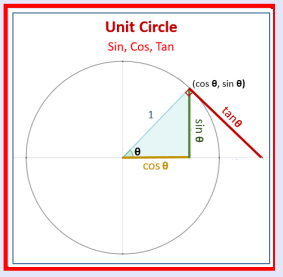
Math 241

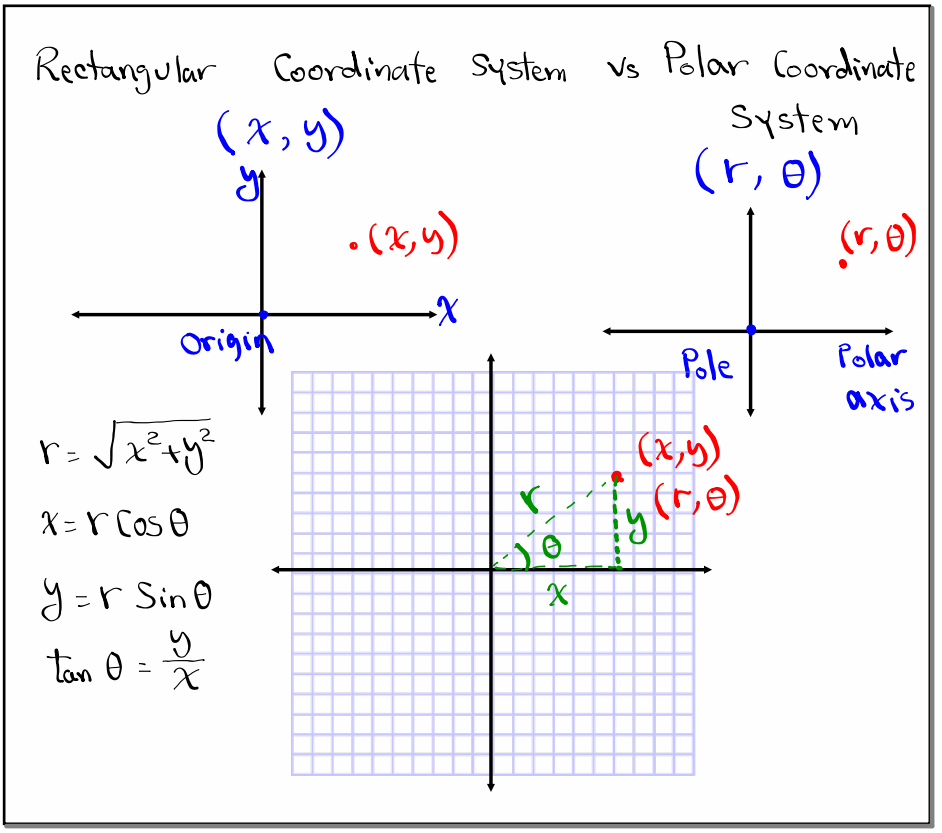
Winter 2024

Lecture 18

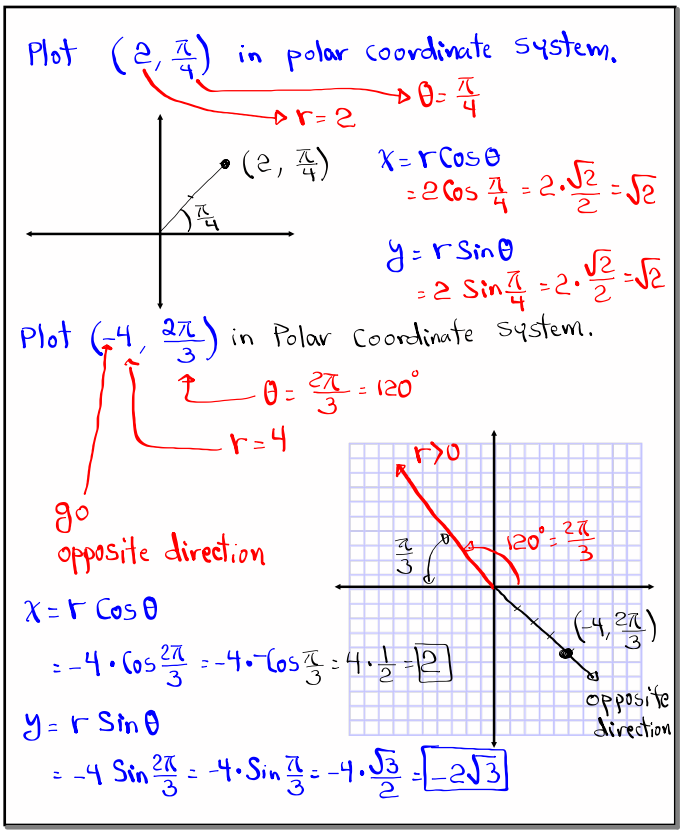


