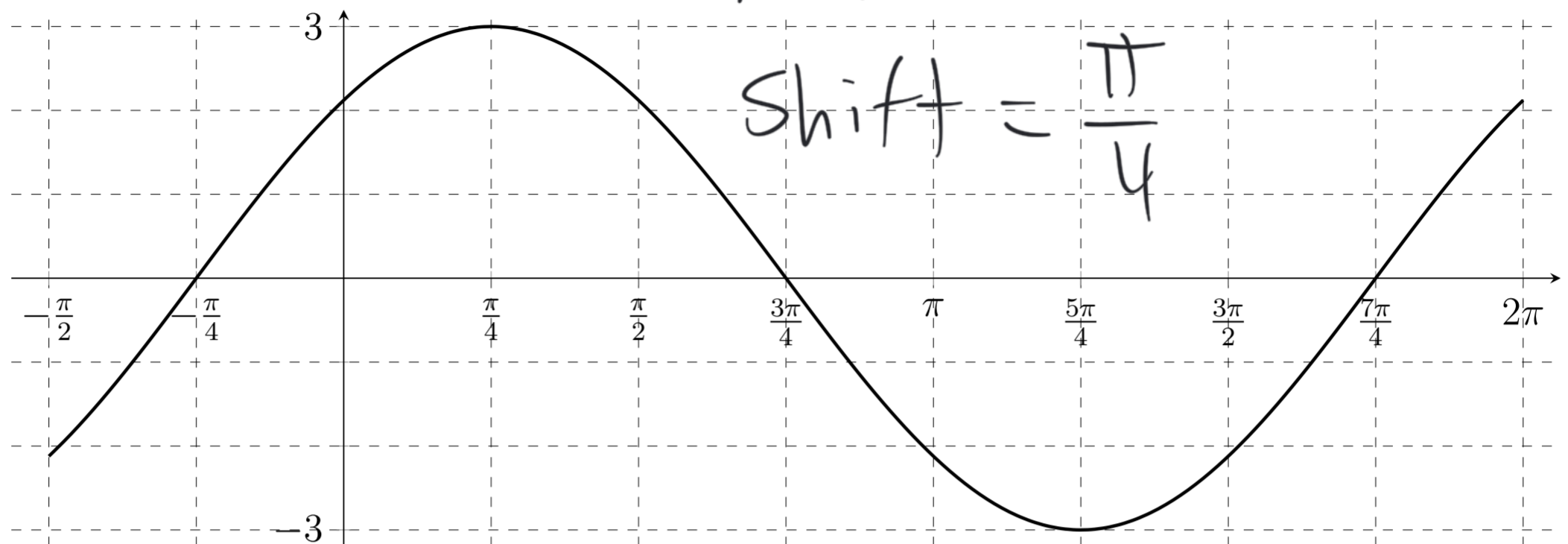


Questions 1–20 are worth 4 points each.

1. Identify the function $f(x)$ graphed below:



A. $f(x) = 3 \cos x - \frac{\pi}{4}$

B. $f(x) = \cos(3x - \frac{\pi}{4})$

C. $f(x) = 3 \cos(x - \frac{\pi}{4})$

D. $f(x) = \cos 3x - \frac{\pi}{4}$

E. $f(x) = 3 \cos x$

2. Let $f(x) = 2 \csc(x + \frac{\pi}{4})$. Which of the following statements are true?

~~I.~~ $f(x)$ is odd.

II. The line $y = -2$ and $f(x)$ intersect at $x = \frac{5\pi}{4}$.

~~III.~~ $y = 0$ is a horizontal asymptote of $f(x)$.

