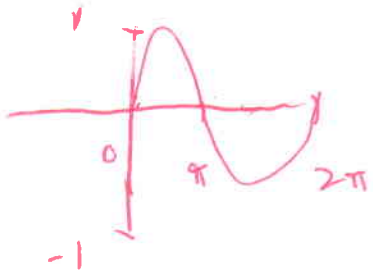
Part I. There are 10 problems in Part I. Little partial credit will be given, so be careful.

[9] 1) Fill in the table: EXACT ANSWERS

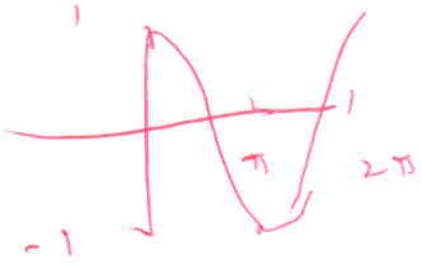
	$\Theta = 30^0$	$\Theta = 45^0$	$\Theta = 60^0$
sin Θ	$\frac{1}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{\sqrt{3}}{2}$
cos Θ	$\frac{\sqrt{3}}{2}$	$\frac{\sqrt{2}}{2}$	$\frac{1}{2}$
tan Θ	$\frac{\sqrt{3}}{3}$	1	$\sqrt{3}$

2) Perform the indicated operation:

[5] a) Graph sin(x) through one period.



[5] b) Graph cos(x) through one period.



[5] 3) If θ is an acute angle and $\cos\theta = \frac{1}{5}$, what is $\sin^2\theta$?

$\left(\sin\theta = \frac{\sqrt{24}}{5}\right)^2 = \frac{24}{25}$

[5] 4) Find the dot product of u and v if $\vec{u} = < 2, -3 >$ and $\vec{v} = < 1, -2 >$.

$u \cdot v = 2 \cdot 1 + (-3)(-2)$

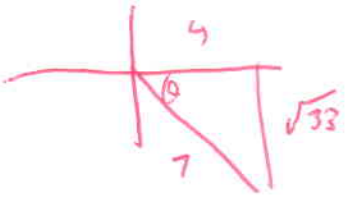
$= 2 + 6$

$= 8$

[8] 5) If $\cos(\Theta) = 4/7$ and Θ is in **quadrant 4**, find:

a) $\sin(\Theta)$ $\frac{\sqrt{33}}{7}$

c) $\sec(\Theta)$ $\frac{7}{4}$



b) $\tan(\Theta)$ $\frac{\sqrt{33}}{4}$

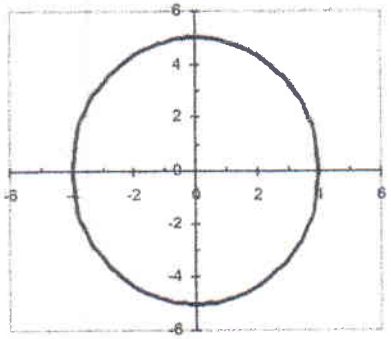
d) $2\cos(\Theta) - 1$

$2\left(\frac{4}{7}\right) - 1 = \frac{8}{7} - \frac{7}{7} = \frac{1}{7}$

$49 - 16 = 33$

$y = \sqrt{33}$

[5] 6) What is the equation for the following graph? <5 points>



a) $\frac{x^2}{5} + \frac{y^2}{4} = 1$ b) $\frac{x^2}{25} + \frac{y^2}{16} = 1$ c) $\frac{x^2}{4} + \frac{y^2}{5} = 1$ d) $\frac{x^2}{16} + \frac{y^2}{25} = 1$ e) Not listed

[5] 7) Which of the following are coterminal to an angle of 70 degrees?

a) 20 degrees b) 110 degrees c) 430 degrees d) 290 degrees e) Not a, b, c or d

$70 + 360 = 430$

[5] 8) Write $\frac{2\pi}{5}$ in degrees. 72°

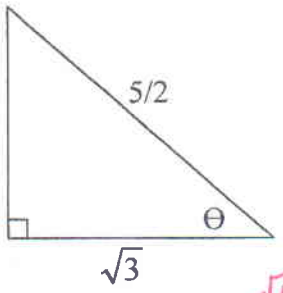
$\left(\frac{2\pi}{5}\right)\left(\frac{180^\circ}{\pi}\right) = \frac{360}{5} = 72^\circ$

$-\frac{C}{B}$ $\frac{3}{2}$

[5] 9) What is phase shift for the graph: $y = -3\sin(2x - 3) + 5$?

a) 5 b) 3/2 c) 3 d) -3/2 e) not a, b, c or d

[7] 10) Find the length of side b and $\tan(\Theta)$.



