

PART A - MULTIPLE CHOICE: Circle the CAPITAL LETTER. Two points each.

1. The quadrant for  $\theta = \frac{20\pi}{17}$  and its reference angle are

- A) I and  $\theta_{\text{ref}} = \frac{\pi}{17}$       D) III and  $\theta_{\text{ref}} = \frac{\pi}{17}$   
B) I and  $\theta_{\text{ref}} = \frac{3\pi}{17}$       E) None of these  
C) III and  $\theta_{\text{ref}} = \frac{3\pi}{17}$

2. Convert  $\frac{2}{9}$  radians to degrees.

- A)  $\left(\frac{40}{\pi}\right)^\circ$       B)  $\left(\frac{80}{\pi}\right)^\circ$       C)  $40^\circ$       D)  $80^\circ$       E) None of these

3. The arclength of the unit circle with central angle of  $120^\circ$  is

- A) 1      D)  $\frac{3\pi}{2}$   
B)  $\frac{2\pi}{3}$       E) 120  
C)  $\pi$

4. The zeroes of  $y = \sin x$  occur (for  $n \in I$ ) at

- A)  $x = \frac{n\pi}{4}$       B)  $x = \frac{n\pi}{2}$       C)  $x = n\pi$       D)  $x = (2n+1)\frac{\pi}{2}$       E)  $x = (2n+1)\pi$

5. The range of  $y = \cot^{-1} x$  is

- A)  $y \in \left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$       B)  $y \in [0, \pi]$       C)  $y \in \left(-\frac{\pi}{2}, \frac{\pi}{2}\right)$       D)  $y \in (0, \pi)$       E) None of these

6. Which of the following is equivalent to  $\sin(-200^\circ)$ ?

- A)  $-\sin 20^\circ$     B)  $\sin 20^\circ$     C)  $\sin 200^\circ$     D) All of these    E) None of these

7. Solve  $\cos \theta = -\frac{1}{2}$  for  $\theta \in [0, 2\pi)$ .

- A)  $\frac{\pi}{6}$  only                      D)  $\frac{5\pi}{6}$  or  $\frac{11\pi}{6}$   
B)  $\frac{5\pi}{6}$  or  $\frac{7\pi}{6}$                   E)  $\frac{2\pi}{3}$  or  $\frac{5\pi}{3}$   
C)  $\frac{2\pi}{3}$  or  $\frac{4\pi}{3}$

8. How many cycles does the graph  $y = \tan(2x)$  complete on the interval  $x \in [0, 2\pi)$ ?

- A)  $\frac{1}{2}$                       B) 1                      C) 2                      D) 4                      E) 8

9. Which of the following trig ratios could be equivalent to  $\frac{3}{e}$ ?

- A)  $\cos^{-1} x$     B)  $\cos x$     C)  $\sin x$     D)  $\tan x$     E)  $\csc^{-1} x$

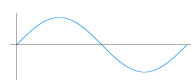
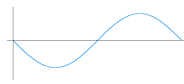
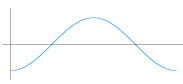
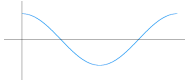
10. The range of  $y = 2\cos x - 5$  is

- A)  $y \in [-2, 2]$     B)  $y \in [-5, 5]$     C)  $y \in [-7, -3]$     D)  $y \in [3, 7]$     E)  $y \in [-3, 7]$

PART B - FREE RESPONSE: No Calculator. Show all your work for partial credit.

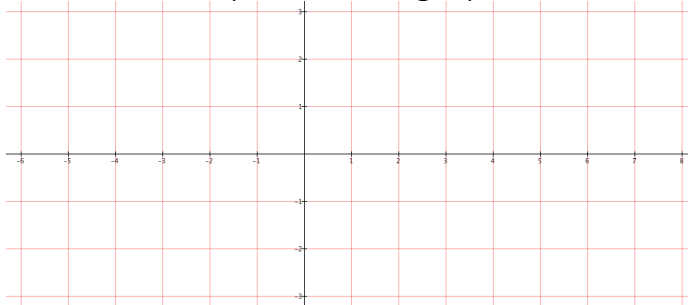
11. (5 points) Given the function  $f(x) = 2\sin\left(-\frac{\pi}{2}x\right)$

a) Circle the shape that best represents the graph of  $f$ .



b) Determine the period and amplitude of the function.

c) Sketch the 3 cycles of the graph.



d) Write a formula in terms of  $n \in I$  for all  $x$  - coordinates of the maximum points of  $f$ .