~~IV.~~ $f(x)$ has exactly one vertical asymptote.

$$2 \csc\left(\frac{5\pi}{4} + \frac{\pi}{4}\right) = 2 \csc\left(\frac{3\pi}{2}\right) = -2$$

A. II only

B. IV only

C. II, III, IV only

D. I and II only

E. I, II, III only

3. An angle θ in standard position has the point $(5, -6)$ on its terminal side. What is $\sin \theta$?

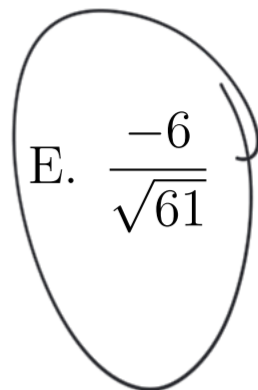
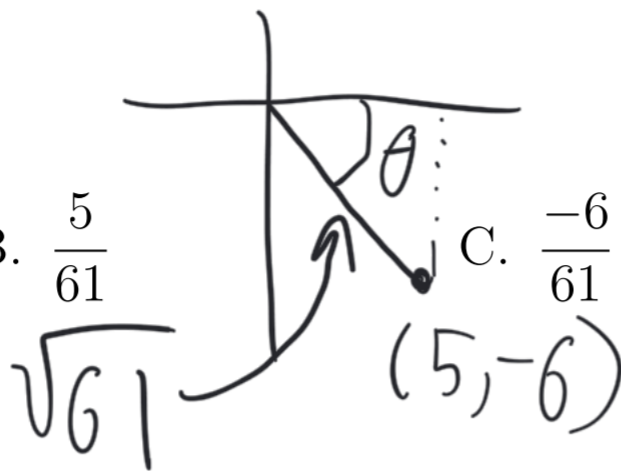
A. $\frac{-6}{5}$

B. $\frac{5}{61}$

C. $\frac{-6}{61}$

D. $\frac{5}{\sqrt{61}}$

E. $\frac{-6}{\sqrt{61}}$



4. Select the false statement.

A. The domain of $h(x) = \arcsin(x)$ is $[-1, 1]$.

☒ B. For any value of a , if $\sin a = b$ then $\arcsin b = a$.

$$\sin \pi = 0 \quad \arcsin 0 = 0$$

C. The function $g(x) = \tan(x)$ is one-to-one on the interval $\left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$.

D. $\arccos(-1) = \pi$

E. $f(x) = \cos(x)$ is not one-to-one on the interval $[0, 2\pi)$.

5. Put the following values in order from lowest to highest:

$$\frac{\sqrt{3}}{2}, \quad \frac{1}{2}, \quad 1, \quad 0$$

$$\sin\left(\frac{\pi}{3}\right), \cos\left(-\frac{\pi}{3}\right), \cos(0), \sin(3\pi)$$

☒ A. $\sin(3\pi) < \cos\left(-\frac{\pi}{3}\right) < \sin\left(\frac{\pi}{3}\right) < \cos(0)$

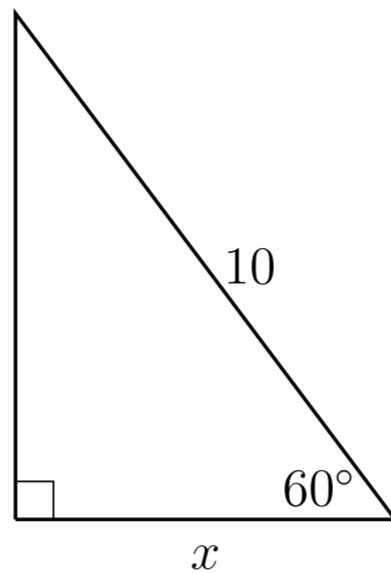
B. $\cos\left(-\frac{\pi}{3}\right) < \sin(3\pi) < \sin\left(\frac{\pi}{3}\right) < \cos(0)$

