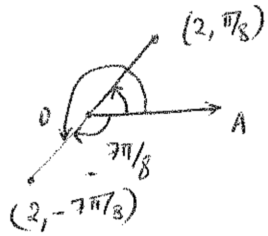
Name: Key **Section:**

Clear your desk of everything except pens, pencils and erasers. **Show all your work.**
If you have a question raise your hand and I will come to you.

1. (3 points) Find a suitable θ for the polar co-ordinate representation: $(2, \frac{\pi}{8}) \equiv (-2, \theta)$ (that represents the same point). (Hint: θ is not unique, and one of them can be obtained as $0 \leq |\theta| \leq \pi$)

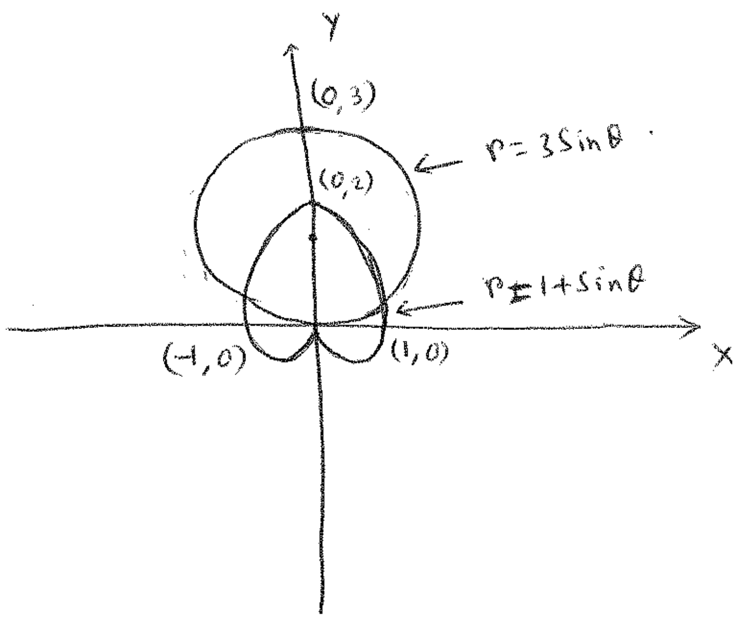


$(2, \pi/8) \equiv (-2, -7\pi/8) \equiv (-2, 9\pi/8)$

$\theta = -\underline{7\pi/8}$ or $\underline{9\pi/8}$.

[Full marks if any other correct θ]

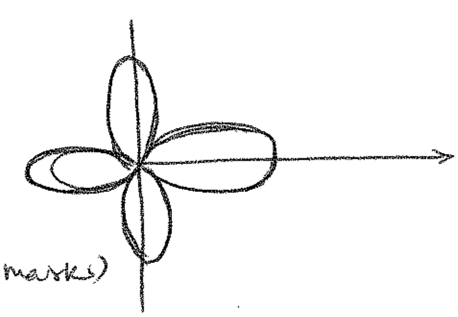
2. (4 points) Draw the curves $r = 3\sin\theta$ and $r = 1 + \sin\theta$ on the same xy-plane (in Cartesian space). Show the co-ordinates of every intersecting points with x and y-axes.



[~~4 pts~~ each pt for each co-ordinate of point. −1 for each mismatch or wrong co-ordinate]

3. (3 points) Set up the definite integral for evaluating the area of just **one leaf** of $r = \cos(2\theta)$. DO NOT EVALUATE THE INTEGRAL.

$$A = \int_{-\pi/4}^{\pi/4} \frac{1}{2} r^2 \, d\theta$$



$$= \underline{\int_{-\pi/4}^{\pi/4} \frac{1}{2} \cos^2(2\theta)\, d\theta}. \checkmark \text{ (full marks)}$$

$$= 2 \cdot \frac{1}{2} \underline{\int_0^{\pi/4} \cos^2(2\theta)\, d\theta} \quad (\;\text{"}\;) \quad = \underline{\int_0^{\pi/4} \cos^2(2\theta)\, d\theta}$$