Q- An object is accelerating along x axis with an acceleration of 2 m/s^2 for three 3s and attaining a velocity of 20 m/s at an angle of 30^0 with positive x direction.

(a) Calculate magnitude of initial velocity of the object.

(b) Find the direction of initial velocity vector.

The final velocity vector can be resolved in x and y direction and the components are given by

$$v_x = v\cos\theta = 20\cos 30^0 = 20 * 0.866 = 17.3\, m/s$$

And $$v_y = v\sin\theta = 20\sin 30^0 = 20 * 0.500 = 10.0\, m/s$$

As the acceleration in x direction is 2 m/s2 the x component of its initial velocity ux is given by using equation of motion as

$$v_x = u_x + at$$

Or $$17.3 = u_x + 2 * 3$$

Or $$u_x = 17.3 - 6 = 11.3\, m/s$$

As there is no acceleration in y direction the y component of velocity remains constant i.e.

$$u_y = v_x = 10.0\, m/s$$

Hence

(a) magnitude of initial velocity

$$u = \sqrt{u_x^2 + u_y^2} = \sqrt{11.3^2 + 10^2} = 15.1\, m/s$$

(b) direction of initial velocity is given by

$$\tan\emptyset = \frac{10}{11.3} = 8.85$$

Or $$\emptyset = \tan^{-1} 8.85 = 41.5^0$$

Thus the initial velocity is 15.1 m/s at an angle of 41.5 degree with positive x direction.