C. $\sin\left(\frac{\pi}{3}\right) < \cos(0) < \sin(3\pi) < \cos\left(-\frac{\pi}{3}\right)$

D. $\cos(0) < \sin\left(\frac{\pi}{3}\right) < \cos\left(-\frac{\pi}{3}\right) < \sin(3\pi)$

E. $\sin\left(\frac{\pi}{3}\right) < \cos\left(-\frac{\pi}{3}\right) < \sin(3\pi) < \cos(0)$

6. Consult the diagram below and determine the exact value of x :



$$\cos 60^\circ = \frac{x}{10}$$

$$\frac{1}{2} = \frac{x}{10}$$

A. $5\sqrt{3}$

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

C. 5

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

E. 10

7. Evaluate $\arcsin\left(\frac{\pi}{2}\right)$.

A. 0

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

C. 1

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

E. Does not exist.

8. Simplify and choose the equivalent expression.

$$\frac{\csc x}{\sin x} - \frac{\cot x}{\tan x} = \frac{1}{\sin^2 x} - \frac{\frac{\cos x}{\sin x}}{\frac{\sin x}{\cos x}}$$

$$= \frac{1}{\sin^2 x} - \frac{\cos^2 x}{\sin^2 x} = \frac{1 - \cos^2 x}{\sin^2 x} = \frac{\sin^2 x}{\sin^2 x}$$

