Task:

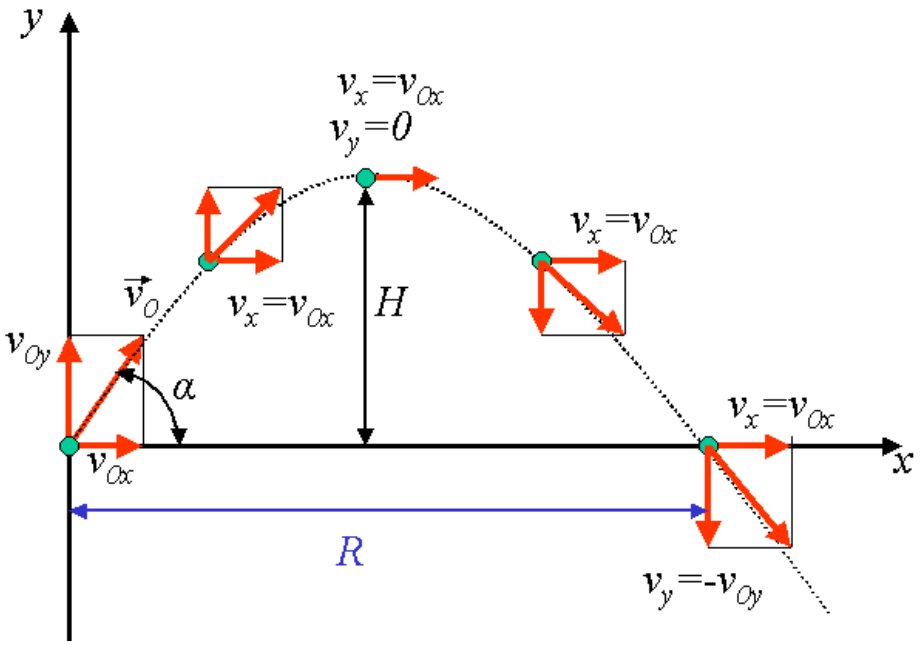
1. A baseball is thrown at 25 m/sec at an angle of 30 degrees above the horizontal.
   a) How far away does the ball land?
   b) What is the maximum height reached?

2. A football is kicked at an angle 45 degrees above the horizontal. What is its initial speed if it covers 150 ft?

3. A golf ball leaves a tee at 60 m/sec. and at an angle of 50 degrees above the horizontal. Find:
   a) The total time of flight
   b) The maximum height reached
   c) The horizontal distance covered.

Solution:

1.



$v_0 = 25\frac{m}{s}$

$\alpha = 30°$

$R = v_0 \cos\alpha \cdot t$

$$H = v_0 \sin\alpha \cdot \frac{t}{2} - g \cdot \frac{\left(\frac{t}{2}\right)^2}{2} = \frac{v_0^2 \sin^2\alpha}{2g}$$

$$t = \frac{R}{v_0 \cos\alpha}$$

$$v_0 \sin\alpha \cdot \frac{\left(\frac{R}{v_0 \cos\alpha}\right)}{2} - g \cdot \frac{\left(\frac{\frac{R}{v_0 \cos\alpha}}{2}\right)^2}{2} = \frac{v_0^2 \sin^2\alpha}{2g}$$

$$R = 55.175\ m$$

$$H = \frac{v_0^2 \sin^2\alpha}{2g} = 7.964\ m$$

2.

$$\alpha = 45°$$

$$R = 150\ ft$$

$$R = v_0 \cos\alpha \cdot t$$

$$H = v_0 \sin\alpha \cdot \frac{t}{2} - g \cdot \frac{\left(\frac{t}{2}\right)^2}{2} = \frac{v_0^2 \sin^2\alpha}{2g}$$

$$t = \frac{R}{v_0 \cos\alpha}$$

$$v_0 \sin\alpha \cdot \frac{\left(\frac{R}{v_0 \cos\alpha}\right)}{2} - g \cdot \frac{\left(\frac{\frac{R}{v_0 \cos\alpha}}{2}\right)^2}{2} = \frac{v_0^2 \sin^2\alpha}{2g}$$

$$v_0 = 69.444 \frac{ft}{s}$$

3.

$$v_0 = 60 \frac{m}{s}$$

$$\alpha = 50°$$

$$R = v_0 \cos\alpha \cdot t$$

$$H = v_0 \sin\alpha \cdot \frac{t}{2} - g \cdot \frac{\left(\frac{t}{2}\right)^2}{2} = \frac{v_0^2 \sin^2\alpha}{2g}$$

$$t = \frac{R}{v_0 \cos\alpha}$$

$$v_0 \sin\alpha \cdot \frac{\left(\frac{R}{v_0 \cos\alpha}\right)}{2} - g \cdot \frac{\left(\frac{\frac{R}{v_0 \cos\alpha}}{2}\right)^2}{2} = \frac{v_0^2 \sin^2\alpha}{2g}$$

$$R = 361.397\ m$$

$$H = \frac{v_0^2 \sin^2\alpha}{2g} = 107.674\ m$$

$$t = \frac{R}{v_0 \cos\alpha} = 9.371\ s$$

Answer:

1. a) $R = 55.175\ m$

b) $H = \frac{v_0^2 \sin^2\alpha}{2g} = 7.964\ m$

2. $v_0 = 69.444\ \frac{ft}{s}$

3. a) $t = \frac{R}{v_0 \cos\alpha} = 9.371\ s$

b) $H = \frac{v_0^2 \sin^2\alpha}{2g} = 107.674\ m$

c) $R = 361.397\ m$