

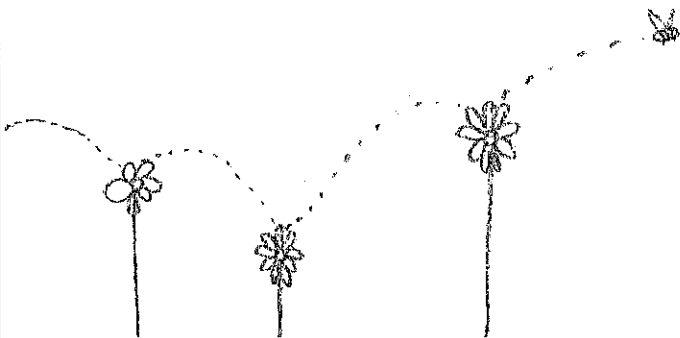
PC 8-3 Parametric Equations Investigation

Parametric equations are equations that define both the x-coordinate and y-coordinate independently. Each as a separate function based on a single variable, t . We think of t as being the time and the x and y coordinates being the path that one follows as time progresses. Remember, both x and y are functions of t .

Graphing parametric equations: For the parametric equations given, complete the table and plot the points. Indicate the time on the graph and draw arrows to indicate the orientation.

As time (t) progresses towards more positive values, the new coordinates (x,y) created provide a pathway for the shape of the parametric equation. It is for this reason that when graphing a parametric equation we use an arrow to indicate the direction of the shape.

Example: A honey bee is flying from one flower to the next. The picture shows the path of the bee at different points (x,y) as time (t) moves forward.

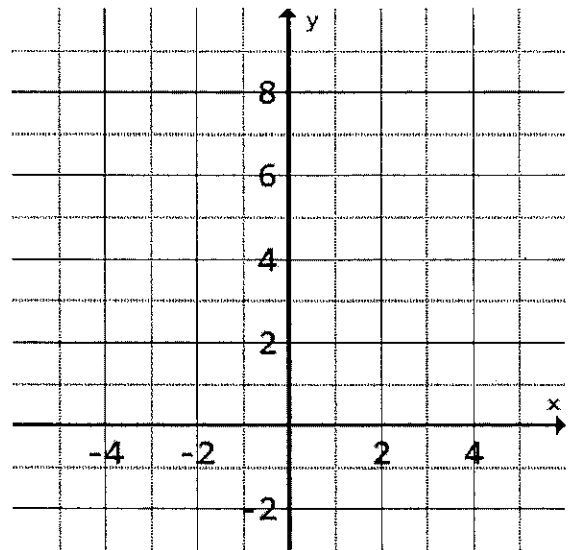


Graph the parametric equations by filling out the table.

$$\begin{cases} x(t) = t + 3 \\ y(t) = t^2 + 2 \end{cases}$$

$$-2 \leq t \leq 3$$

t	$x(t)$	$y(t)$
-2		
-1		
0		
1		
2		
3		



Circle Equations

The graph of the parametric equations

$$\begin{cases} x(t) = h + r \cos(t) \\ y(t) = k + r \sin(t) \end{cases} \text{ for } 0 \leq t \leq 2\pi$$

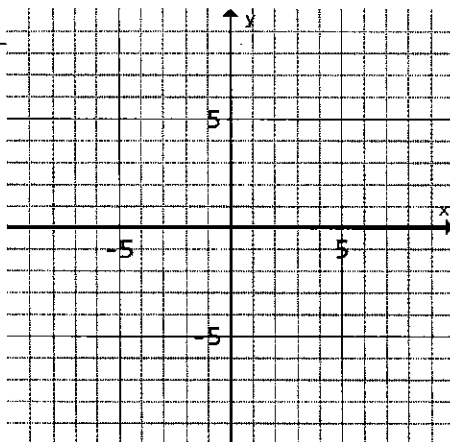
is a circle with radius _____ and center at _____. The rectangular equation for such a circle is

$$(x - h)^2 + (y - k)^2 = r^2.$$

Graph.

$$\begin{cases} x(t) = 3 + 2 \cos(t) \\ y(t) = 2 \sin(t) \end{cases}$$

Write the rectangular Equation below:



Ellipse Equations

The graph of the parametric equations

$$\begin{cases} x(t) = h + a \cos(t) \\ y(t) = k + b \sin(t) \end{cases} \text{ for } 0 \leq t \leq 2\pi$$

is an ellipse with center at (h,k) and a determines the horizontal "radius" and b determines the vertical "radius".

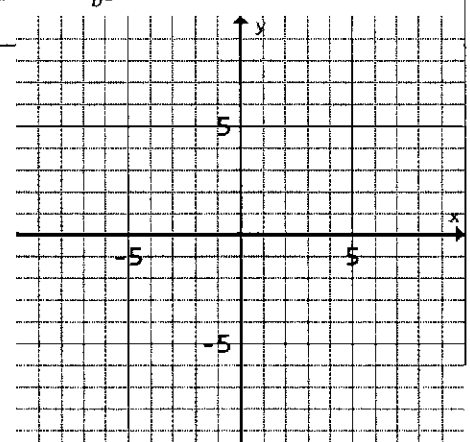
The rectangular equation for an ellipse is

$$\frac{(x-h)^2}{a^2} + \frac{(y-k)^2}{b^2} = 1.$$

Graph.

$$\begin{cases} x(t) = 5 \cos(t) \\ y(t) = 2 \sin(t) \end{cases}$$

Write the rectangular Equation below:



----- Fold this paper and glue it in your notebook -----

Implicit equations:

Rectangular equations like the one for the ellipse and a circle, where y is not explicitly solved for, are called implicit equations. In other words, any rectangular equation where x and y are on the same side is considered implicit.

Practice: Remove the parameter t in the parametric equations below and re-write as an implicit equation.

Parametric Equation:

Implicit Equation:

$$\begin{cases} x(t) = t + 3 \\ y(t) = t^2 \end{cases}$$

Parametric Equation:

Implicit Equation:

$$\begin{cases} x(t) = 2 + 7 \cos(t) \\ y(t) = -3 + 4 \sin(t) \end{cases}$$