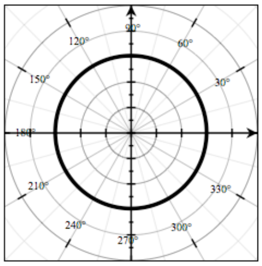
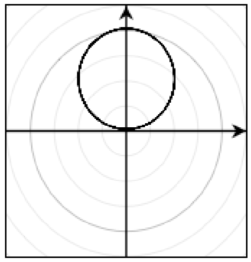
<u>Classifying Polar Graphs</u>

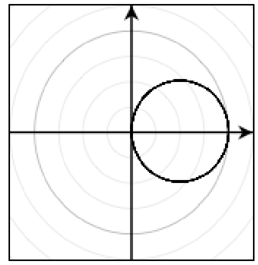
Just as was true with rectangular graphs, there are graphs in polar form that occur all the time and students should be able to recognize them by their equations.



$r = a$
Circle
center at the pole
radius = a

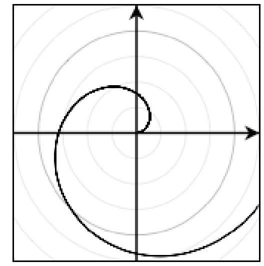


$r = a\sin\theta$



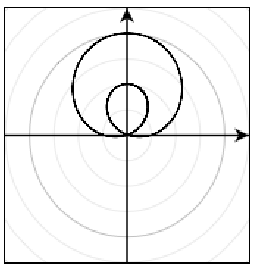
$r = a\cos\theta$

Circles not centered at the pole
a is the diameter
<u>*sine*</u> curves are symmetric to <u>*y*-axis</u> <u>*cosine*</u> curves are symmetric to <u>*x*-axis</u>

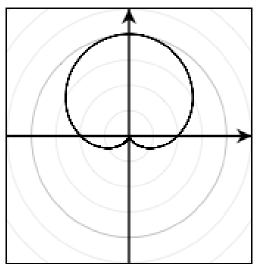


$r = a\theta$
Spiral of Archimides
a controls the width
(must be in radian mode)

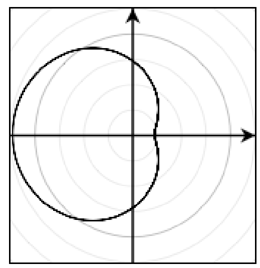
Limaçons are in the form $r = a \pm b\sin\theta$ (symmetric to *y*-axis) or $r = a \pm b\cos\theta$ (symmetric to *x* - axis)



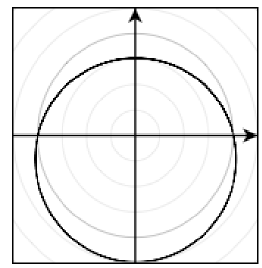
$a < b$
Limaçon with inner loop



$a = b$
Cardioid
(heart shaped)

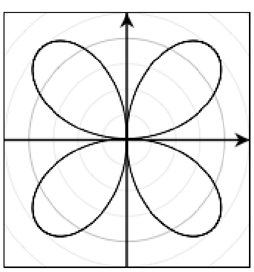


$b < a < 2b$
Dimpled Limaçon

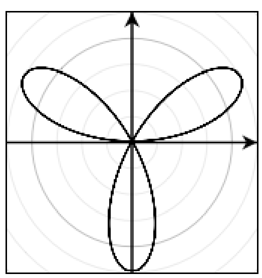


$a \geq 2b$
Convex Limaçon
(one side is flattened)

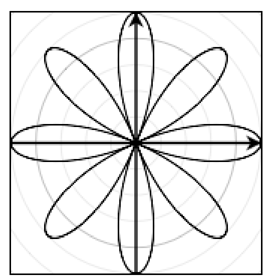
<u>Rose curves</u> are in the form $r = a\cdot\sin(n\theta)$ or $r = a\cdot\cos(n\theta)$. The maximum diameter of a petal is controlled by a. If n is even, the rose curve will have $2n$ petals. If n is odd, the rose curve will have n petals. Interesting patters can be formed if n is a decimal and the curve is viewed with θ starting at 0 and going out to very large numbers.



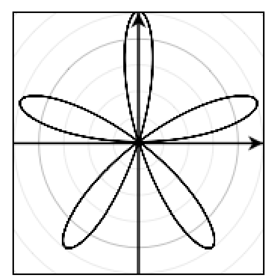
$r = a\cdot\sin(2\theta)$



$r = a\cdot\sin 3\theta$



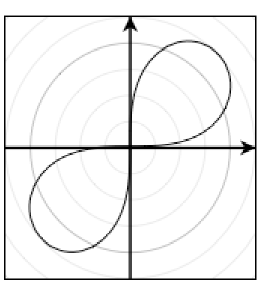
$r = a\cdot\cos(4\theta)$



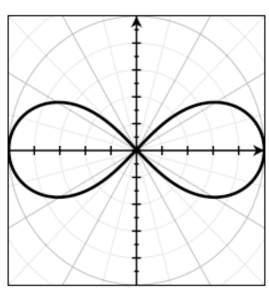
$r = a\cdot\sin(5\theta)$

<u>Lemniscates</u> look like infinity signs and are in the form $r^2 = a^2\cdot\sin(2\theta)$ [symmetric to the origin] and $r^2 = a^2\cdot\cos(2\theta)$ [symmetric to the *x*-axis]

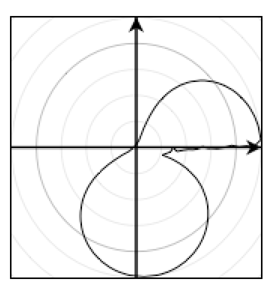
If the coefficient of θ is a number other than 1 or 2, a deformed lemniscates will result.



