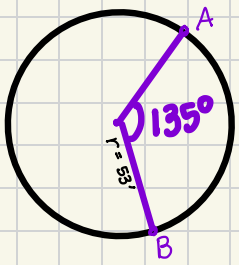
Ch. 17- Polar Equations - Board Problems

1) List 3 additional ways to express

a) $(-7, 138°)$ c)

b) d)

2)



Find the distance $\overset{\frown}{AB}$.

3) Quadratic equation

4) Vertex form

5) Solve for x.

$y = x^2 - 12x + 46$ ⟶

6) Put into vertex form.

7) Rewrite into graphing form.

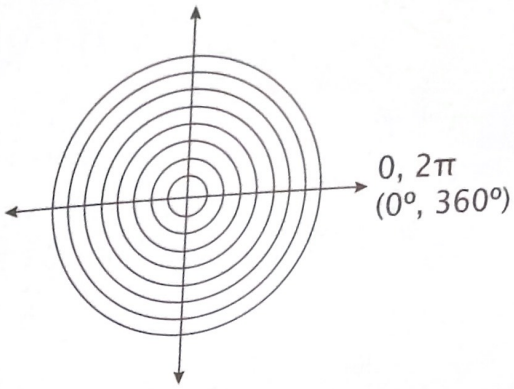
$-6x + x^2 - 4y + y^2 = -4$

Plot the polar coordinates. Describe the answer three more ways using degrees.

1. $(6, 420°)$

2. $(8, 510°)$

For #1 and #2

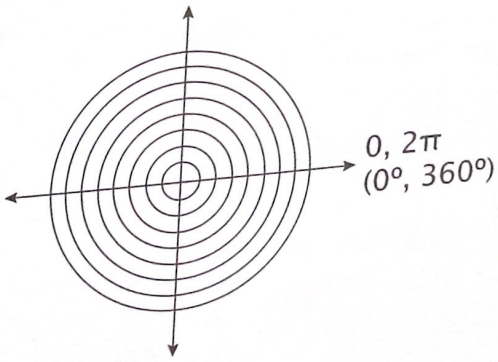


Plot the polar coordinates. Describe the answer three more ways using radians.

3. $(6, \frac{\pi}{12})$

4. $(4, \frac{-7\pi}{6})$

For #3 and #4

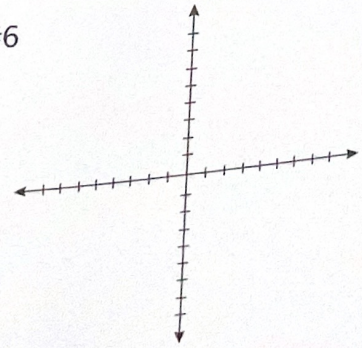


Change the polar coordinates to rectangular coordinates and graph.

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

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

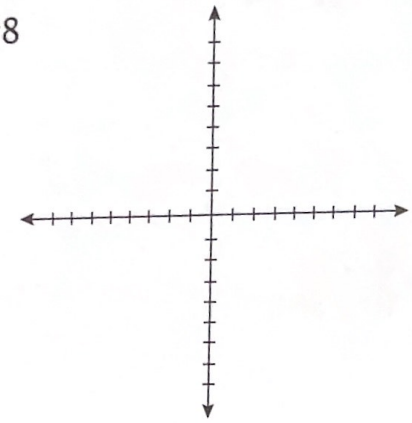
For #5 and #6



7. $(4\sqrt{3}, \frac{4\pi}{3})$

8. $(-8, \frac{7\pi}{6})$

For #7 and #8

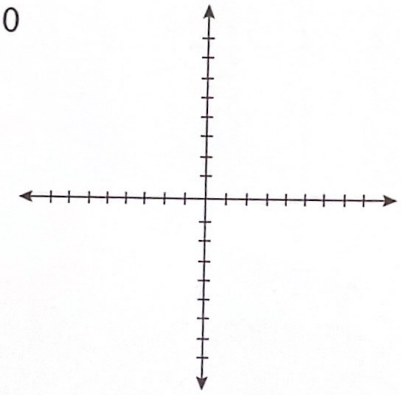


Change the rectangular coordinates to polar coordinates and graph.

