

Name: KEY

Show all work on the quiz in the space provided. Correct answers without work will not receive credit. There are to be no calculators used for this quiz.

(4 points) 1. Convert the following equations (a) from rectangular to polar and (b) from polar to rectangular.

(a) $2xy = -1$

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

$$2r^2\cos\theta\sin\theta = -1$$

$$r^2\sin 2\theta = -1$$

(b) $r = \frac{3}{2 + \sin\theta}$

$$2r + r\sin\theta = 3$$

$$2r = 3 - r\sin\theta$$

$$4r^2 = (3 - r\sin\theta)^2 = 9 - 6r\sin\theta + r^2\sin^2\theta$$

$$4(x^2 + y^2) = 9 - 6x + x^2$$

$$4y^2 = -3x^2 - 6x + 9$$

$$3x^2 + 6x + 4y^2 = 9$$

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

$$(b) 3x^2 + 6x + 4y^2 = 9$$

(6 points) 2. Make at least 6 values for θ of the equation $r = 2 - 3 \cos \theta$ and graph this equation, labelling your points. Be sure to show work for any symmetry properties you use!

| θ | r |
|----------|------------------------------------------|
| 0 | $2 - 3 = -1$ |
| $\pi/6$ | $2 - \frac{3\sqrt{3}}{2} \approx -0.598$ |
| $\pi/4$ | $2 - \frac{3\sqrt{2}}{2} \approx -1.121$ |
| $\pi/3$ | $2 - \frac{3}{2} = 0.5$ |
| $\pi/2$ | $2 - 0 = 2$ |
| $2\pi/3$ | $2 + \frac{3}{2} = 3.5$ |
| $3\pi/4$ | $2 + \frac{3\sqrt{2}}{2} \approx 4.12$ |
| $5\pi/6$ | $2 + \frac{3\sqrt{3}}{2} \approx 4.598$ |
| π | $2 + 3 = 5$ |

check symmetry:

- to polar axis, sub $-\theta$ for θ :
 $2 - 3 \cos(-\theta) = 2 - 3 \cos \theta = r$
 so this equation is symmetric with respect to the polar axis

- to line $\theta = \frac{\pi}{2}$, sub $\pi - \theta$ for θ :
 $2 - 3 \cos(\pi - \theta) =$
 $2 - 3(\cos \pi \cos \theta + \sin \pi \sin \theta) =$
 $2 - 3(-\cos \theta + 0) =$
 $2 + 3 \cos \theta \neq r$, so this is not necessarily symmetric to the line $\theta = \frac{\pi}{2}$.

