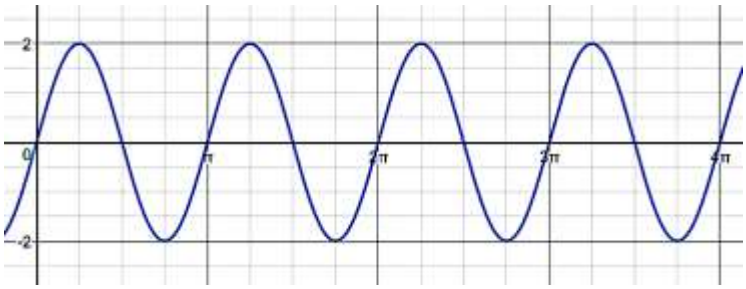
Date Completed: _____
Mentor Initials: _____

Trigonometry (Advanced)

1. The weight of a grandfather clock oscillates back and forth in a swinging motion. The distance d, in inches, between the center of mass of the weight after t seconds and the midline of the clock is modeled by the function $d = 3\sin(6\pi t)$. What is the amplitude of the function?

A. $\frac{1}{2}$
B. 2
C. 3
D. 6
E. 18

2. The function $f(x) = 2\sin(2x)$ is graphed below. What is the period of this function?

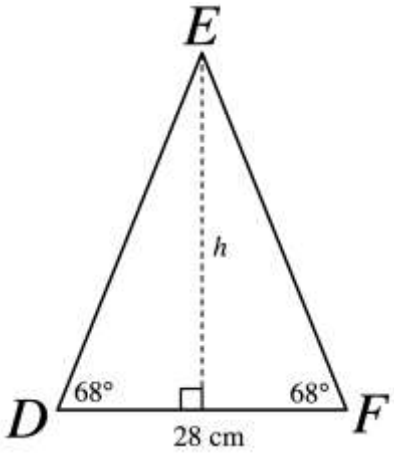


A. $\frac{\pi}{4}$
B. $\frac{\pi}{2}$
C. π
D. 2π
E. 4π

3. Given that $\cos^2 x = \frac{9}{13}$, what is $\tan^2 x$?

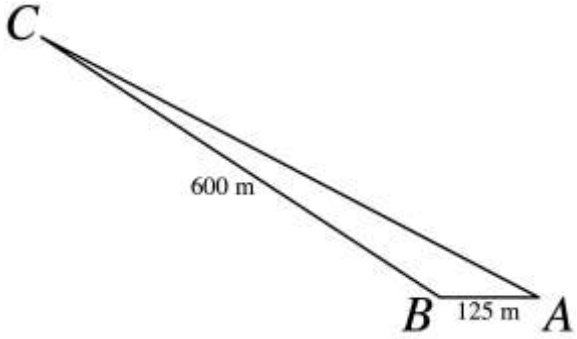
A. $\frac{4}{13}$
B. $\frac{4}{9}$
C. $\frac{13}{9}$
D. $\frac{9}{4}$
E. $\frac{13}{4}$

4. Isosceles triangle ΔDEF has an altitude of h inches, a base of 28 centimeters, and two base angles measuring 68° each, as shown in the figure below. What is the value of h?



A. $14 \tan 68°$
B. $14 \sin 68°$
C. $28 \tan 68°$
D. $28 \cot 68°$
E. $28 \sin 68°$

5. As shown below, George walked 125 meters due west of Point A to Point B and then walked 600 meters in a straight line 33° north of west to Point C. Which of the following expressions is equal to the distance, in feet, between Point A and Point C?



A. $\frac{725}{\cos 33°}$
B. $\frac{125}{\cos 33°} + 600$
C. $\frac{125}{\sin 147°} + 600$
D. $\sqrt{600^2 + 125^2 - 2(600)(125)\cos 33°}$
E. $\sqrt{600^2 + 125^2 - 2(600)(125)\cos 147°}$

6. For every angle θ, measured in radians, which of the following is equal to $\cos(4\pi + \theta)$?

A. $\cos(-\pi + \theta)$

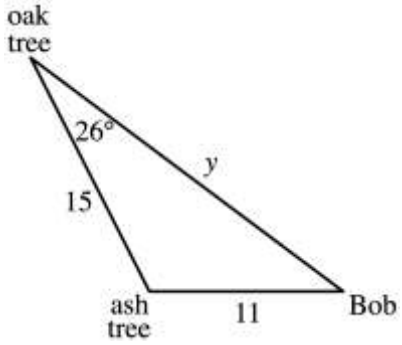
B. $\cos(\frac{\pi}{2} + \theta)$

C. $\cos(\frac{2\pi}{3} + \theta)$

D. $\cos\theta$

E. $\cos(\pi + \theta)$

7. Bob is standing 11 feet from an ash tree that is 15 feet from an oak tree, as shown in the figure below, in which the measure of an angle is given. Which of the following equations, when solved for y, gives the distance, y feet, between Bob and the oak tree?



