

1. (9pts) If $\sec \theta = \frac{5}{\sqrt{2}}$ and θ is in the fourth quadrant, find the exact values of all the trigonometric functions of θ . Draw a picture.

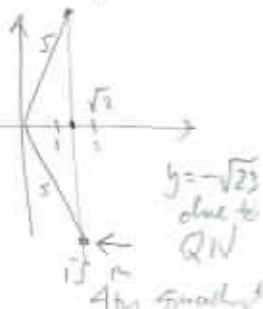
$$\frac{1}{\cos \theta} = \frac{5}{\sqrt{2}}$$

$$\cos \theta = \frac{\sqrt{2}}{5} = \frac{x}{r}$$

$$\sqrt{2}^2 + y^2 = 5^2$$

$$2 + y^2 = 25$$

$$y = \pm \sqrt{23}$$



$$\cos \theta = \frac{\sqrt{2}}{5}$$

$$\sec \theta = \frac{5}{\sqrt{2}}$$

$$\sin \theta = -\frac{\sqrt{23}}{5}$$

$$\csc \theta = -\frac{5}{\sqrt{23}}$$

$$\tan \theta = -\frac{\sqrt{23}}{\sqrt{2}}$$

$$\cot \theta = -\frac{\sqrt{2}}{\sqrt{23}}$$

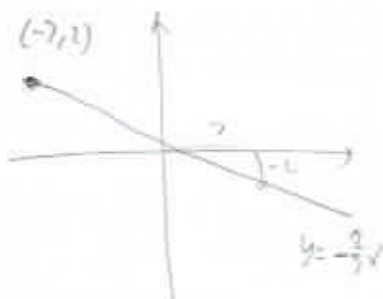
2. (7pts) The terminal side of angle θ is in the second quadrant and lies on the line $2x + 7y = 0$. Find the exact values of $\sin \theta$ and $\tan \theta$. Draw a picture.

$$2x + 7y = 0$$

$$7y = -2x$$

$$y = -\frac{2}{7}x$$

$$x = -7, y = 2$$



$$r = \sqrt{(-7)^2 + 2^2}$$

$$= \sqrt{49 + 4} = \sqrt{53}$$

$$\sin \theta = \frac{y}{r} = \frac{2}{\sqrt{53}}$$

$$\tan \theta = \frac{y}{x} = \frac{2}{-7} = -\frac{2}{7}$$

3. (8pts) Sketch angles in standard position with indicated radian measure.

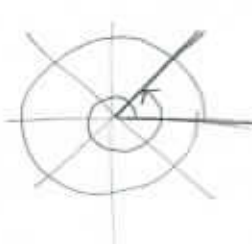
$$\frac{7\pi}{6}$$



$$-\frac{4\pi}{7}$$



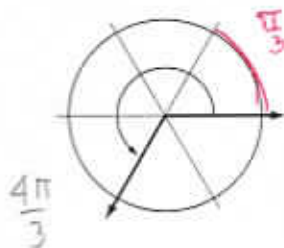
$$\frac{9\pi}{4}$$



$$-\frac{7\pi}{9}$$

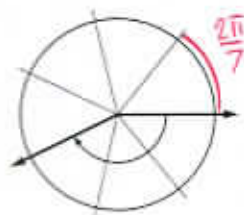


4. (8pts) Indicate both the radian and degree measure under the following angles. (Use equally-spaced lines to help you determine what the angles are.)



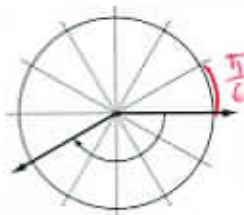
$$\frac{4\pi}{3}$$

$$240^\circ$$



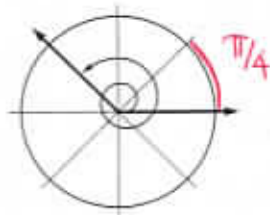
$$-3 \cdot \frac{2\pi}{7} = -\frac{6\pi}{7}$$

$$-154.285714^\circ$$



$$-\frac{5\pi}{6}$$

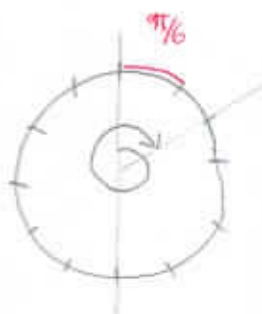
$$-150^\circ$$



$$2\pi + \frac{2\pi}{4} = \frac{8\pi}{4} + \frac{2\pi}{4} = \frac{10\pi}{4}$$

$$495^\circ$$

5. (8pts) What is the length of the arc that the tip of the minute hand traces out while it travels an hour and 10 minutes? The length of the minute hand is 6 cm.



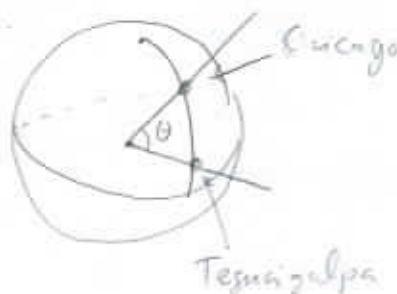
In 1 hr 10 min
the minute hand
traces out the angle

$$2\pi + 2 \cdot \frac{\pi}{6} = \frac{6\pi}{3} + \frac{2\pi}{3} = \frac{8\pi}{3}$$

$$S = r\theta$$

$$S = 6 \cdot \frac{8\pi}{3} = 16\pi = 43.982297 \text{ cm}$$

6. (8pts) What is the distance from Chicago, IL (latitude $41^\circ 52' 17''$) to Tegucigalpa, Honduras (latitude $14^\circ 4' 15''$) which lies directly south of Chicago? Radius of Earth is 3960 miles.



$$\theta = 41^\circ 52' 17'' - 14^\circ 4' 15'' = 27^\circ 48' 2''$$

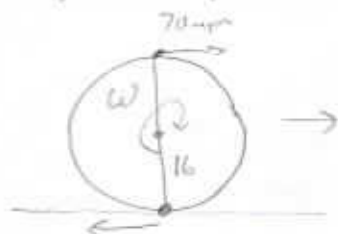
$$= \left(27 + \frac{48}{60} + \frac{2}{3600}\right)^\circ = 27.800556^\circ$$

$$\theta \text{ in radians is } 27.8 \cdot \frac{\pi}{180} = 0.485211$$

$$S = r\theta = 3960 \cdot 0.485211 = 1921.436464 \text{ miles}$$

7. (12pts) The diameter of a car tire is 32 inches. Suppose the car is traveling along the highway at 70 mph (thus, you may assume that every point at the edge of the tire has this linear speed).

- a) What is the angular speed of the wheel in radians per minute?
b) How many revolutions per minute does the wheel make?



$$v = 70 \text{ mph}$$

$$= \frac{70 \cdot 5280 \cdot 12 \text{ in}}{60 \text{ min}}$$

$$= 73920 \text{ in/min}$$

$$a) r = \frac{32}{2} = 16 \text{ in}$$

$$v = r\omega$$

$$73920 = 16 \cdot \omega$$

$$\omega = \frac{73920}{16} = 4620 \text{ rad/min}$$

$$b) \frac{4620}{2\pi} = 735.295827$$

revolutions
per minute