Lesson 5

Read Chapter 4

Parametric coordinates of motion for linear motion

The parametric equation of motion of a moving object are a pair of equations of the form

$$x(t) = \text{formula in } t$$

$$y(t) = \text{formula in } t$$

They give us the coordinates of the object at time t

Parametric equations. Uniform rectilinear motion.

Suppose an object is at $P(x_1, y_1)$ at time t_1 and it moves along a straight line at constant speed v.
The parametric equations of motion of the object are :

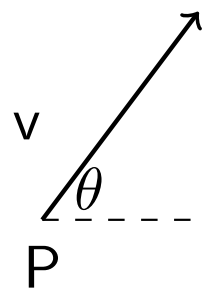
$$x = x_1 + v_x(t - t_1), \qquad y = y_1 + v_y(t - t_1)$$

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

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

Alice is running in the xy plane. She runs in a straight line from the point (1,2) to the point (-3,5) taking 5 seconds. Find her equations of motion.

Alice is running at a speed of 5mi/hr 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 $Q(4, 4)$?

A crop dusting airplane flying a constant speed of 120mph is first spotted 2 miles South and 1.5 miles East of the center of circular irrigated field. The irrigated field has radius 1 mile. The plane flies in a straight line to a point 1 mile West of the center of the irrigated field.
Find the location A where the crop duster enters the airspace above the field

When does the plane first enter the airspace above the field ?
(Assume time t=0 corresponds to when the plane is first spotted)

How much time does the plane spend flying over the irrigated field?