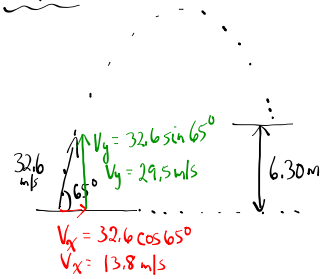
Projectiles Launched at an angle

MP|539



a) $\Delta t = ?$

b) $\Delta d_x = ?$

c) $\vec{V}_{impact} = ?$

a) Vertically - constant acceleration

$V_1 = 29.5$ m/s

$\Delta d = +6.30$m

$a = -9.81$ m/s^2

$\Delta t = ?$

$$\Delta d = V_1 t + \frac{1}{2} a t^2$$

$$6.30 = 29.5t - 4.905t^2$$

$$4.905t^2 - 29.5t + 6.30 = 0$$

$$t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

$$t = \frac{29.5 \pm \sqrt{(-29.5)^2 - 4(4.905)(6.30)}}{2(4.905)}$$

$$t = \frac{29.5 \pm 27.3}{9.81}$$

$t = 0.224$s or 5.79s ← this is the solution we are interested in

b) horizontally - velocity is constant

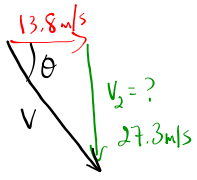
$$v = \frac{\Delta d}{\Delta t}$$

$$\Delta d = v \Delta t$$

$$\Delta d = (13.8 \text{ m/s})(5.79 \text{ s})$$

$$\Delta d = 79.9 \text{ m}$$

c) At impact: to find the final vertical velocity



$V_2 = V_1 + a\Delta t$ (from $a = \frac{\Delta V}{\Delta t}$)

$V_2 = (29.5 \text{ m/s}) - (9.81 \text{ m/s}^2)(5.79 \text{ s})$

$V_2 = -27.3$ m/s

$V^2 = 13.8^2 + 27.3^2$

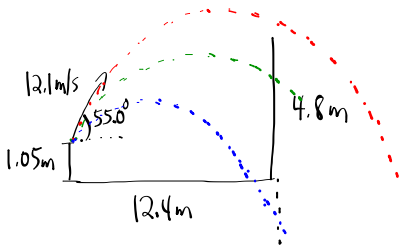
$V = 30.6$ m/s

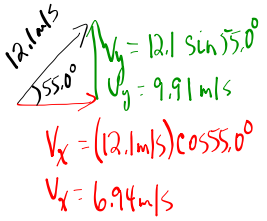
$\tan\theta = \frac{27.3}{13.8}$

$\theta = 63.2°$

The velocity of the ball when it hits the ground is 30.6 m/s [63.2° below the horizontal]

MP|542





Basically, we need to find out how ~~how~~ high the ball is when it has travelled 12.4m horizontally.

Horizontally - the velocity is constant

$$V = \frac{\Delta d}{\Delta t}$$

$$\Delta t = \frac{\Delta d}{V}$$

$$\Delta t = \frac{12.4m}{6.94m/s}$$

$$\Delta t = 1.79s$$

How high is the ball after it has been in the air for 1.79s?

vertically - constant acceleration

$V_i = 9.91 m/s$
$a = -9.81 m/s^2$
$\Delta t = 1.79s$
$\Delta d = ?$

$$\Delta d = V_i t + \frac{1}{2} a t^2$$

$$\Delta d = (9.91)(1.79) - 4.905(1.79)^2$$

$\Delta d = 1.99m$ ← the height above the launch level of 1.05m

The height of the ball will be $1.99m + 1.05m = 3.04m$

Since $3.04m < 4.8m$, the ball hits the fence.

TO DO

① PP|536 - 537 (HW Probe - Mon)
② PP|543
③ Assignment: p570|15-20 (due Wed)

Quiz Thurs.