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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.

$2t + 5 = 8$

$2t = 3$

$t = 3/2$

$x(3/2) = \left(\frac{3}{2}\right)^2 + 3\left(\frac{3}{2}\right)$

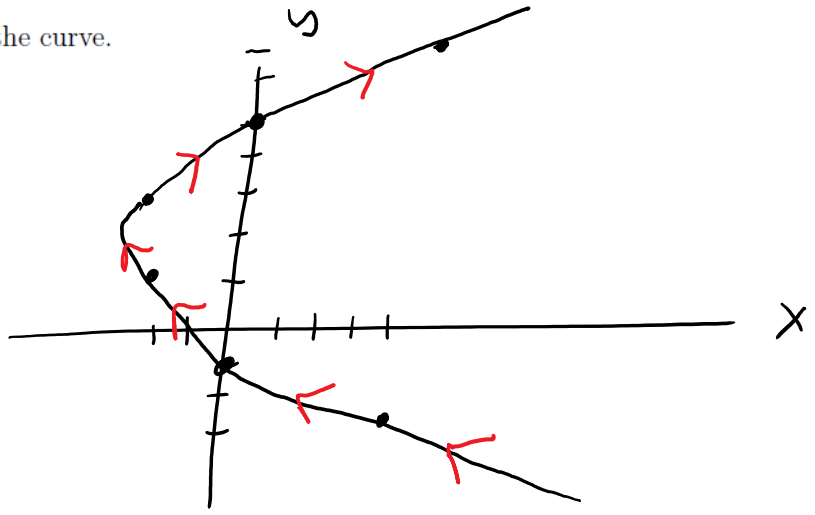
$= \frac{9}{4} + \frac{9}{2}$

$= \frac{9}{4} + \frac{18}{14}$

$= \frac{27}{4} \neq 10$

B) Sketch the graph of the curve.

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.

$x = t^2 + 3t$ $\quad y = 2t + 5$

$y - 5 = 2t$

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

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

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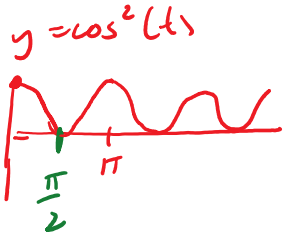
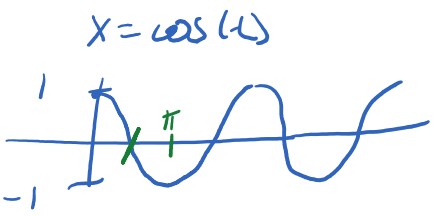
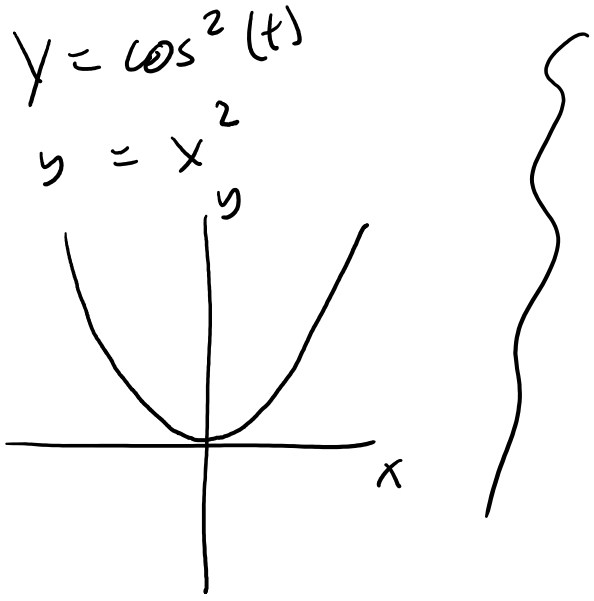
Example: Sketch the curve $x = \cos(t)$, $y = \cos^2(t)$.

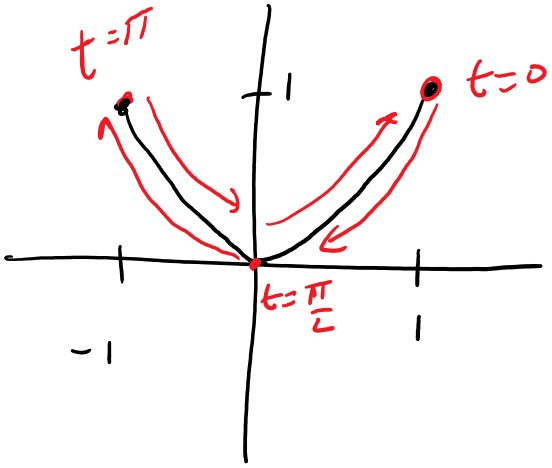




$-1 \le x \le 1$

$0 \le y \le 1$





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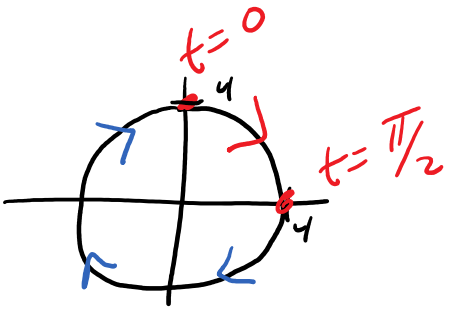
Example: Sketch the graph of these parametric curves.

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

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



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

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

$\frac{x^2}{16} + \frac{y^2}{16} = 1$

$x^2 + y^2 = 16$

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