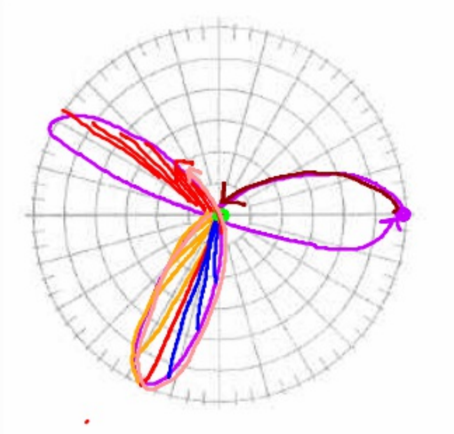
$r = \cos 3\theta$

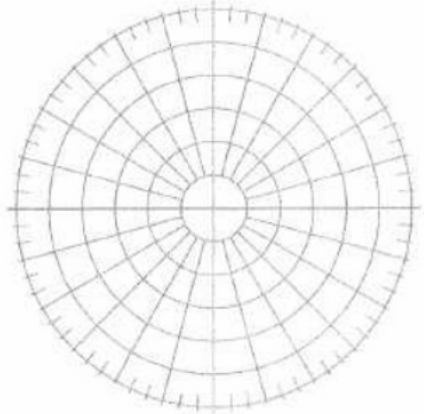
$\boxed{\left.\frac{dr}{d\theta}\right|_{\theta=\frac{\pi}{2}} = 3}$

5. Graph the circle $r = 2\sin\theta$. Then determine the slope of the curve at $\theta = \frac{\pi}{4}$ and then determine $\frac{dr}{d\theta}$

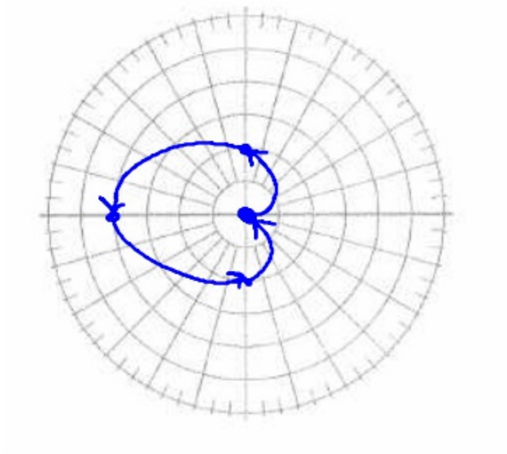


6. Graph the cardiod $r = 2 - 2\sin\theta$. Then determine the slope of the curve at $\theta = \frac{\pi}{2}$

and then determine $\frac{dr}{d\theta}$



7.Graph the cardiod $r=2-2\cos\theta$. Then determine the slope of the curve at $\theta=\frac{\pi}{2}$



8.Graph the 4 pedaled rose $r=\cos 2\theta$. Then $\boxed{\text{determine the slope}}$ of the curve at $\theta=\frac{3\pi}{2}$ and then determine $\left.\frac{dr}{d\theta}\right|_{\theta=\frac{3\pi}{2}} = -2\sin 2\theta \to -2\sin 2\left(\frac{3\pi}{2}\right)$

