Projectile Motion

Independance of Motion in Two Dimensions

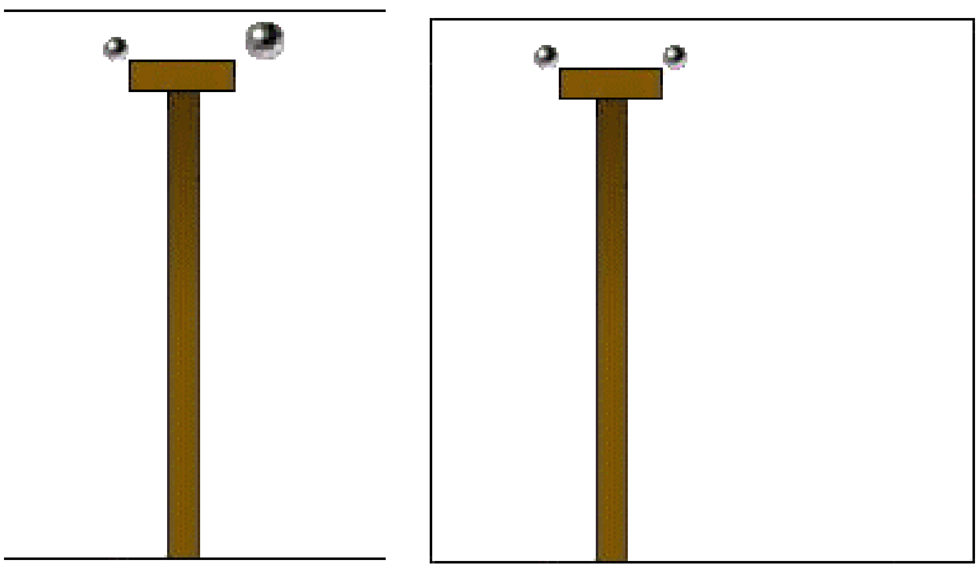
Projectile motion has motion in two dimensions (planes).

There is motion in the vertical and horizontal at the same time

Because the planes are perpendicular to each other they have *no effect* of each other.

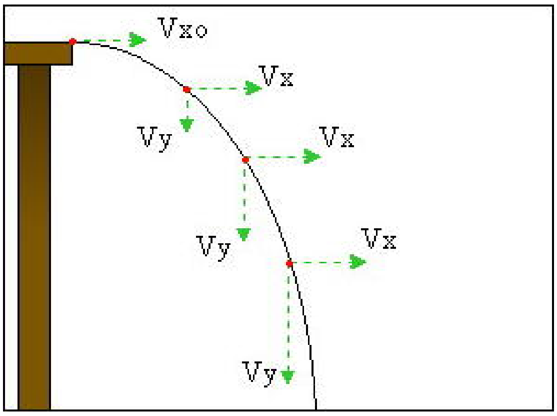
Motion in the "x" does not effect motion in the "y"

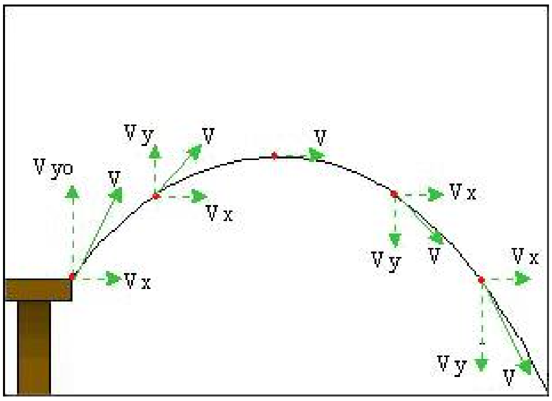
Dec 4-6:28 AM



http://library.thinkquest.org/2779/

Nov 14-9:29 AM





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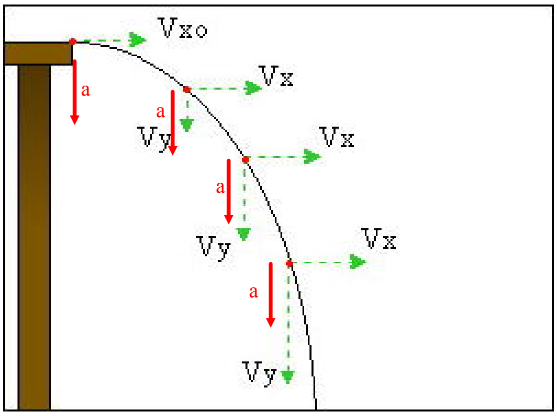
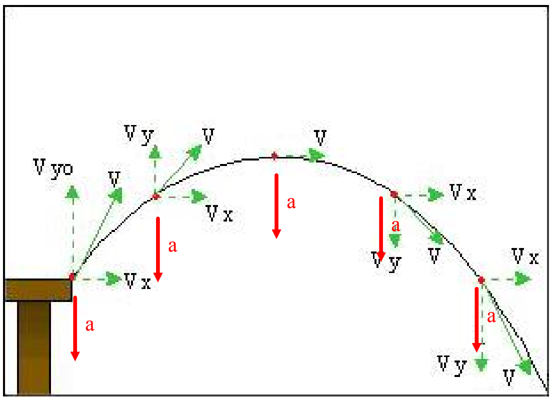
Nov 14-9:30 AM





