

10.4a Graphing Polar Equations p. 722 # 2-42

Polar to Rectangular Conversion: $x = r \cos \theta$
 $y = r \sin \theta$

2) $(-2, \frac{5\pi}{3})$ $x = -2 \cos(\frac{5\pi}{3}) = -2(\frac{1}{2}) = -1$ $y = -2 \sin(\frac{5\pi}{3}) = -2(-\frac{\sqrt{3}}{2}) = \sqrt{3}$ $(-1, \sqrt{3})$

4) $(0, -\frac{7\pi}{6})$ $x = 0 \cos(-\frac{7\pi}{6}) = 0$ $y = 0 \sin(-\frac{7\pi}{6}) = 0$ $(0, 0)$

6) $(-2, \frac{11\pi}{6})$ $x = -2 \cos(\frac{11\pi}{6}) = -\sqrt{3}$ $y = -2 \sin(\frac{11\pi}{6}) = 1$ $(-\sqrt{3}, 1)$

8) $(-3, -1.57)$ (x, y)
 $(-0.0024, 3)$

10) $(9.25, 1.2)$ $(3.3518, 8.6214)$

Rectangular to Polar Conversion: $\tan \theta = \frac{y}{x}$
 $r^2 = x^2 + y^2$

12) $(0, -6)$
 $\tan \theta = \frac{-6}{0} = \text{undefined}$
 $r^2 = 0^2 + 6^2$
 $r = 6$

$(r, \theta) \rightarrow (6, \frac{3\pi}{2}), (-6, \frac{\pi}{2})$

Rectangular to Polar

14) $(4, -2)$

$$\tan \theta = \frac{y}{x} = \frac{-2}{4}$$

$$\tan \theta = -\frac{1}{2}$$

$$\theta = -0.464, 2.678$$

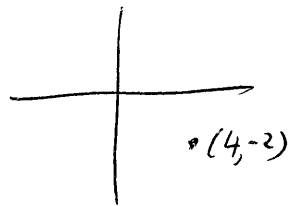
$$x^2 + y^2 = r^2$$

$$4^2 + 2^2 = r^2 \quad r = \sqrt{20} = 2\sqrt{5}$$

$$(r, \theta)$$

$$(2\sqrt{5}, -0.464)$$

$$(-2\sqrt{5}, 2.678)$$



$$\pi + (-0.464)$$

16) $(3, -\sqrt{3})$

$$\tan \theta = \frac{-\sqrt{3}}{3} \quad \theta = \frac{5\pi}{6}, \frac{11\pi}{6}$$

