Fill in the blanks.

SCORE: ____ / 4 PTS

[a] The point with rectangular co-ordinates $(-6, -2\sqrt{3})$ has polar co-ordinates $(4\sqrt{3}, \frac{7\pi}{6})$. (1)

$r = \sqrt{(-6)^2 + (-2\sqrt{3})^2}$

$\tan\theta = \frac{-2\sqrt{3}}{-6} = \frac{\sqrt{3}}{3}$ IN Q3

NOTE: Both parts of your answer for this question must be positive.

[b] The point with polar co-ordinates $(9, -\frac{4\pi}{3})$ has rectangular co-ordinates $(-\frac{9}{2}, \frac{9\sqrt{3}}{2})$. (1)

$x = 9\cos(-\frac{4\pi}{3})$

$y = 9\sin(-\frac{4\pi}{3})$

[c] The polar co-ordinates $(-6, -\frac{6\pi}{5})$ correspond to the same point as the polar co-ordinates $(6, \frac{9\pi}{5})$ and $(-6, \frac{4\pi}{5})$. (1) (1)

$-\frac{6\pi}{5} + \pi + 2\pi$

$-\frac{6\pi}{5} + 2\pi$

NOTE: Both your answers for this question must be positive.

Convert the polar equation $r = 2 - 3\cos 2\theta$ to rectangular, and simplify as shown in the website handout. **SCORE: ____ / 5 PTS**

$r = 2 - 3(\cos^2\theta - \sin^2\theta)$ (1)

$r = 2 - 3\left(\frac{x^2}{r^2} - \frac{y^2}{r^2}\right)$ (1)

$r^3 = 2r^2 - 3x^2 + 3y^2$ (1)

$(x^2+y^2)^{\frac{3}{2}} = 2(x^2+y^2) - 3x^2 + 3y^2$

$= 5y^2 - x^2$ (1)

$(x^2+y^2)^3 = (5y^2 - x^2)^2$ (1)

OR

$r = 2 - 3(2\cos^2\theta - 1)$ (1)

$r = 2 - 3\left(\frac{2x^2}{r^2} - 1\right)$ (1)

$r^3 = 2r^2 - 6x^2 + 3r^2$

$= 5r^2 - 6x^2$ (1)

$(x^2+y^2)^{\frac{3}{2}} = 5(x^2+y^2) - 6x^2$

$= 5y^2 - x^2$ (1)

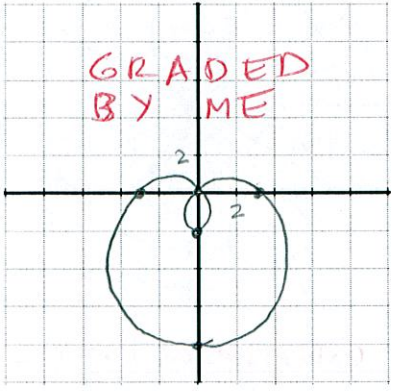
$(x^2+y^2)^3 = (5y^2 - x^2)^2$ (1)

GRADE AGAINST ONE VERSION ONLY

TALK TO ME IF YOU REPLACED $\cos 2\theta$ WITH $1 - 2\sin^2\theta$

Consider the graph of the polar equation $r = 3 - 5\sin\theta$.

SCORE: _____ / 6 PTS



[a] Fill in the blanks.

$|3| < |-5|$ IE. $\left|\frac{3}{-5}\right| < 1$

[i] The shape of the graph is a/an LIMACON WITH LOOP (1).

[ii] The graph DOES (1) pass through the pole.

does / does not

NO POINTS IF "LOOP" MISSING

[iii] Find the **rectangular** coordinates of the

θ	r
0	3
$\frac{\pi}{2}$	-2
π	3
$\frac{3\pi}{2}$	8

x – intercept(s): $(3,0)$ $(-3,0)$ (1)

y – intercept(s): $(0,-2)$ $(0,-8)$, (1)

[b] Sketch the graph on the grid provided above. **You must provide a scale for the axes & plot all points from part [a][iii] above.**

Consider the graph of the polar equation $r = 4 - 4\sin 3\theta$.

SCORE: _____ / 15 PTS

POLE AXIS POLE

NOTE: $(-r, \theta)$, $(-r, \pi-\theta)$ and $(r, \pi+\theta)$ tests do NOT show that the graph is symmetric

[a] **Using the information above, and the tests and shortcuts shown in lecture**, test if the graph is symmetric over the pole, the polar axis, and/or $\theta = \frac{\pi}{2}$. State your conclusions in the table. **NOTE: Run as FEW tests as needed to prove your answers are correct.**

AXIS: $r = 4 - 4\sin 3(-\theta)$ (1)

$r = 4 + 4\sin 3\theta$ (1/2) ✗

$\theta = \frac{\pi}{2}$: $r = 4 - 4\sin 3(\pi - \theta)$ (1)

$r = 4 - 4\sin(3\pi - 3\theta)$

$r = 4 - 4(\sin 3\pi \cos 3\theta - \cos 3\pi \sin 3\theta)$

$\sin 3\pi = 0$, $\cos 3\pi = -1$

$r = 4 - 4\sin 3\theta$ ✓ (1)

Type of symmetry	Conclusion
Over the polar axis (1/2)	NO CONCLUSION
Over $\theta = \frac{\pi}{2}$ (1/2)	SYMMETRIC
Over the pole (1/2)	NO CONCLUSION

[b] Based on the results of part [a], what is the minimum interval of the graph you need to plot first (before using reflections to draw the rest of the graph) ?

$\left[-\frac{\pi}{2}, \frac{\pi}{2}\right]$ (1)

[c] Find the angles **algebraically** in the minimum interval in part [b] at which the graph goes through the pole.

$0 = 4 - 4\sin 3\theta$ $\quad -\frac{\pi}{2} \le \theta \le \frac{\pi}{2}$

(1) $\sin 3\theta = 1$ $\quad -\frac{3\pi}{2} \le \theta \le \frac{3\pi}{2}$

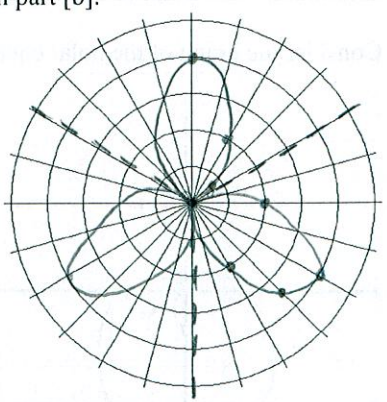
(1) $3\theta = -\frac{3\pi}{2}, \frac{\pi}{2}$ (1/2) $\rightarrow \theta = -\frac{\pi}{2}, \frac{\pi}{6}$

[d] Find the value of r (rounded to 1 decimal place) for all common angles in the minimum interval in part [b].

NOTE: You do NOT need to show work, only answers.

θ	r	(1/4)
$-\frac{\pi}{2}$	0	(1/4)
$-\frac{\pi}{3}$	4	(1/4)
$-\frac{\pi}{4}$	6.8	(1/4)
$-\frac{\pi}{6}$	8	(1/4)
0	4	(1/2)

θ	r	
$\frac{\pi}{6}$	0	(1/2)
$\frac{\pi}{4}$	1.2	(1/2)
$\frac{\pi}{3}$	4	(1/2)
$\frac{\pi}{2}$	8	(1/2)



GRADED BY ME

[d] Sketch the graph on the grid provided below. **You must provide a scale for the polar axis & plot all points from part [c] above.**