P11 - 1.1 - $v_f^2 = v_i^2 + 2ad$ Notes

What is the final velocity of a boat if it accelerates at $4\frac{m}{s^2}$ *from* $25\frac{m}{s}$ *in* $125\,m$?

$$v_f^2 = v_i^2 + 2ad$$
$$v_f^2 = 25^2 + 2(4)(125)$$
$$v_f^2 = 1625$$
$$\sqrt{v_f^2} = \sqrt{1625}$$
$$v_f = 40.3\,m$$

$$\boxed{v_f^2 = v_i^2 + 2ad}$$

$$\boxed{\begin{aligned} v_f^2 &= v_i^2 + 2ad \\ v_f &= \sqrt{v_i^2 + 2ad} \\ v_f &= \sqrt{25^2 + 2(4)(125)} \\ v_f &= 40.3\,m \end{aligned}}$$

What is the initial velocity of a whale if it accelerates at $5\frac{m}{s^2}$ *to* $75\frac{m}{s}$ *in* $60\,m$?

$$v_f^2 = v_i^2 + 2ad$$
$$48^2 = v_i^2 + 2(5)(60)$$
$$2304 = v_i^2 + 600$$
$$\sqrt{1704} = \sqrt{v_i^2}$$
$$v_i = 41.3\frac{m}{s}$$

$$\boxed{\begin{aligned} v_f^2 &= v_i^2 + 2ad \\ v_i &= \sqrt{v_f^2 - 2ad} \\ v_i &= \sqrt{75^2 - 2(5)(60)} \\ v_i &= 70.9\frac{m}{s} \end{aligned}}$$

How far does a plane travel if it accelerates at $4\frac{m}{s^2}$ *from* $25\frac{m}{s}$ *to* $45\frac{m}{s}$.

$$v_f^2 = v_i^2 + 2ad$$
$$45^2 = 25^2 + 2(4)d$$
$$2025 = 625 + 8d$$
$$1400 = 8d$$
$$d = 175\,m$$

$$\boxed{\begin{aligned} v_f^2 &= v_i^2 + 2ad \\ d &= \frac{v_f^2 - v_i^2}{2a} \\ d &= \frac{45^2 - 25^2}{2(4)} \\ d &= 175m \end{aligned}}$$

P11 - 1.1 - $v_f = v_i + at, v_f^2 = v_i^2 + 2ad$ Notes

$What\ is\ the\ accleration\ of\ an\ object\ which\ accelerates\ from\ 2\frac{m}{s}\ to\ 8\frac{m}{s}\ in\ 12\ m?$

$$v_f^2 = v_i^2 + 2ad$$
$$8^2 = 2^2 + 2(a)(12)$$
$$64 = 4 + 24a$$
$$60 = 24a$$
$$a = 2.5\frac{m}{s^2}$$

$$\boxed{\begin{aligned} v_f^2 &= v_i^2 + 2ad \\ a &= \frac{v_f^2 - v_i^2}{2d} \\ a &= \frac{8^2 - 2^2}{2(12)} \\ a &= 2.5\frac{m}{s^2} \end{aligned}}$$

$How\ far\ does\ a\ plane\ travel\ if\ it\ deccelerates\ at\ 6\frac{m}{s^2} from\ 72\frac{m}{s}\ to\ 48\ \frac{m}{s}.$

$$v_f^2 = v_i^2 + 2ad$$
$$48^2 = 72^2 + 2(-6)d$$
$$2304 = 5184 - 12d$$
$$-2880 = -12d$$
$$d = 240m$$

$$v_f^2 = v_i^2 + 2ad$$
$$d = \frac{v_f^2 - v_i^2}{2a}$$
$$d = \frac{48^2 - 72^2}{2(-6)}$$
$$d = 240m$$

$What\ is\ the\ Acceleration\ of\ a\ Bear\ reaching$
$a\ Velocity\ of\ 15\frac{m}{s}\ from\ Rest\ in\ 5s?$

$$v_f = v_i + at$$
$$v_f = at$$
$$a = \frac{v_f}{t}$$
$$a = \frac{15}{5}$$
$$a = 3\frac{m}{s^2}$$

$$\boxed{v_i = 0}$$

$How\ Far\ did\ the\ Bear\ get\ in\ that\ time?$

$$v_f^2 = v_i^2 + 2ad$$
$$d = \frac{v_f^2}{2a}$$
$$d = \frac{15^2}{2(3)}$$
$$d = 37.5\ m$$

$How\ far\ does\ a\ cheetah\ running\ at\ 6\frac{m}{s}\ accelerates\ at\ 3\frac{m}{s^2}\ for\ 4\ seconds. What\ is\ her\ Final\ Velocity?$

$v_i = 6$ $\quad a = 2$ $\quad t = 4$

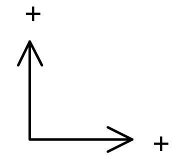
$$v_f^2 = v_i^2 + 2ad$$
$$d = \frac{v_f^2 - v_i^2}{2a}$$
$$d = \frac{18^2 - 6^2}{2(3)}$$
$$d = 48\ m$$

$$\boxed{\begin{aligned} v_f &= v_i + at \\ v_f &= 6 + 3(4) \\ v_f &= 18\frac{m}{s} \end{aligned}}$$

