(45)} \Rightarrow k = \frac{\ln(1/2)}{45} \sim -0.0154$$

$$.35 = e^{-0.0154t}$$

$$\Rightarrow t = \frac{\ln(.35)}{-0.0154} \sim 68$$

5. Find the acute angle x to the nearest 0.1° that solves the equation.

$$\tan x = 2.65$$

- (A) 69.3°
 B. 72.3°
 C. 36.2°
 D. 20.7°
 E. 11.8°

$$\tan^{-1}(2.65) \sim 69.33^\circ$$

6. Solve the following equation for x .

$$\ln(x+9) + \ln(x) = \ln 10$$

- A. $x = -1, x = 10$
 (B) $x = 1$
 C. $x = -10, x = 1$
 D. $x = 10$
 E. There are no real solutions

$$\ln[(x+9)x] = \ln 10$$

$$(x+9)x = 10$$

$$x^2 + 9x - 10 = 0$$

$$(x+10)(x-1) = 0 \rightarrow x = -10, \boxed{x = 1}$$

can't take $\ln(-10)$



7. Solve for x using natural logarithms.

$$3^{5x-6} = 4^{6x+5}$$

A. $x = \frac{6\ln 3 - 5\ln 4}{5\ln 3 + 6\ln 4}$

B. $x = \frac{5\ln 3 - 6\ln 4}{6\ln 3 - 5\ln 4}$

C. $x = \frac{5\ln 3 + 6\ln 4}{6\ln 3 + 5\ln 4}$

(D) $x = \frac{6\ln 3 + 5\ln 4}{5\ln 3 - 6\ln 4}$

E. $x = \frac{5\ln 3 - 6\ln 4}{6\ln 3 + 5\ln 4}$

$$\ln 3^{5x-6} = \ln 4^{6x+5}$$

$$(5x-6)\ln 3 = (6x+5)\ln 4$$

$$5(\ln 3)x - 6\ln 3 = 6(\ln 4)x + 5\ln 4$$

$$5(\ln 3)x - 6(\ln 4)x = 5\ln 4 + 6\ln 3$$

$$(5\ln 3 - 6\ln 4)x = 5\ln 4 + 6\ln 3$$

$$x = \frac{5\ln 4 + 6\ln 3}{5\ln 3 - 6\ln 4}$$

8. Find the general solution to the equation $4\sin^2 x = 3$

A. $x = \frac{\pi}{3} + \pi n$

B. $x = \frac{\pi}{6} + 2\pi n, \frac{5\pi}{6} + 2\pi n$

☒ C. $x = \frac{\pi}{3} + \pi n, \frac{5\pi}{3} + \pi n$

D. $x = \frac{\pi}{4} + \frac{\pi}{2}n$

E. $x = \frac{\pi}{3} + 2\pi n, \frac{2\pi}{3} + \pi n$

$$\sin^2 x = \frac{3}{4}$$

$$\sin x = \pm \frac{\sqrt{3}}{2}$$



$$x = \frac{\pi}{3} + \pi n$$

$$x = \frac{2\pi}{3} + \pi n \quad (= \frac{5\pi}{3} + \pi n)$$

9. A ladder 26 feet long leans against the side of a building. The angle between the ladder and the ground is 60° . Estimate the distance from the base of the building to the ladder along the ground to two decimal places.

