جامعة تكريت

كلية التربية للبنات

قسم الرياضيات

المرحلة الثانية

مادة التفاضل المتقدم

رسم المنحني على شكل زهرة في الاحداثيات القطبية

Graphing flower-shaped curves in Polar Coordinates

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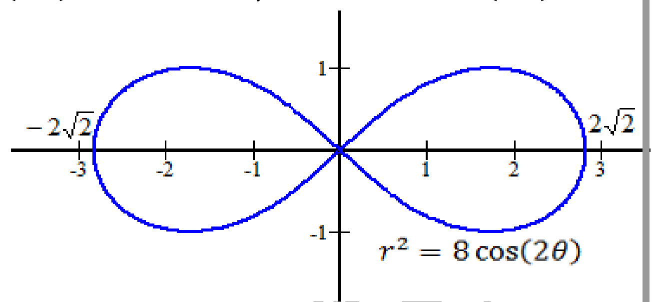
Ex: Sketch the following:

1) $r^2 = 8\cos(2\theta)$ 2) $r^2 = -9\cos(2\theta)$ 3) $r^2 = -16\sin(2\theta)$

Sol: Let α the angle od around, then

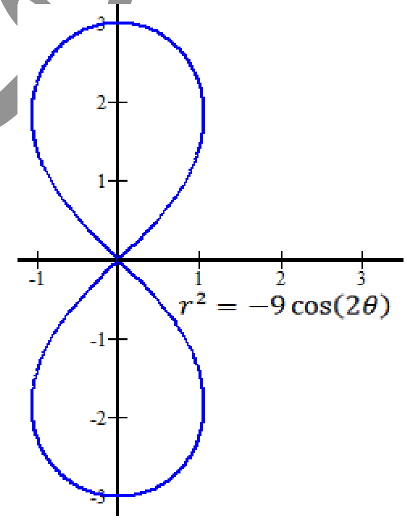
1) $r^2 = 8\cos(2\theta)$, then $a^2 = 8$,

so $a = 2\sqrt{2}$. $\alpha = 0$.

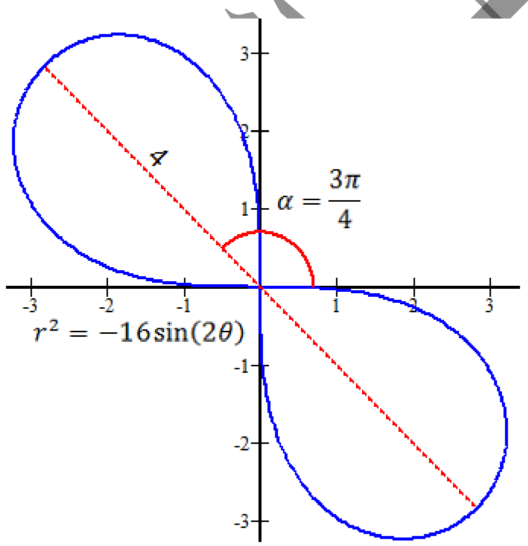


2) $r^2 = -9\cos(2\theta)$, then $-a^2 = -9$, so $a = 3$.

Or $r^2 = 9\cos 2\left(\theta - \frac{\pi}{2}\right)$.$\alpha = \frac{\pi}{2}$.



3) $r^2 = -16\sin(2\theta)$, then $-a^2 = -16$, so $a = 4$.Or $r^2 = -16cos2\left(\theta - \frac{\pi}{4}\right)$. Therefore $r^2 = 16cos2\left(\theta - \frac{3\pi}{4}\right)$.$\alpha = \frac{3\pi}{4}$.



Ex: Sketch the following:

1) $r^2 = -9\cos\left(2\theta - \frac{\pi}{3}\right)$ 2) $r^2 = 16\cos\left(\frac{\pi}{4} - 2\theta\right)$

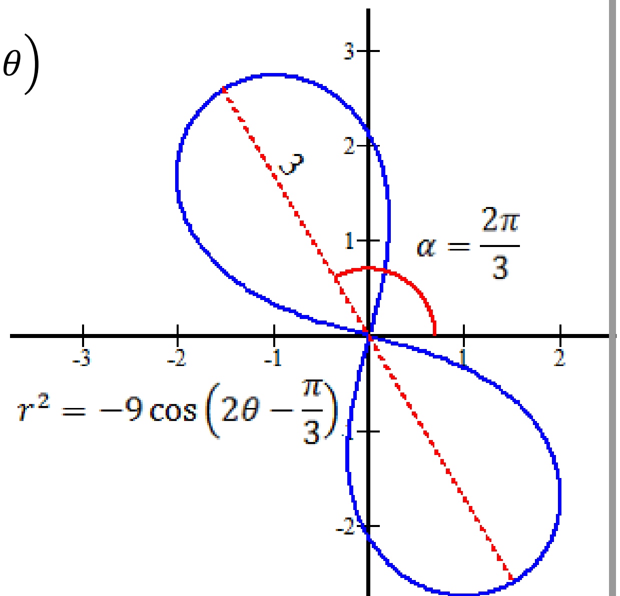
3) $r^2 = 8\cos^2\theta - 4$ 4) $r^2 = 9 - 18\sin^2\theta$

