Instructor: **Grøndahl**

Name: Key

MATH 173
Unit Exam 3

Show All Work
Justify All Conclusions
No Graphing Calculators Allowed

Dazzle Me

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1) Estimate the period of g

z	1	11	21	31	41	51	61	71	81
$g(z)$	5	3	2	3	5	3	2	3	5

$P = 41 - 1 = 40$

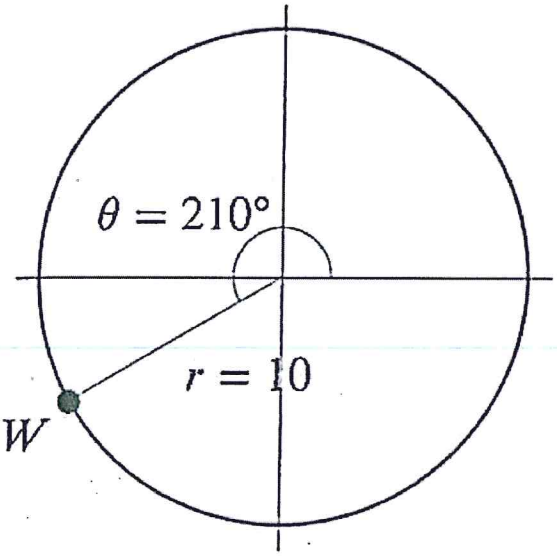
2) Give the reference angle for the angle 100°

$\theta_{REF} = 80^\circ$

3) What angle in radians corresponds to -2 rotations around the unit circle?

$\theta = -2(2\pi) = -4\pi$

4) Find the exact values for the coordinates of point W

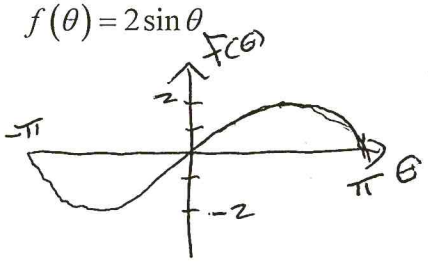


$X = r\cos\theta = 10\cos 210^\circ = 10\left(\frac{-\sqrt{3}}{2}\right) = -5\sqrt{3}$

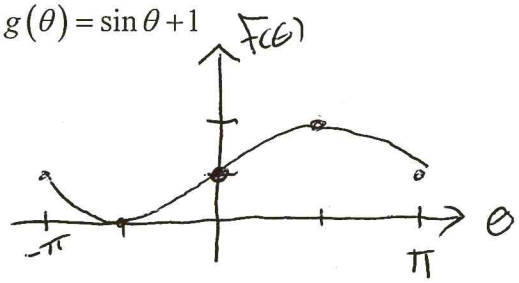
$y = r\sin\theta = 10\sin 210^\circ = 10\left(\frac{-1}{2}\right) = -5$

5) Graph the following functions and determine if the function is odd or not.

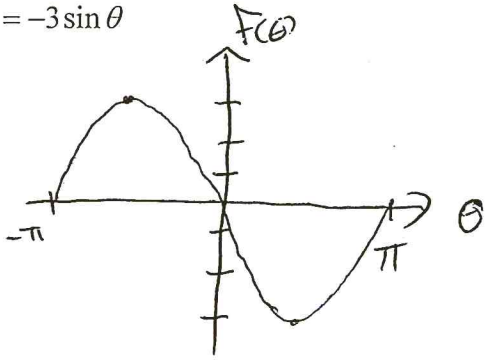
a. $f(\theta) = 2\sin\theta$



b. $g(\theta) = \sin\theta + 1$



c. $h(\theta) = -3\sin\theta$



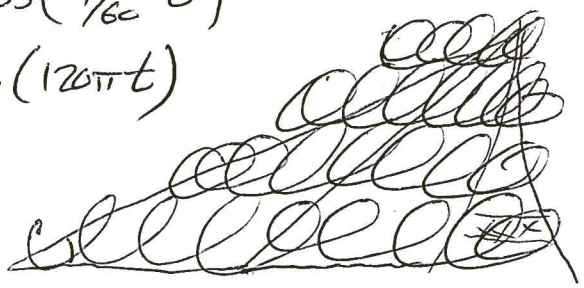
6) Household electrical power in the US is provided in the form of alternating current. Typically the voltage cycles smoothly between +155.6 volts and -155.6 volts 60 times per second. Use a sinusoidal function to model voltage, V, as a function of time, t, in seconds since the voltage was at its peak.

