


Special Polar Graphs

Several important types of graphs have equations that are simpler in polar form than in rectangular form. For example, the circle $r = 4 \sin \theta$ in Example 1 has the more complicated rectangular equation $x^2 + (y - 2)^2 = 4$. The following list gives several other types of graphs that have simple polar equations.

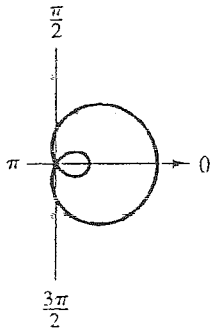
$$r = a + b \cos \theta$$

$a \neq 0$

$a + b \sin \theta$, $a \neq 0$, is one of these rotated 90° .

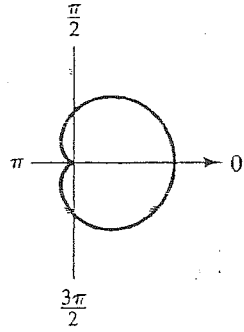
$a + b \cos n\theta$
are roses
e.g. $r = \cos 2\theta$ 

$a + b \sin n\theta$ is
 $a + b \cos n\theta$
rotated 90°



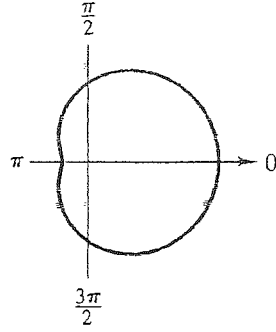
$$\frac{a}{b} < 1$$

Limaçon with inner loop



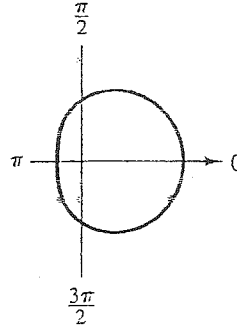
$$\frac{a}{b} = 1$$

Cardioid (heart-shaped)



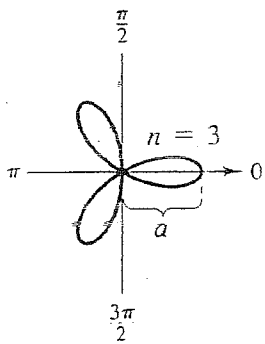
$$1 < \frac{a}{b} < 2$$

Dimpled limaçon

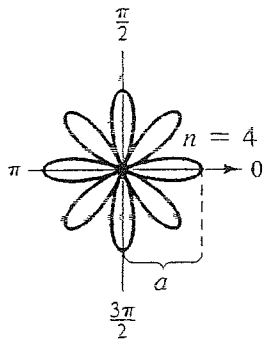


$$\frac{a}{b} \geq 2$$

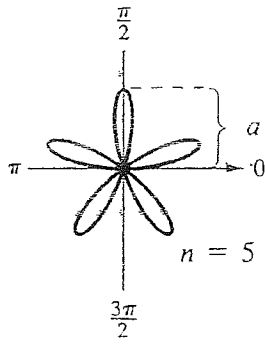
Convex limaçon



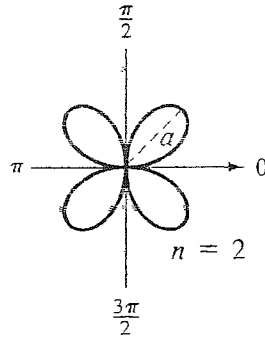
$r = a \cos n\theta$
Rose curve



$r = a \cos n\theta$
Rose curve

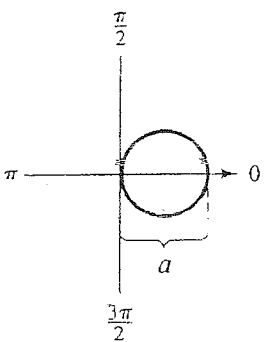


$r = a \sin n\theta$
Rose curve

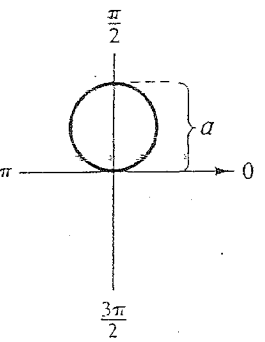


$r = a \sin n\theta$
Rose curve

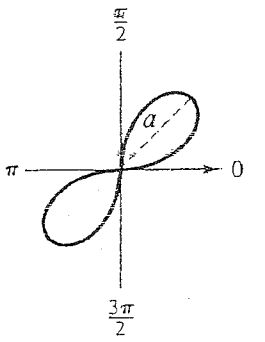
n odd $\Rightarrow n$ petals
 n even $\Rightarrow 2n$ petals



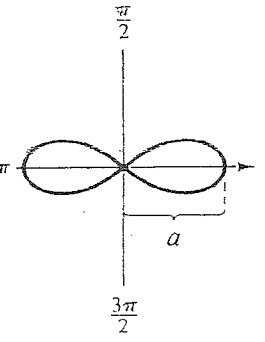
$r = a \cos \theta$
Circle



$r = a \sin \theta$
Circle



$r^2 = a^2 \sin 2\theta$
Lemniscate



$r^2 = a^2 \cos 2\theta$
Lemniscate

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