A. $\csc x - \cot x$

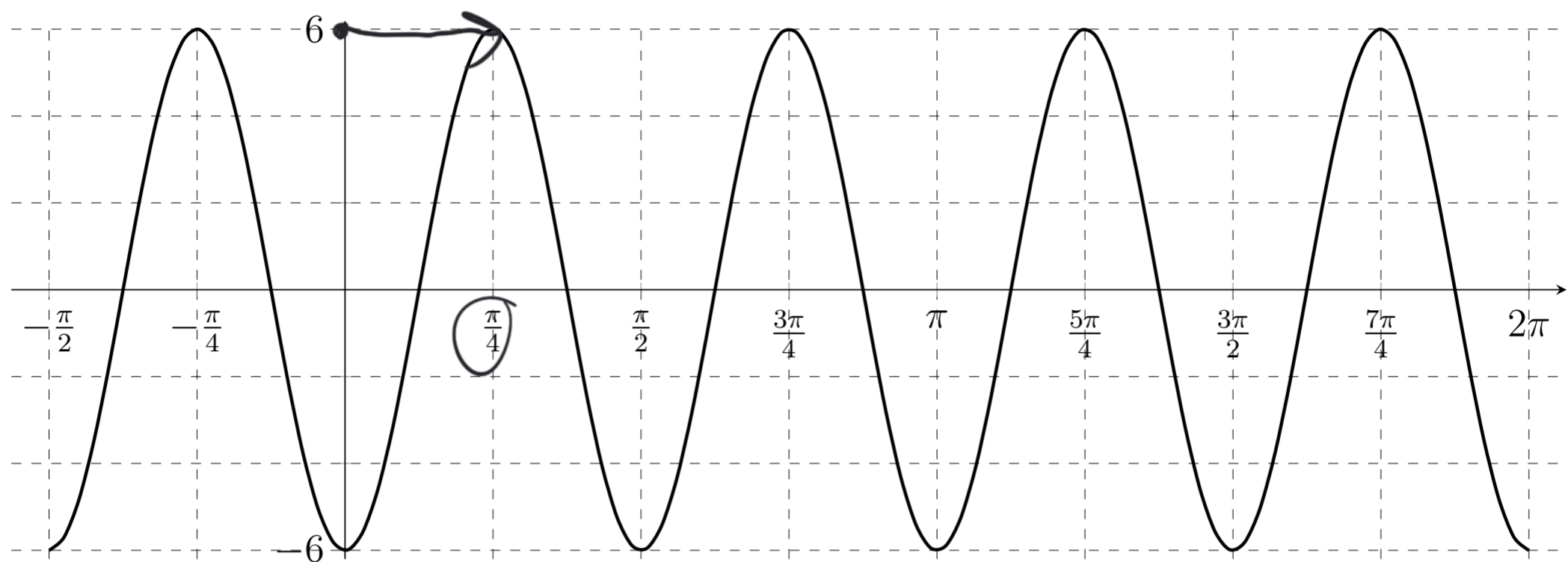
B. $\sin^2 x \sec x$

C. $\csc^2 x$

D. -1

E. 1

9. The function $f(x) = a \cos(bx - c) + d$ is graphed below. If $a > 0$, what is its phase shift?



A. 0

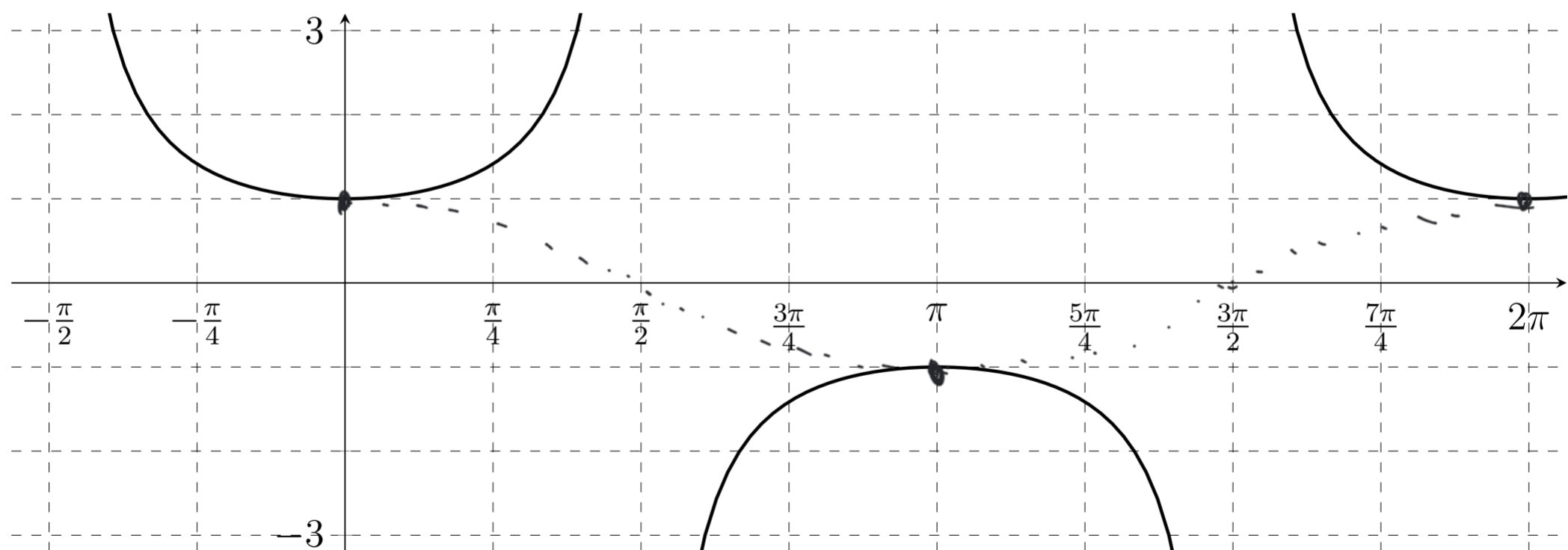
B. $-\pi$

C. $\frac{\pi}{6}$

D. π

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

10. Identify the trigonometric function graphed below.



A. $\cos x$

B. $\sin x$

C. $\tan x$

D. $\sec x$

E. $\csc x$

11. Evaluate: $\arccos\left(\cos\left(\frac{4\pi}{3}\right)\right) = \arccos\left(-\frac{1}{2}\right) = \frac{2\pi}{3}$

A. 0

B. $\frac{\pi}{3}$ C. $\frac{2\pi}{3}$ D. π E. $\frac{4\pi}{3}$

12. Let $f(x) = 5 \cos\left(\frac{\pi}{2}x\right)$ for $-1 \leq x \leq 11$. If n is the number of times $f(x)$ attains its maximum value on the given interval and m is the number of times $f(x)$ attains its minimum value on the given interval, find $n + m$.

