Extra projectile Motion Problems

Assume zero air resistance for all problems

1.   An object hits the ground (height = 0) at an angle of 62°, relative to horizontal. Prior to hitting the ground, its X displacement was 3m. When it hits the ground, its y-velocity is -10m/s. Find "everything:"
   - Initial velocities (x, y, and overall speed)
   - Launch angle
   - Time aloft
   - Initial height
   - Final velocities (x and overall speed)

2.   An apple is dropped out of the window of a moving car. If the car was traveling a speed of 20m/s, and the apple travels a horizontal distance of 11m, what was the height of the apple's release point?

Solutions on Next Page

1.

Y	X	both
$V_{oy} = 5.68$ m/s	$\Delta X = 3$ m	$\theta_0 = 71°$
$V_y = -10$ m/s	$V_x = 1.88$ m/s	$\theta = 62°$
$\Delta y = -3.46$	$\Delta t = 1.6$ s	$V_0 = 6$ m/s
$a = -9.8$ m/s²	3	$V = -10.1$ m/s
$\Delta t = 1.16$ s	1.88 m/s	

$V = V_0 + at$

$-10 = V_0 + (-9.8)(1.6 s)$

$V_0 = 5.68$ m/s

$\Delta y = 5.68(1.6) + \frac{1}{2}(-9.8)(1.6)^2$

$\Delta y = -3.46$

$V_y = 10$ m/s $62°$ $V = \sqrt{10^2 + 1.88^2} = 10.2$ m/s

$V_x = 1.88$ m/s

$\sqrt{5.68^2 + 1.88^2} = 6$ $Tan \, 62 = \dfrac{10 \text{m/s}}{V_x}$

$V_0 = \sqrt{5.68^2 + 1.88^2}$ $5.68 = V_{oy}$

θ_0 $1.88 = V_{ox}$

$\theta_0 = 71°$

2.

$V_{oy} = 0$

$V_{ox} = 20$ m/s

$\Delta y = ?$

$\Delta x = 11$ m

$\dfrac{\Delta X}{V_x} = \Delta t$

$\dfrac{11 m}{20 \text{m/s}} = 0.55 s = \Delta t$

$\Delta y = V_{oy} t + \frac{1}{2} a t^2$

$\Delta y = 0 + \frac{1}{2}(-9.8 \text{m/s}^2)(0.55 s)^2$

$\Delta y = -1.48$ m

Release Point
height = 1.48 m