Sol: 1) $r^2 = -9\cos\left(2\theta - \frac{\pi}{3}\right)$

$\Rightarrow r^2 = -9\cos 2\left(\theta - \frac{\pi}{6}\right)$

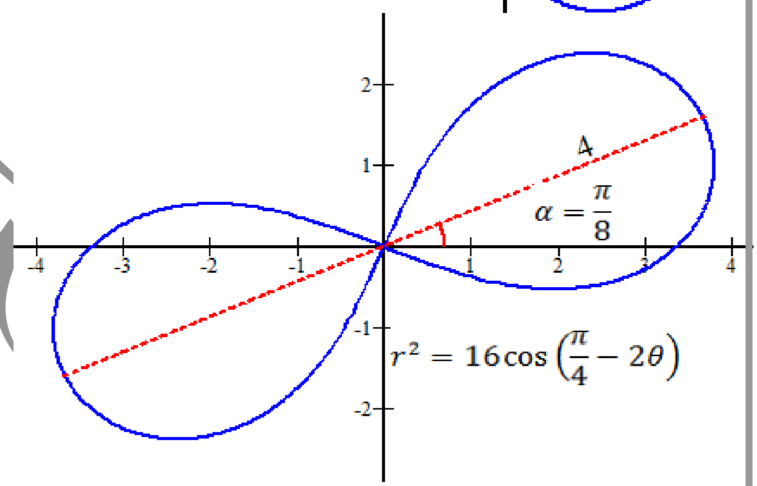
$\Rightarrow r^2 = 9\cos 2\left(\theta - \frac{2\pi}{3}\right)$

So $\alpha = \frac{2\pi}{3}$.



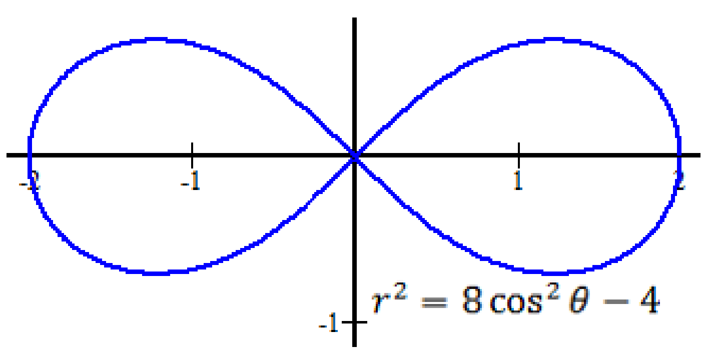
2) $r^2 = 16\cos\left(\frac{\pi}{4} - 2\theta\right)$

$\Rightarrow r^2 = 16\cos 2\left(\theta - \frac{\pi}{8}\right)$. $\alpha = \frac{\pi}{8}$.



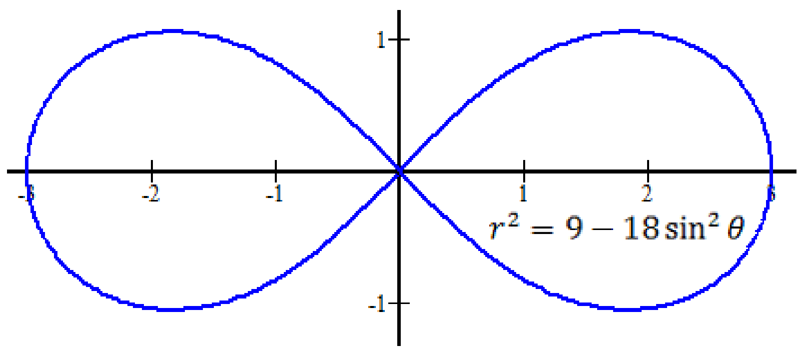
3) $r^2 = 8\cos^2\theta - 4$

$\Rightarrow r^2 = 4(2\cos^2\theta - 1) = 4\cos(2\theta)$.



4) $r^2 = 9 - 18\sin^2\theta$

$\Rightarrow\ r^2 = 9(1 - 2\sin^2\theta) = 9\cos(2\theta).$



Ex: Sketch the following: (H.W.)

1) $r^2 = \pm a^2 sin\theta$ 2) $r^2 = \pm a^2\cos\theta$ 3) $r^2 = 9\cos\left(\theta + \frac{\pi}{6}\right)$.

