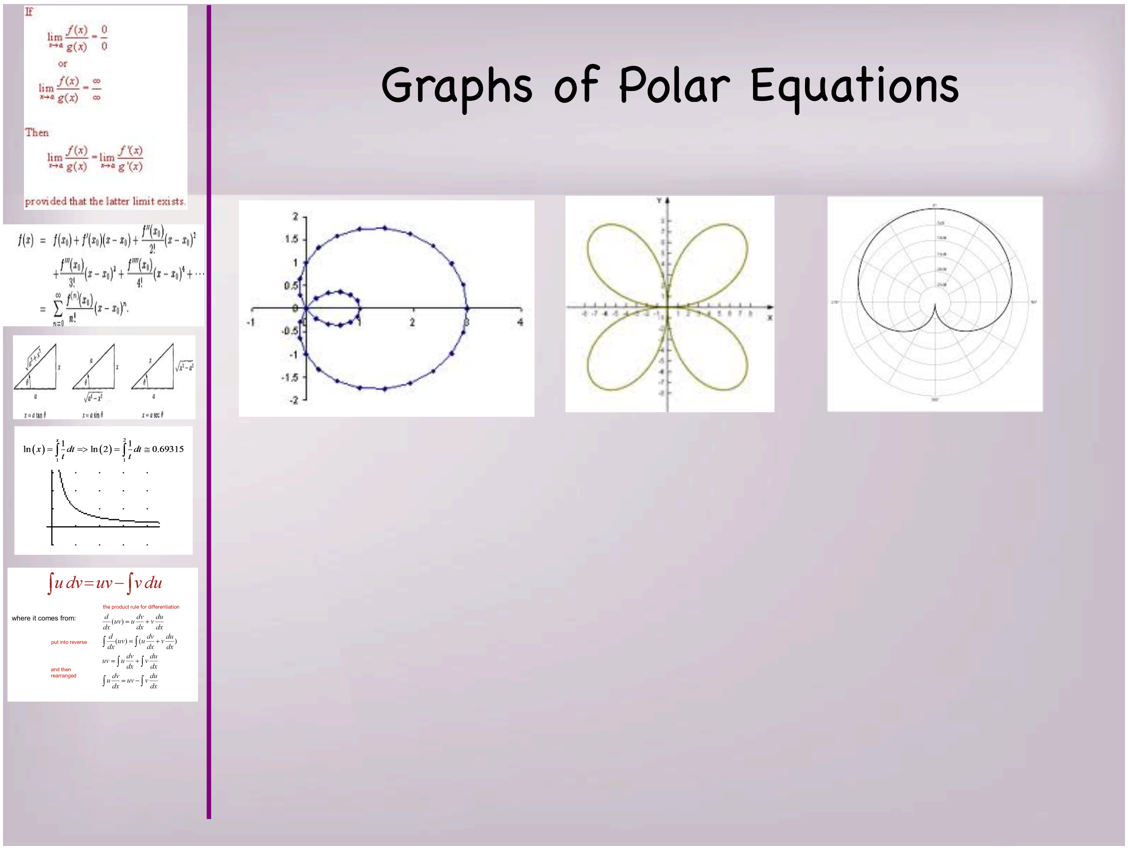
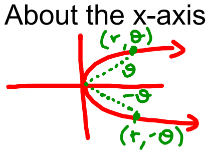


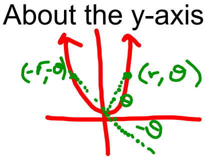
Graphs of Polar Equations

Symmetry

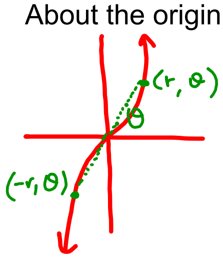
About the x-axis ⇒ replacing (r,θ) with $(r,-\theta)$ produces equivalent equation



About the y-axis ⇒ replacing (r,θ) with $(-r,-\theta)$ produces equivalent equation



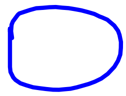
About the origin ⇒ replacing (r,θ) with $(-r,\theta)$ produces equivalent equation

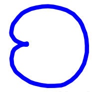


Polar Equations

limacon $r = a \pm b \cos\theta$ $r = a \pm b \sin\theta$

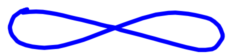
$a > b$ $a = b$ $a < b$



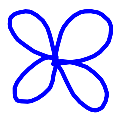


cardioid

lemniscate $r^2 = \pm a \cos(2\theta)$ $r^2 = \pm a \sin(2\theta)$



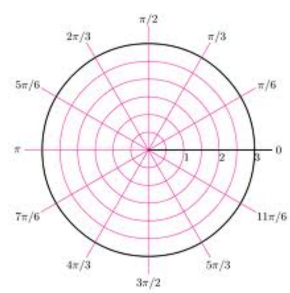
rose $r = a \cos(n\theta)$ $r = a \sin(n\theta)$



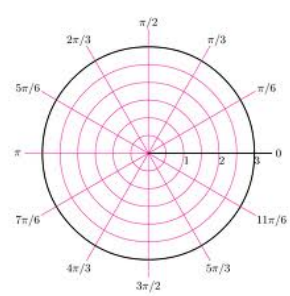
(n leaves if n odd
2n leaves if n even)

EX 1 Sketch a graph of the given polar equations.

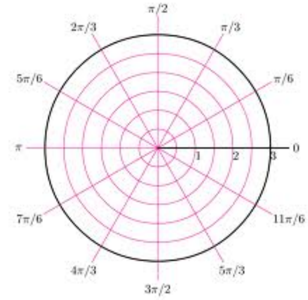
a) $r = 4 \sin\theta$

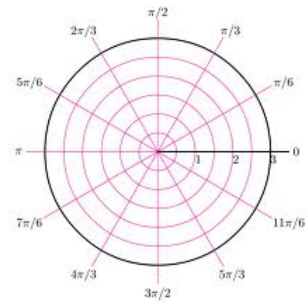


b) $r = -16 \cos(2\theta)$



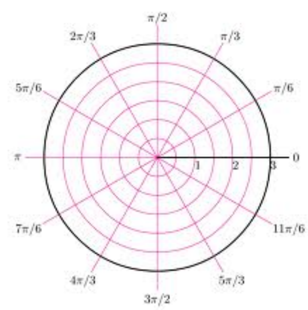
c) $r = 4 - 3\sin\theta$

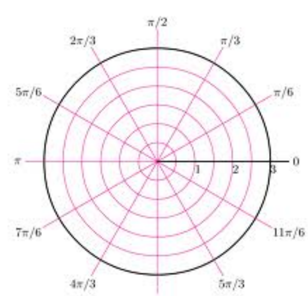




d) $r = 2\theta$

e) $r = \sqrt{2} - \sqrt{2}\sin\theta$





f) $r^2 = 4\cos(2\theta)$