9. $(-3.5\sqrt{2}, 3.5\sqrt{2})$

10. $(3\sqrt{2}, 3\sqrt{6})$

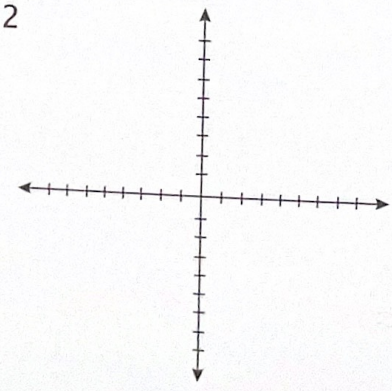
For #9 and #10



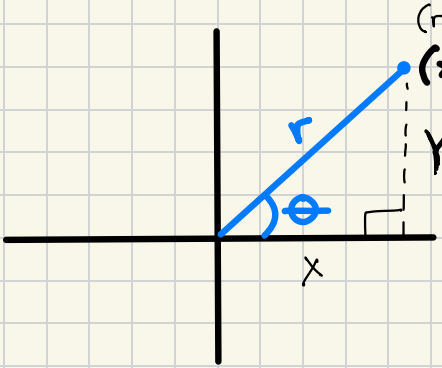
11. $(-6, -6\sqrt{3})$

12. $(4\sqrt{3}, -4)$

For #11 and #12



POLAR COORDINATES / POLAR GRAPHING



$X = r\cos\theta$

$Y = r\sin\theta$

$(r,\theta) \rightarrow$ polar

$(x,y) \rightarrow$ RECTANGULAR COORDINATES

EX. 1 Change to POLAR COORDINATES.

$y = 3x + 1$

a) REPLACE
$x =$
$y =$

b) SOLVE FOR r.

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

$(\quad)^2 + (\quad)^2 = 25$

Ex 2a $x^2 + y^2 - 8y + 16 = 8$

(oddly, this one ends in $r^2 = u\,(r\quad)$)

Ex. 3 Polar → Rectangular Coordinates

$r\cos\theta = 3$

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

Ex. 4 $r^2 = \dfrac{9}{\cos^2\theta - \sin^2\theta}$

Ex. 5 $r = \dfrac{8\sin\theta + 8\cos\theta}{\sin^2\theta}$

POLAR GRAPHING

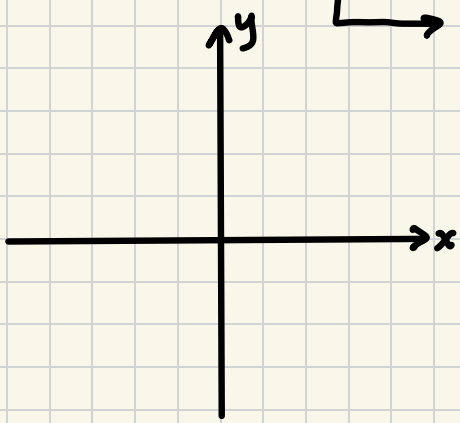
WHAT IS EQUATION OF A CIRCLE?

CENTER

_____

r =

PLOT $r = 3$

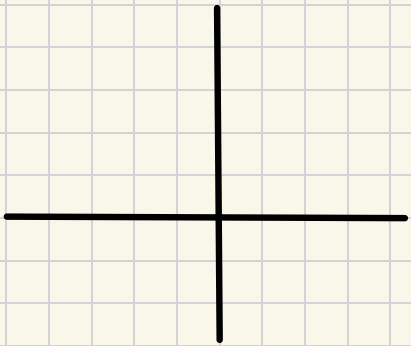


→ CIRCLE OF RADIUS = ___

SO THIS TRUE FOR ALL VALUES OF

(,)

EX. 6 PLOT $\theta = \frac{\pi}{6}$ THIS EQUATION IS A _____



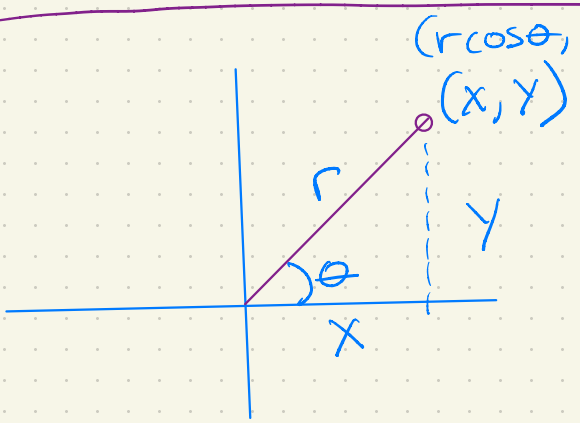
$\frac{\pi}{6} =$ _____ °

(,)

TRUE FOR ALL VALUES OF r.

Ex. 7 $r \cdot r = 4r\cos\theta$

Polar Coordinates / Polar Graphing



$x = r\cos\theta$

$y = r\sin\theta$

$r, \theta \rightarrow$ polar

$x, y \rightarrow$ rectang.

EX 1 Change to polar.

$y = 3x + 1$

a) replace
$x = r\cos\theta$
$y = r\sin\theta$

b) solve for r

$r\sin\theta = 3r\cos\theta + 1$

$r\sin\theta - 3r\cos\theta = 1$

$\dfrac{r(\sin\theta - 3\cos\theta)}{(\sin\theta - 3\cos\theta)} = \dfrac{1}{\sin\theta - 3\cos\theta}$

$$r = \frac{1}{\sin\theta - 3\cos\theta}$$

EX. 2 Change to polar.

