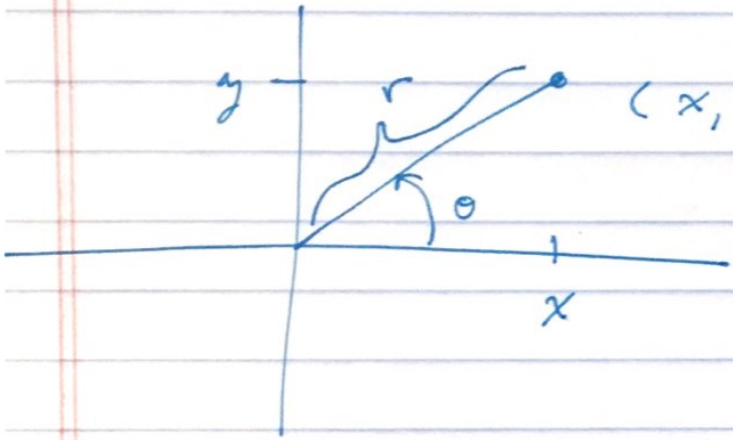
Polar Coordinates

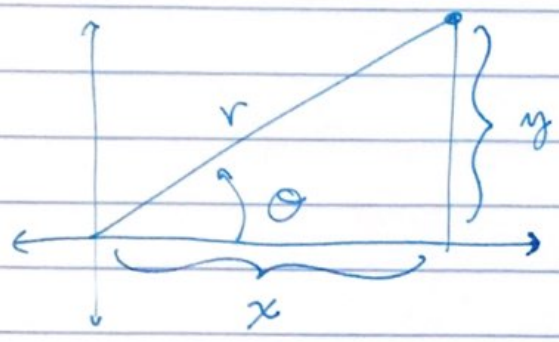


Another way to describe the point (x, y) is (r, θ).

Ex: $(x, y) = \left(\frac{\sqrt{3}}{2}, \frac{1}{2}\right)$

$(r, \theta) = \left(1, \frac{\pi}{6}\right)$

10.3 cont



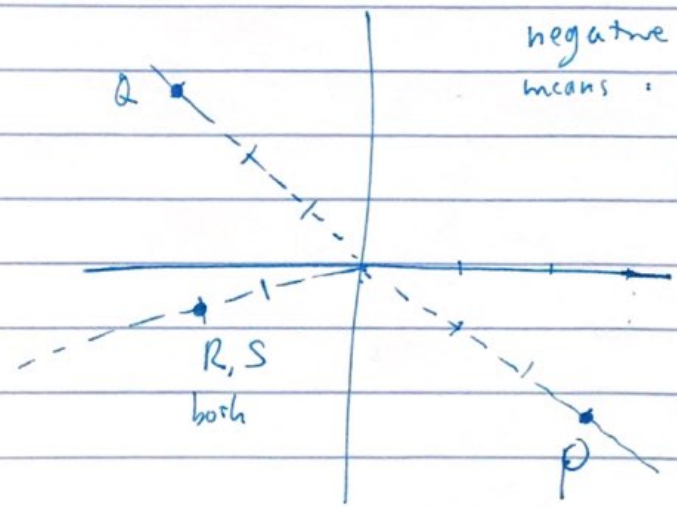
Plot polar points

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

Q $(-3, \frac{7\pi}{4})$

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

S $(2, \frac{7\pi}{6})$



negative radius means: 1) find the angle θ
2) go 180° away from θ.
3) use the positive radius

Find the x, y values for these points

$x = r\cos\theta$ (since $\frac{x}{r} = \cos\theta$)

$y = r\sin\theta$ (since $\frac{y}{r} = \sin\theta$)