$V(t) = 155.6\cos\left(\frac{2\pi}{1/60}t\right)$

$= 155.6\cos(120\pi t)$

$f = 60$

$p = 1/60$

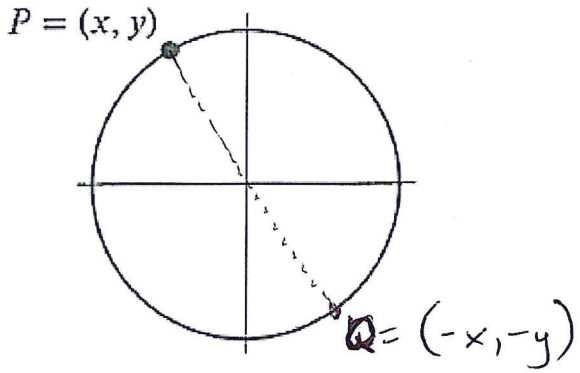


7) Find the slope of the line perpendicular to the line, l , passing through the origin at an angle of $35°$.

SLOPE OF l : $m = \tan 35°$

SLOPE OF $\perp$: $m = \frac{-1}{\tan 35°}$

8) Using the unit circle below where the point P corresponds to an angle of t radians,



a. What are the coordinates of the point Q corresponding to the angle $t+\pi$

$Q = (-x, -y)$

b. Show that $\cos(t+\pi) = -\cos t$

$\cos(t)$ = X COORDINATE OF P

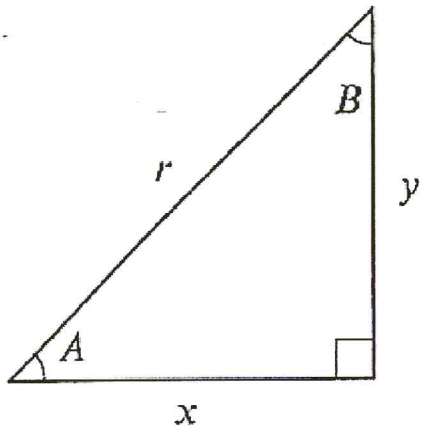
$\cos(t+\pi)$ = X COORDINATE OF Q

So $\cos(t+\pi) = -\cos(t)$

9) Solve $\tan t = \sqrt{3}$, $0 \le t \le 2\pi$

$t = \frac{\pi}{3}, \frac{4\pi}{3}$

10) Find the value of $A, r,$ and y , given that $B = 77^\circ$ and $x = 9$



$A = 90^\circ - B = 90^\circ - 77^\circ = 13^\circ$

$\text{TAN}\, B = \frac{x}{y}$

$y = \frac{9}{\text{TAN}\, 77^\circ}$

$\text{SIN}\, B = \frac{x}{r}$

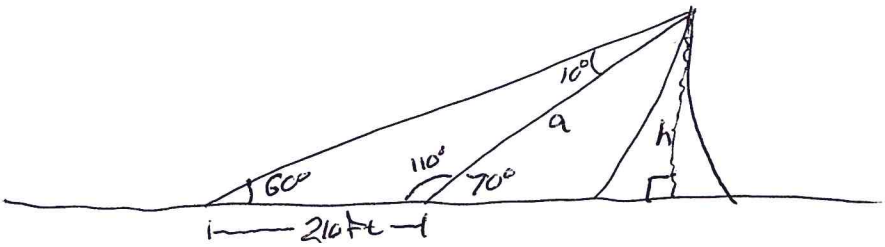
$\text{SIN}\, 77^\circ = \frac{9}{r}$

$r = 9 / \text{SIN}\, 77^\circ$

11) To measure the height of the Eiffel Tower in Paris, a person stands away from the base and measure the angle of elevation to the top of the tower to be 60°. Moving 210 ft. closer, the angle of elevation to the top of the tower is 70°. How tall is the Eiffel Tower?