Per = $\frac{2\pi}{\pi/2} = 4$

Max at $x = 0, 4, 8$

Min at $x = 2, 6, 10$

A. 4

B. 5

C. 6

D. 7

E. 8

13. Identify the expression that is not equivalent to the other four.

A. $\cos^2 \theta$ B. $\frac{\sin^2 \theta}{\tan^2 \theta}$ C. $1 - \sin^2 \theta$ D. $\tan^2 \theta \cdot \cos^2 \theta$ E. $\cot^2 \theta \cdot \sin^2 \theta$

14. An angle θ has $\tan \theta < 0$ and $\cos \theta > 0$. In which quadrant does θ lie when in standard position?

$\cos -$	$\cos +$
$\tan -$	$\tan +$
$\cos -$	$\cos +$
$\tan +$	$\tan -$

A. I

B. II

C. III

D. IV

E. Um, V?

15. How many solutions does the equation $\sin(x) = \frac{\sqrt{5}}{10}$ have? Choose the correct statement.

A. One solution, given by $\arcsin\left(\frac{\sqrt{5}}{10}\right)$.

B. None, since $\frac{\sqrt{5}}{10}$ is not on the unit circle.

C. Infinitely many, since $\sin(x)$ is periodic.

D. Two, given by $\arcsin\left(\pm\frac{\sqrt{5}}{10}\right)$ since $\sin(x)$ is an odd function.

E. Four, given by $\pm\arcsin\left(\pm\frac{\sqrt{5}}{10}\right)$ since $\sin(x)$ is an odd function.

16. Suppose that $\csc x = 4$ and that $\cot x > 0$. What is the value of $\cos x$?

Handwritten work:

$$\sin x = \frac{1}{4}$$

$$\csc^2 x = \frac{15}{16}$$

$$\left(\frac{1}{4}\right)^2 + \cos^2 x = 1$$

$$\cos x = \pm \frac{\sqrt{15}}{4}$$

Since $\cot x > 0$, $\cos x > 0$.