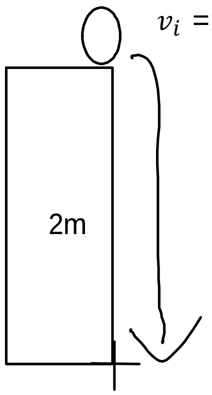
Notes

August 11, 2015 12:23 AM

P11 - 1.2 - Ball Drop Lab



$v_i = 0$



$t = ?$

Trial times
0.59s
0.64s
0.65s

$$\Delta d = v_i t + \frac{1}{2}at^2 \qquad ; v_i = 0$$
$$d = \frac{1}{2}at^2$$

$$d = \frac{1}{2}at^2$$

$$\Delta d = d_f - d_i$$
$$\Delta d = 0 - 2$$
$$\Delta d = -2$$

$$a = g = -9.8\frac{m}{s^2}$$

$$d = \frac{1}{2}at^2$$
$$-2 = \frac{1}{2}(-9.8)(0.59)^2$$
$$-2 = -1.71$$

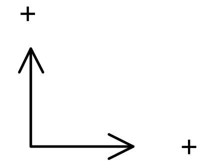
$$d = \frac{1}{2}at^2$$
$$-2 = \frac{1}{2}(-9.8)(0.64)^2$$
$$-2 = -2.01$$

$$d = \frac{1}{2}at^2$$
$$-2 = \frac{1}{2}(-9.8)(0.65)^2$$
$$-2 = -2.07$$

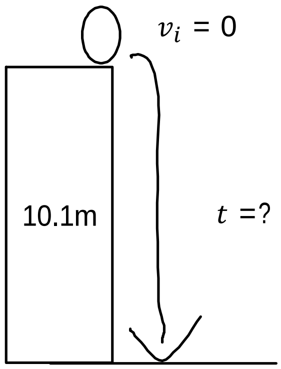
$$d = \frac{1}{2}at^2$$
$$-2 = \frac{1}{2}(-9.8)t^2$$
$$t = 0.6389$$

$$t = \sqrt{\frac{2d}{a}} \qquad ; v_i = 0$$

$$d = \frac{1}{2}at^2$$
$$d = \frac{1}{2}(-9.8)t^2$$
$$d = -4.9t^2$$



P11 - 1.2 - Ball Drop Notes



$\Delta d = v_i t + \frac{1}{2}at^2$; $v_i = 0$

$\boxed{d_i = 10 \quad t_{total} = ? \quad v_i = 0 \quad v_{before\,impact} = ?}$

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-10.1 = \cancel{0 \times t} + \frac{1}{2}(-9.8)t^2$$
$$-10.1 = \frac{1}{2}(-9.8)t^2$$
$$-10.1 = -4.9t^2$$
$$2.06 = t^2$$
$$t = 1.44s$$

$$\boxed{\begin{aligned} \Delta d &= d_f - d_i \\ \Delta d &= 0 - 10.1 \\ \Delta d &= -10.1m \end{aligned}}$$

$$\boxed{a = g = -9.8\frac{m}{s^2}}$$

$Time\ to\ Fall = 1.44s$

Velocity before impact

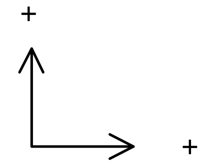
$$v_f^2 = v_i^2 + 2ad$$
$$v_f^2 = (0)^2 + 2(-9.8)(-10.1)$$
$$v_f^2 = 197.96$$
$$v_b = -14.07\frac{m}{s}$$

; $v_b = -ve*$

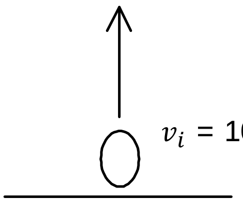
Or

$$\boxed{\begin{aligned} v_b &= v_i + at \\ v_b &= at \\ v_b &= (-9.8)(1.44) \\ v_b &= -14.11\frac{m}{s} \end{aligned} \qquad v_i = 0}$$

$Velocity\ Before\ Impact = -14.07\frac{m}{s}$



P11 - 1.3 - Ball Throw Up from Ground

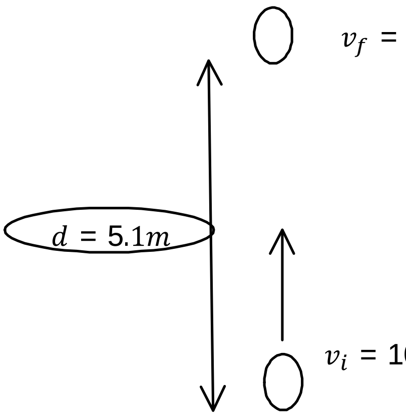


$v_i = 10\frac{m}{s}$

Symmetry

$v_b = v_i$
$v_b = 10\frac{m}{s}$

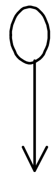
$v_i = 10$ $h = ?$
$t_{max} = ?$
$t_{total} = ?$



$v_f = 0$

$d = 5.1m$

$v_i = 10\frac{m}{s}$



$v_i = 0\frac{m}{s}$

To find Max Height, $v_f = 0$

$$v_f^2 = v_i^2 + 2ad$$
$$0^2 = 10^2 + 2(-9.8)d$$
$$0 = 100 - 19.6d$$
$$19.6d = 100$$
$$d = 5.1m$$

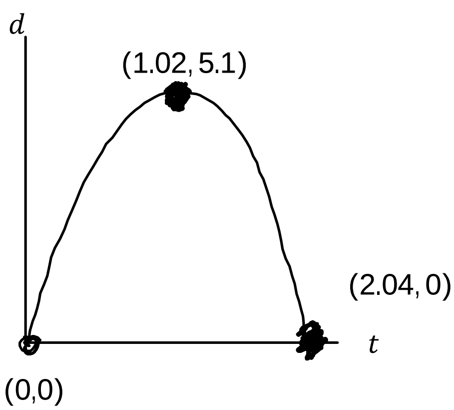
$Max\ Height = 5.1m$

To find time, Drop it from Max Height, $v_i = 0$

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-5.1 = \cancel{0 \times t} + \frac{1}{2}(-9.8)t^2$$
$$-5.1 = -4.9t^2$$
$$1.04 = t^2$$
$$t = 1.02s$$

