145 pts

PreCalculus
Fall Take Home Midterm 2013
Calculator Allowed--25 minutes

Directions: Round at 3 decimal places.
Show all work.

1. Find the approximate trig value for the following:

$\cot(-18.3°)$ = −3.024

$\cos 8.2$ = −.339

Csc 312° = −1.346

2. Find ALL approximate values in **degrees** for the following:

$\cos^{-1}(-0.876) = \begin{cases} \pm 151.164 \pm 360n \end{cases}$

$\csc^{-1} 2.115 = \begin{cases} 28.217 \pm 360n \\ 151.228 \pm 360n \end{cases}$

$\tan^{-1} 0.45 = \begin{cases} 24.228 \pm 180n \end{cases}$

3. Identify the Quadrant and reference angle of each of these:

a. 965° Q III $\theta_{REF} = 65°$

b. −732° Q IV $\theta_{REF} = 12°$

c. 1614° Q II $\theta_{REF} = 6°$

d. −572° Q II $\theta_{REF} = 32°$

4. The S.I. soccer team is playing a game. S.I.'s winning shot started with a 10-foot pass at $40°$ and a final shot of 25 feet at $287°$. How far from the original pass was the goal and at what direction?

$$10\cos 40\vec{i} + 10\sin 40\vec{j}$$
$$25\cos 287\vec{i} + 25\sin 287\vec{j}$$

$$14.970\vec{i} - 17.480\vec{j}$$

$$\text{Dist} = \sqrt{14.970^2 + 17.480^2} = 23.014'$$

$$\theta = -\cos^{-1}\left(\frac{14.970}{23.014}\right) = -49.423°$$

5. If $\vec{s} = -15\vec{i} - 8\vec{j}$ and $\vec{r} = 5\vec{i} + 18\vec{j}$, find:

a. $4\vec{s} - \vec{r}$ $= 4(-15\vec{i} - 8\vec{j}) - (5\vec{i} + 18\vec{j})$

$$= -65\vec{i} - 50\vec{j}$$

b. $|5\vec{s} + 2\vec{r}|$ $= |-65\vec{i} - 4\vec{j}| = \sqrt{65^2 + \cancel{4^2}} = \cancel{\sqrt{3089}}\ \sqrt{4241}$

$$= 65.123$$

c. The unit vector in the direction $\vec{s}$

$$\cancel{\frac{5}{\sqrt{349}}\vec{i} + \frac{18}{\sqrt{349}}\vec{j}}\quad \frac{-15}{17}\vec{i} - \frac{8}{17}\vec{j}$$

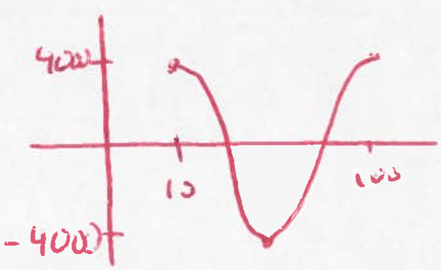
6. When a spaceship is fired into orbit from a site such as Cape Canaveral, which is not on the equator, it goes into an orbit that takes it alternately north

and south of the equator. Its distance from the equator is an approximately sinusoidal function of time.

Suppose that a spaceship is fired into orbit from Cape Canaveral. Ten minutes after it leaves the Cape, it reaches it farthest distance *north* of the equator, 4000 kilometers. Half a cycle later it reaches its farthest distance *south* of the equator (on the other side of the Earth), also 4000 kilometers. The spaceship completes an orbit once every 90 minutes.

Let y be the number of kilometers the spaceship is *north* of the equator (you may consider distances south of the equator to be negative). Let t be the number of minutes that have elapsed since liftoff.

(a) Sketch a complete cycle of the graph of y versus t.
(b) Write the particular equation expressing y in terms of t.
(c) Use your equation to predict the distance of the spaceship from the equator when
 i. $t = 25$
 ii. $t = 41$
 iii. $t = 163$
(d) Calculate the distance of Cape Canaveral from the equator by calculating y when $t = 0$.