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

$$(r\cos\theta)^2 + (r\sin\theta)^2 = 25$$

$$r^2\cos^2\theta + r^2\sin^2\theta = 25$$

$$r^2(\cos^2\theta + \sin^2\theta) = 25$$

$$r^2 = 25$$

$$\boxed{x^2 + y^2 = r^2}$$

$$\boxed{\begin{aligned} x &= r\cos\theta \\ y &= r\sin\theta \end{aligned}}$$

4) $x^2 + y^2 - 8y + 16 = 8$

$x^2 + y^2 \to r^2$

$-8y \to -8r\sin\theta$

$$r^2 - 8r\sin\theta = -8$$

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

$$\boxed{r^2 = 8(r\sin\theta - 1)}$$

Ex. 3 polar → rectangular

$r\cos\theta = 3$

$x = 3$

$x = r\cos\theta$

$y = r\sin\theta$

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

Ex 4

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

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

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

$x^2 - y^2 = 9$ ← done

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

$r\cos\theta = x$

EX. 5

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

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

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

$$\boxed{y^2 = 8y + 8x}$$

POLAR GRAPHING

EQ of a circle

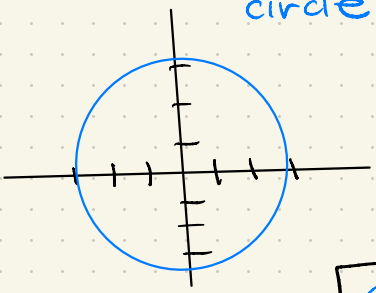
$(x-h)^2 + (y-k)^2 = r^2$ $\quad (h,k)$ center, r = radius

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

$\boxed{r = 3}$ → circle of radius = 3

circle

$(3,\theta)$ for all values of θ

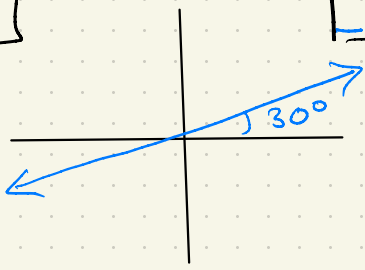


EX. 6

$\boxed{\theta = \frac{\pi}{6}}$ or 30°

Line

$(r, 30^\circ)$ for all values of r.



EX. 7 $r \cdot r = 4\cos\theta \, r$

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

$x^2 + y^2 = 4x$

$-4x \quad -4x$

$(x-h)^2 + (y-k)^2 = r^2$

center (h, k)

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

$\frac{-4}{2}$

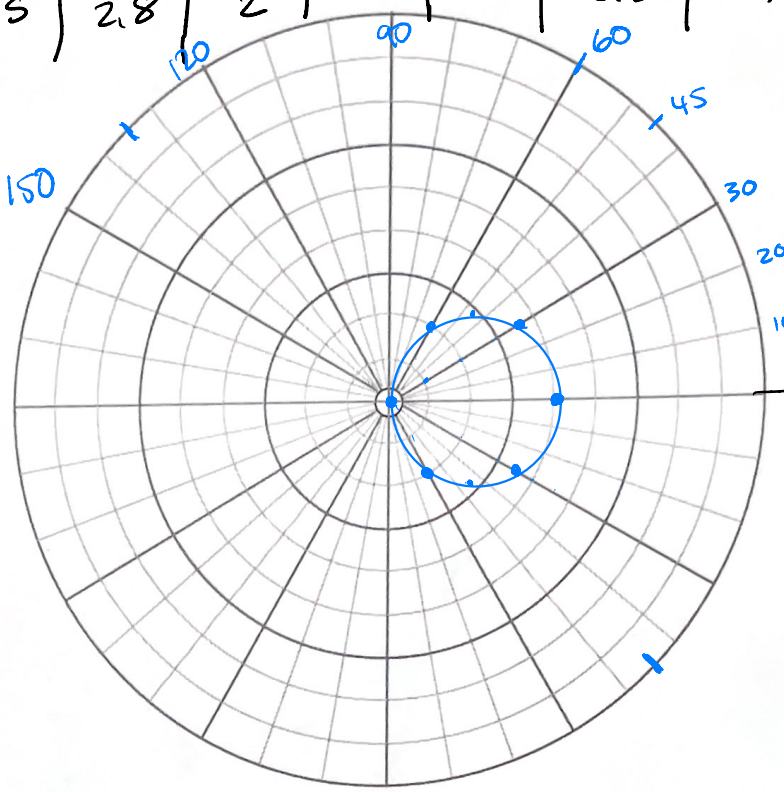
$(x-2)^2 + y^2 = 4$

ce $(2, 0)$

$r = 2$

circle centered at $(2, 0)$ $r = 2$

θ	0	30°	45°	60°	90°	120°	135°	180°	150°
$\cos\theta$	1	.87	.71	.5	0	-.5	-.71	-1	-.87
$4\cos\theta$	4	3.5	2.8	2	0	-2	-2.8	-4	-3.5



$r = 4\cos\theta$