

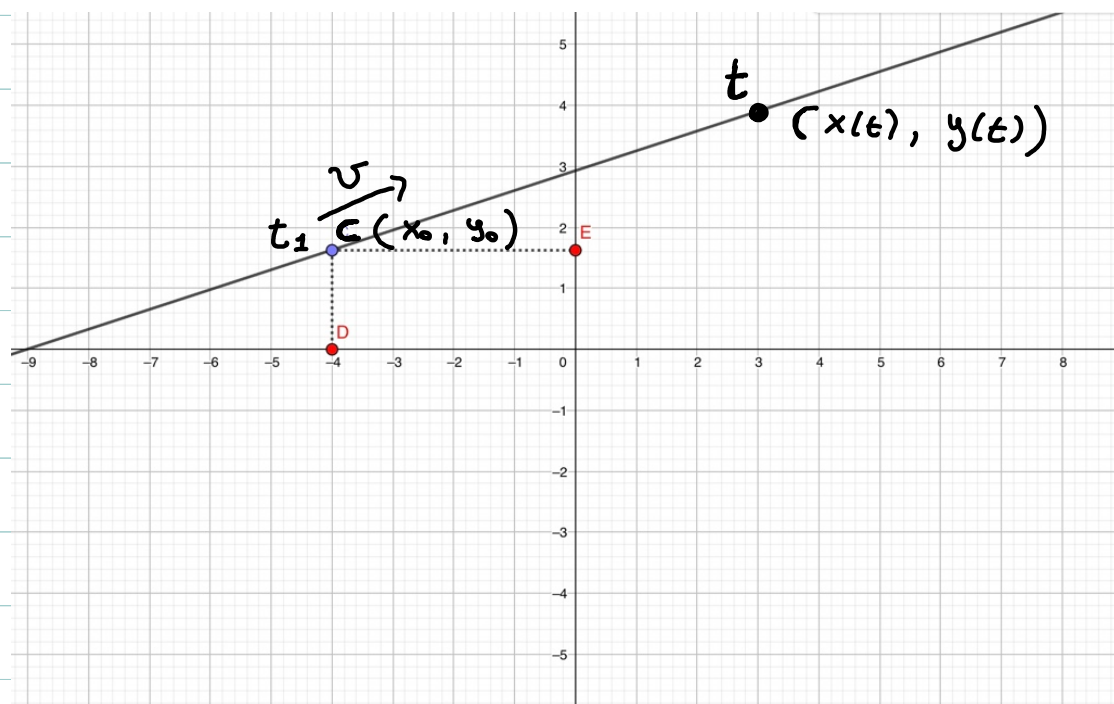
Lesson 7

Finish Chapter 4, start Chapter 5

Parametric equations of motion

Functions, domain range

Uniform linear motion



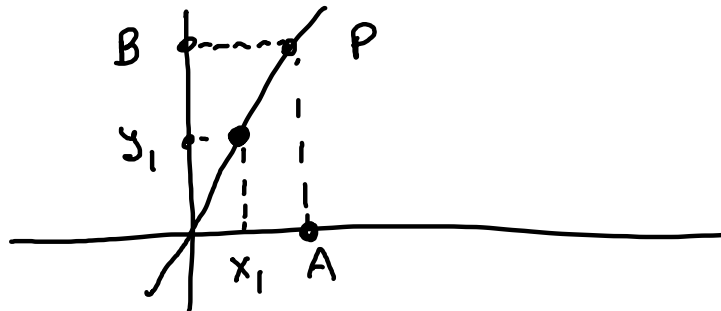
Parametric equations. Uniform rectilinear motion.

Suppose an object is at (x_1, y_1) at time t_1 and it moves along a straight line at constant speed v .

The parametric equations of motion of the object are :

$$x(t) = x_1 + v_x(t - t_1), \quad y(t) = y_1 + v_y(t - t_1)$$

for t and t_1 greater than the time when the object started moving, where v_x is the horizontal component of the velocity and v_y is the vertical component of the velocity.

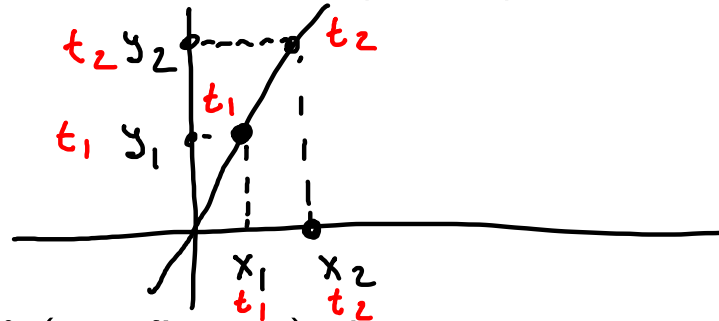


You can calculate v_x and v_y in different ways, depending on what the problem gives you :