$d = 4000 \cos\left[\frac{\pi}{45}(t - 10)\right]$

c) $d(25) = 2000$
$d(41) = -2236.771$
$d(163) = \cancel{3577.334}\ -1236.068$

d) $d(0) = \cancel{3999.903}\ 3064.178$

7. (-5, 2) is on the terminal side of A. Find the six exact trig values:

Sin A= $2/\sqrt{29}$ Cos A= $-5/\sqrt{29}$

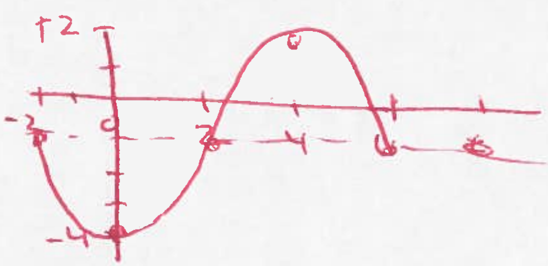
Tan A= $-2/5$ Cot A= $-5/2$

Sec A= $-\sqrt{29}/5$ Csc A= $\sqrt{29}/2$

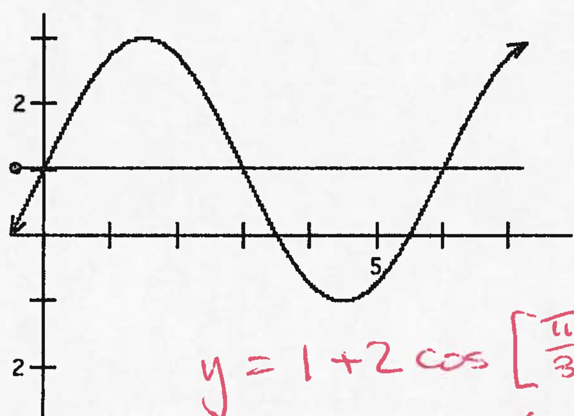
A= $2.761 \pm 2\pi n$

or $158.199 \pm 360n$

8. Sketch one cycle of $y = -1 - 3\sin\left[\frac{\pi}{4}(x+2)\right]$



9. Find one cosine and one sine equation for this graph:



$y = 1 + 2\cos\left[\frac{\pi}{3}(x - 1.5)\right]$

$y = 1 + 2\sin\left(\frac{\pi}{3}x\right)$

10. $\sec B = -\frac{4}{3}$ in Quadrant III. Find the other five exact trig values:

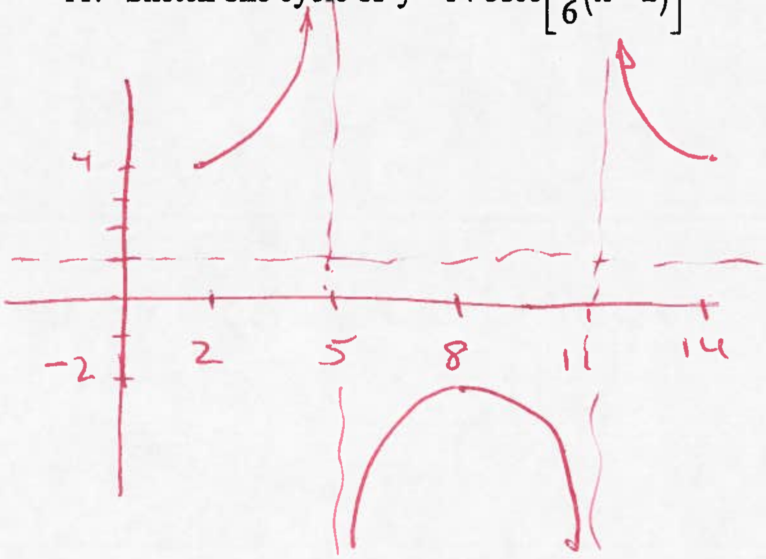
$\sin B = -\sqrt{7}/4$ $\qquad$ $\cos B = -3/4$