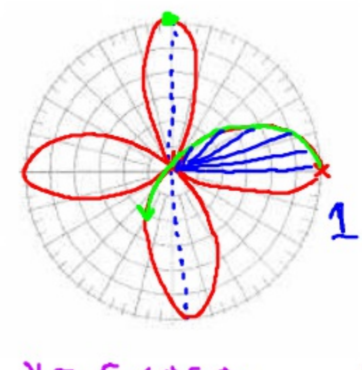
$\to -2\sin 3\pi = 0$

$$\left.\frac{dr}{d\theta}\right|_{\theta=\frac{\pi}{4}} = -2\sin 2\theta$$

$$= -2\sin\frac{2\pi}{4}$$

$$= -2\sin\frac{\pi}{2}$$

$$= -2$$



1

$$\boxed{\frac{dr}{d\theta}=0}$$

$$\boxed{\frac{dy}{dx}=\frac{0}{-1}=0}$$

$x = r\cos\theta$ $\quad$ $y = r\sin\theta$

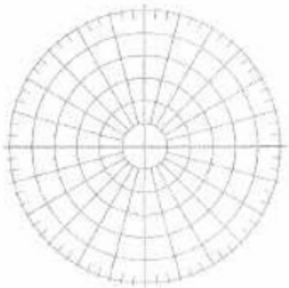
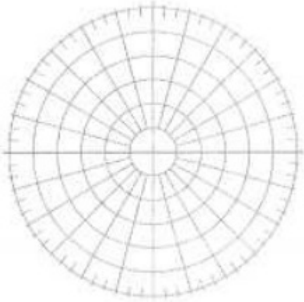
$x = \cos 2\theta\cos\theta$ $\quad$ $y = \cos 2\theta\sin\theta$

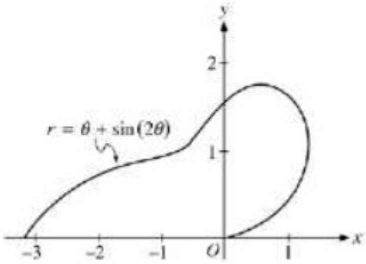
$$\frac{dx}{d\theta} = \cos(2\theta)(-\sin\theta) + \cos\theta(-2\sin 2\theta)$$

$$= \cos\left(2\cdot\frac{3\pi}{2}\right)\cdot\left(-\sin\left(\frac{3\pi}{2}\right)\right) = -1$$

$$\frac{dy}{d\theta} = \cos 2\theta\cdot\underbrace{\cos\theta}_{\cos\frac{3\pi}{2}} + \sin\theta(-2\sin 2\theta)$$

$$\frac{dy}{d\theta} = 0$$

	1. Graph the 4 pedaled rose $r=\sin 2\theta$. Then determine the slope of the curve at $\theta=\frac{3\pi}{2}$  2. Graph the limacon $r=2-3\sin\theta$. Then determine the slope of the curve at $\theta=\pi$ 



2005 BC2 (Calculator)

The curve above is drawn in xy-plane and is described by the equation in polar coordinates $r=\theta+\sin(2\theta)$ for $0\le\theta\le\pi$, where r is measured in meters and θ is measured in radians. The derivative of r with respect to θ is given by $\frac{dr}{d\theta}=1+2\cos(2\theta)$.

a. Find the slope of the curve at the point $\theta=\frac{\pi}{2}$.

c. Find the angle θ that corresponds to the point on the curve with x-coordinate -2.

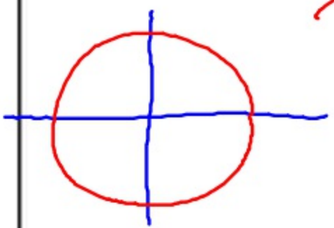
d. For $\frac{\pi}{2}<\theta\le\frac{2\pi}{3}$, $\frac{dr}{d\theta}$ is negative. What does this fact say about r? What does this fact say about the curve?

e. Find the value of θ in the interval $0\le\theta\le\frac{\pi}{2}$ that corresponds to the point on the curve in the first quadrant with greatest distance from the origin. Justify your answer.

$A = \frac{1}{2}\int_0^{\pi} 4^2 \, d\theta = \frac{1}{2}\left[4^2\theta\right]_0^{\pi}$

$\frac{1}{2}[16\pi] = 8\pi$

Circle $r = 4$



Whole Circle

$A = \pi r^2$

$A = \pi(4)^2 = 16\pi$

$\frac{1}{2}$ circle

$A = \frac{1}{2}\pi r^2 = 8\pi$

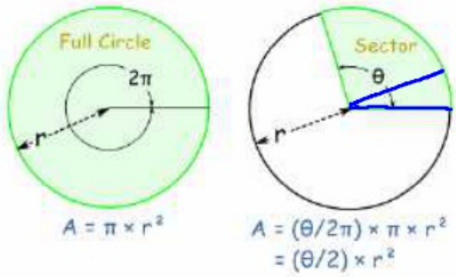
$\frac{\pi}{2\pi} =$

Polar Area

Area of a Sector

You can work out the Area of a Sector by comparing its angle to the angle of a full circle.