12. (4 points) Evaluate exactly.

a)  $\cos\left(\frac{20\pi}{3}\right) =$

c)  $\cot(\pi) =$

b)  $\tan(-225^\circ) =$

d)  $\csc\left(\frac{3\pi}{2}\right) =$

13. (4 points) Evaluate exactly.

a)  $\cos^{-1}\left(\frac{\sqrt{2}}{2}\right) =$

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

b)  $\tan^{-1}(-\sqrt{3}) =$

d)  $\cos^{-1}\left[\cos\left(-\frac{\pi}{2}\right)\right] =$

14. (4 points) Evaluate exactly.

a)  $\cos\left(\tan^{-1}\frac{15}{8}\right)$

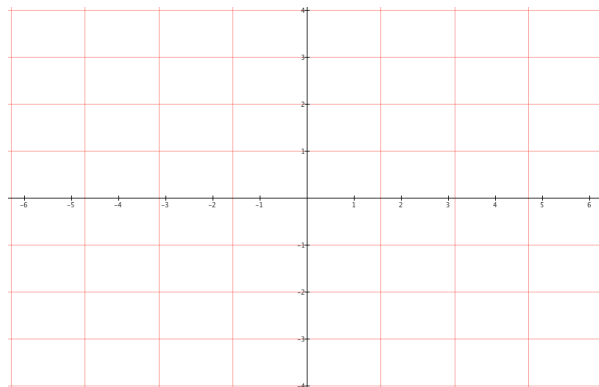
b)  $\cos[\sec^{-1}(2)]$

c)  $\sin[\sin^{-1}(2)]$

15. (3 points) Sketch 2 cycles of  $y = \csc x$  and evaluate the following limits:

a)  $\lim_{x \rightarrow 0^-} \csc x =$

b)  $\lim_{x \rightarrow \frac{\pi}{2}} \csc x =$



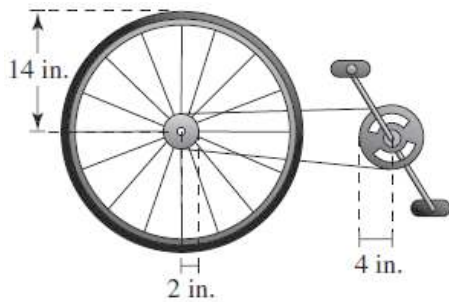
16. (5 points) Express  $y = \cos\left(\sin^{-1} \frac{x+1}{x}\right)$  as an algebraic function (without trig and inverse trig functions) and state the domain of the function.

17. (3 points) Write a trig equation that produces the solutions of  $\theta = \frac{5\pi}{6}$  or  $\frac{11\pi}{6}$ .

18. (3 points) A line passes through the origin and is inclined from the  $x$ -axis by an angle of  $\theta$ . If  $\sin \theta = \frac{3}{5}$ , then what is the equation of the line?

19.(2 points) Consider the diagram below of the wheel (big circle), wheel sprocket (small circle) and pedal sprocket (medium circle) below. Fill in the blanks:

- a) The \_\_\_\_\_ speeds of the big and small wheels are the same.
- b) The \_\_\_\_\_ speeds of the medium and small wheels are the same.



20.(4 points) Write an equation of a sinusoid function to model the water level  $y$  in meters with respect to time  $x$  in hours as the ocean tide changes, given that low tide occurs at 3 a.m. at a depth of 1 meter and high tide occurs at 9 a.m. at a depth of 5 meters. Include a labeled sketch in your solution. Note:  $x = 0$  refers to midnight.