HW 15 POLAR Shanks p. 492 #1-23 odd, 28, 29, 33
RED BK p. 9 #1, 2, 25-29, 31, 53, 54

Note: r is directional

1. $(3, \pi/6) \rightarrow 3\cos\pi/6,\ 3\sin\pi/6 \rightarrow \left(\frac{3\sqrt{3}}{2}, \frac{3}{2}\right)$

3. $(-4, -5/4\,\pi) \rightarrow -4\cos\left(-5/4\,\pi\right), -4\sin\left(-5/4\,\pi\right) \rightarrow (2\sqrt{2}, -2\sqrt{2})$

5. $(\sqrt{3}, -\pi/3) \rightarrow \sqrt{3}\cdot\frac{1}{2},\ \sqrt{3}\cdot\frac{-\sqrt{3}}{2} \rightarrow \left(\frac{\sqrt{3}}{2}, -\frac{3}{2}\right)$

7. $(5,5) \rightarrow$  $\rightarrow (5\sqrt{2}, \pi/4)$

9. $(-2,-2) \rightarrow$  $(2\sqrt{2}, 5\pi/4)$ or $(-2\sqrt{2}, \pi/4)$

11. $\left(\frac{3}{5}, \frac{4}{5}\right)$ $r^2 = x^2 + y^2 \rightarrow r^2 = \frac{9+16}{25} = 1$ $\tan\theta = \frac{y}{x} = \frac{4}{5}/\frac{3}{5} = \frac{4}{3}, \theta = \tan^{-1}(4/3)$

$(1, \tan^{-1}(4/3)) \rightarrow (1, .927 \text{ radians})$ or $(1, 53.1^\circ)$

13. $x^2 + y^2 = a^2$ polar form: $r = a$

15. $x + y = 2$ polar form: $r\cos\theta + r\sin\theta = 2$; $r(\cos\theta + \sin\theta) = 2$

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

17. $(x^2+y^2)^2 = a^2(x^2 - y^2)$ polar form:

$[r^2\cos^2\theta + r^2\sin^2\theta]^2 = a^2(r^2\cos^2\theta - r^2\sin^2\theta)$ let's keep going:

$r^4[1]^2 = a^2 \cdot r^2(\cos 2\theta)$ ← double angle formula

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

19. $r = a\sin\theta$ rectangular form:

Since $y = r\sin\theta \rightarrow \sin\theta = \frac{y}{r}$: $r = a\cdot\frac{y}{r} \rightarrow r^2 = ay$

$x^2 + y^2 = ay$

21. $r = \frac{1}{1-\cos\theta}$ rectangular form:

$\frac{r}{r} = \frac{1}{r(1-\cos\theta)} \rightarrow 1 = \frac{1}{r - r\cos\theta} \rightarrow 1 = \frac{1}{\pm\sqrt{x^2+y^2} - x}$

$\pm\sqrt{x^2+y^2} - x = 1$

23. $r = \tan\theta$ rectangular form: since $\tan\theta = \frac{y}{x}$

$\pm\sqrt{x^2+y^2} = \frac{y}{x} \rightarrow y = \pm x\sqrt{x^2+y^2}$ can write as $y^2 = x^2(x^2+y^2)$

28. $4x^2 + 3y^2 - 2y - 1 = 0$ polar form:

$4r^2\cos^2\theta + 3r^2\sin^2\theta - 2r\sin\theta - 1 = 0$

29. $y^2 = x^3$ polar form: $r^2\sin^2\theta = r^3\cos^3\theta \rightarrow \tan^2\theta = r\cos\theta$

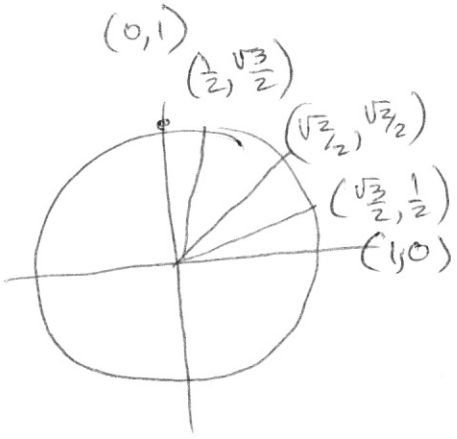
33. $r = \theta$ rectangular form: $\frac{y}{x} = \tan\theta \therefore \theta = \tan^{-1}\left(\frac{y}{x}\right)$

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

Red book: p. 9 #1, 2, 25-29, 31, 53, 54

1. $r = 3\cos 2\theta$

θ	0	$\pi/4$	$\pi/2$	$3\pi/4$	π	$5\pi/4$	$3\pi/2$	$7\pi/4$
r	3	0	-3	0	3	0	-3	0



2. $r = 2\sin 3\theta$

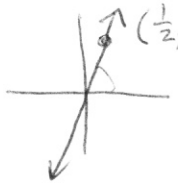
θ	0	$\pi/6$	$\pi/3$	$\pi/2$	$2\pi/3$	$5\pi/6$	π
r	0	2	0	-2	0	2	0

"Analyze": Sketch a graph (maybe w/a table) & describe shape.

25. $r = 3$ circle w/ radius 3, center @ (0,0)

26. $r = -2$ circle w/ radius 2, center @ (0,0)

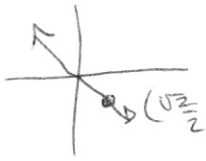
27. $\theta = \pi/3$ line thru origin, in Q1 & 3



$m = \sqrt{3}$

$y = \sqrt{3}x$

28. $\theta = -\pi/4$ line thru origin, in Q2 & 4



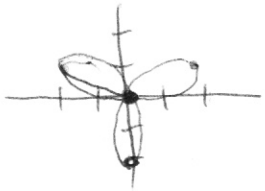
$m = -1$

$y = -x$

29. $r = 2\sin 3\theta$

see table from #2

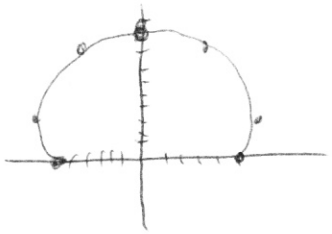
3 leaves;



use supplied polar paper

31. $r = 5 + 4\sin\theta$

θ	0	$\pi/6$	$\pi/3$	$\pi/2$	$2\pi/3$	$5\pi/6$	π
r	5	7	$5+2\sqrt{3}$	9	$5+2\sqrt{3}$	7	5



53. Graph in TI

$\theta min = 0$

$\theta max = 2\pi$

54. Graph in TI

max r = 4

$\theta min = 0$

$\theta max = 2\pi$