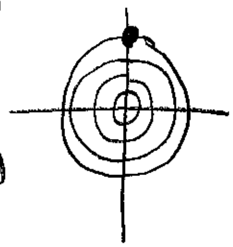
AP Calculus BC **Name:** Answer Key *

Unit 11 – Day 4 – Assignment

#'s 1 & 2: Plot the point in polar coordinates and find the corresponding rectangular coordinates for the point.

1) (4, 3π/6) $= (4, \frac{\pi}{2})$

r θ



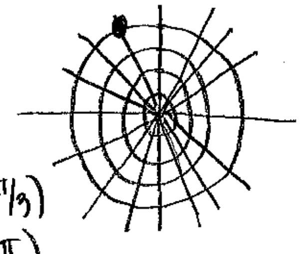
$x = r\cos\theta$
$= 4\cos(\frac{\pi}{2})$
$= 4(0)$
$= 0$

$y = r\sin\theta$
$= 4\sin(\frac{\pi}{2})$
$= 4$

$\boxed{(0,4)}$

2) (-4, - π/3)

$-\frac{\pi}{3} + \frac{6\pi}{3} = \frac{5\pi}{3}$



$x = r\cos\theta$
$-4\cos(-\frac{\pi}{3})$
$-4\cos(\frac{5\pi}{3})$
$-4(\frac{1}{2})$
$= -2$

$y = r\sin\theta$
$= -4\sin(-\pi/3)$
$-4\sin(\frac{5\pi}{3})$
$-4(-\frac{\sqrt{3}}{2}) = +2\sqrt{3}$

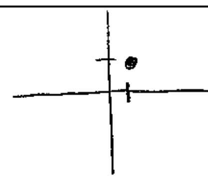
$(\frac{1}{2}, -\frac{\sqrt{3}}{2})$

$\boxed{(-2, 2\sqrt{3})}$

#'s 3 & 4: The rectangular coordinates of a point are given. Plot the point and find two sets of polar coordinates for the point for 0 ≤ θ ≤ 2π.

3) (1, 1)

x y



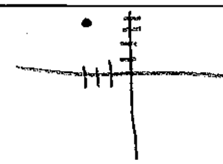
$r^2 = x^2 + y^2$
$r^2 = (1)^2 + (1)^2$
$r = \pm\sqrt{2}$

$\tan\theta = \frac{y}{x}$
$\tan\theta = \frac{1}{1}$
$\tan\theta = 1$
$\theta = \frac{\pi}{4}, \frac{5\pi}{4}$

$\boxed{(\sqrt{2}, \frac{\pi}{4})}$ $\boxed{(-\sqrt{2}, \frac{5\pi}{4})}$

4) (-3, 4)

x y



$r^2 = x^2 + y^2$
$r^2 = (-3)^2 + (4)^2$
$r^2 = 25$
$r = \pm 5$

$\tan\theta = \frac{y}{x}$
$\tan\theta = \frac{4}{-3}$
$\theta = -.927$

$\boxed{(5, -.927)}$
$\boxed{(-5, \pi - .927)}$

#'s 5 – 8: Convert the rectangular equation to polar form.

5) $x^2 + y^2 = a^2$

$r^2 = a^2$

$\boxed{r = a}$

6) $y = 4$

$r\sin\theta = 4$

$r = \frac{4}{\sin\theta}$ $\boxed{r = 4\csc\theta}$

7) $3x - y + 2 = 0$

$3(r\cos\theta) - r\sin\theta + 2 = 0$

$r(3\cos\theta - \sin\theta) = -2$

$\boxed{r = \frac{-2}{3\cos\theta - \sin\theta}}$

8) $y^2 = 9x$

$r^2\sin^2\theta = 9r\cos\theta$

$r\sin^2\theta = 9\cos\theta$

$r = \frac{9\cos\theta}{\sin^2\theta} \Rightarrow \boxed{r = 9\cos\theta\csc^2\theta}$

#'s 9 – 12: Convert the polar equation to rectangular form.

9) r = 3

$\boxed{x^2+y^2=3}$

10) r = sinθ

$r = \frac{y}{r}$

$r^2 = y$

$x^2+y^2=y$

$\to x^2+y^2-y+\left(\frac{-1}{2}\right)^2 = \left(\frac{-1}{2}\right)^2$

$\boxed{x^2+(y-\frac{1}{2}) = \frac{1}{4}}$

11) r = θ

$\tan r = \tan\theta$

$\tan\sqrt{x^2+y^2} = \frac{y}{x}$

$\boxed{\sqrt{x^2+y^2} = \arctan\frac{y}{x}}$

12) r = 3secθ

$\frac{r}{\sec\theta} = \frac{3\sec\theta}{\sec\theta}$

$r\cos\theta = 3$

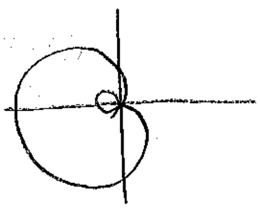
$\boxed{x = 3}$

#'s 13 – 16: Name the type of polar curve. Graph the polar curve on your calculator and sketch the graph. Find an interval for θ over which the graph is traced only once.

13) r = 3 – 4cosθ

a b

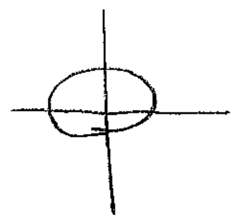
$\boxed{\text{Limacon} \to \text{Loop}}$



$\boxed{0 \le \theta < 2\pi}$

14) r = 2 + sinθ

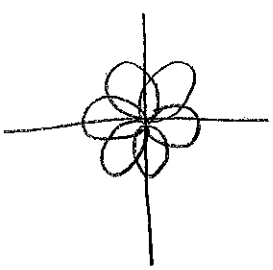
$\boxed{\text{Ellipse}}$



$\boxed{0 \le \theta < 2\pi}$

15) r = 2cos(3θ/2)

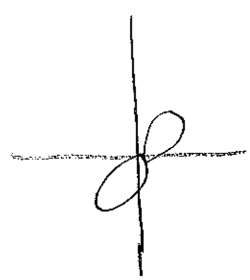
$\boxed{\text{Rose curve}}$



$\boxed{0 \le \theta < 4\pi}$

16) r² = 4sin2θ

$\boxed{\text{Lemniscate}}$



$\boxed{0 \le \theta < 2\pi}$

$r = \sqrt{4\sin 2\theta}$

Change θmax in calc to 4π

If you only use $0 \le \theta < 2\pi$, the entire rose curve doesn't graph.