A. $11^2 = y^2 + 15^2 - 2(10)(15)(\cos 26°)$

B. $11^2 = y^2 + 15^2 - 2y(15)(\cos 26°)$

C. $15^2 = y^2 + 15^2 - 2y(15)(\cos 26°)$

D. $y^2 = 11^2 + 15^2 - 2(10)(15)(\cos 26°)$

E. $y^2 = 11^2 + 15^2 - 2y(15)(\cos 26°)$

8. For all real values of x, which of the following equations is true?

A. $\cos(5x) + \sin(5x) = 1$

B. $\cos(5x) + \sin(5x) = 5$

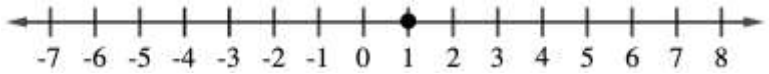
C. $5\cos(5x) + 5\sin(5x) = 10$

D. $\cos^2(5x) + \sin^2(5x) = 5$

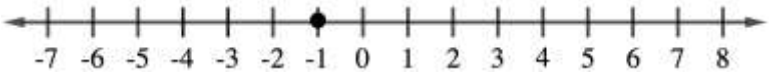
E. $\cos^2(5x) + \sin^2(5x) = 1$

9. Consider the family of functions $y = f(x) = \cos x + d$, where d is a real number. Which of the following number lines represents the graph of all and only the possible values of d for which the graph of y has exactly one x-intercept when $0 \leq x \leq 2\pi$?

A.

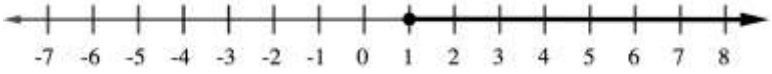


B.

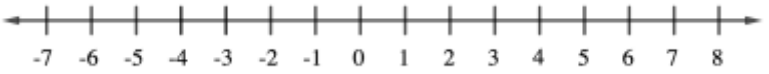


C.

D.



E.



(Empty Set)

10. In a right triangle, one angle measures $y°$, where $\cos y° = \frac{3}{5}$. What is $\sin(90 - y°)$?

A. $\frac{1}{5}$

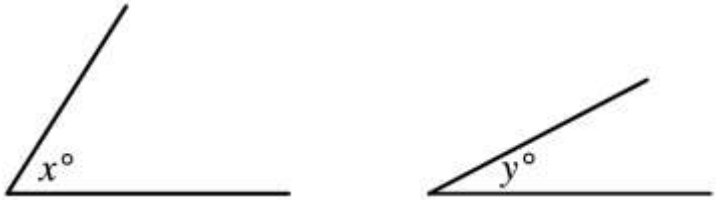
B. $\frac{2}{5}$

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

D. $\frac{3}{4}$

E. $\frac{4}{5}$

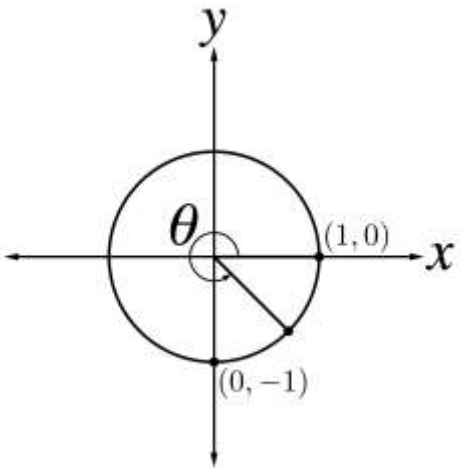
11.



The angles show above are acute and $\sin(x°) = \cos(y°)$. If $x = 6z + 30$ and $y = 2z - 8$, what is the value of z?