$$\frac{\sin 60^\circ}{a} = \frac{\sin 10^\circ}{210}$$

$$a = \frac{210 \sin 60^\circ}{\sin 10^\circ}$$

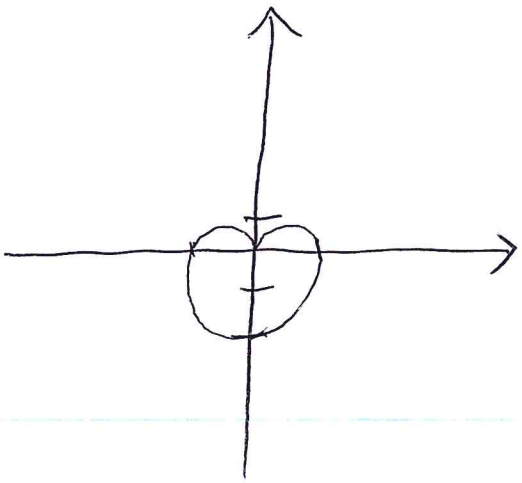


$$\sin 70^\circ = \frac{h}{a}$$

$$h = a \sin 70^\circ = \frac{210 \sin 60^\circ \sin 70^\circ}{\sin 10^\circ}$$

12) Sketch a graph of the polar equation $r = 1 - \sin\theta$

r	θ
1	0
0	$\pi/2$
1	π
2	$3\pi/2$
0	2π



13) Solve $\cos(2t)=\frac{1}{2}$

$$2t = \pm\frac{\pi}{3} + 2\pi k$$
$$t = \pm\frac{\pi}{6} + \pi k$$

14) Simplify $\frac{\cos\phi-1}{\sin\phi}+\frac{\sin\phi}{\cos\phi+1}$

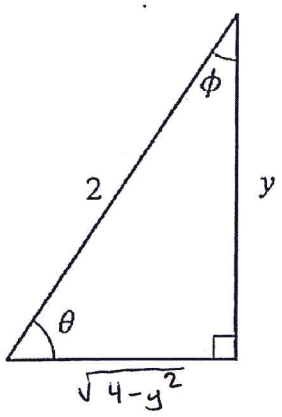
$$= \frac{(\cos\phi-1)(\cos\phi+1)}{\sin\phi(\cos\phi+1)} + \frac{\sin^2\phi}{\sin\phi(\cos\phi+1)}$$

$$= \frac{\cos^2\phi - 1 + \sin^2\phi}{\sin\phi(\cos\phi+1)}$$

$$= \frac{1-1}{\sin\phi(\cos\phi+1)}$$

$$= 0$$

15) Find a simplified expression for the following in terms of y



a. $\cos(\theta-\phi)$

$\cos\theta\cos\phi + \sin\theta\sin\phi$

$= \left(\frac{\sqrt{4-y^2}}{2}\right)\left(\frac{y}{2}\right) + \left(\frac{y}{2}\right)\left(\frac{\sqrt{4-y^2}}{2}\right)$

$= \frac{y\sqrt{4-y^2}}{2}$

b. $\sin(\theta+\phi)$

$= \sin(90^\circ)$

$= 1$

16) Use DeMoivre's Thm. to evaluate $\left(\cos\frac{2\pi}{3}+i\sin\frac{2\pi}{3}\right)^3$

$= \left(-\frac{1}{2}+\frac{\sqrt{3}}{2}i\right)^3$ $\quad r = 1$, $\theta = \frac{2\pi}{3}$

$= \left(e^{\frac{2\pi}{3}i}\right)^3$

$= e^{2\pi i}$

$= \cos 2\pi + i\sin 2\pi$

$= 1$