

TEST: 5.1-5.5—Calculator Permitted

Part I: Multiple Choice

_____ 1. What is the period of the following sinusoid: $y = 5 - 3 \cos\left(\frac{2\pi}{3} + \frac{4\pi}{3}x\right)$?

(A) $\frac{2\pi}{3}$ (B) $\frac{4\pi}{3}$ (C) $\frac{3}{2}$ (D) 2 (E) 3

_____ 2. Which of the following angles is coterminal with $\frac{447755\pi}{7}$?

(A) $\frac{3\pi}{7}$ (B) $\frac{5\pi}{7}$ (C) $\frac{9\pi}{7}$ (D) $\frac{11\pi}{7}$ (E) π

_____ 3. Which of the following is equal to $\sec^{-1} 0.5$?

(A) 0.524 (B) 0.016 (C) 0.954 (D) 1.139 (E) undefined

_____ 4. For $\theta = -16115123.2^\circ$, Find the reference angle, θ_{ref}

(A) 6.798° (B) 83.202° (C) -83.202° (D) -6.798° (E) $\frac{\pi}{6}$

_____ 5. If the terminal ray of θ passes through the point $(-1, -2)$, then $\csc \theta = ?$

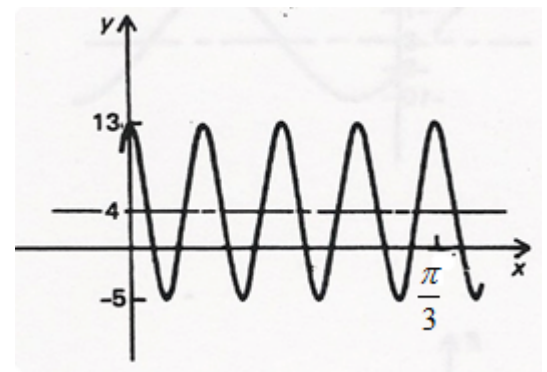
(A) $\frac{1}{2}$ (B) 2 (C) $-\frac{\sqrt{5}}{2}$ (D) $-\sqrt{5}$ (E) $-\frac{\sqrt{5}}{5}$

_____ 6. Approximately how many cycles will the function $f(x) = 13\sin(4\pi x) - 14$ have from 0 to 2π ?

(A) 12.5 (B) 4 (C) 2 (D) 0.5 (E) 0.25

_____ 7. For the given graph shown at right, how many cycles does it have between 0 and 2π ?

(A) $\frac{\pi}{3}$ (B) $\frac{2\pi}{3}$ (C) 24 (D) 12 (E) 36



_____ 8. Determine the range of the function $y = -\frac{3b}{2} + \frac{b}{2} \cos 4ax$, where $a > 0$, $b > 0$.

(A) $\left\{y \mid \frac{b}{2} \leq y \leq \frac{3b}{2}\right\}$ (B) $\left\{y \mid -\frac{3b}{2} \leq y \leq -\frac{b}{2}\right\}$ (C) $\{y \mid b \leq y \leq 2b\}$
 (D) $\{y \mid -2b \leq y \leq -b\}$ (E) $\{y \mid -b \leq y \leq 2b\}$

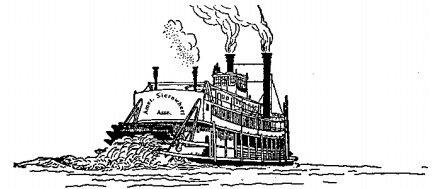
Part II: Free Response

Show all work, including the equations you are solving/evaluating on your calculator. Give simplified, exact answers when specified, otherwise report **three decimals**. Avoid intermediate rounding error. Box your final answers, **with units** when appropriate.



Mark Twain sat on the deck of a river steamboat with his stopwatch. As the paddlewheel turned, **a point** on the outer edge of the paddlewheel moved in such a way that its distance, d in **feet**, from the water's surface was a sinusoidal function of time, t in **seconds**. When his stopwatch read 4 seconds, the point was at its highest, 16 ft above the water's surface. The wheel's diameter was 18 ft and rotates at 6 RPMs (revolutions per minute).

- (a) What is the period, in seconds, of the paddle wheel?
- (b) Sketch at least 2 cycles of the graph of the sinusoid. Be sure to label and scale both your axes. Show it crossing the y -axis.



- (c) Write an equation of your graph modeling the height, $d(t)$, at time t .
 - (d) Where was the point, in feet, **in relation to the water's surface** when Mark started his stopwatch? At this time, in which vertical direction was that point moving?
 - (e) During the first 15 seconds from the time Mark started his watch, for how many seconds does the point remain underwater? Show the work that leads to your answer.
 - (f) What is the total distance, in feet, this point on the outer edge of the paddlewheel travel in one minute?
 - (g) What is the linear velocity, in feet per second, of this point?
 - (h) What was the full birth name of Mark's grandfather's son's son's name?
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