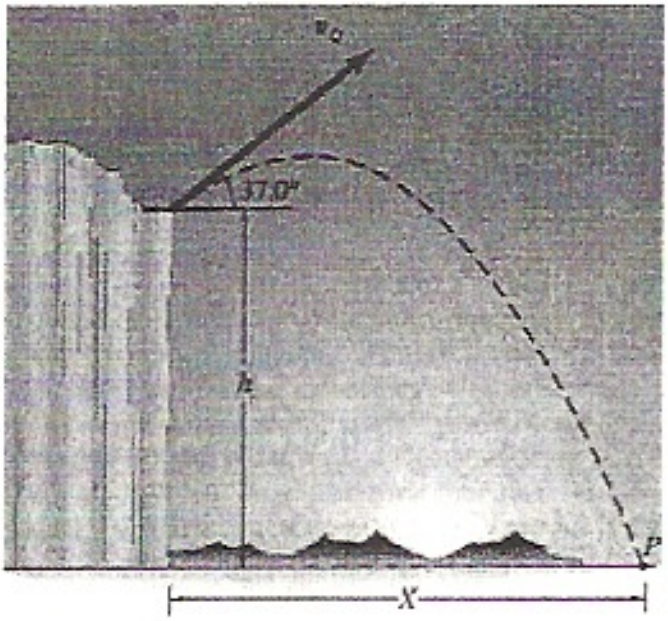
Example 4

A projectile is shot from the edge of a cliff 125 m above the ground with an initial velocity of 105 m/s at an angle of 37.0°.

A. How much time does it take for the projectile to reach P at the ground level?
B. What is the range of the projectile?
C. Find the x- and y- components as well as the magnitude and angle of the velocity of the projectile after 8.00 seconds



X

$x =$

$v_x = 83.9\ m/s$

$t =$

y: 0 m (top), $y = -125$ m (bottom)

$v_{oy} = 63.2\ m/s$

$v_y =$

$a_y = -9.8\ m/s^2$

$t =$

$v_0 = 105\ m/s$, $37°$, v_y, v_x

$v_x = \cos(37°)\cdot 105 = 83.9\ m/s$

$v_{oy} = \sin(37°)\cdot 105 = 63.2\ m/s$

A.) $t = ?$

$y = -125\ m$

$v_{oy} = 63.2\ m/s$

$a_y = -9.8\ m/s^2$

$y = v_{oy}t + \frac{1}{2}a_y t^2$

$-125 = (63.2)t + \frac{1}{2}(-9.8)t^2$

$-125 = 63.2\cdot t - 4.9t^2$

$4.9t^2 - 63.2t - 125 = 0$

QUADRATIC

$t = 14.6\ s$ $\quad t = -1.74\ s$

B.) $x = v_x \cdot t$

$x = (83.9)(14.6)$

$x = 1224.94 \approx 1220\ m$

C.) v v_y OR v_x v v_y ?

$v_x =$ constant $= 83.9\ m/s$

$v_y = ?$

$t = 8.00\ s$

$v_{oy} = 63.2\ m/s$

$a_y = -9.8\ m/s^2$

$v_y = v_{oy} + a_y t$

$v_y = 63.2 + (-9.8)(8.00)$

$v_y = 63.2 - 78.4$

$v_y = -15.2\ m/s$

$v_x = 83.9\ m/s$, v, $v_y = -15.2\ m/s$

$v = \sqrt{(83.9)^2 + (-15.2)^2}$

$v = 85.3\ m/s$

$\theta = \tan^{-1}\left(\frac{-15.2}{83.9}\right)$

$\theta = -10.3°$