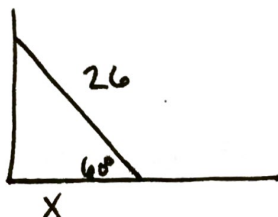
A. 45.03 feet

☒ B. 13.00 feet

C. 15.01 feet

D. 52.00 feet

E. 22.52 feet



$$\cos 60^\circ = \frac{x}{26}$$

$$26 \cos 60^\circ = x$$

$$26 \cdot \frac{1}{2} = x$$

$$13 = x$$

10. What value of x is a solution to the following system of equations?

$$\begin{cases} 5x + 8y = 31 \\ 4x - 7y = -2 \end{cases}$$

A. 5

B. 2

C. 7

☒ D. 3

E. -1

$$5x + 8y = 31$$

$$\Leftrightarrow 5(33 - 15y) + 8y = 31$$

$$165 - 75y + 8y = 31$$

$$134 = 67y$$

$$\boxed{2 = y}$$

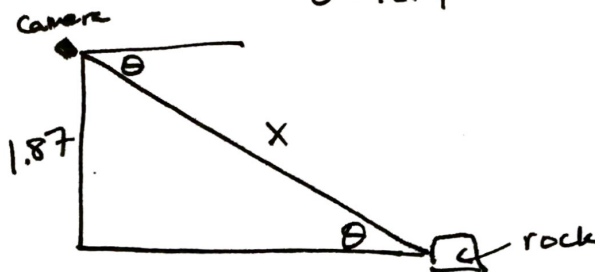
$$\begin{array}{r} 5x + 8y = 31 \\ - (4x - 7y = -2) \\ \hline x + 15y = 33 \end{array}$$

$$\Rightarrow x = 33 - 15y$$

$$x = 33 - 15(2) = 33 - 30 = 3$$

11. A robot arm is on the surface of Mars. The angle of depression from a camera on the robot to a rock on the surface of Mars is 12.4° . The camera is 1.87 meters above the surface of the planet. How far from the camera is the rock? Express your answer in meters to 3 three decimal places.

$$\theta = 12.4^\circ$$

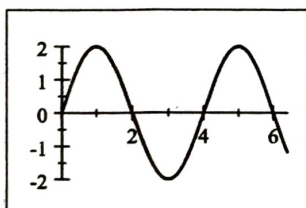


$$\sin(12.4^\circ) = \frac{1.87}{x}$$

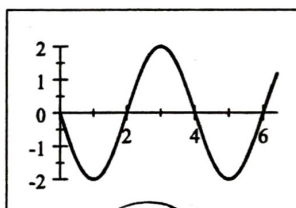
$$x = \frac{1.87}{\sin(12.4^\circ)} \sim 8.708$$

- A. 8.708 meters
B. 4.016 meters
C. 1.915 meters
D. 1.826 meters
E. 8.505 meters

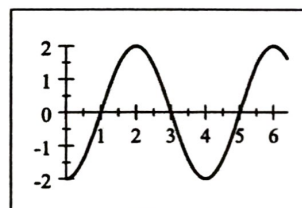
12. Which of the following could be the graph of $y = -2 \sin\left(\frac{\pi x}{2}\right)$?



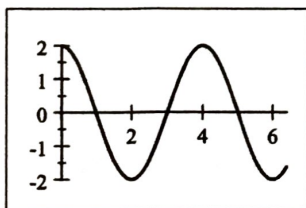
A.



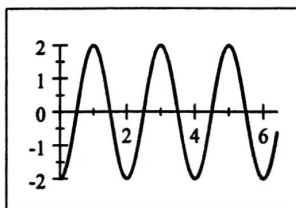
B.



C.



D.



E.

$$P = \frac{2\pi}{\pi/2} = 2\pi \cdot \frac{2}{\pi} = 4$$

$$A = 2$$

$$\sin(0) = 0.$$

13. In what quadrant will the terminal side of θ lie if $\cos \theta < 0$ and $\sin \theta > 0$?

- A. Quadrant I
- ☒ B. Quadrant II
- C. Quadrant III
- D. Quadrant IV
- E. Cannot be determined



14. Evaluate $\sin\left(-\frac{13\pi}{3}\right)$

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

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

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

☒ D. $-\frac{\sqrt{3}}{2}$

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

$$-\frac{13\pi}{3} + \frac{6\pi}{3} + \frac{6\pi}{3} + \frac{6\pi}{3} = \frac{5\pi}{3}$$



15. For the function $f(x) = \sin\left(\frac{x}{2}\right)$, find all interval(s) where $f(x) > 0$ on the interval $(0, 8\pi)$

- ☒ A. $(0, 2\pi) \cup (4\pi, 6\pi)$
- B. $(\pi, 2\pi) \cup (3\pi, 4\pi) \cup (5\pi, 6\pi) \cup (7\pi, 8\pi)$
- C. $(0, \pi) \cup (2\pi, 3\pi) \cup (4\pi, 5\pi) \cup (6\pi, 7\pi)$
- D. $(2\pi, 4\pi) \cup (6\pi, 8\pi)$
- E. $(0, \pi) \cup (3\pi, 5\pi) \cup (7\pi, 8\pi)$

$$P = \frac{2\pi}{\frac{1}{2}} = 4\pi$$