Feb 19-8:47 AM

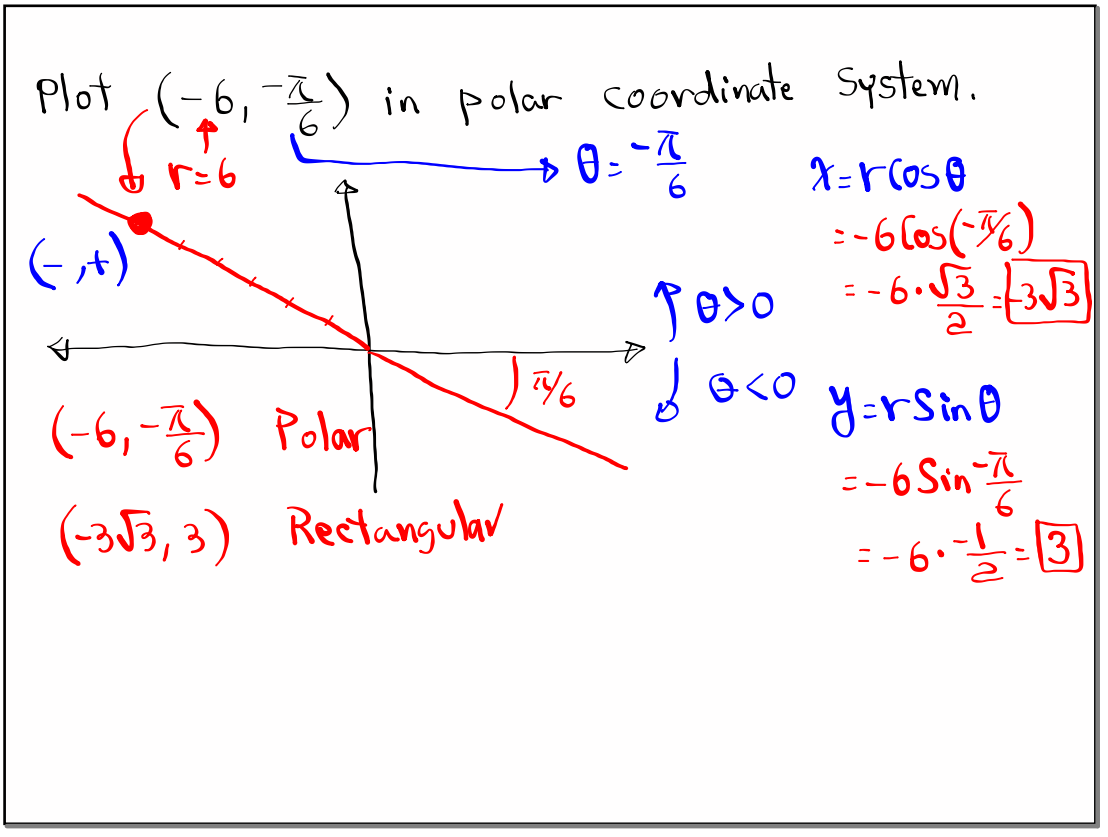
Rectangular Coordinate System vs Polar Coordinate System



