

AP Calculus BC

Polar Equations - Area

1) $r = 5 \sin \theta$

$5 \sin \theta = 0$

$\theta = 0, \pi$

$$\text{Area} = \frac{1}{2} \int_0^{\pi} (5 \sin \theta)^2 d\theta$$

$$= \underline{19.6349}$$

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

$1 - \cos 2\theta = 0$

$\cos 2\theta = 1$

$2\theta = 0, 2\pi$

$\theta = 0, \pi$

$$\text{Area} = \frac{1}{2} \int_0^{\pi} (1 - \cos(2\theta))^2 d\theta$$

$$= \underline{2.356}$$

3) $r = 3 \cos(3\theta)$

$3 \cos 3\theta = 0$

$\cos 3\theta = 0$

$3\theta = \frac{\pi}{2}$

$\theta = \frac{\pi}{6}$

$$\text{Area} = \int_0^{\pi/6} (3 \cos 3\theta)^2 d\theta$$

$$= \underline{2.356}$$

4) $r = 4 + 4 \sin \theta$

$$\text{Area} = \int_{\pi/2}^{3\pi/2} (4 + 4 \sin \theta)^2 d\theta$$

$$= \underline{75.398}$$

5) $r = 1 + 2 \cos \theta$

$1 + 2 \cos \theta = 0$

$\cos \theta = -\frac{1}{2}$

$\theta = \frac{2\pi}{3}, \frac{5\pi}{3}$

$$\text{Area} = \frac{1}{2} \int_{2\pi/3}^{5\pi/3} (1 + 2 \cos \theta)^2 d\theta$$

$$= \underline{1.248}$$

6) $r = 4 \sin(6\theta)$

$4 \sin(6\theta) = 0$

$\sin(6\theta) = 0$

$6\theta = 0, \pi$

$\theta = 0, \pi/6$

$$\text{Area} = \frac{1}{2} \int_0^{\pi/6} (4 \sin(6\theta))^2 d\theta$$

$$= \underline{2.094}$$