P: $x = 3\cos\frac{7\pi}{4} = 3\left(\frac{\sqrt{2}}{2}\right)$

$y = 3\sin\frac{7\pi}{4} = 3\left(\frac{-\sqrt{2}}{2}\right)$

Q : $\left(-\frac{3\sqrt{2}}{2}, \frac{3\sqrt{2}}{2}\right)$

R : $\left(-2\frac{\sqrt{3}}{2}, 2\cdot\frac{1}{2}\right) = (-\sqrt{3}, 1)$

S : $(-\sqrt{3}, 1)$

More equations

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

$$\tan\theta = \frac{y}{x} \quad \text{or} \quad \sin\theta = \frac{y}{r}$$

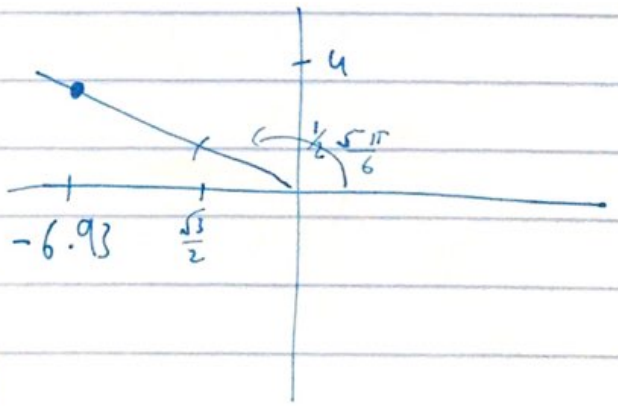
Given (x, y) find (r, θ) (not unique)

by

1) graphing (x, y)

2) finding r & θ using ★, making sure it fits the graph.

$(x, y) = (-4\sqrt{3}, 4)$



$r^2 = 16 \cdot 3 + 16 = 64$

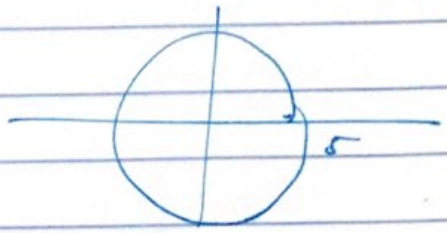
$r = 8 \quad$ (choose $r \geq 0$)