Feb 1-8:09 AM



Feb 1-8:14 AM

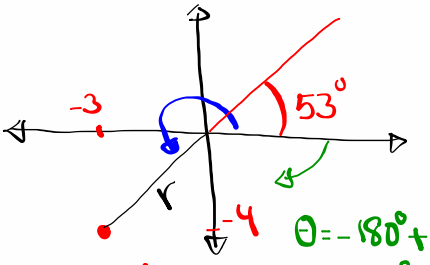


Feb 1-8:23 AM

Find Polar Coordinates for the point $(-3,-4)$

in rectangular. $r = \sqrt{x^2+y^2} = \sqrt{(-3)^2+(-4)^2} = \sqrt{25} = 5$

$\boxed{r=5}$



$\tan\theta = \frac{y}{x}$ $\tan\theta = \frac{-4}{-3}$

$\theta = -180° + 53° = -127°$ $\tan\theta = \frac{4}{3}$

$RA = \tan^{-1}\frac{4}{3} \approx 53°$

$\theta = 180° + RA$

$\theta = 180° + 53° \approx 233°$

$(-3,-4)$

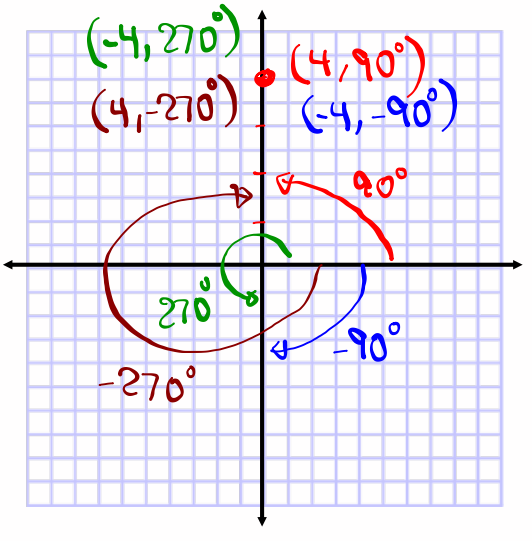
$(5, 233°)$

$(-5, 53°)$

$(5, -127°)$

Feb 1-8:28 AM

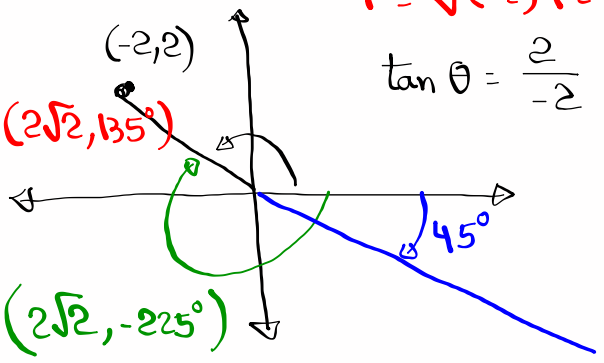
Plot $(4,90°)$, $(-4,-90°)$, $(-4,270°)$, $(4,-270°)$



Feb 1-8:35 AM

Consider $(-2, 2)$ in rectangular

$r = \sqrt{(-2)^2 + 2^2} = \sqrt{8} = 2\sqrt{2}$



$\tan\theta = \frac{2}{-2}$ $\tan\theta = -1$

RA $45°$

$\theta = 180° - 45° = 135°$

Feb 1-8:39 AM

Graphing Simple Polar equations:

Graph $r = 4$

$\sqrt{x^2 + y^2} = 4$

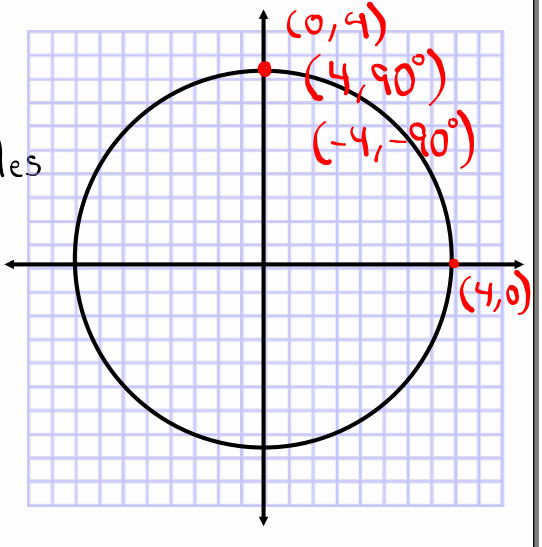
Square both sides

$x^2 + y^2 = 16$

Circle

Center $(0,0)$

Radius 4

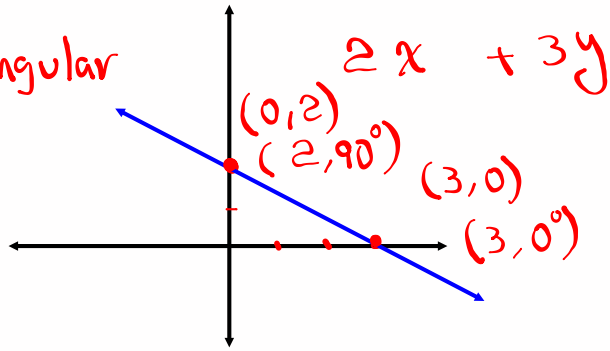


Feb 1-8:44 AM

Graph $r = \dfrac{6}{2\cos\theta + 3\sin\theta}$

Cross-Multiply $\quad 2r\cos\theta + 3r\sin\theta = 6$

Convert to rectangular $\quad 2x + 3y = 6$



x	y
0	2
3	0

Feb 1-8:48 AM

Graph $r = 2\sin\theta$

Multiply both sides by r

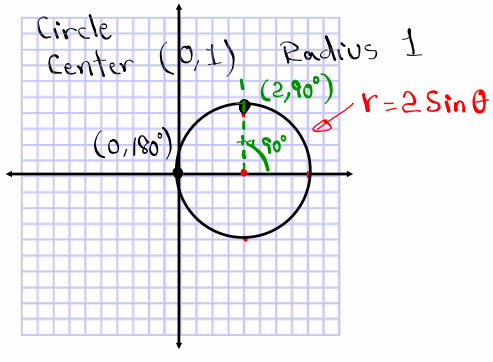
$r^2 = 2r\sin\theta$

Convert to rectangular

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

$(x-h)^2+(y-k)^2=R^2$ $\quad x^2 + y^2 - 2y + 1 = 0 + 1$

$(x-0)^2 + (y-1)^2 = 1$



Feb 1-8:53 AM

Graph $r = -4\cos\theta$

θ	r
0°	-4
90°	0
180°	4
270°	0
360°	-4

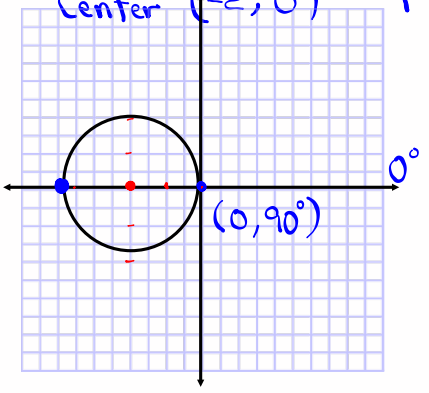
