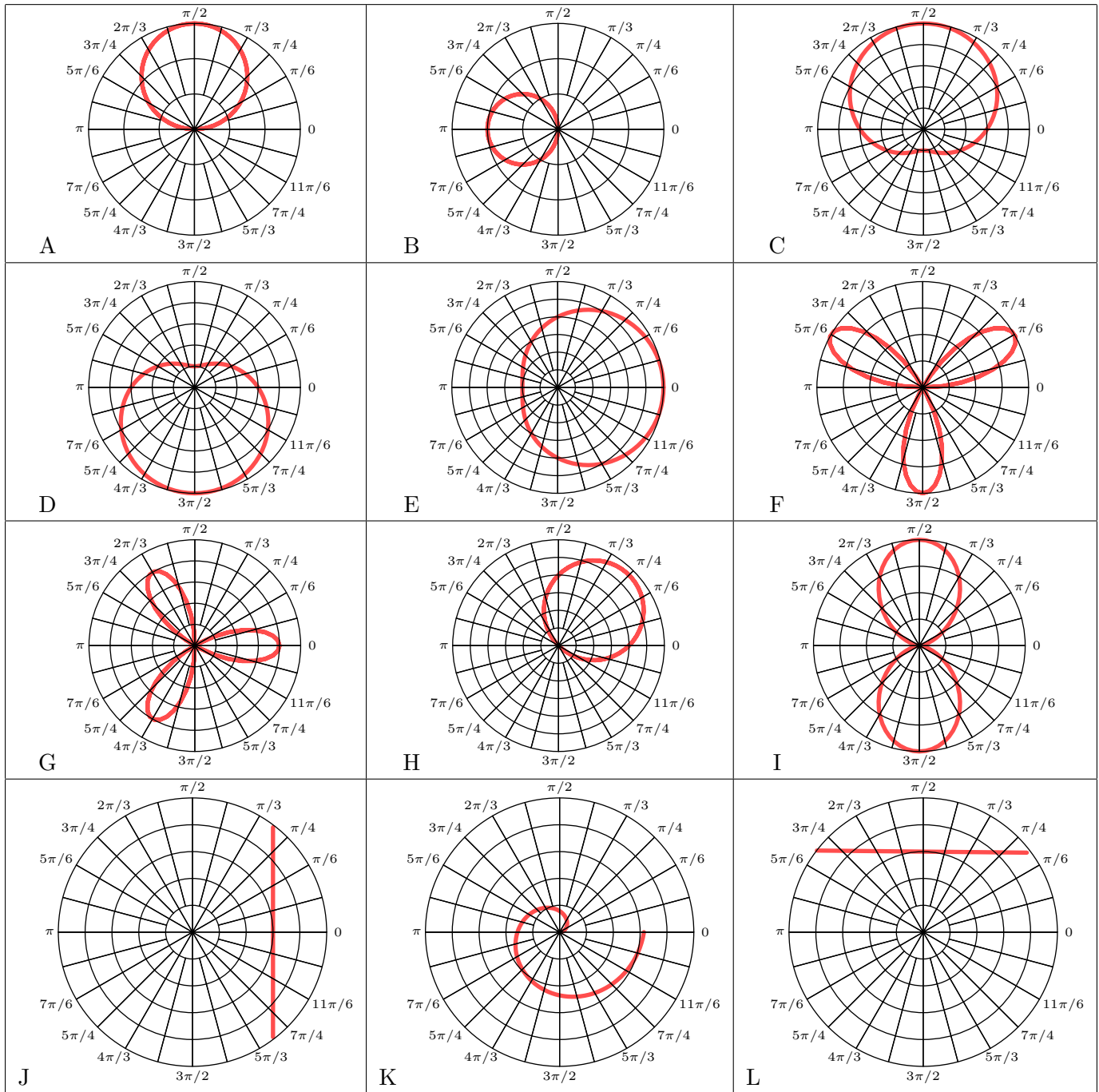


## Matching – 1 pt each



1.  $r = 3 \sec(\theta)$  \_\_\_\_\_

2.  $r = 4 \cos(3\theta)$  \_\_\_\_\_

3.  $r = 4 \sin(\theta) + \cos(\theta)$  \_\_\_\_\_

4.  $r = -2 \cos(\theta)$  \_\_\_\_\_

5.  $r = 3 + 2 \sin(\theta)$  \_\_\_\_\_

6.  $r = 4 \sin(3\theta)$  \_\_\_\_\_

7.  $r = 4 + 2 \cos(\theta)$  \_\_\_\_\_

8.  $r = 3 - 2 \sin(\theta)$  \_\_\_\_\_

9.  $r = 4 \sin^2(\theta)$  \_\_\_\_\_

10.  $r = 3 \sin(\theta)$  \_\_\_\_\_

11.  $r = 3 \csc(\theta)$  \_\_\_\_\_

12.  $r = \theta/2$  \_\_\_\_\_

## Multiple Choice – 2 pts each

Work must be shown for credit.