$\Delta d = d_f - d_i$
$\Delta d = 0 - 5.1$
$\Delta d = -5.1m$

$Time\ to\ Max\ Height = 1.02s$

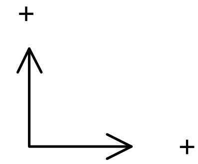


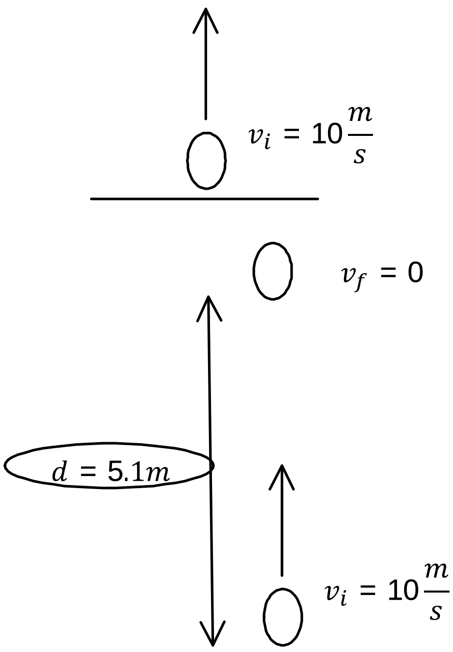
$$t = 1.02 \times 2$$
$$t = 2.04s$$

Double Time

$Total\ Time = 2.04s$

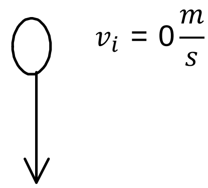
P11 - 1.3 - Alt Ball Throw Up from Ground





$$\boxed{\begin{aligned} v_b &= v_i \\ v_b &= 10\frac{m}{s} \end{aligned}}$$

$v_i = 10$	$h = ?$
	$t_{max} = ?$
	$t_{total} = ?$



To find Max Height, $v_f = 0$

$v_f = v_i + at$

$0 = 10 + (-9.8)t$ $\quad v_f = 0$

$t = 1.02s$ $\quad Time\ to\ Max\ Height = 1.02s$

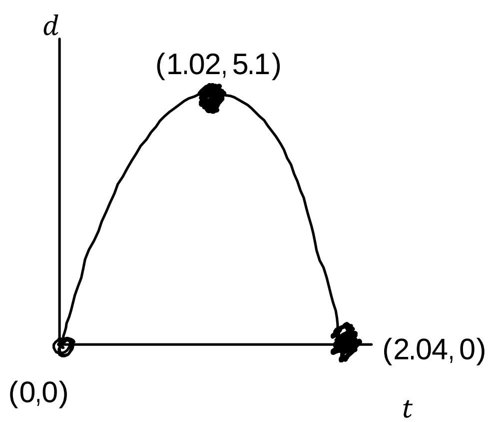
To find max height

Sub t into $d =$ equation

$\Delta d = v_i t + \frac{1}{2}at^2$

$d = 10(1.02) + \frac{1}{2}(-9.8)(1.02)^2$

$d = 5.1m$ $\quad Max\ Height = 5.1m$



Solve for time

$\Delta d = v_i t + \frac{1}{2}at^2$

$0 = 10t + \frac{1}{2}(-9.8)t^2$

$0 = -4.9t^2 + 10t$

$0 = -4.9t(t - 2.04)$

$\boxed{\Delta d = 0}$

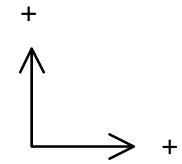
$-4.9t = 0$ $\quad t - 2.04 = 0$

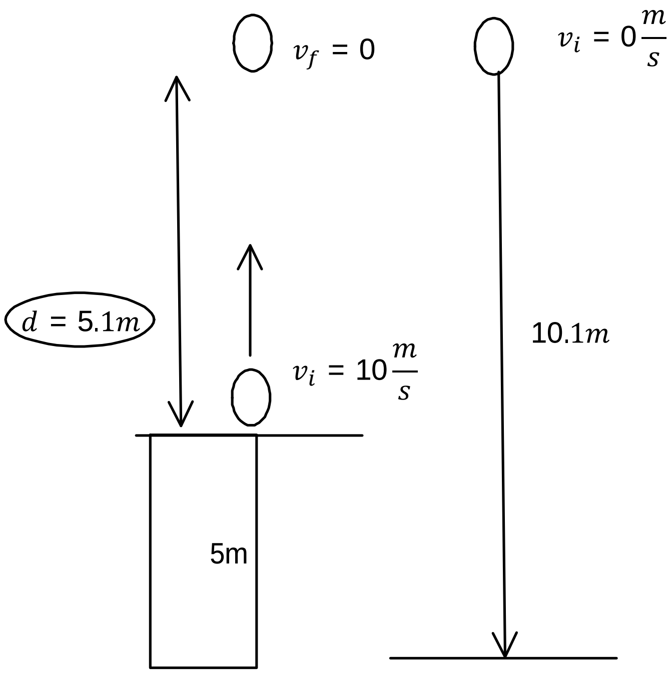
$t = 0s$ $\quad t = 2.04s$

Or use Quadform/Square Root Method

$t = 2.04s$ $\quad Total\ Time = 2.04s$

P11 - 1.3 - Ball Drop Throw Up from Building





To find Max Height, $v_f = 0$

$d_i = 5$	$h = ?$
$v_i = 10$	$t_{max} = ?$
	$t_{total} = ?$

$$v_f^2 = v_i^2 + 2ad$$
$$0^2 = 10^2 + 2(-9.8)d$$
$$0 = 100 - 19.6d$$
$$19.6d = 100$$
$$d = 5.1m$$

$$d = 5 + 5.1$$

Add original height to rise

$$d = 10.1m$$

$Max\ Height = 10.1m$

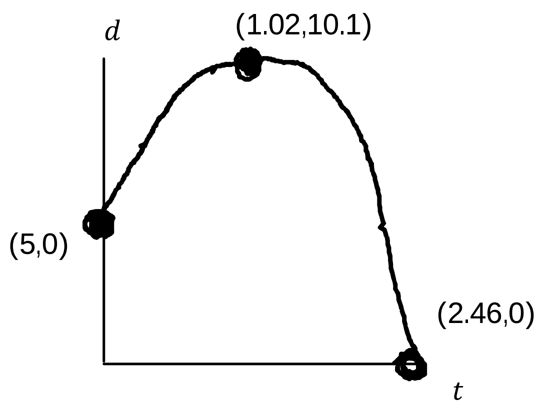
To find time down, Drop it from Max Height to building height, $v_i = 0$

