10.5 Parametric Equations

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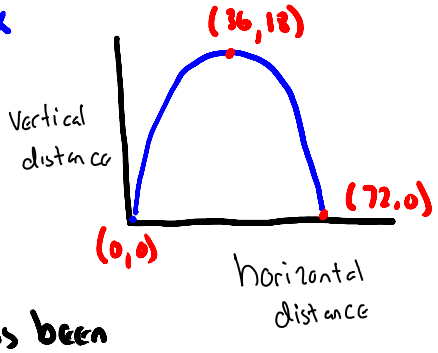
11:21 AM

Consider the path of an object propelled into the air at an angle of 45°. If the initial velocity is 48 ft/sec, the object follows a parabolic path:

$$y = -\frac{x^2}{72} + x$$



The eqn. $y = -\frac{x^2}{72} + x$

- tells <u>where</u> the obj. has been or going to be.
- does not tell <u>when</u> the obj. will be at a given point (x,y).
- Need a third variable "t" is needed for the <u>when</u>.

Parameter is the third variable of a function.

If you rewrite the equation as a function of "t" you obtain the **Parametric Eqn.**

$$x = 24\sqrt{2}\,t$$
$$y = -16t^2 + 24\sqrt{2}\,t$$

For these eqns, you can determine that $t = 0$ when the object is at $(0,0)$

at $t = 1$ $\quad x = 24\sqrt{2}(1) \approx 33.94$ ft

$y = -16(1)^2 + 24\sqrt{2}(1) \approx 17.94$ ft

at 1 sec, the object was 33.94 ft horizontally and 17.94 ft vertically.

At the vertex (max) what is the time?

(36, 18)

$x = 24\sqrt{2}t$

$\frac{36}{24\sqrt{2}} = \frac{24\sqrt{2}t}{24\sqrt{2}}$

$t \approx 1.06$ sec

$y = -16t^2 + 24\sqrt{2}t$

$18 = -16t^2 + 24\sqrt{2}t$

$0 = -16t^2 + 24\sqrt{2}t - 18$

When does the ball hit the ground?

(72, 0)

$x = 24\sqrt{2}t$

$72 = 24\sqrt{2}t$

$t = 2.12$ sec

$x = 24\sqrt{2}t$ and $y = -16t^2 + 24\sqrt{2}t$ are Continuous

Defn. of a Plane Curve

If "f" and "g" are continuous functions of "t" on the interval I, the set of ordered pairs $(f(t), g(t))$ is a Plane Curve "C".

The eqns $x = f(t)$ and $y = g(t)$ are Parametric eqns for C, and t is parameter.

* Plane Curves have directions (arrow heads) and have a beginning and ending.

Sketch a curve represented by a Parametric Eqn.

- Plot points in the x, y plane

- Each set of coordinates (x, y) is determined from a value chosen for the parameter (t).
- Plotting the resulting values of t, trace the curve in a SPECIFIC direction (Orientation of the Curve).