10.5 POLAR COORDINATES

$x = \sqrt{3}$

$Y = 1$

$x^2 + Y^2 = r^2$

$(\sqrt{3})^2 + 1^2 = r^2$

$3 + 1 = r^2 \quad r^2 = 4$

$r = 2$

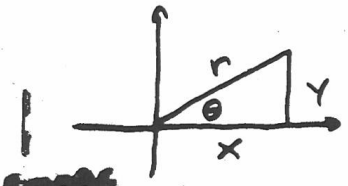
$\tan\theta = \frac{Y}{X} \rightarrow \tan\theta = \frac{1}{\sqrt{3}} \quad \theta = \tan^{-1}\frac{1}{\sqrt{3}} \quad \theta = 30°$ OR $\theta = \frac{\pi}{6}$ RADIANS

CARTESIAN RECTANGULAR $(X, Y) = (\sqrt{3}, 1)$

POLAR $(r, \theta) = (2, \frac{\pi}{6})$

NOTE: $(2, \frac{\pi}{6}) = (2, \frac{13\pi}{6}) = (2, \frac{\pi}{6} + 2\pi n)$ etc.....

CONVERTING POLAR INTO RECTANGULAR



$\cos\theta = \frac{x}{r}$ $\quad x = r\cos\theta$

$\sin\theta = \frac{Y}{r}$ $\quad Y = r\sin\theta$

LIKE

EXAMPLE $(r, \theta) = (-10, \frac{\pi}{3}) \rightarrow (x, Y) = (r\cos\theta, r\sin\theta)$

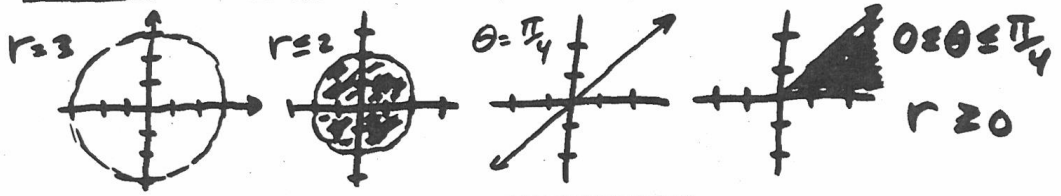
$= (-10\cos\frac{\pi}{3}, -10\sin\frac{\pi}{3}) = (-5, -5\sqrt{3})$

EXAMPLE REC → POLAR

$x + Y = 4 \rightarrow r\cos\theta + r\sin\theta = 4$ OR $r = \frac{4}{\cos\theta + \sin\theta}$

EXAMPLE CONVERT TO RECTANGULAR

$r = 2 + \sin\theta \rightarrow r^2 = 2r + r\sin\theta \rightarrow x^2 + Y^2 = 2\sqrt{x^2 + Y^2} + Y$

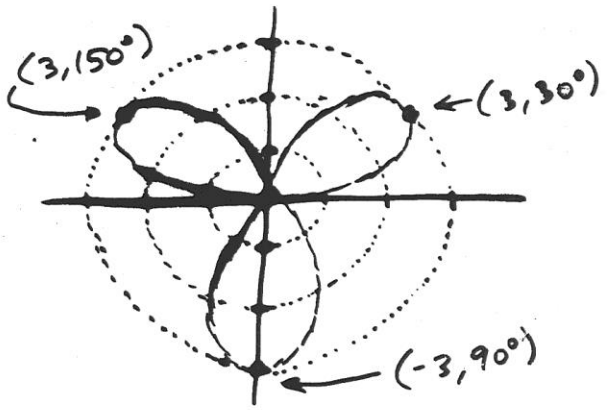


HWORK p. 558 → 1-41 ODD

p. 558 # 48 GRAPH $r = 3\sin(3\theta)$ 3-LEAVED ROSE

θ	r
0	0
30°	3
60°	0
90°	-3
120°	0
150°	3
180°	0

etc....



THIS GRAPH COMPLETES ITS PICTURE IN 180° (π RADIANS)

HWORK p. 558 → 49, 50, 52, 54, 55, 57

MORE HOMEWORK BELOW! →

LENGTH OF A POLAR CURVE (10.6)

$$L = \int_{\alpha}^{\beta} \sqrt{r^2 + \left(\frac{dr}{d\theta}\right)^2}\, d\theta \quad \text{(p.564)}$$

RADIAN MODE

$$L = \int_{0}^{\pi} \sqrt{(3\sin(3\theta))^2 + (9\cos(3\theta))^2}\, d\theta = 20.05$$

HOMEWORK p. 567 → 31, 35, 37