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-5.1 = \cancel{0 \times t} + \frac{1}{2}(-9.8)t^2$$
$$-5.1 = -4.9t^2$$
$$1.04 = t^2$$

$$\boxed{\begin{aligned}\Delta d &= d_f - d_i\\ \Delta d &= 0 - 5.1\\ \Delta d &= -5.1m\end{aligned}}$$

$$t = 1.02s$$

$Time\ to\ Max\ Height = 1.02s$



To find time up, Drop it from Max Height, $v_i = 0$

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-10.1 = \cancel{0 \times t} + \frac{1}{2}(-9.8)t^2$$
$$-10.1 = -4.9t^2$$
$$2.06 = t^2$$

$$\boxed{\begin{aligned}\Delta d &= d_f - d_i\\ \Delta d &= 0 - 10.1\\ \Delta d &= -10.1m\end{aligned}}$$

$$t = 1.44s$$

$Time\ to\ Fall = 1.44s$

To find Total Time:

$$t = 1.02 + 1.44$$

Total Time=Time Up+Time Down

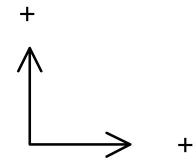
$$t = 2.46s$$

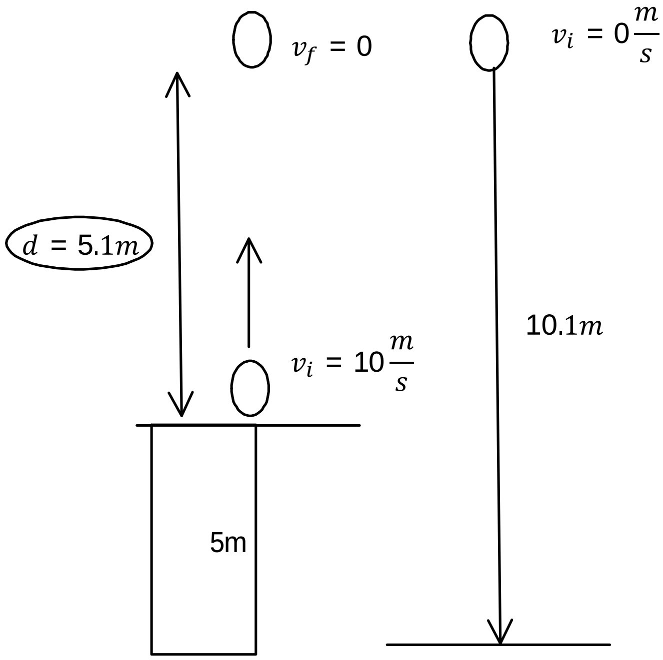
$Total\ Time = 2.46s$

We could have doubled time to max height, then found the time to fall thrown down at

$v_i = -10\frac{m}{s}$. *See next page.* $t = 1.02 \times 2 + 0.42 = 2.46s$

P11 - 1.3 - Alt Ball Drop Throw Up from Building





To find time to Max Height, $v_f = 0$

$d_i = 5$	$h = ?$
$v_i = 10$	$t_{max} = ?$
	$t_{total} = ?$

$$v_f = v_i + at$$
$$0 = 10 + (-9.8)t$$
$$t = 1.02s$$

Time to Max Height = 1.02s

To find max height

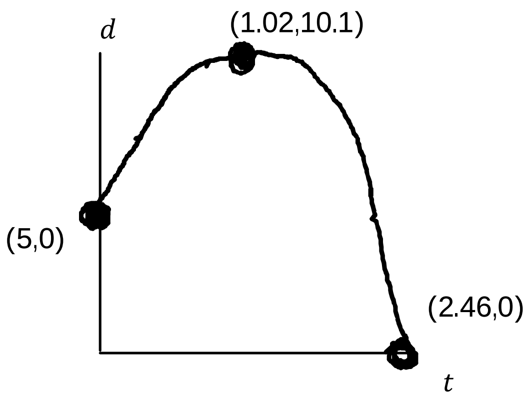
Sub t into d = equation

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$\Delta d = (10)(1.02) + \frac{1}{2}(-9.8)(1.02)^2$$
$$\Delta d = 5.1m$$

Add original height to rise

$$d = 5 + 5.1$$
$$d = 10.1m$$

$Max\ Height = 10.1m$



Solve Total Time

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-5.1 = 10t + \frac{1}{2}(-9.8)t^2$$
$$0 = -4.9t^2 + 10t + 5.1$$

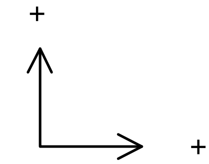
$$\boxed{\begin{aligned}\Delta d &= d_f - d_i\\ \Delta d &= 0 - 5.1\\ \Delta d &= -5.1m\end{aligned}}$$

$\cancel{t = -ve}$ $\quad t = 2.46s$

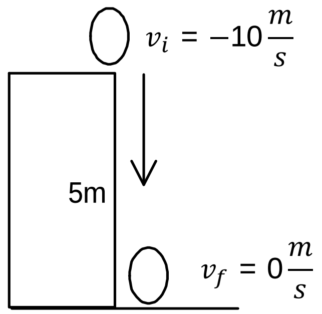
Or use Quadform/Square Root Method

$Total\ Time = 2.46s$

We could have completed the square to find (time,max height)



P11 - 1.3 - Ball Drop Throw Down from Building



To find time down:

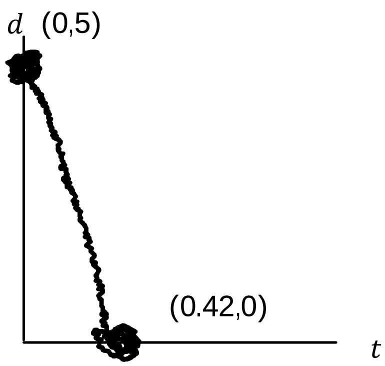
$d_i = 5$ $\quad t_{total} = ?$

$v_{before\ impact} = ?$

$v_i = -10$

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-5 = (-10) \times t + \frac{1}{2}(-9.8)t^2$$
$$-5 = -10t - 4.9t^2$$
$$0 = -4.9t^2 - 10t + 5$$

$$\boxed{\begin{aligned}\Delta d &= d_f - d_i\\ \Delta d &= 0 - 5\\ \Delta d &= -5m\end{aligned}}$$