$r^2 = -4r\cos\theta$

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

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

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

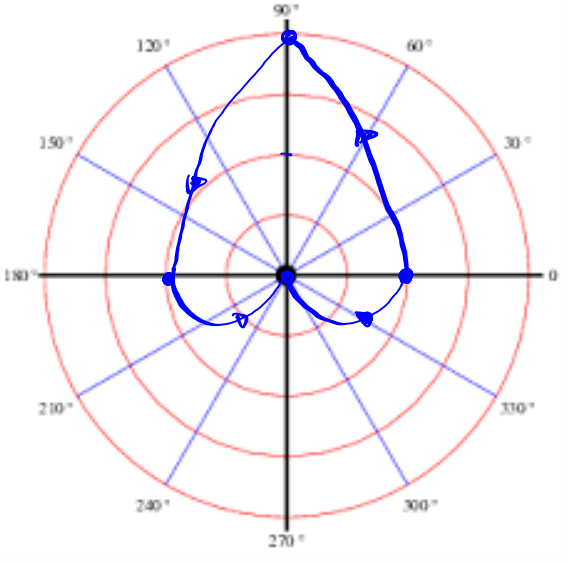
Center $(-2, 0)$ $r = 2$



Feb 1-9:00 AM

Graph $r = 1 + \sin\theta$

θ	r
0°	1
90°	2
180°	1
270°	0
360°	1

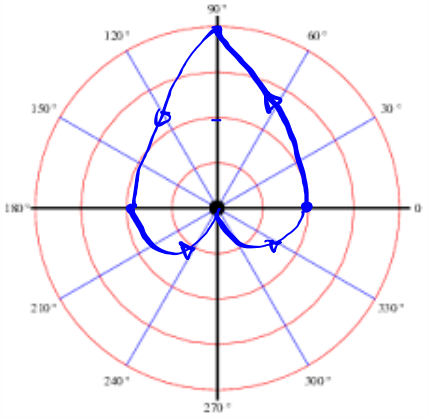


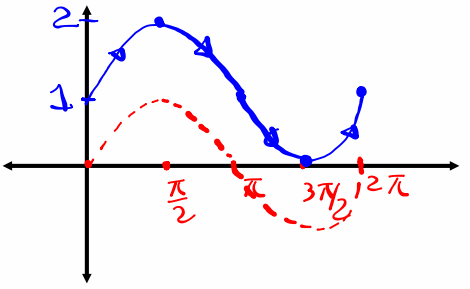
Feb 1-9:08 AM

Graph $r = 1 + \sin\theta$

Hold!

Graph $y = 1 + \sin x$





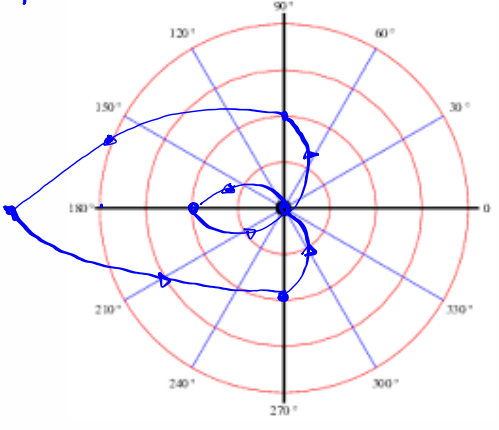
Feb 1-9:14 AM

Graph $r = 1 - 2\cos\theta$

θ	r
$0°$	-1
$90°$	1
$180°$	3
$270°$	1
$360°$	-1

$r = 0 \quad 1 - 2\cos\theta = 0 \quad \cos\theta = \frac{1}{2} \quad \theta = 60°$

$r = 0 \quad 1 - 2\cos\theta = 0 \quad \cos\theta = \frac{1}{2} \quad \theta = 300°$

