(not available before school)

6.4B Notes Converting Polar and Rectangular Equations

Remember:

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

Example #1: Graph $r = 4\sec\theta$ on your calculator then convert it to rectangular form and identify the graph.

$r = 4 \cdot \frac{1}{\cos\theta}$

$r\cos\theta = 4$

$x = 4$

Example #2: Graph $r = 3\csc\theta$ on your calculator then convert it to rectangular form and identify the graph.

$r = 3 \cdot \frac{1}{\sin\theta}$

$r\sin\theta = 3$

$y = 3$

Example #3: Graph $r = -12\cos\theta$ on your calculator then convert it to rectangular form and identify the graph.

$r^2 = -12r\cos\theta$

$x^2 + y^2 = -12x$

$x^2 + 12x + y^2 = 0$

→ complete the square

$x^2 - 12x + 36 + y^2 = 36$

$(x+6)^2 + y^2 = 36$

circle $C(-6, 0)$ $r = 6$

Example #4: Graph $r = 4\cos\theta - 8\sin\theta$ on your calculator then convert it to rectangular form and identify the graph.

$r^2 = 4r\cos\theta - 8r\sin\theta$

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

$x^2 - 4x + y^2 + 8y = 0$

→ complete the square

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

$(x-2)^2 + (y+4)^2 = 20$

CIRCLE $C(2, -4)$ $r = \sqrt{20}$

Example #5: Identify $x^2 + y^2 = 9$ then convert it to polar form and graph.

CIRCLE $C(0,0)$, $r = 3$

$r^2 = 9$

$r = \pm 3$ both are CIRCLES $C(0,0)$, $r = 3$

Example #4: Identify $(x-2)^2 + (y+7)^2 = 53$ then convert it to polar form and graph.

CIRCLE $C(2,-7)$ $r = \sqrt{53}$

$x^2 - 4x + 4 + y^2 + 14y + 49 = 53$

$(x^2 + y^2) - 4(x) + 14(y) = 0$

$(r^2) - 4(r\cos\theta) + 14(r\sin\theta) = 0$

$r(r - 4\cos\theta + 14\sin\theta) = 0$

$r = 0$ CIRCLE $C(0,0)$ $r = 0$

or

$r - 4\cos\theta + 14\sin\theta = 0$

$r = 4\cos\theta - 14\sin\theta$

CIRCLE $C(2,-7)$ $r = \sqrt{53}$

Example #5: Identify $2x - 3y = 7$ then convert it to polar form and graph.

$2(x) - 3(y) = 7$

LINE w/ slope $\frac{2}{3}$, y-INT $-\frac{7}{3}$

$2(r\cos\theta) - 3(r\sin\theta) = 7$

$r(2\cos\theta - 3\sin\theta) = 7$

$r = \dfrac{7}{2\cos\theta - 3\sin\theta}$

$-3y = -2x + 7$

$y = \frac{2}{3}x - \frac{7}{3}$

Example #6: Radar detects two airplanes at the same altitude. Their polar coordinates are (8mi, 110°) and (5mi,15°). How far apart are the planes? HINT: Plot the two coordinates and draw a triangle with these points at the ends of the hypotenuse.

1) Convert to rectangular + use distance formula

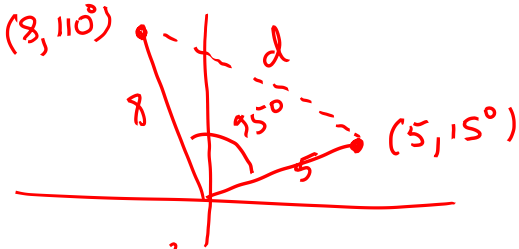
$(8, 110°) \approx (-2.74, 7.52)$

$(5, 15°) \approx (4.83, 1.29)$

$d = \sqrt{(-2.74 - 4.83)^2 + (7.52 - 1.29)^2}$

≈ 9.8

2) use law of cosines



$d^2 = 5^2 + 8^2 - 2 \cdot 5 \cdot 8 \cos 95°$

$d \approx 9.8$