1. Convert the polar coordinate to rectangular coordinates:  $(-2, 2\pi/3)$

A.  $(1, \sqrt{3})$   
B.  $(1, 1/\sqrt{3})$   
C.  $(1, -\sqrt{3})$   
D.  $(\sqrt{3}, 1)$   
E.  $(-1, 1/\sqrt{3})$

1. \_\_\_\_\_

2. Convert the polar coordinate to rectangular coordinates:  $(4, -\pi/2)$

A.  $(4, 0)$   
B.  $(-4, 0)$   
C.  $(0, -4)$   
D.  $(0, 4)$   
E.  $(4, -4)$

2. \_\_\_\_\_

3. Convert the rectangular coordinate to polar coordinates:  $(15, 5\sqrt{3})$

A.  $(10\sqrt{3}, \frac{\pi}{3})$   
B.  $(10\sqrt{3}, \frac{\pi}{4})$   
C.  $(10\sqrt{3}, \frac{\pi}{6})$   
D.  $(10\sqrt{3}, \frac{\pi}{3})$   
E.  $(\sqrt{30}, \frac{\pi}{6})$

3. \_\_\_\_\_

4. Convert the rectangular coordinate to polar coordinates:  $(-12, -12)$

A.  $(12\sqrt{2}, \frac{3\pi}{4})$   
B.  $(12\sqrt{2}, -\frac{3\pi}{4})$   
C.  $(12\sqrt{2}, -\frac{\pi}{4})$   
D.  $(2\sqrt{12}, \frac{3\pi}{4})$   
E.  $(2\sqrt{12}, -\frac{5\pi}{4})$

4. \_\_\_\_\_

5. Convert the rectangular equation to polar:  $x^2 + y^2 = 16$

A.  $r = 16 \sin \theta$

B.  $r = \frac{16}{2 \sin \theta}$

C.  $r = 4$

D.  $r = 16$

E.  $r = 4 \sin \theta$

5. \_\_\_\_\_

6. Convert the rectangular equation to polar:  $2xy = 1$

A.  $r = \frac{1}{2(\sin \theta + \cos \theta)}$

B.  $r^2 = \frac{1}{2} \sec(\theta) \cot(\theta)$

C.  $r^2 = \frac{1}{2 \sin \theta \cos \theta}$

D.  $r = \frac{1}{2 \sin(2\theta)}$

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

6. \_\_\_\_\_

7. Convert the polar equation to rectangular:  $\theta = 2\pi/3$

A.  $y = -\sqrt{3}x$

B.  $y = \sqrt{3}x$

C.  $x + y = \sqrt{3}$

D.  $y = -(1/\sqrt{3})x$

E. None of the above

7. \_\_\_\_\_

8. Convert the polar equation to rectangular:  $r = \frac{2}{1 + \sin \theta}$

A.  $x^2 - y^2 = (x + y)$

B.  $x^2 + y^2 = (y - 2)^2$

C.  $x^2 + xy - y^2 = 4$

D.  $x^2 + y^2 + y = 4$

E. None of the above

8. \_\_\_\_\_

9. Find the intersection points of  $r = 3 \cos \theta$  and  $r = \sqrt{3} \sin \theta$

A.  $\{\pi/3, 5\pi/6\}$

B.  $\{4\pi/3, 7\pi/3\}$

C.  $\{5\pi/6, 11\pi/6\}$

D.  $\{2\pi/3, 4\pi/3\}$

E.  $\{\pi/3, 4\pi/3\}$

9. \_\_\_\_\_

## Free Response Section

### Calculator Active

A remote control drone is flying in the air and casts a shadow onto an  $xy$  plane below. Its shadow on the  $xy$ -plane has position  $(x(t), y(t))$  at time  $t \geq 0$  with

$$\frac{dx}{dt} = \sqrt{3t} \text{ and } \frac{dy}{dt} = 3 \cos\left(\frac{t^2}{2}\right)$$

The particle is at position  $(2, 4)$  at time  $t = 4$ .

1. Find the acceleration vector at time  $t = 4$ .
2. Find the  $y$ -coordinate of the position of the shadow at time  $t = 0$ .
3. On the interval  $0 \leq t \leq 4$ , at what time does the speed of the shadow first reach 3.5 ?
4. Find the total distance traveled by the shadow over the time interval  $0 \leq t \leq 4$ .