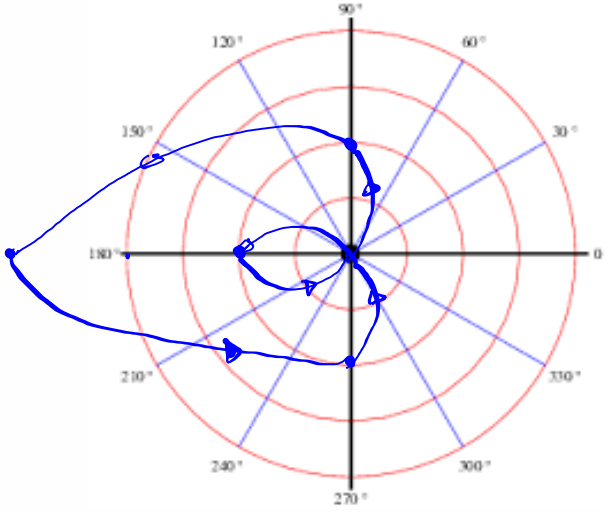


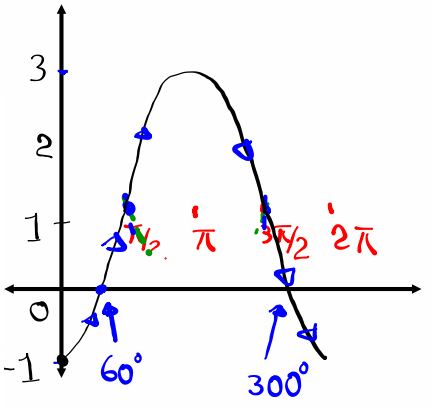
Feb 1-9:38 AM

Graph $r = 1 - 2\cos\theta$

Hold!

Graph $y = 1 - 2\cos x$





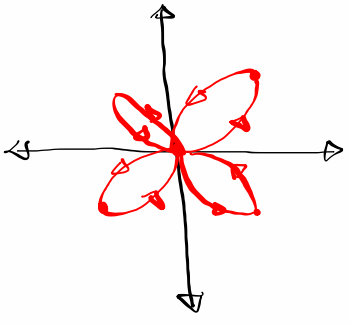
Feb 1-9:47 AM

Graph $r = 2\sin 2\theta$

θ	r
0°	0
90°	0
180°	0
270°	0
360°	0

θ	r
0°	0
45°	2
90°	0
135°	-2
180°	0
225°	2

$r = 2\sin 2\theta$



Feb 1-9:56 AM

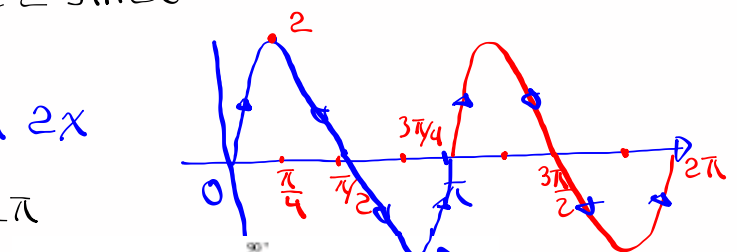
Graph $r = 2\sin 2\theta$

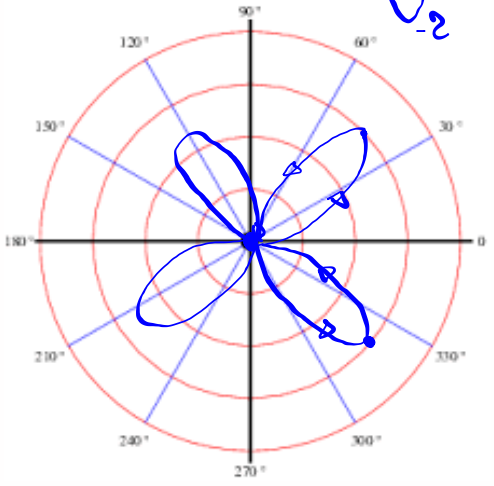
Hold!

$y = 2\sin 2x$

$0 \le 2x \le 2\pi$

$0 \le x \le \pi$





Feb 1-10:04 AM

Graph $r = 2\cos 3\theta$

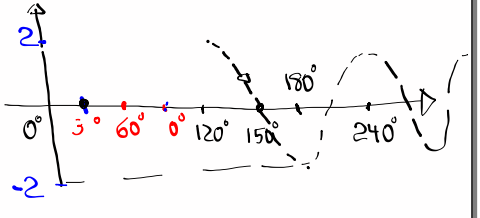
Hold!