A. $\frac{1}{\sqrt{15}}$

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

C. $\frac{\sqrt{15}}{4}$

D. $\sqrt{15}$

E. $\frac{4}{\sqrt{15}}$

17. Identify the vertical asymptotes of the function $f(x) = \tan\left(x - \frac{\pi}{7}\right)$.

$\tan x$ has VA when $x = \frac{\pi}{2}$

A. $x = \frac{9\pi}{14} + n\pi$, where n is an integer

B. $x = \frac{9\pi}{14} + 2n\pi$, where n is an integer

C. $x = \frac{\pi}{7} + n\pi$, where n is an integer

D. $x = \frac{\pi}{7} + 2n\pi$, where n is an integer

E. The function does not have any vertical asymptotes.

$$x - \frac{\pi}{7} = \frac{\pi}{2} \rightarrow x = \frac{9\pi}{14}$$

$$\text{Per} = \pi$$

18. Evaluate: $\cos \frac{5\pi}{6}$

A. 0

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

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

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

E. $-\frac{\sqrt{3}}{2}$

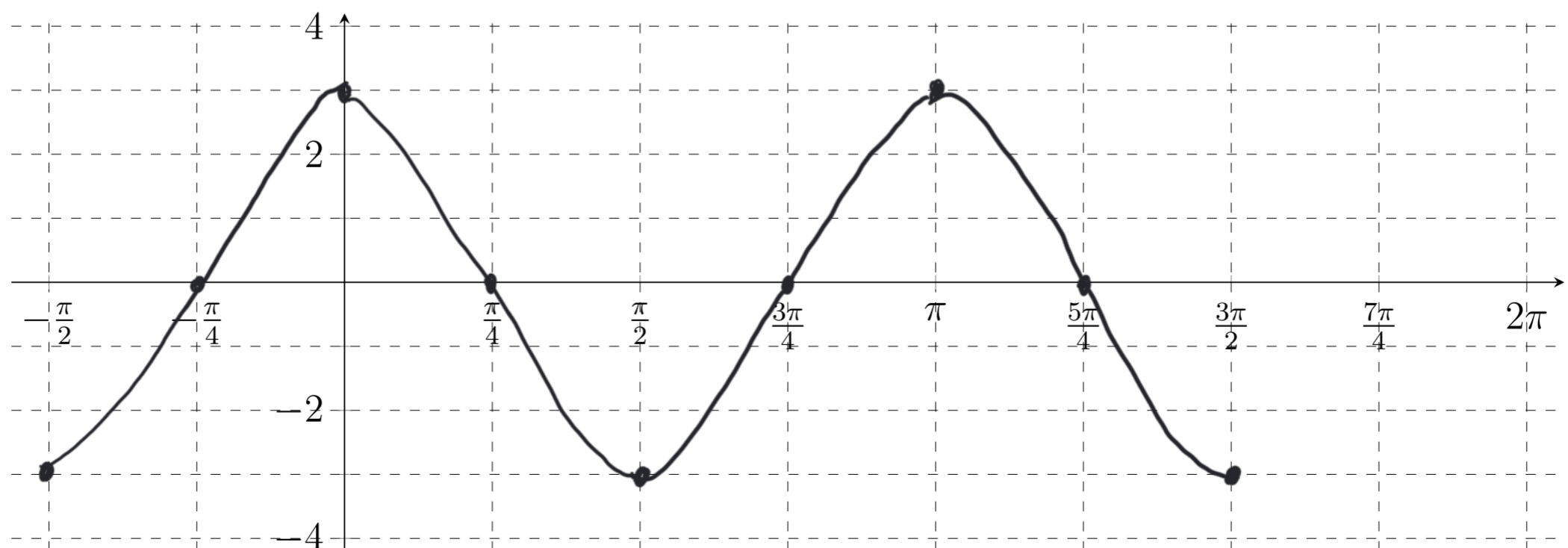
T.A. _____ Disc. Per. _____ Name _____

Honor Pledge: "On my honor, I have neither given nor received unauthorized aid for this exam."