Note: we are using radians for the angles.

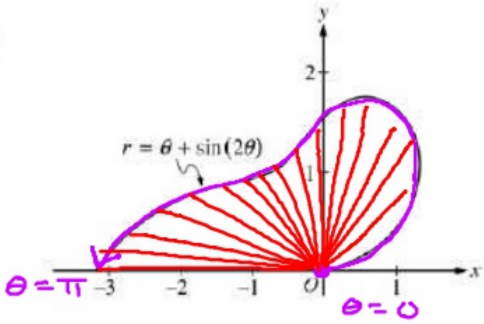


$A = \left(\frac{\theta}{2\pi}\right)\pi r^2$

$A = \frac{\theta}{2} r^2$

$A = \frac{1}{2}\theta r^2$

$$\boxed{A = \frac{1}{2}\int_{\theta_1}^{\theta_2} r^2 \, d\theta}$$



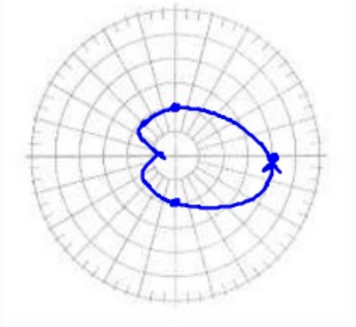
The curve above is drawn in xy-plane and is described by the equation in polar coordinates $\boxed{r = \theta + \sin(2\theta)}$ for $0 \le \theta \le \pi$, where r is measured in meters and θ is measured in radians. The derivative of r with respect to θ is given by $\frac{dr}{d\theta} = 1 + 2\cos(2\theta)$.

b. Find the area bounded by the curve and the x-axis

$A = \frac{1}{2}\int_0^{\pi} (\theta + \sin(2\theta))^2 =$

$r = 2 + 2\cos\theta$

Find the area inside the polar curve $r = 2(1+\cos\theta)$.

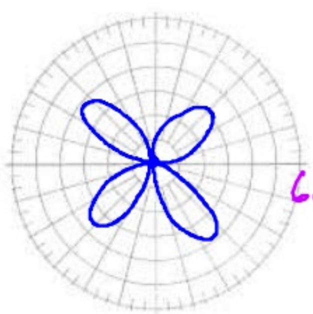


$$A = \frac{1}{2}\int_0^{2\pi} \left[2(1+\cos\theta)\right]^2 d\theta$$

OR

$$A = \frac{1}{2}(2)\int_0^{\pi} \left[2(1+\cos\theta)\right]^2 d\theta$$

Find the area inside the polar curve $r = 2\sin(2\theta)$.



$$6.283 \rightarrow A = \frac{1}{2}\int_0^{2\pi} \left(2\sin(2\theta)\right)^2$$

OR

$$6.283 \rightarrow A = \frac{1}{2}(2)\int_0^{\pi} \left(2\sin(2\theta)\right)^2$$

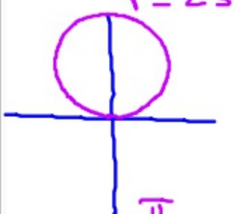
OR

$$6.283 \rightarrow A = \frac{1}{2}(4)\int_0^{\pi/2} \left(2\sin(2\theta)\right)^2$$

OR

$$6.283 \rightarrow A = \frac{1}{2}(8)\int_0^{\pi/4} \left(2\sin(2\theta)\right)^2$$

$r = 2\sin\theta$



$$A = \frac{1}{2}\int_0^{\pi} \left(2\sin\theta\right)^2$$