

1. (2pts) Convert to degrees or radians:

$$165^\circ =$$

$$\frac{2\pi}{5} =$$

2. (4pts) Use a unit circle to compute the exact values (do not use the calculator):

$$\cos 135^\circ$$

$$\tan \frac{7\pi}{6}$$

$$\sec \frac{\pi}{6}$$

3. (4pts) The point $(-2, -5)$ is on the terminal side of the angle θ that is in standard position. Compute $\sin \theta$ and $\cot \theta$.

4. (2pts) Find exact values of the following expressions. A picture may help you. Do not use the calculator.

$$\arcsin\left(-\frac{\sqrt{3}}{2}\right)$$

$$\arccos\left(-\frac{1}{2}\right)$$

5. (5pts) Use complementary angles, odd-even and periodicity properties to compute:

$$\sin 395^\circ \cdot \sec 65^\circ =$$

$$\tan\left(\pi + \frac{\pi}{5}\right) + \frac{\sin\left(-\frac{\pi}{5}\right)}{\sin\left(\frac{\pi}{2} - \frac{\pi}{5}\right)} =$$

6. (4pts) A refinery guard is walking around a large oil tank whose radius is 20m. If he walks from the westernmost part of the tank to the northernmost part of the tank the long way (counterclockwise), what distance does he walk?

7. (3pts) State the angles for which $\tan \theta$ is not defined. Explain. (Hint: looking at the unit circle and writing what $\tan \theta$ is in terms of x and y coordinates may help.)

Use trigonometric identities to establish the following identities:

8. (4pts) $\sec^4 \theta - \sec^2 \theta = \tan^4 \theta + \tan^2 \theta$

9. (3pts) $\cos\left(\frac{\pi}{2} + \theta\right) = -\sin \theta$

10. (8pts) Solve the equations:

a) $2 \cos^2 \theta - \sqrt{3} = 0$.

b) $\sin 2\theta = \frac{\sqrt{2}}{2}, 0 \leq \theta \leq \pi$

11. (6pts) Sketch the graph of $y = 2 \cos 3x$. Use the following to accurately draw the graph:

a) What is the amplitude of the function?

b) What is the period of the function?

c) Indicate all the characteristic points on the graph (x -intercepts, peaks, valleys).

12. (4pts) Use either an addition formula or a half-angle formula to find the exact value of $\cos 165^\circ$.

13. (8pts) Suppose that $\pi < \alpha < \frac{3\pi}{2}$ and $0 < \beta < \frac{\pi}{2}$ are angles so that $\sin \alpha = -\frac{1}{3}$ and $\cos \beta = -\frac{3}{4}$. Find the following (pay attention to signs):

$$\cos \alpha$$

$$\sin \beta$$

$$\cos(\alpha - \beta)$$

$$\sin \frac{\alpha}{2}$$

14. (5pts) Use the graphing feature of your calculator to solve the equation $5 - x^2 = \sin x$ with accuracy to two decimal places. Draw the graph here and indicate the solutions.

15. (4pts) A guy wire 80 feet long is attached to the top of a radio tower. The guy wire makes an angle of 25° with the ground. How tall is the tower?

16. (7pts) Solve the triangle with $b = 3$, $c = 5$, $\gamma = 25^\circ$. How many solutions are there?

17. (7pts) A sandbox is the shape of a triangle whose sides have lengths 14ft, 9ft and 8ft. What is the area of the sandbox?

Bonus (8pts) The highest bridge in the world is the bridge over the Royal Gorge in Colorado. Sightings to the same point at water level directly under the bridge are taken from each side of the 880-ft-long bridge, as indicated in the figure. How high is the bridge?