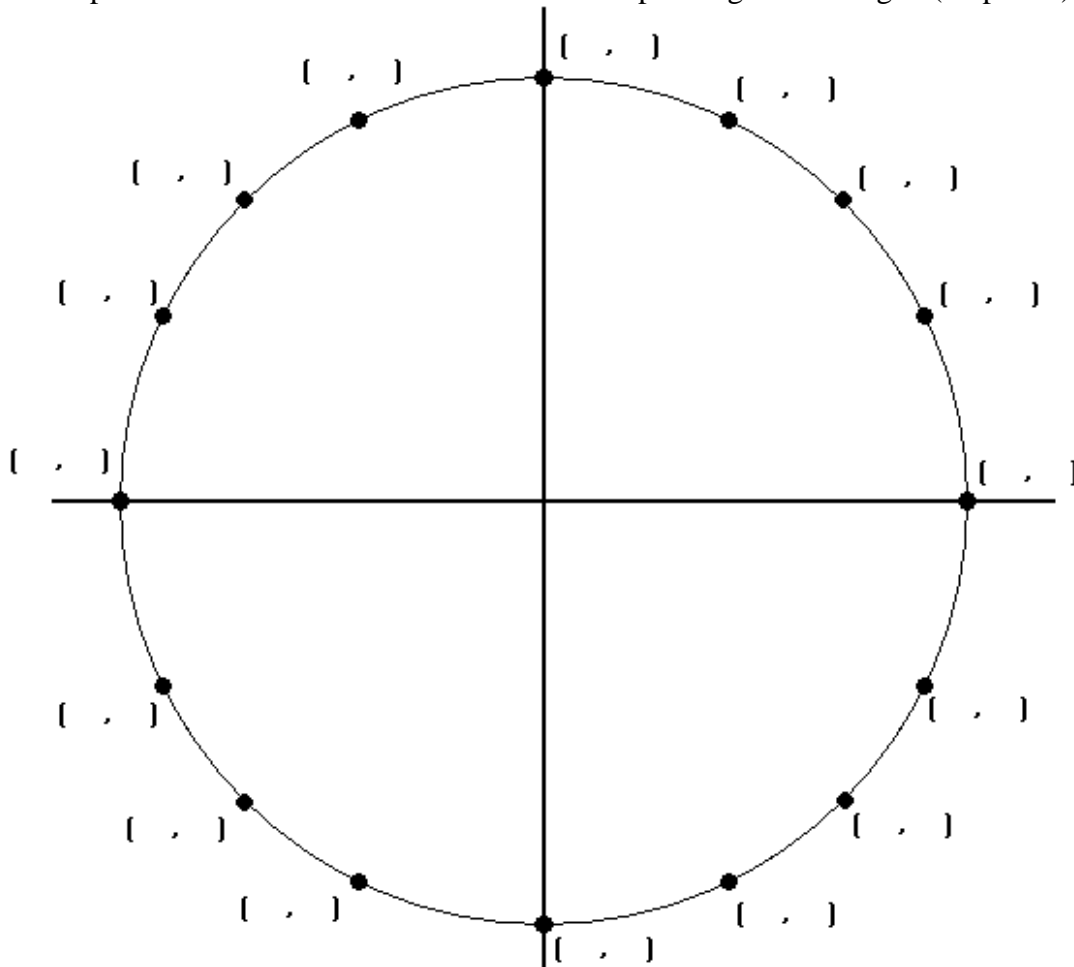


## Final Exam

Answer each question to the best of your ability. Show all of your work.

1. Fill in each of the point coordinates on the given standard unit circle, and clearly label each point with the radian measure of the corresponding central angle. (25 points)



2. The terminal side of an angle  $\theta$  passes through the point  $(-5, 12)$ . Find the six trigonometric function values for this angle. (10 points)

$$\sin \theta = \underline{\hspace{2cm}}$$

$$\cos \theta = \underline{\hspace{2cm}}$$

$$\tan \theta = \underline{\hspace{2cm}}$$

$$\cot \theta = \underline{\hspace{2cm}}$$

$$\sec \theta = \underline{\hspace{2cm}}$$

$$\csc \theta = \underline{\hspace{2cm}}$$

3. The shadow of a vertical tower is 33 meters long when the elevation of the sun is  $21^\circ$ . How tall is the tower? (10 points)

4. Convert  $117^\circ$  into radians. (5 points)

5. Graph the function  $y = \sin(2x + \pi) - 1$  over one period. Give the amplitude, period, vertical translation, and phase shift (as applicable), and label 3 points on the graph. (15 points)

6. Verify the identity  $\frac{\cot \theta}{\csc \theta} = \cos \theta$ . (15 points)

7. Verify the identity  $\frac{1 + \cos 2x}{\sin 2x} = \cot x$ . (20 points)

8. Evaluate  $\sin(\arctan 7)$  exactly (without a calculator!) (10 points)

9. Solve  $\tan 3x = \sqrt{3}$  for  $x$  in  $[0^\circ, 360^\circ)$ . (20 points)

10. An airplane is headed on a bearing of  $119^\circ$  at an airspeed of 400 km per hr. A 19 km per hr wind is blowing from a direction of  $200^\circ$ . Find the groundspeed and resulting bearing of the plane. (10 points)

11. Find all fourth roots of  $16\text{cis } 225^\circ$ . (10 points)

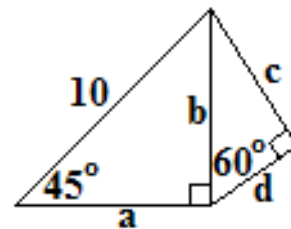
12. Solve for  $a$ ,  $b$ ,  $c$ , and  $d$  in the following figure. (10 points)

$a =$  \_\_\_\_\_

$b =$  \_\_\_\_\_

$c =$  \_\_\_\_\_

$d =$  \_\_\_\_\_



13. Solve the following linear system using substitution, elimination, or matrices.  
(20 points)

$$\begin{cases} 3x + 5y - z + 2 = 0 \\ 4x - y + 2z = 0 \\ -6x - 10y + 2z = 0 \end{cases}$$

14. Solve for  $x$ :  $2 \arccos\left(\frac{x-\pi}{3}\right) = 2\pi$  (10 points)

15. Find  $\cos(x+y)$  given  $\sin x = \frac{5}{13}$ ,  $\cos y = -\frac{3}{5}$  and both  $x$  and  $y$  lie in quadrant II.  
(10 points)