$\cancel{t = -ve}$ $\quad t = 0.42s \quad Time\ to\ Fall = 0.42$

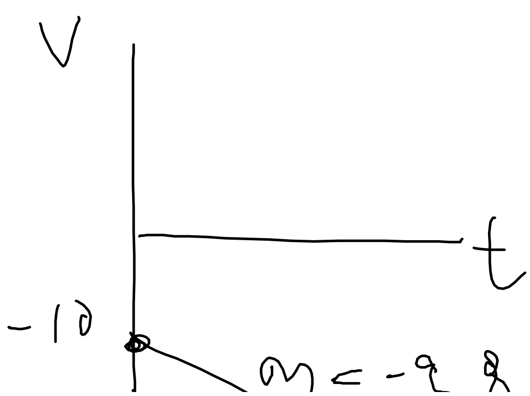
Or use Quadform/Square Root Method

$$v_f^2 = v_i^2 + 2ad$$
$$v_f^2 = (-10)^2 + 2(-9.8)(-5)$$
$$v_f^2 = 198$$
$$v_f = -14.07\frac{m}{s} \quad ; v_f = -ve *$$

Or

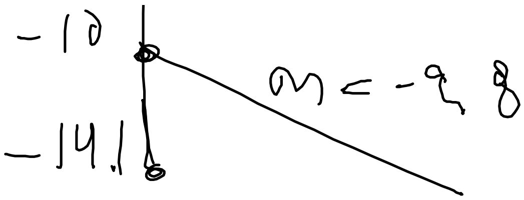
$$\boxed{\begin{aligned}v_b &= v_i + at\\ v_b &= (-10) + (-9.8)(0.42)\\ v_b &= -14.12\frac{m}{s}\end{aligned}}$$

$$Velocity\ Before\ Impact = -14.07\frac{m}{s}$$

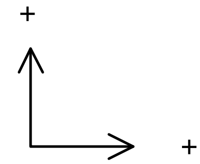


$$\boxed{\begin{aligned}v_f &= v_i + at\\ -14.1 &= -10 + (-9.8)t\\ t &= 0.42s\end{aligned}}$$

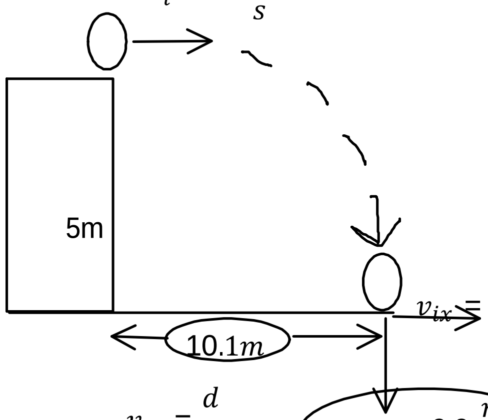
$t = 0.42s$



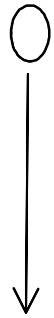
P11 - 1.3 - Ball shot straight off cliff Notes



$v_i = 10\frac{m}{s}$



$v_{iy} = 0\frac{m}{s}$



$v_{ix} = 10\frac{m}{s}$

$v_{by} = -9.9\ \frac{m}{s}$

$v_{ix} = \frac{d}{t}$
$d = v_{ix}t$
$d = 10t$

$d = 10t$
$d = 10(1.01)$

$d = 10.1m$

$\Delta d = v_{iy}t + \frac{1}{2}at^2$
$-5 = \cancel{0 \times t} + \frac{1}{2}(-9.8)t^2$
$-5 = \frac{1}{2}(-9.8)t^2$
$-5 = -4.9t^2$
$1.02 = t^2$

$t = 1.01s$

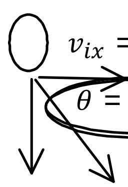
$\boxed{\begin{aligned}\Delta d &= d_f - d_i\\ \Delta d &= 0 - 5\\ \Delta d &= -5m\end{aligned}}$

$\boxed{a = g = -9.8\frac{m}{s^2}}$

$\boxed{Time\ is\ the\ Link\ Between\ x\ and\ y, Galileo}$

$v_{by} = v_i + at$
$v_{by} = at$
$v_{by} = (-9.8)(1.01)$

$v_{by} = -9.9\ \frac{m}{s}$

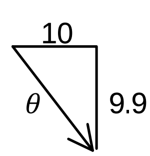


$v_{ix} = 10\frac{m}{s}$

$\theta = 44.7^o$

$v_{by} = -9.9\ \frac{m}{s}$

$v_r = 14.1\frac{m}{s}$



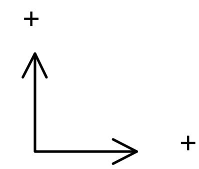
$a^2 + b^2 = c^2$
$10^2 + 9.9^2 = c^2$
$198 = c^2$

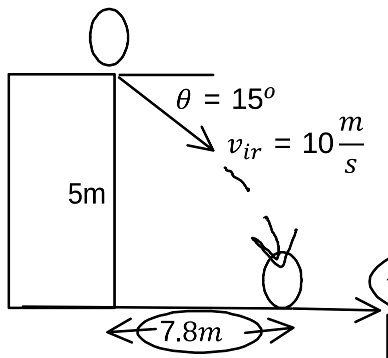
$c = 14.1\frac{m}{s}$

$tan\theta = \frac{o}{a}$
$tan\theta = \frac{9.9}{10}$
$\theta = \tan^{-1}\left(\frac{9.9}{10}\right)$

$\theta = 44.7^o$

P12 - 1.1 - Ball shot Down Angle Notes





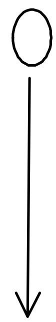
$v_{ix} = 9.66\frac{m}{s}$

$v_{by} = -9.9\ \frac{m}{s}$

$v_{ix} = \frac{d}{t}$
$d = v_{ix}t$
$d = 10t$

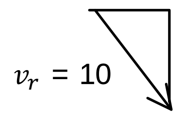
$d = 10t$
$d = 10(0.78)$

$d = 7.8m$



$v_{iy} = -2.59\frac{m}{s}$

$v_x = hcos\theta$
$v_x = 10cos15$
$v_x = 9.66\frac{m}{s}$

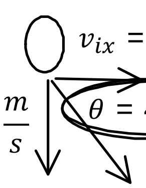


$v_{iy} = hsin\theta$
$v_{iy} = 10sin15$
$v_{iy} = 2.59\frac{m}{s}$

$\Delta d = v_{iy}t + \frac{1}{2}at^2$
$-5 = -2.59t + \frac{1}{2}(-9.8)t^2$
$0 = -2.59t + \frac{1}{2}(-9.8)t^2 + 5$
$0 = -4.9t^2 - 2.59t + 5$

