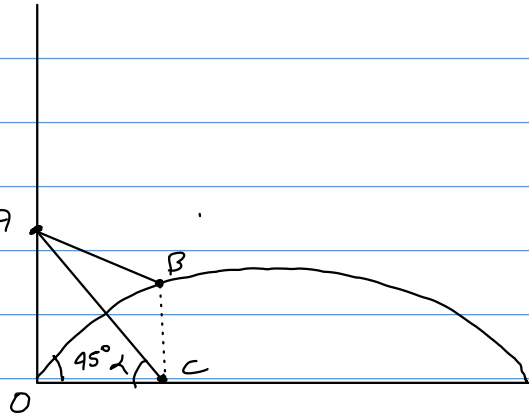
5(b) Two particles are thrown up simultaneously with the velocity of 30 m/s, one vertically and another at 45°. Find out the distance between them at t = 1.5 seconds.

Let OA be the distance covered by the first particle under 't' seconds. Similarly OC and OB be the horizontal and vertical Displacement covered by particle by under 't' seconds.



For the first particle,

$$s = ut + \frac{1}{2}gt^2$$

$$s = 30 \times 1.5 + \frac{1}{2} \times (-10) \times (1.5)^2$$

$$s = 75 - 5 \times 2.25$$

$$s = 75 - 11.25$$

$$s = 63.75 m$$

For Horizontal Displacement

$$s = u_x t - \frac{1}{2} g_x t^2$$

$$s = u\cos\theta t - \frac{1}{2} \times 0 \times t^2$$

∵ No gravity Under horizontal displacement

$$s = u\cos\theta t$$

$$s = 30 \times \cos 45 \cdot 1.5$$

$$= 30 \times \frac{1}{\sqrt{2}} \times 1.5$$

$$= \frac{75}{\sqrt{2}}$$

$$= 53.03 m$$

In ΔAOC

we know

$$AC^2 = AO^2 + OC^2$$

$$AC = \sqrt{(63.75)^2 + (53.03)^2}$$

$$= \sqrt{4064.06 + 2812.5}$$

$$= \sqrt{6876.56}$$

$$= 82.92 m$$

For Vertical Distancement.

$$s = u_y t - \frac{1}{2} g_y t$$

$$s = u \sin\theta t - \frac{1}{2} g_y t$$

$$s = 30 \times \sin 45 \cdot 1.5 - \frac{1}{2} \times 10 \times (1.5)$$

$$s = 30 \times \frac{1}{\sqrt{2}} \times 1.5 - 5 \times 1.5$$

$$s = \frac{75}{\sqrt{2}} - 11.25$$

$$s = 53.03 - 11.25$$

$$s = 41.78 m$$

Here, In ΔAOC

$$\cos\theta = \frac{b}{h}$$

$$= \frac{OC}{AC}$$

$$= \frac{53.03}{82.92} = 50.29^\circ$$

Now,

$$\angle ACB = 90^\circ - 50.24$$
$$= 39.75^\circ$$

Now, using triangle law of vector addition

$$R = \sqrt{A^2 + B^2 + 2AB\cos\theta}$$
$$AB = \sqrt{(BC)^2 + (CA)^2 + 2 \cdot BC \cdot CA \cdot \cos\theta}$$
$$AB = \sqrt{(41.78)^2 + (82.92)^2 + 2 \cdot (41.78) \cdot (82.92) \cdot \cos(39.75^\circ)}$$
$$AB = \sqrt{1745.56 + 6880.70 + 147.3}$$
$$AB = \sqrt{8773.57}$$
$$= 93.667$$