Name: KEY

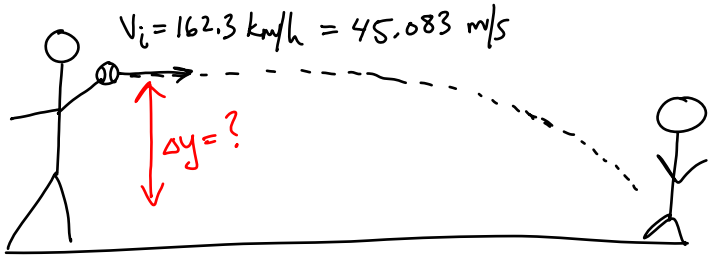
Date:

Section C D F

The Masters School
Mr. Alex Rawson
Physics
DOBBS

Projectile Motion I - Horizontal

1. The fastest recorded pitch in Major League Baseball, thrown by Nolan Ryan in 1974, was clocked at 162.3 km/h (100.8 mi/h). If a pitch were thrown horizontally with this velocity, how far would the ball fall vertically by the time it reached home plate, 18.3 m (60.0 ft) away?



$\Delta x = 18.3$ $\quad \Delta y = ?$
$V_{ix} = 45.1$ $\quad V_{iy} = 0$
$V_{fx} =$ $\quad V_{fy} =$
$a = 0$ $\quad a = 9.81$
Δt $\quad = \quad \Delta t =$

1) $\Delta x = V_x \Delta t$

$\Delta t = \frac{\Delta x}{V_x} = \frac{18.3}{45.1}$

$\Delta t = .406$ s

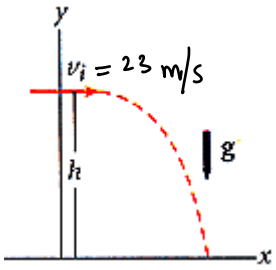
2) $\Delta y = V_{iy}\Delta t - \frac{1}{2} g \Delta t^2$

$\Delta y = -\frac{1}{2}(9.81)(.406)^2$

$\Delta y = -.8082$ m

2. A person standing at the edge of a seaside cliff kicks a stone over the edge with a speed of v_i = 23 m/s. The cliff is h = 48 m above the water's surface.

   a. How long does it take for the stone to fall to the water?



$\Delta x =$ $\quad \Delta y = -48$ m
$V_{ix} = 23$ m/s $\quad V_{iy} = 0$
$V_{fx} = 23$ m/s $\quad V_{fy} = ?$
$a = 0$ $\quad a = 9.81$
Δt $\quad = \quad \Delta t = ?$

1) $V_{yf}^2 = V_i^2 \sin\theta^2 - 2g\Delta y$

$V_{yf}^2 = -2(9.81)(48)$

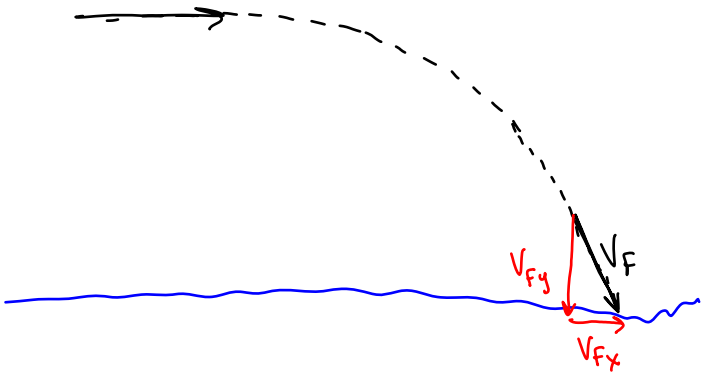
$V_{yf} = -30.69$ m/s

2) $V_{yf} = V_i \sin\theta - g\Delta t$

$\Delta t = \frac{V_{yf}}{-g} = \frac{-30.69}{-9.81} = 3.13$ s

   b. With what speed does it strike the water? (*Hint: you have to find V_f here, not $V_{f,y}$*)

3.