$t = 0.78s$ $\boxed{Quadform}$

$v_{by} = v_i + at$
$v_{by} = -2.59 + (-9.8)(0.78)$
$v_{by} = -2.59 - 7.6$
$v_{by} = -10.2\frac{m}{s}$

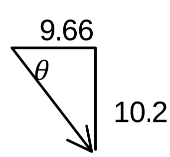


$v_{ix} = 9.66\frac{m}{s}$

$v_{by} = -10.2\ \frac{m}{s}$

$\theta = 46.6^o$

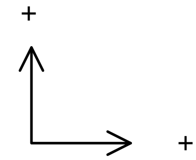
$v_r = 14.05\frac{m}{s}$



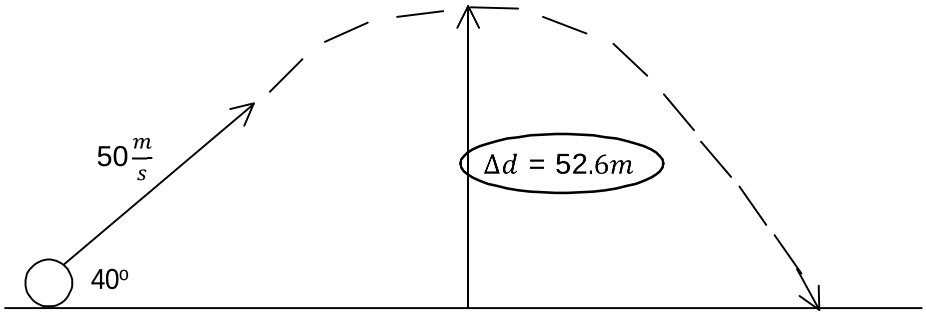
$a^2 + b^2 = c^2$
$10.2^2 + 9.66^2 = c^2$
$197.3 = c^2$
$c = 14.05\frac{m}{s}$

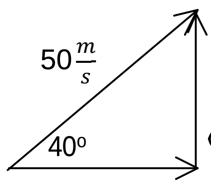
$tan\theta = \frac{o}{a}$
$tan\theta = \frac{10.2}{9.66}$
$\theta = \tan^{-1}\left(\frac{10.2}{9.66}\right)$
$\theta = 46.6^o$

P12 - 1.1 - Projectile Motion Ground



A ball is shot at $50\frac{m}{s}$ at an angle of 40º above the horizontal. What is its max height? What is its time in flight? What is the distance the ball travels?





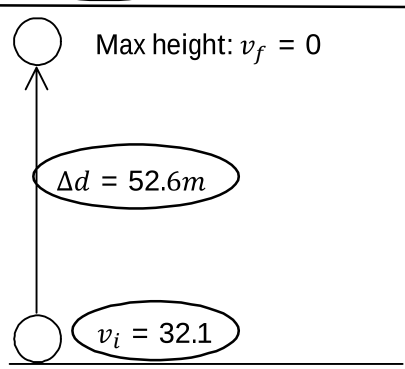
$v_y = h\sin\theta$
$v_y = 50\sin 40$
$v_y = 32.1$

$$sin\theta = \frac{o}{h}$$
$$hsin\theta = o$$

$$cos\theta = \frac{a}{h}$$
$$hcos\theta = a$$

$v_x = h\cos\theta$
$v_x = 50\cos 40$
$v_x = 38.3$

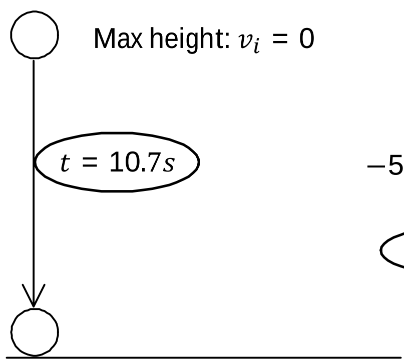
Max height: $v_f = 0$



$$v_f{}^2 = v_i{}^2 + 2a\Delta d$$
$$0 = 32.1^2 + 2(-9.8)\Delta d$$
$$\Delta d = 52.6m$$

Max height $= 52.6m$

Max height: $v_i = 0$



$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-52.6 = 0 + \frac{1}{2}(-9.8)t^2$$
$$t = 10.7s$$

$$\Delta d = d_f - d_i$$
$$\Delta d = 0 - 52.6$$
$$\Delta d = -52.6m$$

Total time in flight:

$t = 10.7 \times 2$

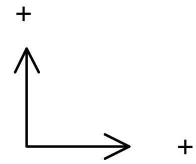
$t = 21.4s$

$$v = \frac{d}{t}$$
$$38.3 = \frac{d}{21.4}$$
$$d = 819.6m$$

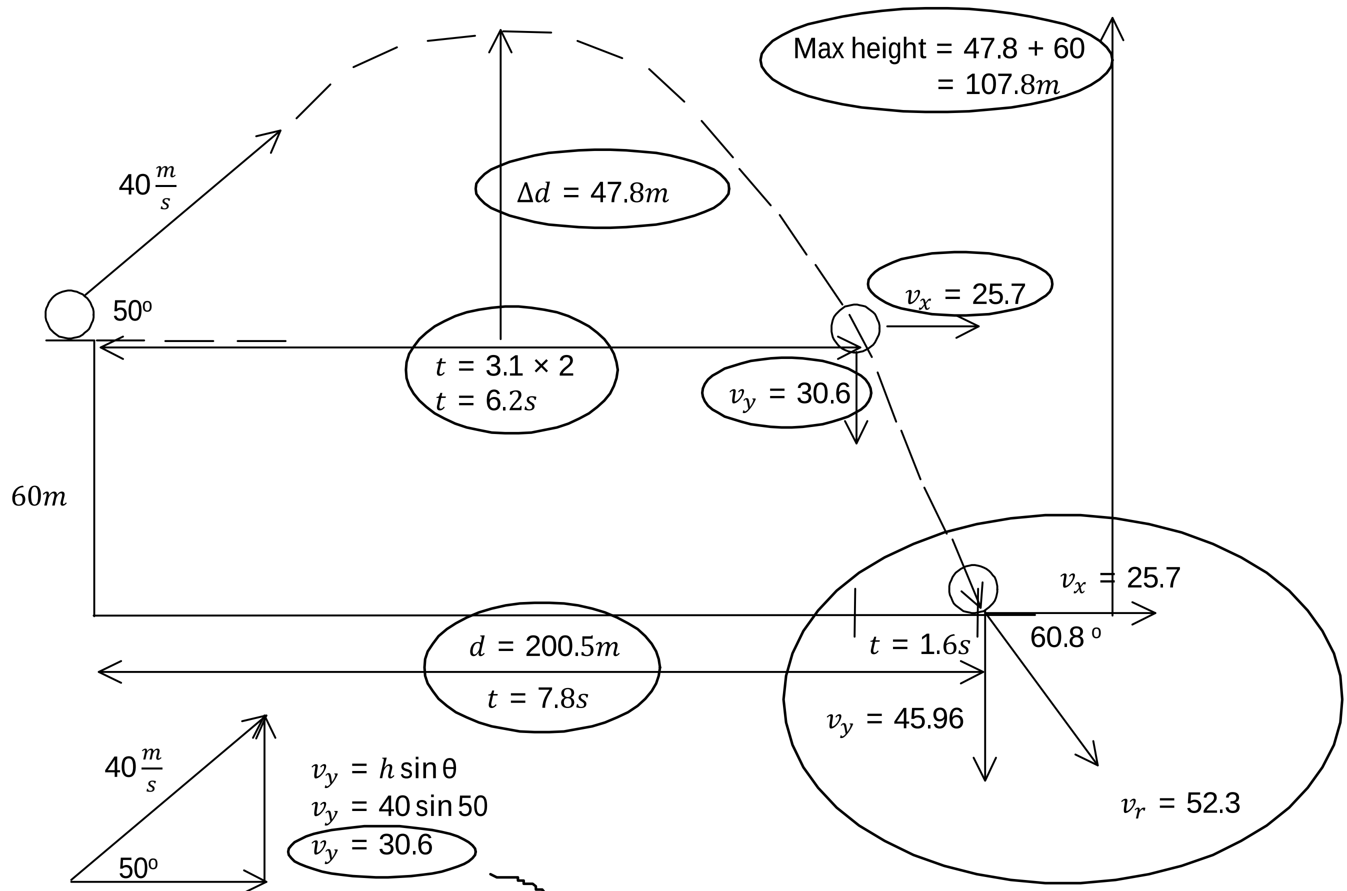
Distance in flight $= 819.6m$

P12 - 1.1 - Projectile Motion Cliff

P12-Projectile Motion



A ball is shot off a $60m$ cliff at $40\,\frac{m}{s}$ at an angle of 50^o from the horizontal. What is its max height? What is its time in flight? What is the horizontal distance the ball travels? What is the velocity and angle at impact?



$v_y\ =\ h\sin\theta$

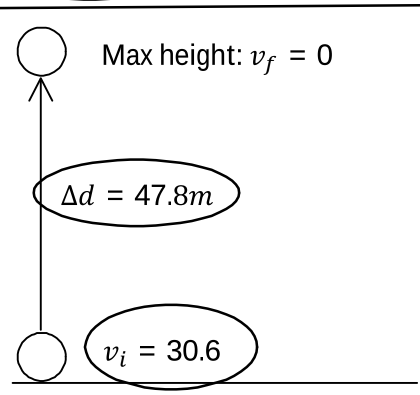
$v_y\ =\ 40\sin 50$

$v_y\ =\ 30.6$

$v_x\ =\ h\cos\theta$

$v_x\ =\ 40\cos 50$

$v_x\ =\ 25.7$



Max height: $v_f\ =\ 0$

$v_f{}^2\ =\ v_i{}^2 + 2a\Delta d$

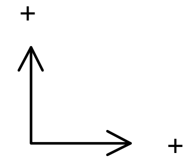
$0\ =\ 30.6^2 + 2(-9.8)\Delta d$

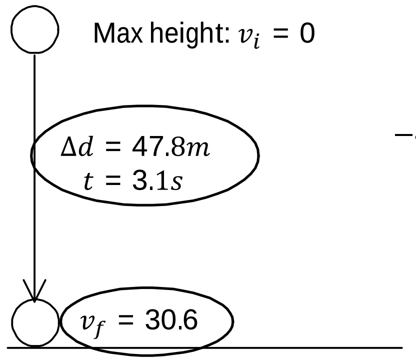
$\Delta d\ =\ 47.8m$

Max height = 47.8 + 60

= 107.8m

P12 - 1.1 - Projectile Motion Cliff Work



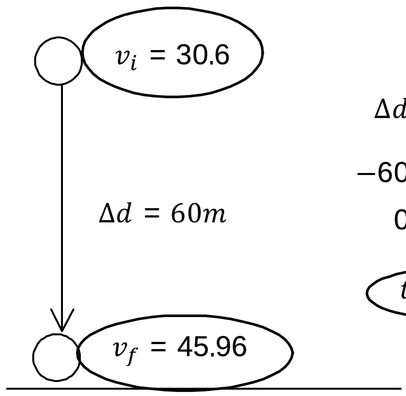


$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-47.8 = 0 + \frac{1}{2}(-9.8)t^2$$
$$t = 3.1s$$

Time up and down to top of cliff $6.2s$

This step is unnecessary

$$v_f{}^2 = v_i{}^2 + 2a\Delta d$$
$$v_f{}^2 = 0 + 2(-9.8)(-47.8)$$
$$v_f{}^2 = 936.9$$
$$v_f = 30.6\frac{m}{s}$$