$\tan B = \sqrt{7}/3$ $\qquad$ $\cot B = 3/\sqrt{7}$

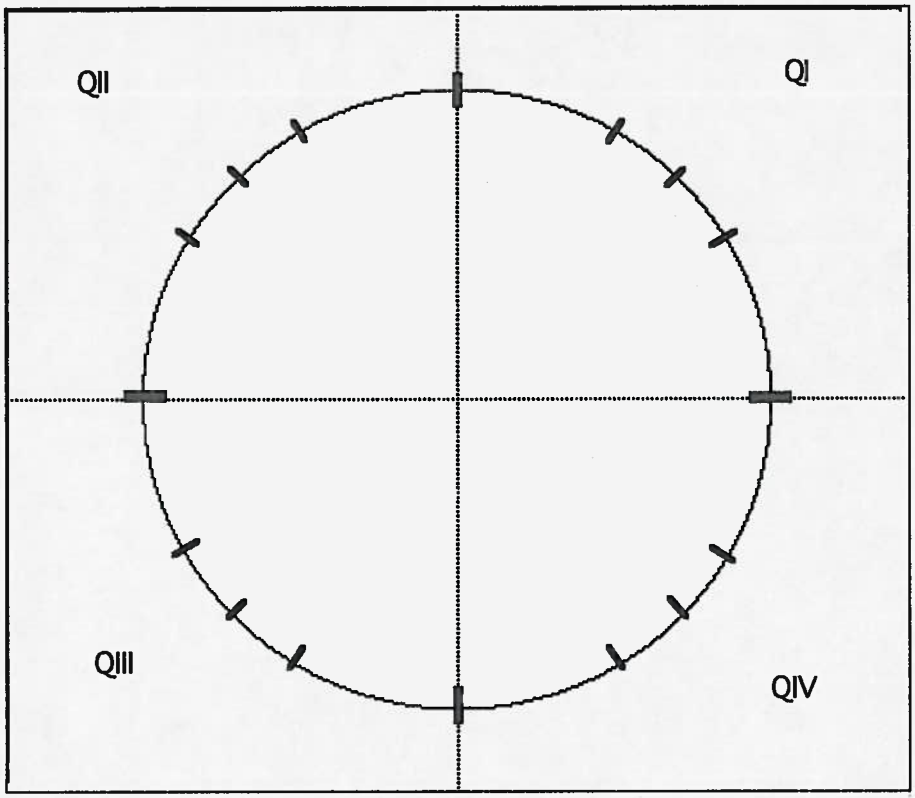
$\sec B = -\frac{4}{3}$ $\qquad$ $\csc B = -4/\sqrt{7}$

B= 138.59° ± 360n

11. Sketch one cycle of $y = 1 + 3\sec\left[\frac{\pi}{6}(x-2)\right]$



12. Fill in the Radian, Cosine and Sine values on the Unit Circle.



13. Find the exact value of the following:

(a) $\tan^2\frac{4\pi}{3} - \sec^2\frac{5\pi}{4}$

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

1

(b) $\csc\frac{5\pi}{6}\tan\frac{3\pi}{4}\cos\frac{2\pi}{3}$

$2(-1)(-\frac{1}{2}) = 1$

(c) $\sin\frac{\pi}{6}\cos\frac{\pi}{3} + \sin\frac{\pi}{3}\cos\frac{\pi}{6}$

$(\frac{1}{2})(\frac{1}{2}) + (\frac{\sqrt{3}}{2})(\frac{\sqrt{3}}{2})$

1

(d) $\dfrac{1}{\cos\frac{5\pi}{3} + \sin\frac{7\pi}{3}} + \dfrac{1}{\sin\frac{11\pi}{3} + \cos\frac{\pi}{3}}$

$$\frac{1}{\frac{1}{2} + \sqrt{3}/2} + \frac{1}{-\frac{\sqrt{3}}{2} + \frac{1}{2}}$$

$$\frac{2}{1+\sqrt{3}} + \frac{2}{1-\sqrt{3}}$$

$$\frac{2 - 2\sqrt{3} + 2 + 2\sqrt{3}}{1-3} = \boxed{-2}$$