$\frac{\sqrt{13}}{2} = b$

$(\frac{5}{2})^2 = b^2 + (\sqrt{3})^2$

$\frac{25}{4} - 3 = b^2$

$\frac{25}{4} - \frac{12}{4} = \frac{13}{4} = b^2$ $b = \frac{\sqrt{13}}{2}$

$\tan\Theta = \frac{\frac{\sqrt{13}}{2}}{\sqrt{3}} = \frac{\sqrt{13}}{2} \cdot \frac{\sqrt{3}}{\sqrt{3}\cdot\sqrt{3}} = \frac{\sqrt{39}}{6}$

Part II. Show all your work. Each problem is worth 6 points.

[6] 11) Given $u = \langle -2,4 \rangle$ and vector $v = \langle -1,-1 \rangle$ what is $|4u - v| = ?$

$4u = \langle -8, 16 \rangle$

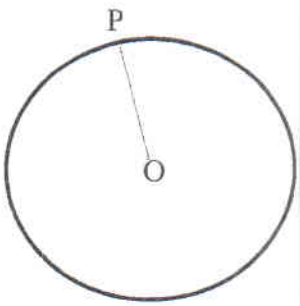
$|\langle -8, 16 \rangle - \langle -1, -1 \rangle|$

$|-7, 17| = \sqrt{(-7)^2 + 17^2} = \sqrt{338}$

[6] 12) Suppose that P is a point on a circle with a radius of 10 inches and the ray OP is rotating with angular speed 100 degrees per second.

a) Find the angular speed in radians per second.

$(100^\circ)(\frac{1\pi}{180^\circ}) = \frac{10}{18} = \frac{5\pi}{9}$

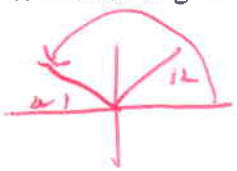


b) Find the distance travelled by P along the arc after 1 second.

$s = r\theta$

$s = (\frac{5\pi}{9})(10'') = \frac{50\pi}{9}''$

[6] 13) Given $\sin x = 0.2$, state the solution set on $[0,360°)$. Approximate to nearest degree. Show all work clearly.

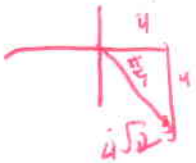


$180 - 12$

$\arcsin(.2) \approx 12°$

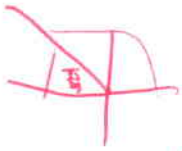
$\approx 168°$

[6] 14) If the rectangular coordinates of a point are $(4,-4)$, what are its polar coordinates (r, θ) given the following?



a) $r > 0, 0 \le \theta < 2\pi$

$\left(4\sqrt{2}, \frac{7\pi}{4}\right)$

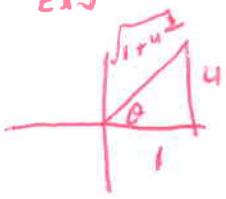


b) $r < 0, 0 \le \theta < 2\pi$

$\left(-4\sqrt{2}, \frac{3\pi}{4}\right)$

[6] 15) Write the trigonometric expression as an algebraic expression in terms of u (u>0) $\csc(\tan^{-1} u)$.

$\tan^{-1}(u)$



$\sin\theta = \frac{u}{\sqrt{u^2+1}}$

$\csc\theta = \frac{\sqrt{u^2+1}}{u}$

[6] 16) Perform the indicated operation:

a) Factor: $2\sin^2 x - 4\cos x \sin x$

$2\sin x(\sin x - 2\cos x)$

b) Simplify: $\frac{\cos^2 x}{1-\sin^2 x}$

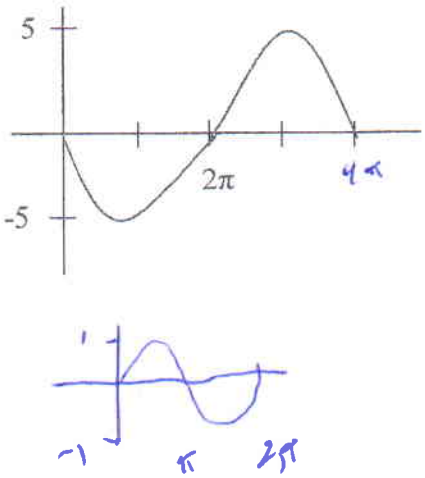
$\frac{\cos^2 x}{\cos^2 x} = 1$

Part III. Partial credit will be given here. Show all your work.

