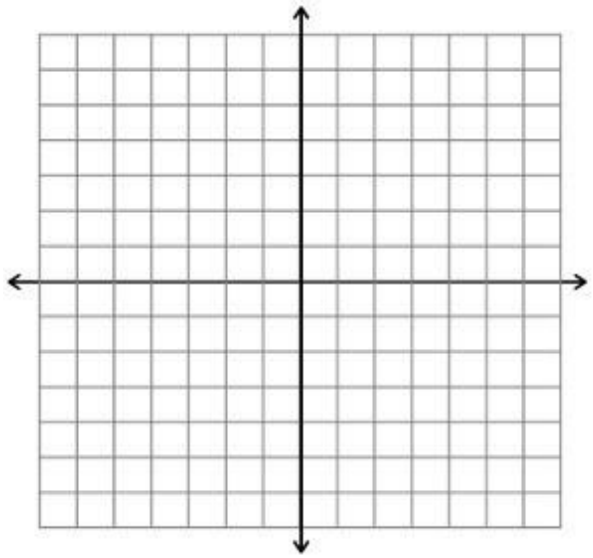
AP Calculus BC Name:

7'.3 DN

A) Imagine there is a little particle floating around on the surface of a pond. If you impose an x-y coordinate system onto the pond, then at any time *t* (seconds), the particle has both an *x* and a *y* coordinate (cm from the origin).

Let's say the *x*-coordinate depends on time according to the function $x(t) = t^2 + t$

And the y-coordinate depends on time according to the function $y(t) = 2t - 1$



1. Plot some points to trace the path of the particle

Time t	*x-coordinate*	*y-coordinate*
-2		
-1		
1/2		
0		
1		

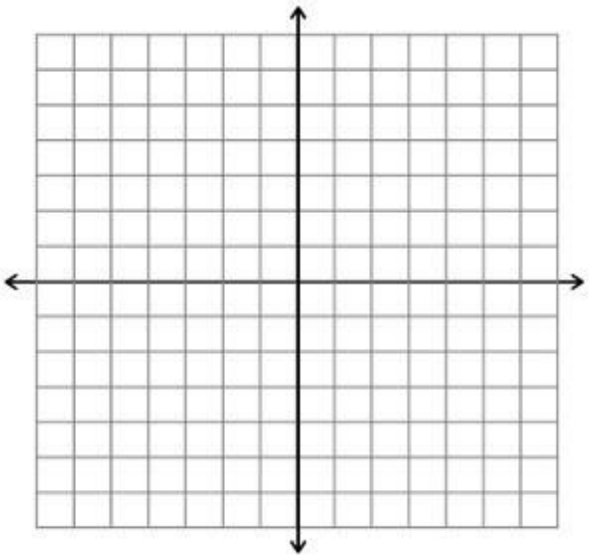
This is called a "parametric equation". Both coordinates are depending on a third variable *t*, called the parameter. *x* and *y* are related to one another, and one can trace a path of x-y coordinates, but they are not necessarily functions of one another. They are both functions of *t*.

2. How do I find an equation for the path of the particle? (not depending on time)

3. What if I restrict the parameter to $-1 \leq t \leq 1$?

B) Consider the parametric equation $x = 5\cos t$, $y = 2\sin t$.

1. What curve will this particle trace as time goes from 0 to 2π?

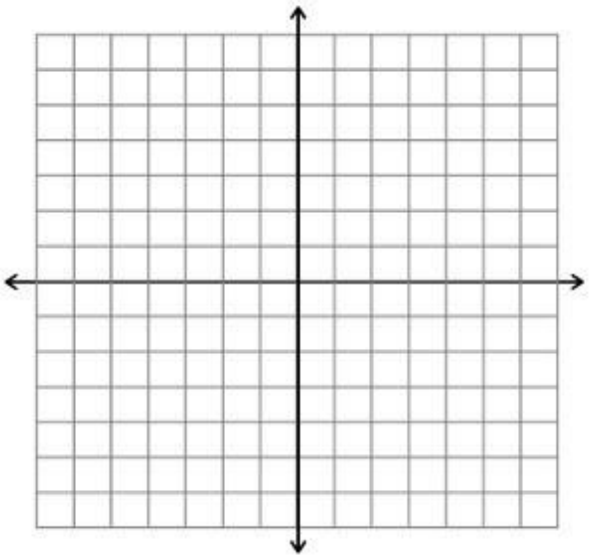


2. How much of the ellipse will be included?

3. In what direction is the particle moving?

C) Now consider the parametric equation
$x = 5\cos(3t), y = 2\sin(3t), 0 \leq t \leq 2\pi$

1. Make a prediction: what effect will multiplying t by 3 have?



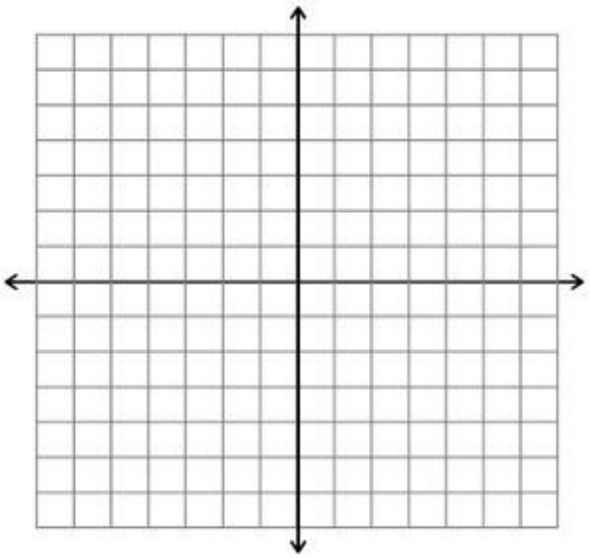
2. Find the equation of the curve

3. How much of the curve is included?

4. What is the direction of motion?

D) Now consider the parametric equation $x = \sin^2 t, y = 2\cos t$.

1. Find the equation of the curve



2. How much of the curve is included?

3. Over what interval of time is this curve traced?

4. What is the direction of motion?