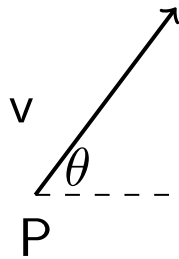
- ▶ If you also know the object is at $Q(x_2, y_2)$ at time t_2 then

$$v_x = \frac{x_2 - x_1}{t_2 - t_1} \left(\frac{\Delta x}{\Delta t} \right)$$

$$v_y = \frac{y_2 - y_1}{t_2 - t_1} \left(\frac{\Delta y}{\Delta t} \right)$$



- ▶ If you know v and θ (see figure) then



$$v_x = v \cos(\theta)$$

$$v_y = v \sin(\theta).$$

Note: in many problems time t_1 is just the initial time so $t_1 = 0$ in which case you have

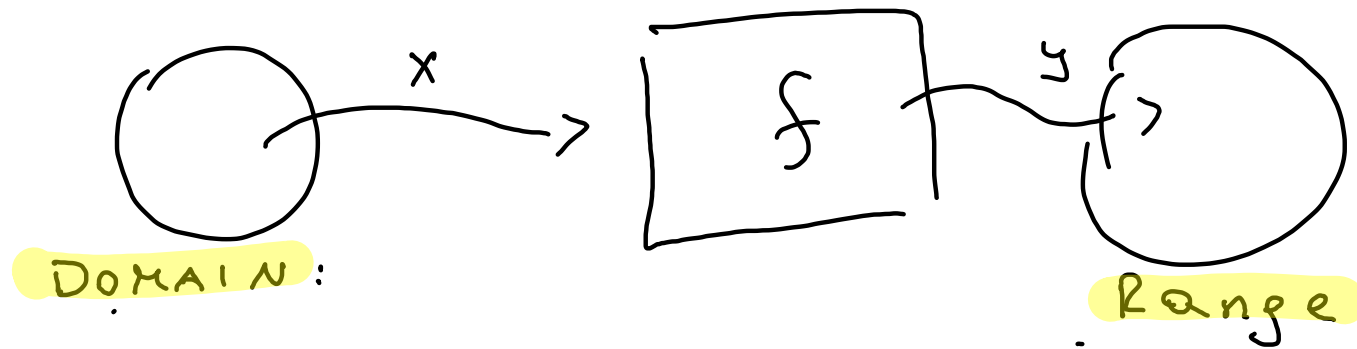
$$x = x_1 + v_x t, \quad y = y_1 + v_y t$$

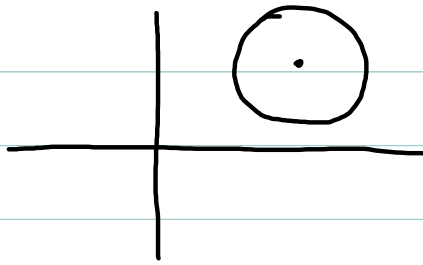
Alice is running at a speed of 5mph starting at $P(1, 3)$ along the line $y = 2x + 1$ in the NE direction. What are Alice's parametric equations of motion ?

When is Alice 's 4 mi away from the point $R(2, 2)$?

At time t Alice is at $(1 + \sqrt{5}t, 3 + 2\sqrt{5}t)$

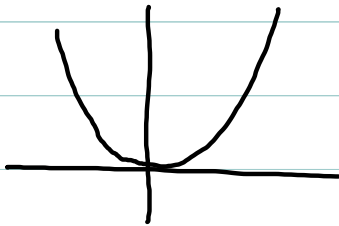
What is a function?





$$(x-x_0)^2 + (y-y_0)^2 = r^2$$

Not a function



$$y = x^2$$

Function

Interval notation

$(2, 3)$ means all x with $2 < x < 3$

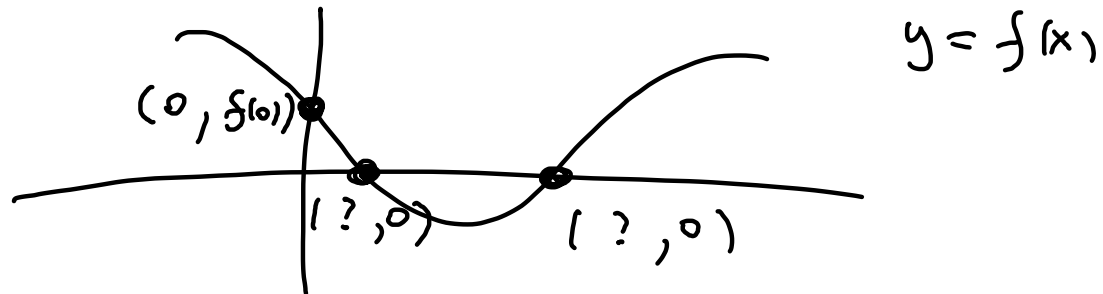
$[2, 3]$ means all x with $2 \leq x \leq 3$

$[2, 3)$ means all x with $2 \leq x < 3$

$(-\infty, +\infty)$ means all x in R

$(2, +\infty)$ $x > 2$

x and y intercepts



Given $y = f(x)$

To find y intercept calculate $f(0)$, if 0 is in domain

To find x intercept(s) set $f(x) = 0$ and solve for x

Find x and y intercepts for $f(x) = x^2 - 5x + 6$
 $y = x^2 - 5x + 6$

1) For y intercept: $x = 0$ compute $f(0) = 6$ $(0, 6)$

2) For x intercept: $y = 0$ solve $0 = x^2 - 5x + 6 \dots x = 2, 3$

$(2, 0)$ $(3, 0)$

