Handout 12

MATH 172 Lab: Sections 7 and 8

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Note: *This handout covers only polar coordinates and parametric equations.*

Instruction: Work in groups to solve the following mathematical problems. DON'T AFRAID TO MAKE MISTAKES BECAUSE WE LEARN FROM OUR MISTAKES!

Problem 1: Change to Cartesian Coordinates:

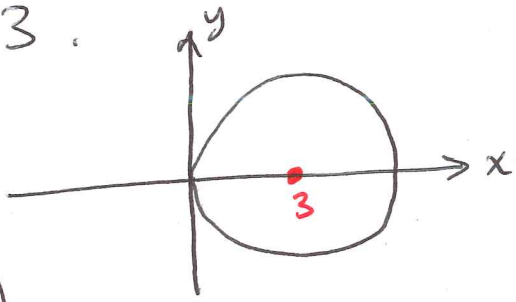
Part a: $r = 6\cos(\theta)$

First, we multiply both sides by r, we obtain:

$r^2 = 6r\cos(\theta)$

$x^2 + y^2 = 6x \Rightarrow x^2 - 6x + y^2 = 0$ by completing the square,

we obtain: $x^2 - 6x + 9 + y^2 = 0 + 9 \Rightarrow (x-3)^2 + y^2 = 9$ Equation of circle centered $(3, 0)$ of radius $= 3$.



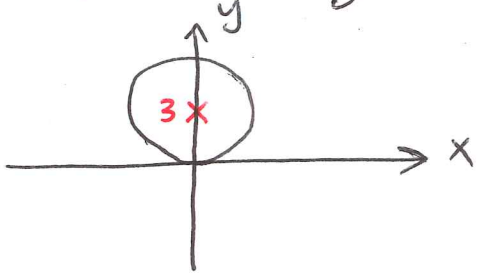
Part b: $r = 6\sin(\theta)$

First, we multiply both sides by r,

we obtain: $r^2 = 6r\sin\theta$

$\Rightarrow x^2 + y^2 = 6y \Rightarrow x^2 + y^2 - 6y = 0 \Rightarrow$ By completing the square,

we obtain: $x^2 + y^2 - 6y + 9 = 0 + 9 \Rightarrow x^2 + (y-3)^2 = 9$



Problem 2: Draw the following: $r = 9\sin(2\theta)$

Replace (r, θ) by $(-r, -\theta)$

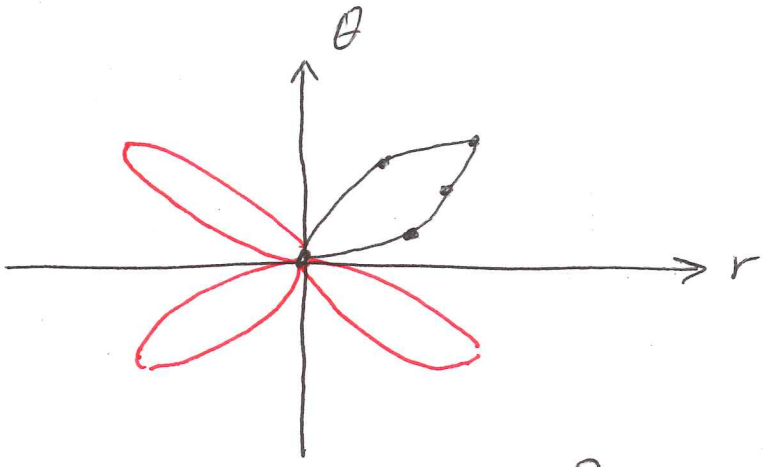
$-r = 9\sin(-2\theta)$

$-r = -9\sin(2\theta)$

$r = 9\sin(2\theta)$

Symmetric w.r.t y-axis

r	0	4.5	7.7	9	7.7	0
θ	0	$\pi/12$	$\pi/6$	$\pi/4$	$\pi/3$	$\pi/2$



Four-Leaved Rose

Problem 3: Find the equation of the tangent line for the parametric curve given by: $x = t^5 - 4t^3$ and $y = t^2$ at (0,4).

$$\frac{dy}{dx} = \frac{\frac{dy}{dt}}{\frac{dx}{dt}} = \frac{2t}{5t^4 - 8t}$$

$0 = t^5 - 4t^3$

$0 = t^3(t^2 - 4)$

$t = 0$ or $t = \pm 2$

$t = -2$ $\Rightarrow y' = \frac{-4}{32} = \frac{-1}{8}$

$y - 4 = \frac{-1}{8}(x - 0)$

$4 = t^2$

$t = \pm 2$. For $t = 2$

$\Rightarrow y' = \frac{4}{32} = \frac{1}{8}$

$y - 4 = \frac{1}{8}(x - 0)$