UF ID # _____ Signature _____

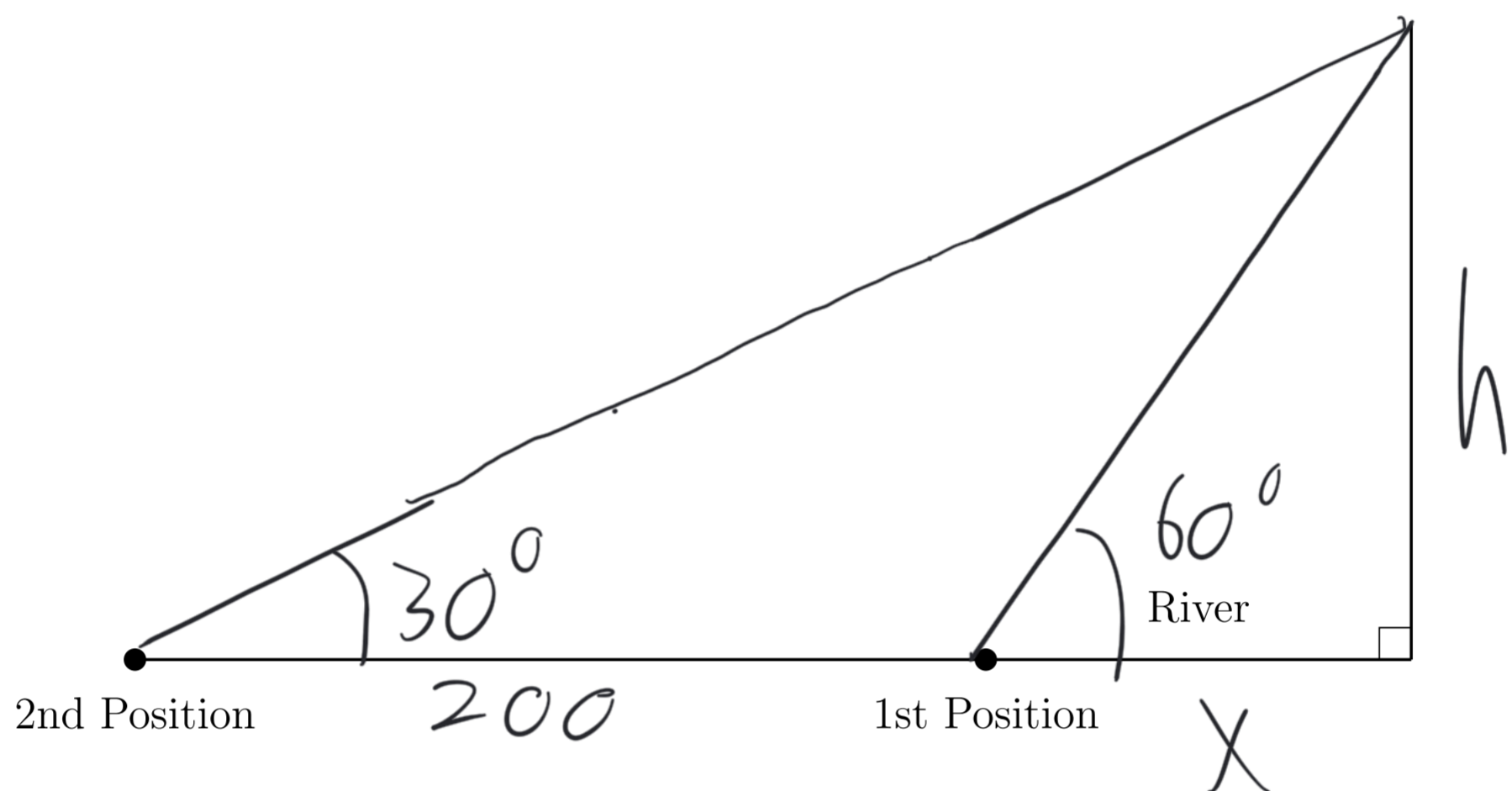
YOU MUST SHOW ALL WORK TO RECEIVE FULL CREDIT.

Free response questions 19–20 are worth 4 points each.

19. Suppose that $f(x) = -3 \cos(2x - \pi)$.a. The amplitude of $f(x)$ is 3.b. The period of $f(x)$ is $\frac{2\pi}{2} = \pi$ c. The phase shift of $f(x)$ is $\frac{c}{b} = \frac{\pi}{2}$.d. Give the coordinates of two x -intercepts of $f(x)$ Coordinates: $(\frac{\pi}{4}, 0)$ $(\frac{3\pi}{4}, 0)$ $(\frac{5\pi}{4}, 0)$ etce. Sketch the graph of $f(x)$ on the axes below. Include at least two full periods.

20. You are standing on the edge of a river. On the other side is a radio tower. You look up at the top of the tower, and note the angle of elevation is 60° . You then walk directly away from the tower a distance of 200 feet and note the new angle of elevation to the top of the tower is 30° .

a. Draw a picture of the situation. Include both angles given above and the distance walked. Label the width of the river as x and the height of the tower as h .



b. Construct two equations involving x and h using trigonometric functions.

$$\textcircled{1} \tan 60^\circ = \frac{h}{x} \quad \textcircled{2} \tan 30^\circ = \frac{h}{x+200}$$

c. Solve the system you created and state the height of the radio tower in feet. Leave your answer in radical form.

$$\begin{array}{l|l} \textcircled{1} \sqrt{3} = \frac{h}{x} & \text{Sub into } \textcircled{2} \\ h = x\sqrt{3} & \frac{1}{\sqrt{3}} = \frac{x\sqrt{3}}{x+200} \\ & 3x = x+200 \\ & x = 100 \end{array}$$

$$h = 100\sqrt{3} \text{ ft}$$

Tower height: _____ feet

Turn in your scantron and your free response to your TA. The worked-out solutions will be posted on Canvas after the test.