

Fill in the blanks.

SCORE: _____ / 4 PTS

- [a] The point with rectangular co-ordinates $(-2\sqrt{3}, -6)$ has polar co-ordinates

① $(4\sqrt{3}, \frac{4\pi}{3})$. $r = \sqrt{(-2\sqrt{3})^2 + (-6)^2}$
 $\tan \theta = \frac{-6}{-2\sqrt{3}} = \sqrt{3}$ IN Q_3

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

- [b] The point with polar co-ordinates $(8, -\frac{7\pi}{6})$ has rectangular co-ordinates

① $(-4\sqrt{3}, 4)$. $x = 8 \cos(-\frac{7\pi}{6})$
 $y = 8 \sin(-\frac{7\pi}{6})$

- [c] The polar co-ordinates $(-6, -\frac{8\pi}{7})$ correspond to the same point as the polar co-ordinates $(6, \frac{13\pi}{7})$ and $(-6, \frac{6\pi}{7})$.

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

① $-\frac{8\pi}{7} + \pi + 2\pi$

① $-\frac{8\pi}{7} + 2\pi$

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

$$r = 3 - 2(\cos^2\theta - \sin^2\theta) \textcircled{1} \quad \text{OR} \quad r = 3 - 2(1 - 2\sin^2\theta) \textcircled{1}$$

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

$$r^3 = 3r^2 - 2x^2 + 2y^2 \textcircled{1}$$

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

$$= x^2 + 5y^2 \textcircled{1}$$

$$(x^2 + y^2)^3 = (x^2 + 5y^2)^2 \textcircled{1}$$

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

$$r^3 = 3r^2 - 2r^2 + 4y^2$$

$$= r^2 + 4y^2 \textcircled{1}$$

$$(x^2 + y^2)^{\frac{3}{2}} = x^2 + y^2 + 4y^2$$

$$= x^2 + 5y^2 \textcircled{1}$$

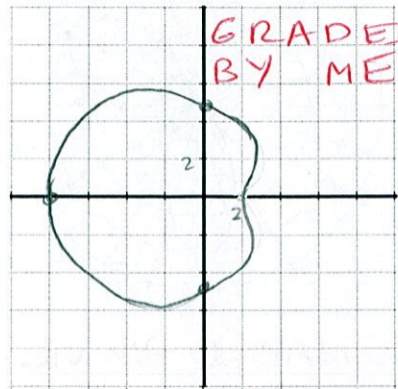
$$(x^2 + y^2)^3 = (x^2 + 5y^2)^2 \textcircled{1}$$

GRADE
AGAINST
ONE
VERSION
ONLY

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

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

SCORE: ___ / 6 PTS



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Fill in the blanks.

[i] The shape of the graph is a/an LIMACON WITH DIMPLE ①

[ii] The graph DOES NOT pass through the pole. **NO POINTS IF "DIMPLE" MISSING**
does / does not

[iii] Find the rectangular coordinates of the

x - intercept(s)

(2, 0) (-8, 0) ①

y - intercept(s)

(0, 5) (0, -5) 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.

0
π/2
π
3π/2

5
8
5
2
r

$$|-3| < |5| < |2-3| \text{ i.e. } 1 < |5-3| < 2$$

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
 $r = 4 - 4 \sin 3\theta$ ②

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

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

$[-\frac{\pi}{2}, \frac{\pi}{2}]$ ①

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

$0 = 4 + 4 \sin 3\theta$ $-\frac{\pi}{2} \leq \theta \leq \frac{\pi}{2}$
 ① $\sin 3\theta = -1$ $-\frac{3\pi}{2} \leq 3\theta \leq \frac{3\pi}{2}$
 ② $3\theta = -\frac{\pi}{2}, \frac{3\pi}{2}$ ① $\rightarrow \theta = -\frac{\pi}{6}, \frac{\pi}{2}$

- [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.

① $\frac{\pi}{4}$ $-\frac{\pi}{2}$ $r = 8$

① $\frac{\pi}{4}$ $-\frac{\pi}{3}$ $r = 4$

① $\frac{\pi}{4}$ $-\frac{\pi}{4}$ $r = 1.2$

① $\frac{\pi}{4}$ $-\frac{\pi}{6}$ $r = 0$

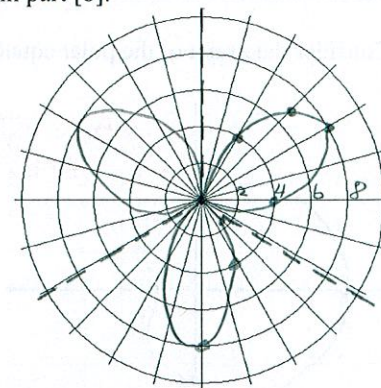
0 $r = 4$ ②

$\frac{\pi}{6}$ $r = 8$ ②

$\frac{\pi}{4}$ $r = 6.8$ ②

$\frac{\pi}{3}$ $r = 4$ ②

$\frac{\pi}{2}$ $r = 0$ ②



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- [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.**