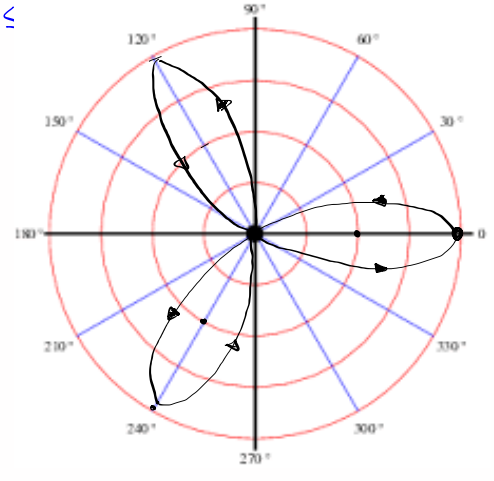
$y = 2\cos 3x$

$0° \le 3x \le 360°$

$0° \le x \le 120°$

$0 \le x \le$





Feb 1-10:09 AM

$r = a \sin n\theta$

$r = a \cos n\theta$

Roses

Loops → Petals

If n is even → $2n$ petals

If n is odd → n petals

$r = 3 \cos 5\theta$ → 5 is odd → 5 petals

$r = 2 \sin 4\theta$ → 4 is even → 8 petals

Feb 1-10:19 AM

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

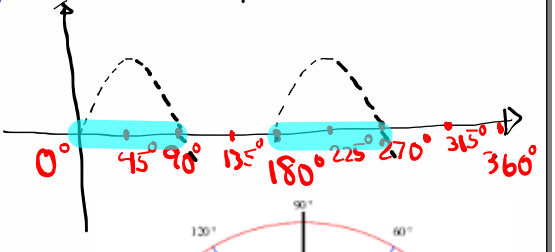
Hold

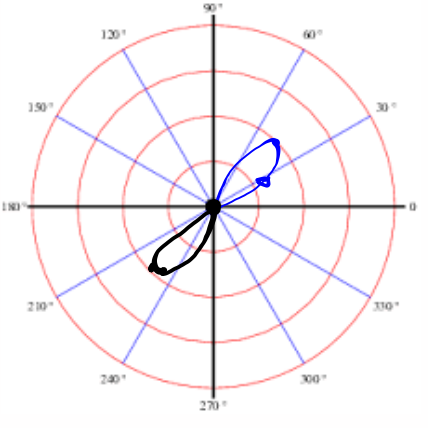
$y^2 = \sin 2x$

$y = \pm\sqrt{\sin 2x}$

Can we take Square-root of negative number? NO

Graph $\sin 2x$





Feb 1-10:23 AM

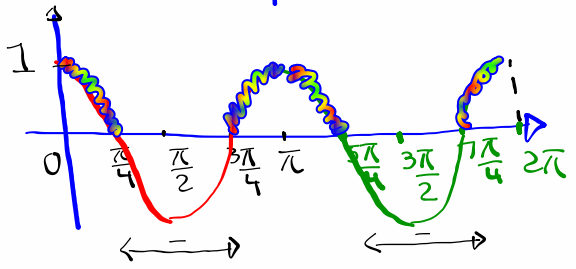
Graph $r^2 = \cos 2\theta$

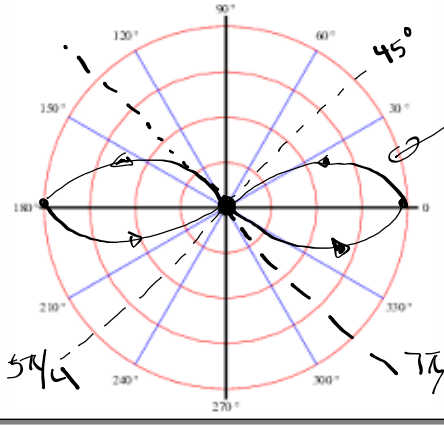
Hold!

Graph $y^2 = \cos 2x$

$y = \pm\sqrt{\cos 2x}$

Graph $\cos 2x$





45°

$r^2 = \cos 2\theta$

5π/4

7π/4

Feb 1-10:33 AM