

Section 8.1 Polar Equations

p. 587 42-54 even, 58

$$x = r \cos \theta$$

$$y = r \sin \theta$$

$$r^2 = x^2 + y^2$$

42) $x^2 + y^2 = 9$

$$r^2 = 9$$

$$\boxed{r = 3} \text{ (only positive)}$$

44) $y = 5$
 $r \sin \theta = 5$

$$r = \frac{5}{\sin \theta}$$

$$\boxed{r = 5 \csc \theta}$$

46) $x^2 - y^2 = 1$
 $(r \cos \theta)^2 - (r \sin \theta)^2 = 1$
 $r^2 \cos^2 \theta - r^2 \sin^2 \theta = 1$

$$r^2 (\cos^2 \theta - \sin^2 \theta) = 1$$

$$r^2 (\cos 2\theta) = 1$$

$$r^2 = \frac{1}{\cos 2\theta}$$

$$\boxed{r^2 = \sec 2\theta}$$

$$r = \sqrt{\sec 2\theta}$$

48) $\theta = \pi$

take tan of both sides.

Since tan has both y and x
 sin, cos

$$\tan \theta = \tan \pi$$

$$\tan \theta = 0$$

$$\frac{\sin \theta}{\cos \theta} = 0$$

$$\frac{y}{x} = \frac{0}{1}$$

$$\boxed{y = 0}$$

$$\#50) \quad r = 6 \cos \theta$$

multiply by r

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

$$x^2 + y^2 = 6x$$

$$x^2 - 6x + y^2 = 0$$

$$\boxed{(x-3)^2 + y^2 = 9}$$

$$52) \quad r^2 = \sin 2\theta$$

$$x^2 + y^2 = 2 \sin \theta \cos \theta$$

$$r^2 (x^2 + y^2) = r^2 2 \sin \theta \cos \theta$$

$$(x^2 + y^2)(x^2 + y^2) = 2r \sin \theta r \cos \theta$$

$$(x^2 + y^2)^2 = 2xy$$

$$\boxed{x^4 + 2x^2y^2 + y^4 - 2xy = 0}$$

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

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

$$r^4 = 2r^2 \sin \theta \cos \theta$$

$$(x^2 + y^2)^2 = 2r \sin \theta r \cos \theta$$

$$\#54) \quad r = \frac{1}{1 + \sin \theta}$$

$$r + r \sin \theta = 1$$

$$r + y = 1$$

$$r = 1 - y$$

$$r^2 = (1 - y)^2$$

$$x^2 + y^2 = 1 - 2y + y^2$$

$$x^2 = 1 - 2y$$

$$\boxed{x^2 + 2y - 1 = 0}$$

$$\Leftrightarrow 2y = 1 - x^2 \rightarrow y = \frac{1}{2} - \frac{x^2}{2} = \boxed{\frac{-x^2 + 1}{2}}$$

$$58 \quad r = 2 - \cos \theta$$

$$r^2 = 2r - r \cos \theta$$

$$x^2 + y^2 = 2r - x$$

$$2r = x^2 + y^2 + x$$

$$4r^2 = (x^2 + y^2 + x)^2$$

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