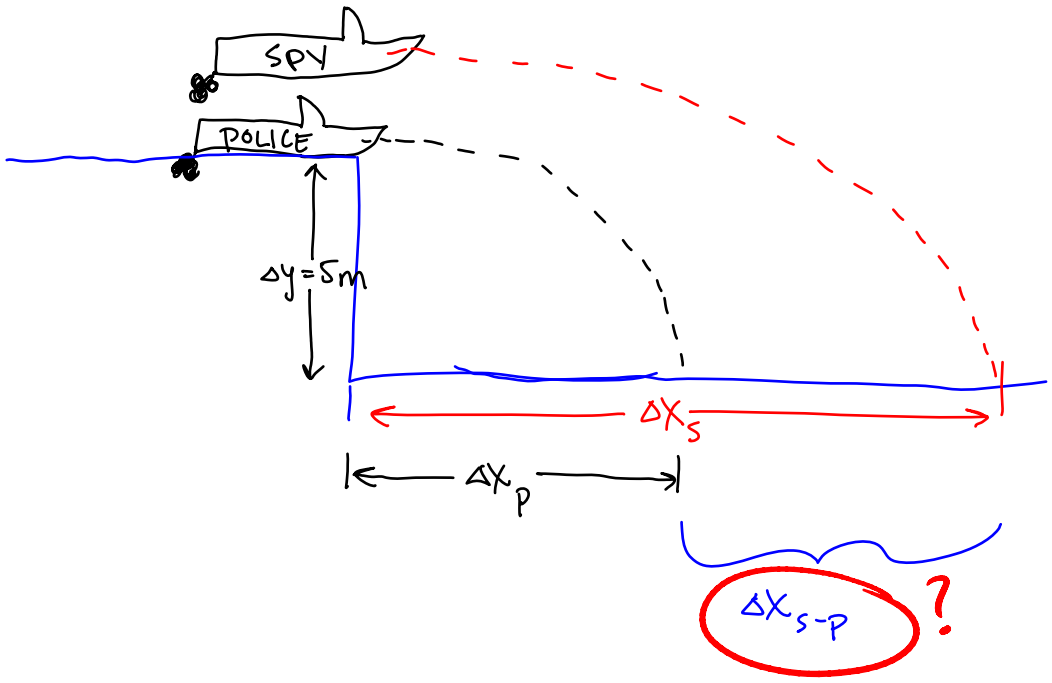


$V_f^2 = V_{fy}^2 + V_{fx}^2$

$V_f^2 = (-30.69)^2 + (23)^2$

$V_f = 38.35$ m/s

Two boats are traveling down a river. The first boat is a spy boat, trying to run from the police boat next to them. The two boats see a 5 meter waterfall ahead, and decide to jump the waterfall. If the spy boat was traveling at 27 m/s, and the police boat was traveling at 16 m/s, how far ahead of the police boat will the spy boat be when they land? (*Assume the two boats were side by side when they launched off the waterfall*)



Police boat

$\Delta x =$	$\Delta y = -5$
$V_{ix} = 16$ m/s	$V_{iy} = 0$
$V_{fx} = 16$ m/s	V_{fy}
$a =$	$a = 9.81$
$\Delta t =$	$\Delta t =$

$\Delta y = V_i \sin\theta \Delta t - \frac{1}{2} g \Delta t^2$

$-5 = -\frac{1}{2}(9.81)\Delta t^2$

$\Delta t = 1.01$ s

$\Delta x_p = V_x \Delta t$

$\Delta x_p = (16)(1.01)$

$\Delta x_p = 16.15$ m

Spy boat

$\Delta x = ?$	$\Delta y = -5$ m
$V_{ix} = 27$ m/s	$V_{iy} = 0$
$V_{fx} = 27$ m/s	V_{fy}
$a =$	a
$\Delta t =$	Δt

$\Delta y = V_i \sin\theta \Delta t - \frac{1}{2} g \Delta t^2$

$-5 = -\frac{1}{2}(9.81)\Delta t^2$

$\Delta t = 1.01$ s

$\Delta x_s = V_x \Delta t$

$= (27)(1.01)$

$\Delta x_s = 27.26$ s

$\Delta x_{s-p} = 11.11$ m