[12] 17) Write an equation for each.

6 Answer $-5\sin\left(\frac{1}{2}x\right)$

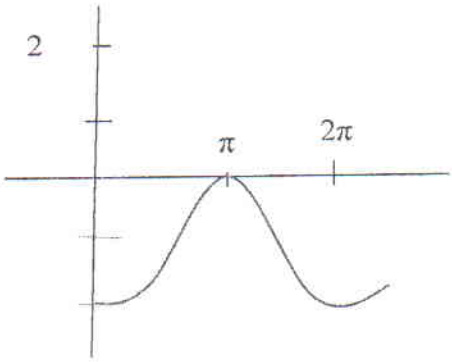
a)



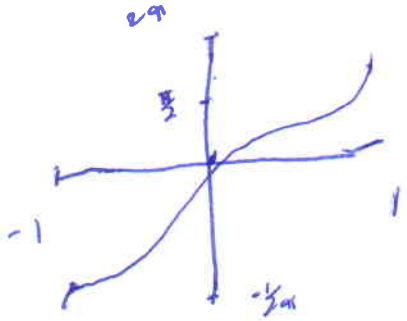
$-\cos(x)-1$

6 Answer $-\cos(x)-1$

b)



5 c) Graph f(x) = $sin^{-1}x$.
Label axes with at least 2 ticks each.



18) [4] a) Write in rectangular form: $(2, 120^0)$ [4]b) convert to polar equation: $x^2 + y^2 = 36$

$(-1, \sqrt{3})$

$r^2 = 36$

$r = 6$

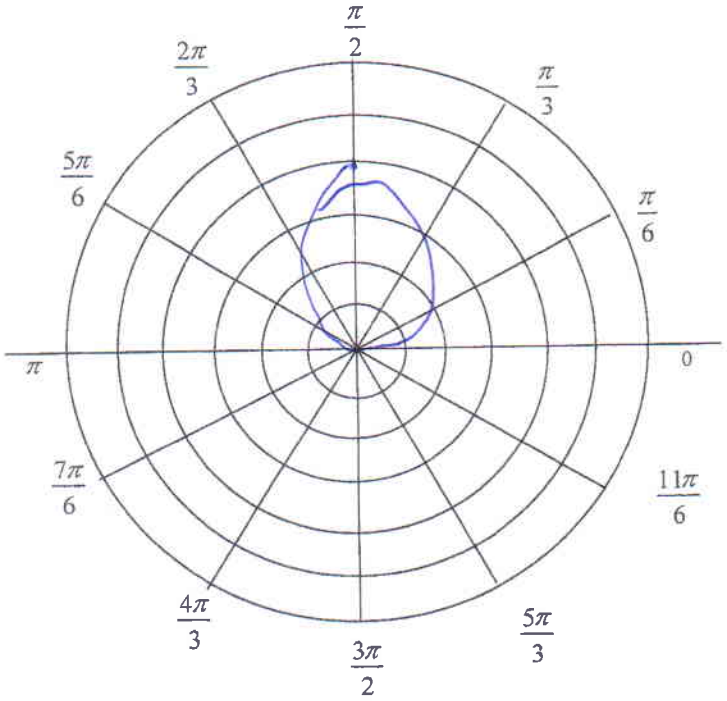
[8] 19) Verify (prove): $\frac{tanx-cotx}{sinxcosx} = sec^2x - csc^2x$

Include all steps and explanations

$\frac{\sin x}{\cos x} - \frac{\cos\alpha}{\sin\alpha} = \frac{\sin^2\alpha - \cos^2\alpha}{\sin\alpha\cos\alpha}$

$\frac{\sin^2 x}{\cot\alpha \sin^2\alpha} = \frac{\cos^2\alpha}{\cos^2 \sin^2\alpha} = \frac{1}{\cos^2\alpha} - \frac{1}{\sin^2\alpha} = \sec^2\alpha - \csc^2\alpha$

[7] 20) a) Graph the polar equation $r = 4\sin\theta$ on the axes below.