(4) Rose Curve

Equations of the form

$$r = asin(n\theta) n > 1 , n \in Z^+$$

$$r = acos(n\theta) n > 1 , n \in Z^+$$

Represent flower-shaped curves called Roses

Remark:

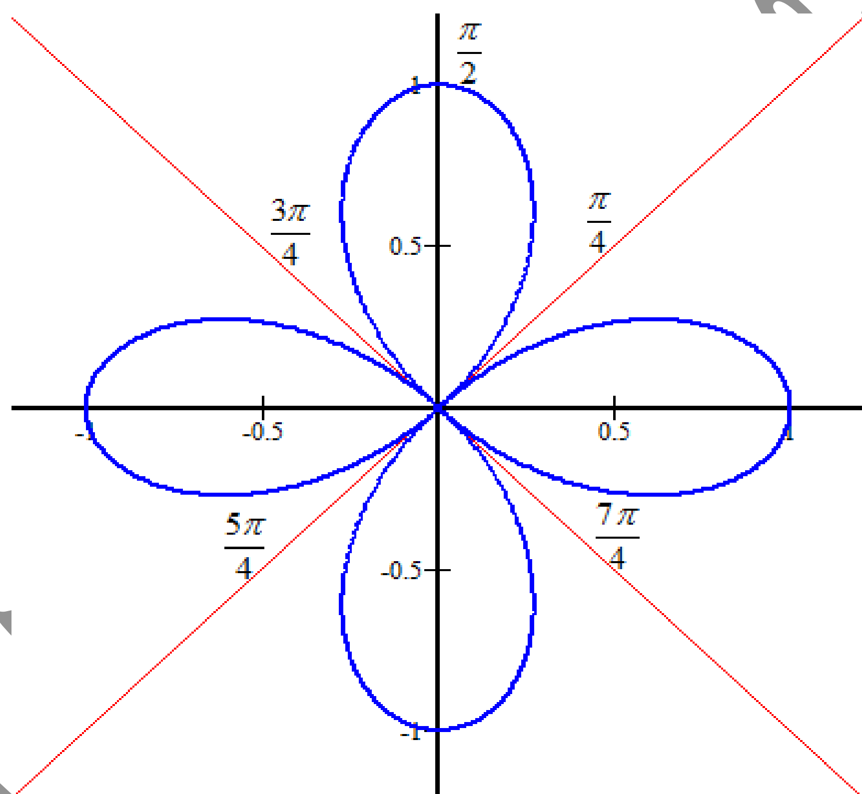
- يكون رسم وردة ذات (n)ورقة اذا كان nعدداً فردياً.
- يكون رسم وردة ذات (2n)ورقة اذا كان (n)عدداً زوجياً.

Ex: Sketch $r = cos2\theta$

Sol: when $r = 0 \Rightarrow cos2\theta = 0 \Rightarrow 2\theta = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \dots \Rightarrow \theta = \frac{\pi}{4}, \frac{3\pi}{4}, \frac{5\pi}{4}, \dots$

So $r = 1 \Rightarrow cos2\theta = 1 \Rightarrow 2\theta = 0, \frac{4\pi}{2}, \frac{8\pi}{2}, \frac{12\pi}{2}, \dots \Rightarrow \theta = 0, \pi, 2\pi, 3\pi, \dots$

also$r = -1 \Rightarrow cos2\theta = -1 \Rightarrow 2\theta = \frac{2\pi}{2}, \frac{6\pi}{2}, \frac{10\pi}{2}, \dots \Rightarrow \theta = \frac{\pi}{2}, \frac{3\pi}{2}, \frac{5\pi}{2}, \dots$



Ex: Sketch $r = sin3\theta$ 3-leafs

Sol: when $r = 0 \Rightarrow sin3\theta = 0 \Rightarrow 3\theta = 0, \frac{2\pi}{2}, \frac{4\pi}{2}, \frac{6\pi}{2}, \ldots \Rightarrow \theta = 0, \frac{\pi}{3}, \frac{2\pi}{3}, \pi, \ldots$

So $r = 1 \Rightarrow sin3\theta = 1 \Rightarrow 3\theta = \frac{\pi}{2}, \frac{5\pi}{2}, \frac{9\pi}{2}, \ldots \Rightarrow \theta = \frac{3\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}, \ldots$

also$r = -1 \Rightarrow sin3\theta = -1 \Rightarrow 3\theta = \frac{3\pi}{2}, \frac{7\pi}{2}, \frac{11\pi}{2}, \ldots \Rightarrow \theta = \frac{3\pi}{6}, \frac{7\pi}{6}, \frac{11\pi}{6}, \ldots$