$r^2 = a^2\cdot\sin(2\theta)$



$r^2 = a^2\cdot\cos(2\theta)$



$r^2 = a^2\cdot\cos(1.3\theta)$

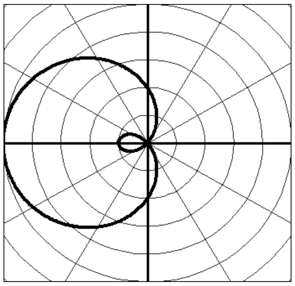
Match the polar equations with their graphs below.

___1) $r = 3 - \cos\theta$ ___2) $r = 2 - 2\sin\theta$ ___3) $r = 5\cos(3\theta)$ ___4) $r = 2 - 2\cos\theta$

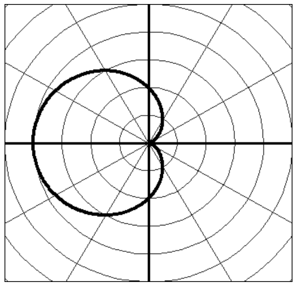
___5) $r = 3 + 1.5\sin\theta$ ___6) $r = 3.5\cos(2\theta)$ ___7) $r = 5\sin(3\theta)$ ___8) $r^2 = -16\cos(2\theta)$

___9) $r = 2 - 3\cos\theta$ ___10) $r = 3\cos(4\theta)$ ___11) $r = -4\cos\theta$ ___12) $r = 3.5\sin(2\theta)$

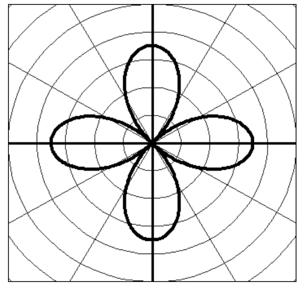
A.



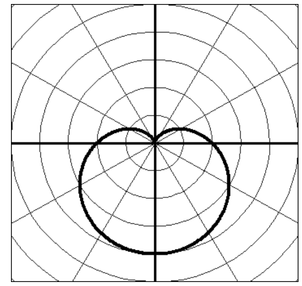
B.



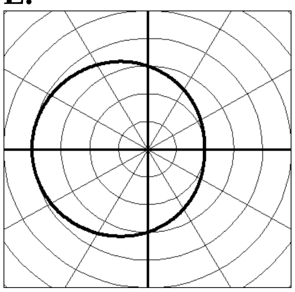
C.



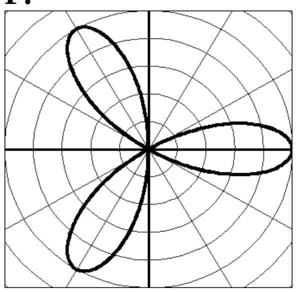
D.



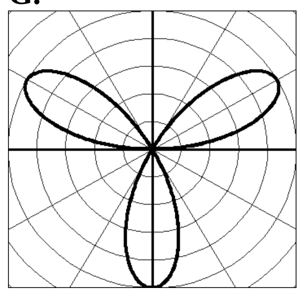
E.



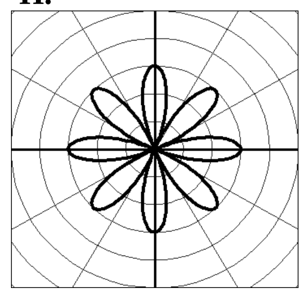
F.



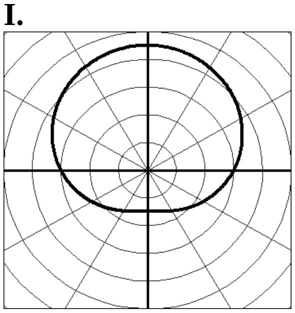
G.



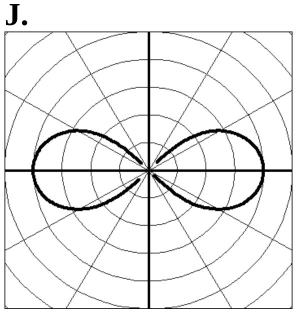
H.



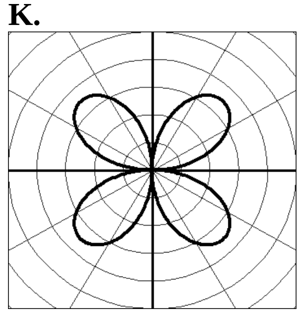
I.



J.



K.



L.