A. 5.5
B. 6.5
C. 7.5
D. 8.5
E. 9.5

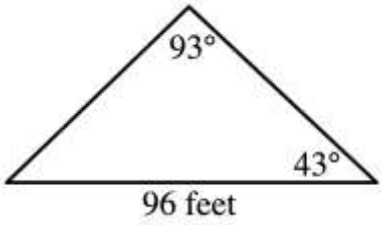
12.



In the given figure, θ is an angle. If $\cos\theta = \frac{\sqrt{2}}{2}$, what is $\tan\theta$?

A. 1
B. $\frac{\sqrt{2}}{2}$
C. 0
D. $-\frac{\sqrt{2}}{2}$
E. -1

13. A litter of puppies is contained within a triangular region, which is shown below. The puppy supervisor plans to contain the puppies by positioning a person about every 6 feet along the perimeter of the triangle. Among the following, which expression best estimates the planned number of people along the perimeter?



A. $\frac{\frac{1}{2}(96)}{6}$

B. $\frac{\frac{1}{2}\left(\frac{96 \sin 43°}{\sin 93°}\right)}{6}$

C. $96 + \frac{96 \sin 44°}{\sin 93°} + \frac{96 \sin 43°}{\sin 93°}$

D. $\frac{96+\left(\frac{96 \sin 44°}{\sin 93°}\right)+\left(\frac{96 \sin 43°}{\sin 93°}\right)}{6}$

E. $\frac{96+\left(\frac{96 \sin 93°}{\sin 44°}\right)+\left(\frac{96 \sin 93°}{\sin 43°}\right)}{6}$

14. For all θ such that $\frac{\pi}{2} \leq \theta \leq \pi$, which of the following expressions is NOT equal to $\cos \theta$?

A. $\cos(\theta + 2\pi)$

B. $\sin(\theta + \frac{\pi}{2})$

C. $\sin(\theta + \frac{5\pi}{2})$

D. $\sqrt{1 - (\sin \theta)^2}$

E. $-\sqrt{1 - (\sin \theta)^2}$

15. What are the values of θ, between 0 and 2π, when $\sin\theta = -\frac{\sqrt{3}}{2}$?

A. $\frac{\pi}{3}$ and $\frac{2\pi}{3}$ only

B. $\frac{2\pi}{3}$ and $\frac{4\pi}{3}$ only

C. $\frac{2\pi}{3}$ and $\frac{5\pi}{3}$ only

D. $\frac{4\pi}{3}$ and $\frac{5\pi}{3}$ only

E. $\frac{\pi}{3}, \frac{2\pi}{3}, \frac{4\pi}{3}$, and $\frac{5\pi}{3}$

16. What is the amplitude of the function $f(x) = -\frac{1}{4}\cos(-2x - \pi)$?

A. -2

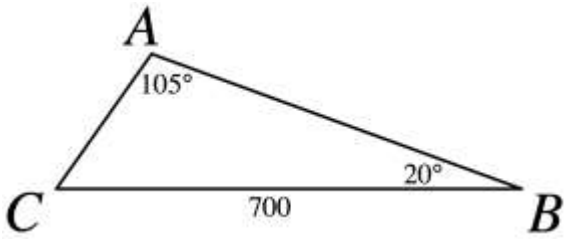
B. $-\frac{1}{4}$

C. $\frac{1}{4}$

D. 2

E. π

17. Which of the following expressions gives the distance, in feet, of $\overline{AB}$ in ΔABC, as shown below?



A. $\frac{5{,}000}{11}$

B. $\frac{700}{\cos 20^\circ}$

C. $\frac{700}{\sin 105^\circ}$

D. $\frac{700\sin 55^\circ}{\sin 105^\circ}$

E. $700\tan 55^\circ$

18. Given that $\cos B = \frac{4}{5}$ and $0° \leq B < 360°$, what are all possible values of $\sin B$?

A. $-\frac{4}{5}$ only

B. $-\frac{4}{5}$ and $\frac{4}{5}$

C. $\frac{3}{5}$ only

D. $-\frac{3}{5}$ only

E. $-\frac{3}{5}$ and $\frac{3}{5}$

19. Let θ be the radian angle measure that satisfies $\cos^2\theta - \cos\theta = -\frac{1}{4}$ for $0 < \theta < \frac{\pi}{2}$. What is $\tan\theta$?

A. $\frac{1}{4}$

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

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

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

E. $\sqrt{3}$