$$\hookrightarrow -\frac{1}{\sqrt{3}} \rightarrow \frac{\pi}{6} \rightarrow$$

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

$$r^2 = 12$$

$$r = 2\sqrt{3}$$

$$(r, \theta)$$

$$(2\sqrt{3}, \frac{11\pi}{6})$$

$$(-2\sqrt{3}, \frac{5\pi}{6})$$

18) $(3\sqrt{2}, 3\sqrt{2})$

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

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

$$r^2 = 18 + 18$$

$$r = 6$$

$$(r, \theta)$$

$$(6, \frac{\pi}{4})$$

$$(-6, \frac{5\pi}{4})$$

20) $(0, -5)$

$$\tan \theta = \frac{-5}{0} = \text{undefined}$$

$$r = 5$$

$$(r, \theta)$$

$$(5, \frac{3\pi}{2})$$

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

Rectangular to Polar

24) $x^2 - y^2 = 9$

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

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

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

$x = r \cos \theta$

$y = r \sin \theta$

$r^2 = \frac{9}{\cos^2 \theta - \sin^2 \theta}$

use trig identity

$r = \sqrt{\frac{9}{\cos 2\theta}}$

$\frac{3}{\sqrt{\cos 2\theta}}$

26) $x^2 + y^2 - 2ax = 0$

$r^2 \cos^2 \theta + r^2 \sin^2 \theta - 2ar \cos \theta = 0$

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

$r^2 (1) - 2ar \cos \theta = 0$

$r(r - 2a \cos \theta) = 0$

$r = 0$

$r = 2a \cos \theta$

28) $x = 12$

$r \cos \theta = 12$

$r = \frac{12}{\cos \theta} = 12 \sec \theta$

30) $xy = 4$

$(r \cos \theta)(r \sin \theta) = 4$

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

$r^2 = \frac{4}{\cos \theta \sin \theta}$

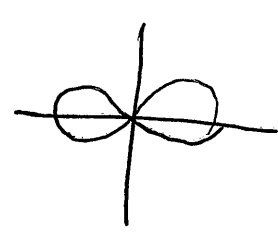
$r = \frac{2}{\cos \theta \sin \theta}$

$\sin 2\theta = 2 \sin \theta \cos \theta$

$\frac{\sin 2\theta}{2} = \sin \theta \cos \theta$

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

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



32) $(x^2 + y^2)^2 - 9(x^2 - y^2) = 0$

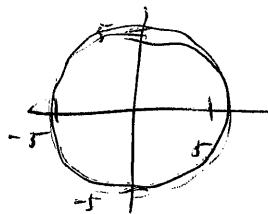
$(r^2)^2 - 9(r^2 \cos^2 \theta - r^2 \sin^2 \theta) = 0$

$r^2 [r^2 - 9 \cos 2\theta] = 0$

Polar to Rectangular: $\tan \theta = \frac{y}{x}$
 $r^2 = x^2 + y^2$

34) $r = -5$ $r^2 = 25$

$$x^2 + y^2 = 25$$



36) $r = 5 \cos \theta$

$$r^2 = 5r \cos \theta$$

$$r^2 = 5x$$

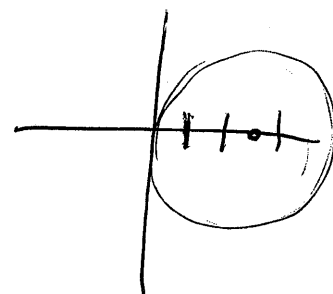
$$x^2 + y^2 = 5x$$

$$x^2 - 5x + y^2 = 0$$

$$x^2 - 5x + \frac{25}{4} + y^2 = \frac{25}{4}$$

$$(x - \frac{5}{2})^2 + y^2 = (\frac{5}{2})^2$$

$$(\frac{5}{2})^2 \quad (\frac{5}{2})^2$$

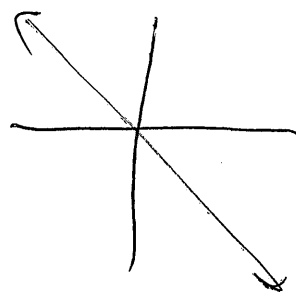


38) $\theta = \frac{5\pi}{6}$

$$\tan \theta = \tan \frac{5\pi}{6}$$

$$\frac{y}{x} = -\frac{\sqrt{3}}{3}$$

$$y = -\frac{\sqrt{3}}{3}x$$

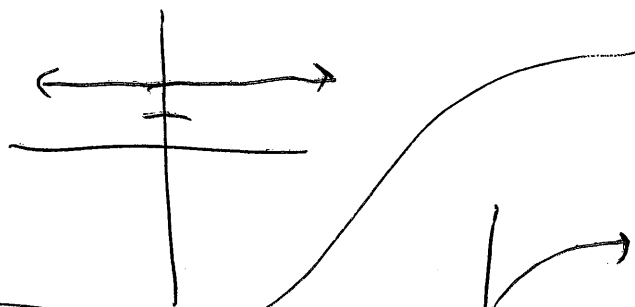


40) $r = 2 \csc \theta$

$$\frac{r}{\csc \theta} = 2$$

$$r \sin \theta = 2$$

$$y = 2$$



42) $r = \cot \theta \csc \theta$
 $r \sin \theta = \cot \theta$

$$r \sin \theta = \frac{x}{y}$$

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

$$y^2 = x$$

$$x = y^2$$

