

**SHOW ALL WORK:** Answers without adequate justification may not receive full credit. Give exact answers wherever possible. **No Calculator.**

1) (4pts) Convert the following and simplify:

a)  $\frac{\pi}{9}$  radians to degrees  $20^\circ$

b) 900 degrees to radians  $5\pi$

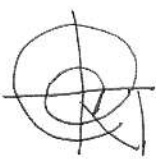
$\frac{\pi}{9} \times \frac{180}{\pi}$

$\frac{900}{180} \times \frac{\pi}{1}$

2) (4pts) Find an angle:

a) between  $0^\circ < \alpha < 360^\circ$  that is Coterminal with  $\theta = 675^\circ$

$315^\circ$



$675 - 360 = 315$

b) between  $0 < \alpha < 2\pi$  that is Coterminal with  $\theta = \frac{-23\pi}{6}$

$\frac{23\pi}{6} - \frac{12\pi}{6} = \frac{11\pi}{6}$

3) (4pts) A wheel with radius 20 cm rolls along the ground, rotating 120 degrees. What distance did the wheel roll?

20 cm

$\frac{40\pi \text{ cm}}{360}$

$\frac{40\pi \text{ cm}}{360} \times \frac{120}{1}$

$41.9 \text{ cm}$

4) (4pts) A Ferris wheel with radius 60 feet rotates 1 revolution every 3 minutes. Find the linear velocity of the wheel.

60

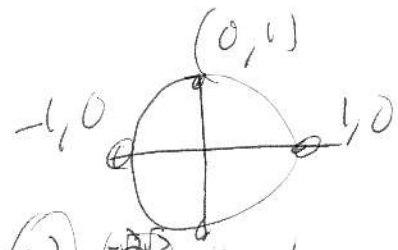
$\frac{120\pi \text{ feet}}{1 \text{ rev}}$

$\frac{1 \text{ rev}}{3 \text{ min}}$

$\frac{40\pi \text{ Feet}}{\text{min}}$

$41.9 \text{ FT/min}$

(30)



5) (14pts) Evaluate each of the following. Give exact values

a)  $\cos\left(\frac{3\pi}{2}\right)$  0

b)  $\csc\left(\frac{4\pi}{3}\right)$   $\frac{2}{\sqrt{3}}$   $\frac{1}{\sin\frac{4\pi}{3}} = \frac{1}{-\frac{\sqrt{3}}{2}} = -\frac{2}{\sqrt{3}}$

c)  $\tan\left(\frac{5\pi}{6}\right)$   $-\frac{\sqrt{3}}{3}$

d)  $\cos(6\pi)$  1 Same as  $\cos(0)$



e)  $\sin\left(-\frac{5\pi}{6}\right)$   $-\frac{1}{2}$

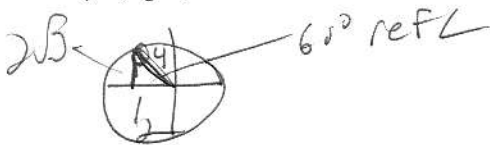
f)  $\cos(135^\circ)$   $-\frac{1}{\sqrt{2}}$

h)  $\cot(-45^\circ)$  -1

g)  $\sec(210^\circ)$   $-\frac{2}{\sqrt{3}}$

$-\frac{1}{\cos 30} = -\frac{1}{\frac{\sqrt{3}}{2}} = -\frac{2}{\sqrt{3}}$

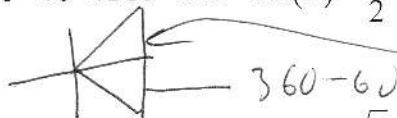
6) (4pts) Find the coordinates of the point on a circle with radius 4 at an angle of  $\frac{2\pi}{3}$



$(-2, 2\sqrt{3})$

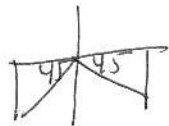
7) (4pts) Find all values of  $\theta$

a. Where  $0^\circ < \theta < 360^\circ$  and  $\cos(\theta) = \frac{1}{2}$



$60^\circ$  or  $300^\circ$

b. Where  $0 < \theta < 2\pi$  and  $\sin(\theta) = -\frac{\sqrt{2}}{2}$



$\frac{4\pi}{4} = \frac{\pi}{4}$   $\frac{8\pi}{4} = \frac{3\pi}{4}$

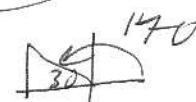
$\frac{5\pi}{4}$  or  $\frac{7\pi}{4}$

8) (4pts) Find a second angle with

a. The same sine value as  $170^\circ$

same  $\gamma$

$300$



b. The same cosine value as  $170^\circ$

$180-30$

$210$



9) (6pts) Find the quadrant containing  $\beta$  if the given conditions are true:

a. If  $\sin \beta > 0$  and  $\cot \beta > 0$  then  $\beta$  is in Quadrant I

I or II I or III

b. If  $\csc \beta > 0$  and  $\sec \beta < 0$  then  $\beta$  is in Quadrant II

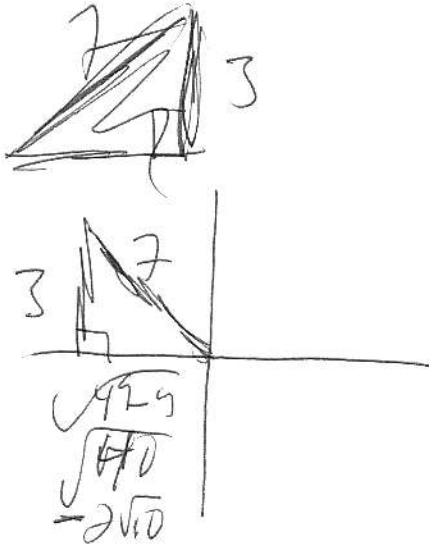
I or II II or III

c. If  $\tan \beta < 0$  and  $\cos \beta > 0$  then  $\beta$  is in Quadrant IV



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10) (12pts) Given  $\sin(\theta) = \frac{3}{7}$ , and  $\tan(\theta) < 0$ , find (without finding  $\theta$ ) and simplify



$\cos(\theta) = \frac{-2\sqrt{10}}{7}$   
 $\tan(\theta) = \frac{3}{-2\sqrt{10}} \text{ or } -\frac{3\sqrt{10}}{20}$   
 $\sec(\theta) = \frac{7}{-2\sqrt{10}} \text{ or } -\frac{7\sqrt{10}}{20}$   
 $\csc(\theta) = \frac{7}{3}$   
 $\cot(\theta) = \frac{-2\sqrt{10}}{3}$

11) (6pts) Simplify the following:  $\frac{\sec^2(\theta)\sin(\theta)}{\tan(\theta)}$  (be sure to show all steps)

~~$\sec^2 \theta = 1 + \tan^2 \theta$~~

$\sec \theta$

$$\frac{\frac{1}{\cos^2} \cdot \frac{\sin \theta}{1}}{\frac{\sin \theta}{\cos \theta}}$$

$$\frac{\frac{\sin \theta}{\cos \theta} \cdot \frac{\cos \theta}{\sin \theta}}{\frac{1}{\cos \theta}}$$

12) (4pts) Simplify the following:  $\frac{\cos^2(\theta)}{1 - \cos^2(\theta)}$  (be sure to show all steps)

$$\frac{\cos^2 \theta}{\sin^2 \theta} = \cot^2 \theta$$

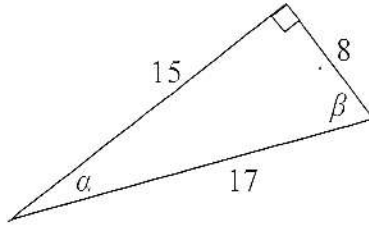
one answer

(3)

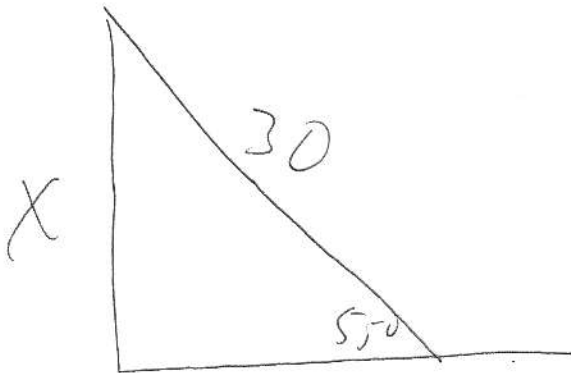
13) (4pts) Given the triangle to the right

a)  $\tan(\alpha) = \frac{8}{15}$

b)  $\cos(\beta) = \frac{8}{17}$



14) (4pts) A 30 ft ladder is leaning against a building so that the angle between the ground and the ladder is  $55^\circ$ . How high on the building does the ladder reach?



$$\sin 55 = \frac{X}{30}$$

$$30 \sin 55 = \boxed{24.6}$$