21) Solve the following.

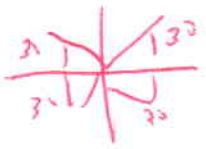
[5] a) Find **all** solutions to $4\cos^2 x - 3 = 0$. Express in terms of **degrees**.

Note: **All solutions** are the same as **general solutions.**

$4\cos^2\alpha = 3$

$\cos^2\alpha = \frac{3}{4}$

$\cos\alpha = \pm\frac{\sqrt{3}}{2}$



$30^\circ + 360^\circ N$

$150^\circ + 360^\circ N$

$210^\circ + 360^\circ N$

$330^\circ + 360^\circ N$

[5] b) $2\sin^2 x = 1 - \sin x$ on $[0, 2\pi)$

$2\sin^2\alpha + \sin\alpha - 1 = 0$

$(2\sin\alpha - 1)(\sin\alpha + 1) = 0$

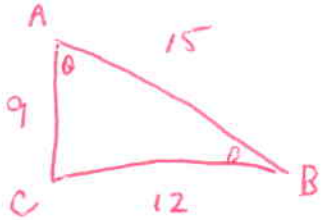
$2\sin\alpha = 1 \qquad \sin\alpha = -1$

$\sin\alpha = \frac{1}{2}$

$x = \frac{\pi}{6}, \frac{5\pi}{6}$

$x = \frac{3\pi}{2}$

[6] 22) Solve the RIGHT triangle, ABC: a = 12 inches, b= 9 inches. Round to two decimal places. Use degrees and put units on answers.



$\arcsin\left(\frac{12}{15}\right) > 53.13$

$\arccos\left(\frac{9}{15}\right)$

$\arcsin\left(\frac{9}{15}\right)$ } 36.87

$\arccos\left(\frac{12}{15}\right)$

c = 15

C = 90 degrees

A = 53.13°

B = 36.87°

[6] 23) Change $2y^2 - 12x + 3x^2 = 6$ into standard form. Identify the graph as an ellipse, circle, parabola. Then graph (include center and foci if necessary).

$(3x^2 - 12x\ \ ) + 2y^2 = 6$ (12)

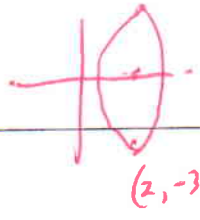
$3(x^2 - 4x\ \ ) + 2(y^2) = 18$

$\frac{(x-2)^2}{6} + \frac{y^2}{9} = 1$ (+4)

center: (2, 0)

foci: $(2, 0-\sqrt{3})$

$(2, 0+\sqrt{3})$



$c^2 = 3$

$c = \sqrt{3}$

PART IV. Here are 6 problems. Do any 4, but only 4. Each is worth 10 points. Be sure to check the box for each problem to be graded.

☐ Grade

24) Find cube roots of $1+i$. Leave answers in trig form.

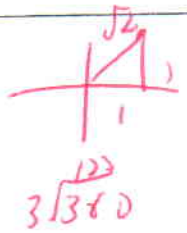
$(1+i)^{\frac{1}{3}}$

$\left[\sqrt{2}(\cos 45^\circ + i\sin(45^\circ)\right]^{\frac{1}{3}}$

$z_1 = \sqrt{2}^{\frac{1}{3}}(\cos 15^\circ + i\sin 15^\circ)$

$z_2 = \sqrt{2}^{\frac{1}{3}}(\cos(135^\circ) + i\sin(135^\circ)$

$z_3 = \sqrt{2}^{\frac{1}{3}}(\cos(255^\circ) + i\sin(255^\circ))$



☐ Grade

25) Graph the following. Indicate and label all critical information.

