14-5 Writing Equations in Polar Form

Rectangular = (x, y) $\Rightarrow$ $x = r\cos\theta$, $y = r\sin\theta$

Polar = (r, θ)

r sort of $\|v\|$ because it's how far we go out from the origin

Changing Rectangular to Polar (other way is Monday)

1) Try to get r by itself if possible. If not, use θ.
2) No trig fractions in final answer.

1) $x = 5$ — Linear (no exponent)

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

$r = \frac{5}{\cos\theta} = \frac{5}{1}\cdot\frac{1}{\cos\theta}$

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

2) $y = x^2$ — Quadratic, Parabola (single power of 2)

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

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

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

$\frac{\sin\theta}{\cos\theta}\cdot\frac{1}{\cos\theta} = r$

$\boxed{\tan\theta\sec\theta = r}$

3) $(x-4)^2 + y^2 = 16$ — Circle (2 powers of 2)

$(r\cos\theta - 4)^2 + (r\sin\theta)^2 = 16$

Square — $(r\cos\theta - 4)(r\cos\theta - 4)$

$r^2\cos^2\theta - 4r\cos\theta - 4r\cos\theta + 16$

$r^2\cos^2\theta - 8r\cos\theta + 16 + r^2\sin^2\theta = 16$

Cancel constant — $-16 \quad -16$

$r^2\cos^2\theta - 8r\cos\theta + r^2\sin^2\theta = 0$

Move r term — $+8r\cos\theta \quad +8r\cos\theta$

$r^2\cos^2\theta + r^2\sin^2\theta = 8r\cos\theta$

Divide by r — $\frac{r^2\cos^2\theta}{r} + \frac{r^2\sin^2\theta}{r} = \frac{8r\cos\theta}{r}$

$r\cos^2\theta + r\sin^2\theta = 8\cos\theta$

GCF — $r(\cos^2\theta + \sin^2\theta) = 8\cos\theta$

Simplify — $r(1) = 8\cos\theta$

$r = 8\cos\theta$

CW/HW - Wksht 6.3