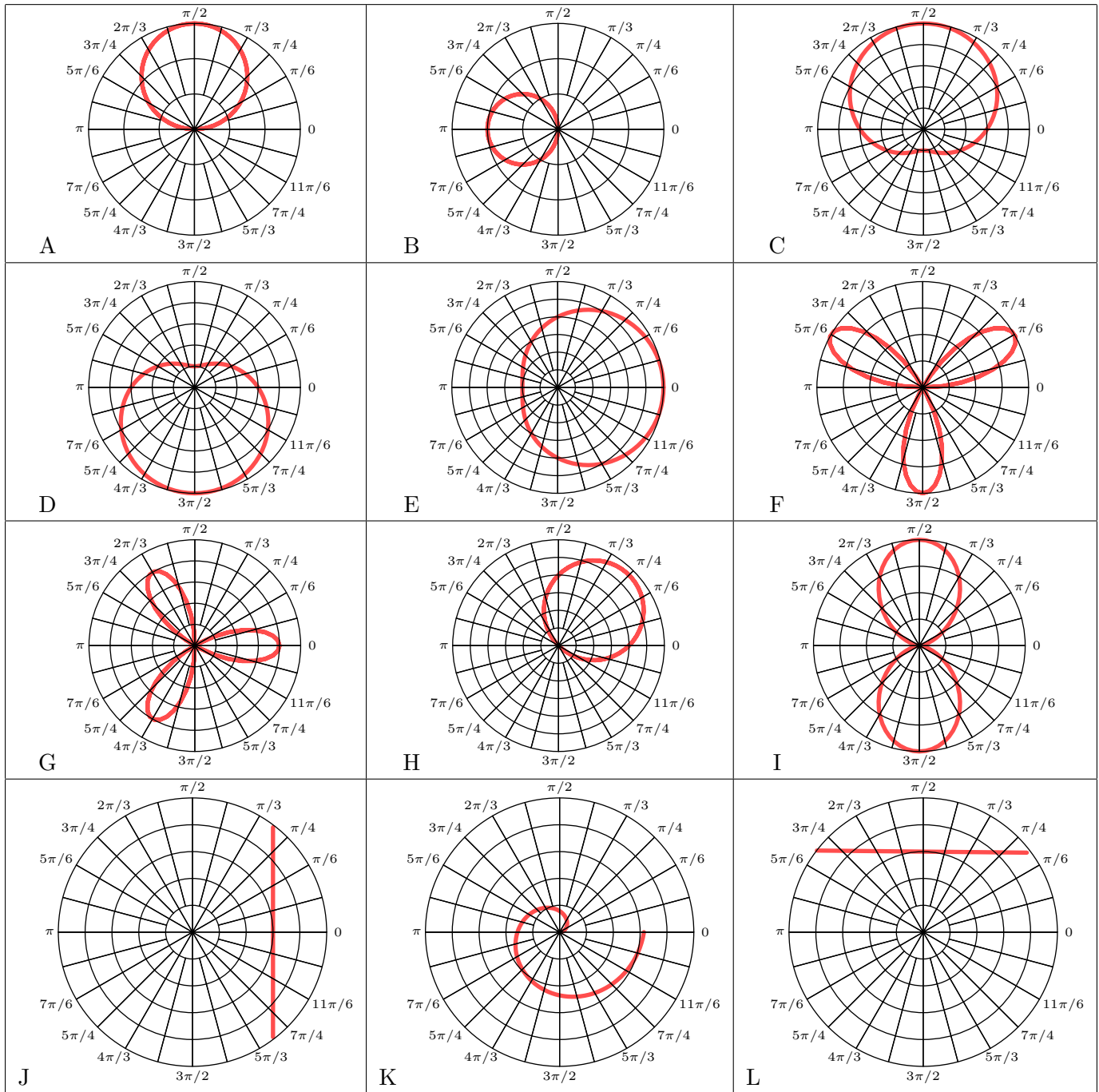


KEY KEY A Matching – 1 pt each



1. $r = 3 \sec(\theta)$ **J**

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

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

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

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

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

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

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

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

10. $r = 3 \sin(\theta)$ **A**

11. $r = 3 \csc(\theta)$ **L**

12. $r = \theta/2$ **K**

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. $x^2 + y^2 + y = 8$

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 $t = 4$.

$$a(4) = \langle v'_x(4), v'_y(4) \rangle = \langle 0.433, -11.872 \rangle$$

2. Find the y -coordinate of the position of the shadow at time $t = 0$.

$$s(0) = s(4) + \int_4^0 v(t) dt = \langle -7.238, 0.601 \rangle$$

3. On the interval $0 \leq t \leq 4$, at what time does the speed of the shadow first reach 3.5 ?

$$\text{Solve } \sqrt{v_x^2(t) + v_y^2(t)} - 3.5 = 0 \text{ and find } t = 2.226$$

4. Find the total distance traveled by the shadow over the time interval $0 \leq t \leq 4$.

$$\int_0^4 \sqrt{v_x^2(t) + v_y^2(t)} dt = 11.129$$