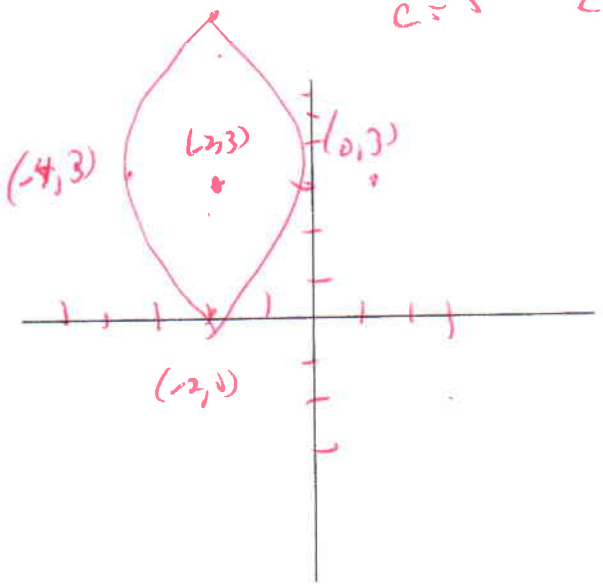
$\frac{(y-3)^2}{9}+\frac{(x+2)^2}{4}=1$ $(-2,6)$

$a^2=9$ $a=3$

$b^2=4$ $b=2$

$c^2=5$ $c=\sqrt{5}$

- Center: $(-2,3)$
- Vertices: $(-2,6)$, $(-2,0)$ $(-4,3)$ $(0,3)$
- Foci: $(-2, 3+\sqrt{5})$ $(-2, 3-\sqrt{5})$

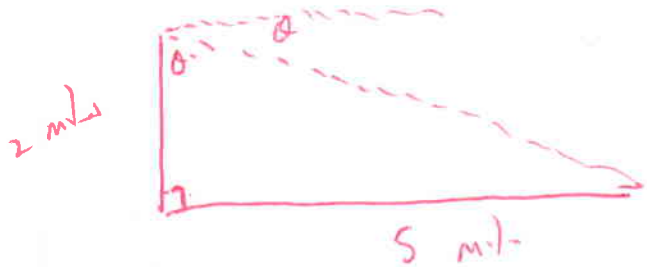


☐ Grade

26) An airplane is flying at a height of 2 miles above the ground. The distance along the ground from the airplane to the airport is 5 miles. What is the angle of depression from the airplane to the airport? Round to 1 decimal place.

$\theta = \text{invtan}\left(\frac{5}{2}\right) = 68.2^\circ$

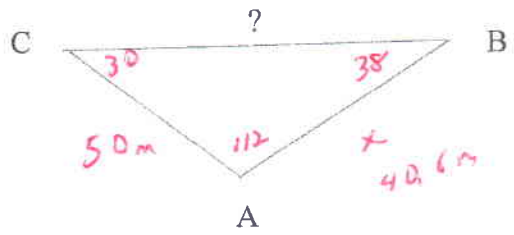
$90 - 68.2 = 21.8^\circ$



☐ Grade

27) Points A & B are on opposite sides of a lunar crater. Point C is 50 m from point A. The measure of angle BAC is 112 degrees and the measure of angle ABC is 38 degrees. What is the width of the crater?

75.3 m



$\frac{\sin 38^\circ}{50} = \frac{\sin 30}{x}$

$x = 40.6$ m

$\frac{\sin 112^\circ}{y} = \frac{\sin 38}{50}$

☐ Grade

28) Prove the following identity: $\tan(A+B) = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

$\frac{\sin(A+B)}{\cos(A+B)} = \frac{\sin A\cos B + \cos A \sin B}{\cos A \cos B - \sin A \sin B}$

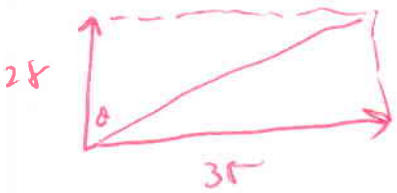
$\frac{\frac{\sin A \cos B}{\cos A \cos B} + \frac{\cos A \sin B}{\cos A \cos B}}{\frac{\cos A \cos B}{\cos A \cos B} - \frac{\sin A \sin B}{\cos A \cos B}} = \frac{\tan A + \tan B}{1 - \tan A \tan B}$

☐ Grade

29) Two forces of 28 N and 35 N act on objects at right angles.

a) Find the magnitude of the resultant vector

b) Find the angle the resultant vector makes with the smaller force.



$r = \sqrt{35^2 + 28^2}$

$r = \sqrt{2009} = 7\sqrt{41}$

$r = 44.82$ N

$\theta = \tan^{-1}\left(\frac{35}{28}\right) = 51.34^\circ$