$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-60 = -30.6t + \frac{1}{2}(-9.8)t^2$$
$$0 = -4.9t^2 - 30.6t + 60$$
$$t = 1.6s$$

Total time in flight:
$t = 6.2 + 1.6$

$$t = 7.8s$$

$$v = \frac{d}{t}$$
$$25.7 = \frac{d}{7.8}$$
$$d = 200.5m$$

Distance in flight $= 200.5m$

$$v_f{}^2 = (-30.6)^2 + 2a\Delta d$$
$$v_f{}^2 = 936.36 + 2(-9.8)(-60)$$
$$v_f{}^2 = 2112.4$$
$$v_f = 45.96\frac{m}{s}$$

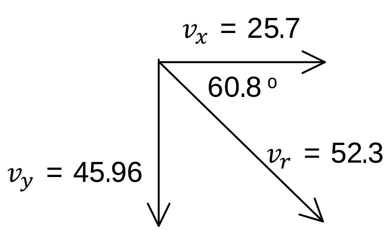
Or Drop it from 107.9m ; $v_i = 0$

$107.8m$

$$v_f{}^2 = (0)^2 + 2a\Delta d$$
$$v_f{}^2 = 2(-9.8)(-107.8)$$
$$v_f{}^2 = 2112.9$$
$$v_f = 45.96\frac{m}{s}$$

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-107.8 = \frac{1}{2}(-9.8)t^2$$
$$-107.8 = -4.9t^2$$
$$t = 4.69s$$

Total time in flight:
$t = 4.69 + 3.1 = 7.8s$



$$a^2 + b^2 = c^2$$
$$45.6^2 + 25.7^2 = c^2$$
$$c = 52.3\frac{m}{s}$$

$$\theta = \tan^{-1}\left(\frac{45.96}{25.7}\right)$$
$$\theta = 60.8^{o}$$

Max height $= 107.8m$. Time in flight $= 7.8s$. Horizontal distance traveled $= 200.5m$. The final velocity $= 52.3\frac{m}{s}$ 60.8^{o} S of E.

$$\Delta d = v_i t + \frac{1}{2}at^2$$
$$-60 = 30.6t + \frac{1}{2}(-9.8)t^2$$
$$0 = -4.9t^2 + 30.6t + 60$$
$$t = 7.8s$$

$$v_f = v_i + at$$
$$v_f = (30.6) + (-9.8)(7.8)$$
$$v_f = -45.84\frac{m}{s}$$

Or you can just do this!

How do we know time/and max height?

P12 - 1.2 - River Boat Current

$a^2 + b^2 = c^2$

$c = \sqrt{a^2 - b^2}$

$c^2 - b^2 = a^2$

$a = \sqrt{c^2 - b^2}$

N_y $SOHCAHTOA$ E_x

Nick swims North across a 30 m river. Nick swims at $4\frac{m}{s}$ *in still water. The river flows West at* $3\frac{m}{s}$.

What is Nick's Resultant Velocity?

$v_{r^2} = v_n^2 + v_f^2$

$v_r = \sqrt{4^2 + 3^2}$

$v_r = \sqrt{25}$

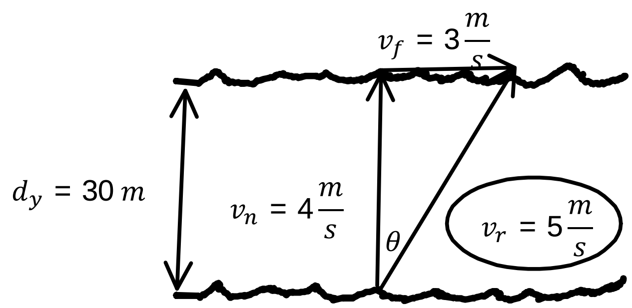
$v_r = 5\ \frac{m}{2}$

$tan\theta = \frac{o}{a}$

$tan\theta = \frac{3}{4}$

$\theta = \tan^{-1}\left(\frac{3}{4}\right)$

$\theta = 36.9^o\ [EoN]$



How long does it take to cross?

$v_y = \frac{d_y}{t}$

$t = \frac{d_y}{v_y}$

$t = \frac{30}{4}$

$t = 7.5\ s$

How far down river does Nick land?

$v_x = \frac{d_x}{t}$

$d_x = v_x t$

$d_x = 3(7.5)$

$d_x = 22.5\ m$

What is Nick's Displacement?

$d_r{}^2 = d_x^2 + d_y^2$

$d_r = \sqrt{22.5^2 + 30^2}$

$d_r = 37.5\ m$

At what heading should Nick head to arrive directly across the river?

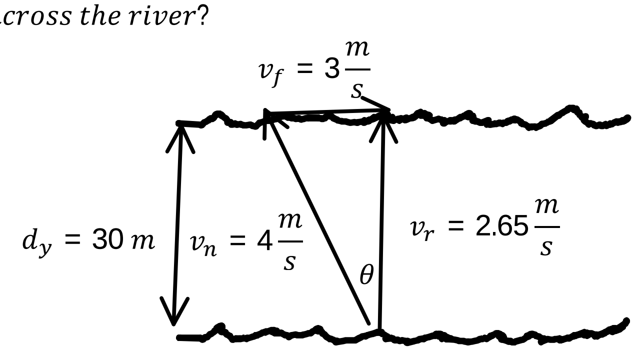
$sin\theta = \frac{o}{h}$

$sin\theta = 3/4$

$\theta = \sin^{-1}\left(\frac{3}{4}\right)$

$\theta = 48.59^o$

$48.59^o\ [WoN]$



What is Nick's Resultant Velocity?

$v_{r^2} = v_n^2 + v_f^2$

$v_r = \sqrt{4^2 - 3^2}$

$v_r = \sqrt{7}$

$v_r = 2.65\frac{m}{s}$

At this heading how long will it take to cross?

$v_y = \frac{d_y}{t}$

$t = \frac{d_y}{v_y}$

$t = \frac{30}{2.65}$

$t = 11.32\ s$

What is Nick's Displacement?

30 m!