$\sin\theta = \frac{4}{8} = \frac{1}{2} \qquad \theta = \frac{5\pi}{6}$

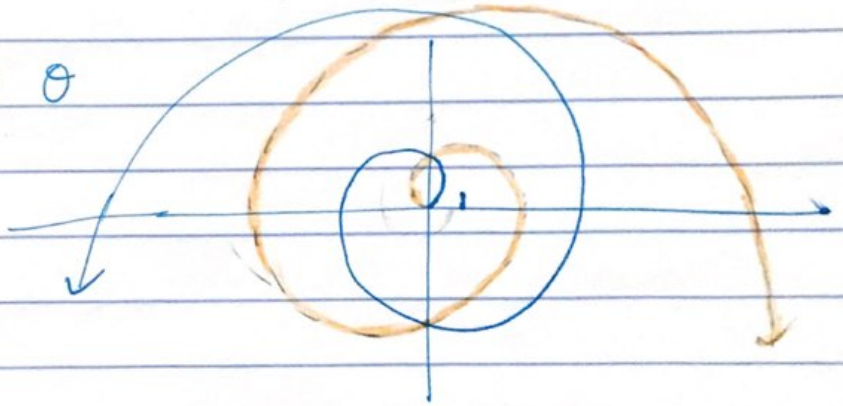
Polar Curves

function $r = f(\theta)$

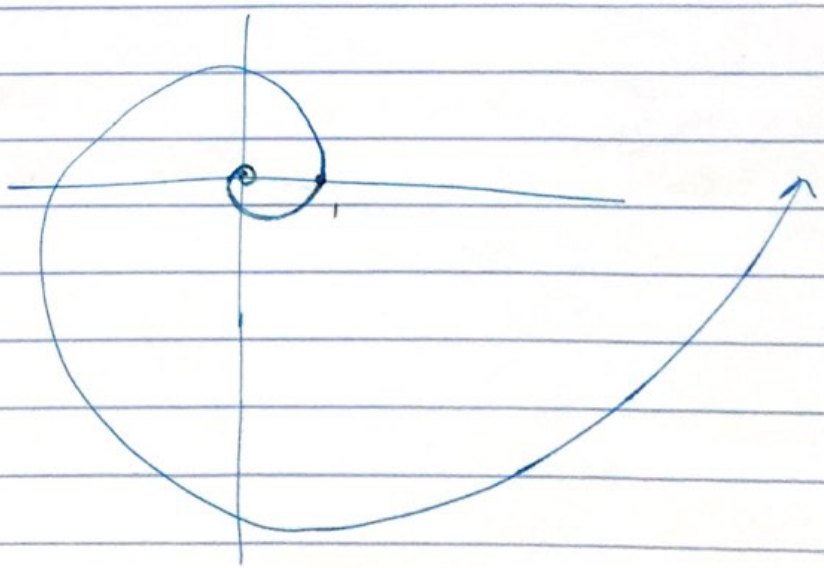
Ex. $r = 5$



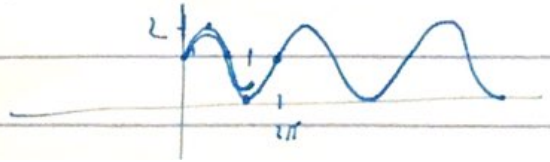
Ex. $r = \theta$

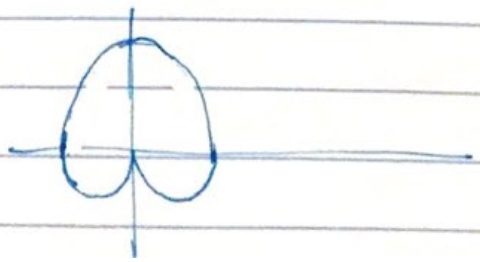


Ex $r = e^{\theta}$

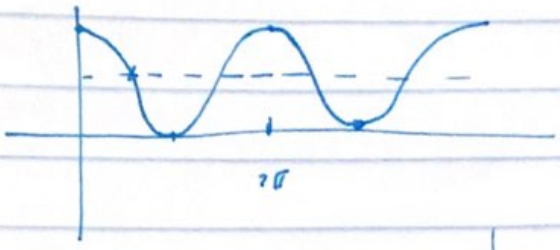


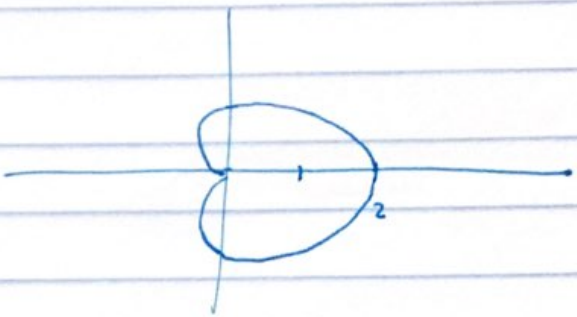
Ex $r = \sin\theta + 1$



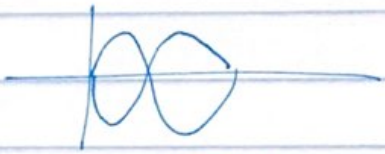


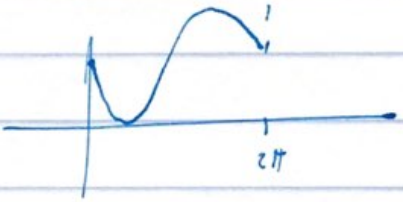
Ex $r = \cos\theta + 1$

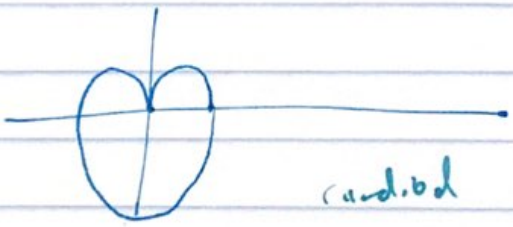




$r = 1 - \sin\theta$

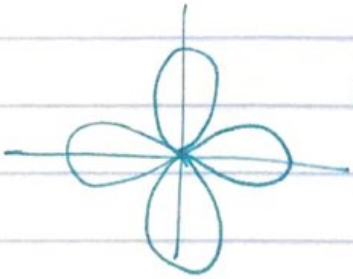






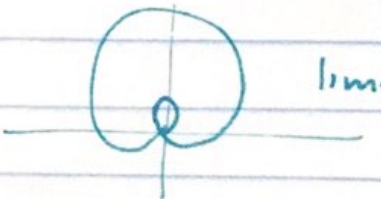
cardioid

$\cos 2\theta$



rose

$1 + 2\sin\theta$



limacon