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Section 10.1: Curves Defined by Parametric Equations

Example: Use the parametric function $x(t) = t^2 + 3t$, $y(t) = 2t + 5$ to answer the following.

A) Is the point $(10, 8)$ on the graph? Justify your answer.

NO!

$y = 2t + 5$

$8 = 2t + 5$

$3 = 2t$

$1.5 = \frac{3}{2} = t$

$x = t^2 + 3t$

$= (1.5)^2 + 3(1.5)$

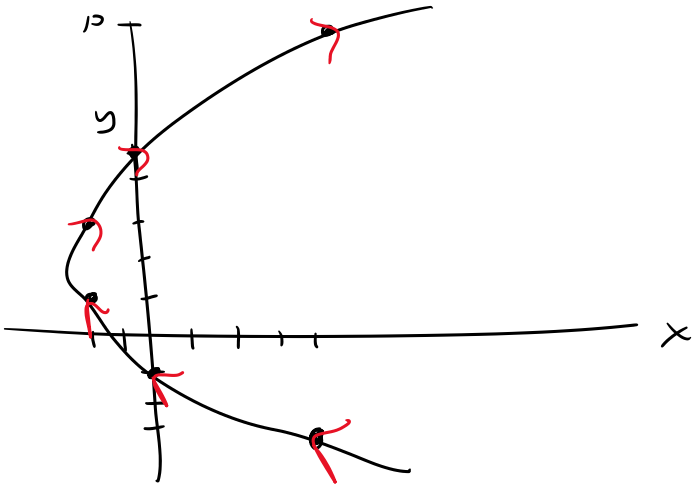
$= 2.25 + 4.5$

$= 6.75 \neq 10$

B) Sketch the graph of the curve.

values of t

t	x	y
-4	4	-3
-3	0	-1
-2	-2	1
-1	-2	3
0	0	5
1	4	7
2	10	9



C) Find the Cartesian equation of the parametric function.

$x = t^2 + 3t$

$y = 2t + 5$

$y - 5 = 2t$

$\frac{y-5}{2} = t$

$x = \left(\frac{y-5}{2}\right)^2 + 3\left(\frac{y-5}{2}\right)$

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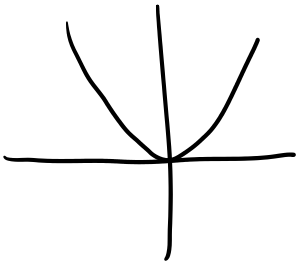
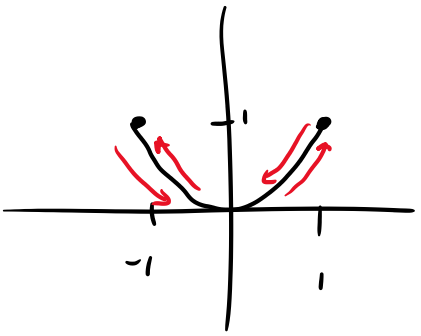
Example: Sketch the curve $x = \cos(t)$, $y = \cos^2(t)$.

$x = \cos t$ $\quad y = \cos^2 t$

$-1 \le x \le 1$ $\quad 0 \le y \le 1$

$y = x^2$





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path of a circle of radius r.

$x = r\cos\theta$	$x = r\sin\theta$
$y = r\sin\theta$	$y = r\cos\theta$

Example: Sketch the graph of these parametric curves.

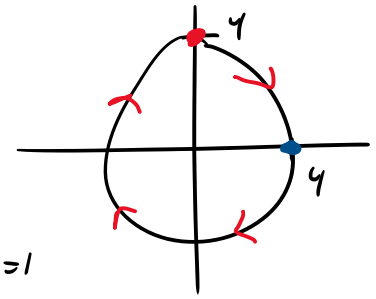
A) $x = 4\sin(t),\ y = 4\cos(t)$

$\frac{x}{4} = \sin t \qquad \frac{y}{4} = \cos t$

$\sin^2(t) + \cos^2(t) = 1$

$\left(\frac{x}{4}\right)^2 + \left(\frac{y}{4}\right)^2 = 1 \rightsquigarrow \frac{x^2}{16} + \frac{y^2}{16} = 1$

$x^2 + y^2 = 16$



$\theta = 0$

$x = 0 \quad y = 4$

$\theta = \frac{\pi}{2}$

$x = 4 \quad y = 0$

B) $x = 4\cos(t),\ y = 4\sin(t)$