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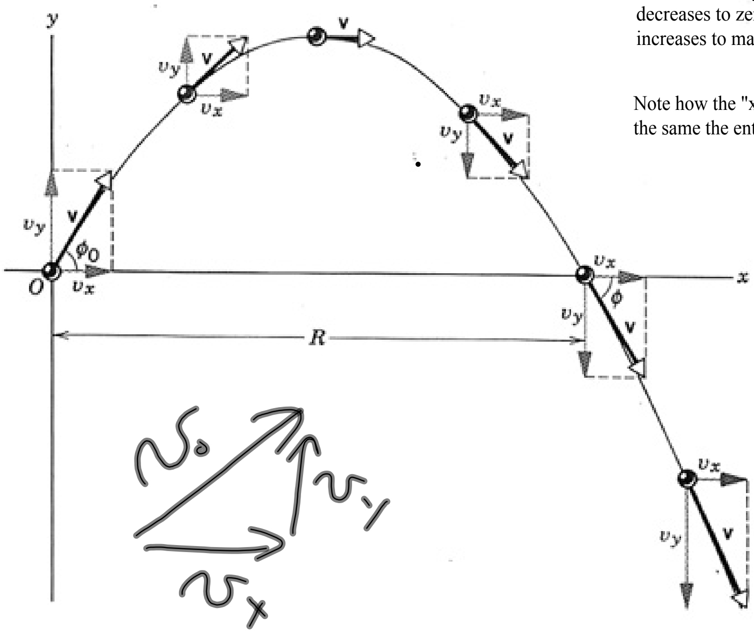
Nov 14-10:36 AM

Nov 16-8:49 AM

Nov 16-8:50 AM



Note how the "y" vector (acceleration) decreases to zero as it goes up and then increases to max as it goes down

Note how the "x" vector (velocity) stays the same the entire path

Dec 4-7:48 AM

A 755 g soccer ball is kicked and leaves the foot at 27.0 m/s at 30.0^0 from the horizontal. a) How long is it in the air? b) How far does it go? c) How high does it go?

$m = 0.755$ kg

$a_y = -9.81\ m/s^2$

$a_x = 0$

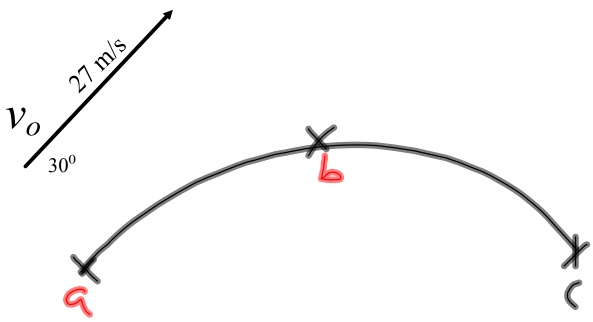
$v_o = 27.0$ m/s

$\theta = 30.0^0$

a) t = ?

b) d_x = ?

c) d_y = ?



Dec 4-7:57 AM

$v_o = 27.0$ m/s

$\theta = 30.0^0$

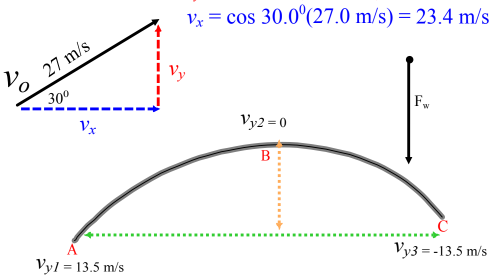
a) t = ?

b) d_x = ?

c) d_y = ?

$v_y = \sin 30.0^0(27.0 \text{ m/s}) = 13.5$ m/s

$v_x = \cos 30.0^0(27.0 \text{ m/s}) = 23.4$ m/s



1) data
2) diagram
3) ID planes of motion
4) ID forces acting on system (object)
4) ID motion (s) involved with each force

time in air is from A to C

how high is A to B, ∴ 1/2 the time

ll (x)	⊥ (y)
no force ΣF = 0	gravity ∴ ΣF = ma
∴ v_c	∴ a
v_x = 23.4 m/s	v_{y1} = 13.5 m/s
d_x = ?	a = g = -9.81 m/s^2
$v_x = d_x/t$	v_{y2} = 0 (top)
d_x = vt	v_{y3} = -13.5 m/s (end)
d_x = 23.4 m/s (t)	

d_x = 23.4 m/s x 2.75 s

d_x = 64.4 m

could solve for "t" or "d"

d_y = ?

t = ?

$t_t = v_{y3} - v_{y1}/a$

t = -13.5 m/s - (13.5 m/s)/(-9.81 m/s^2)

t = 2.75 s

$d_y = v_{y2}^2 - v_{y1}^2/2a$

d_y = [0 - (13.5 m/s)^2]/[2(-9.81 m/s^2)]

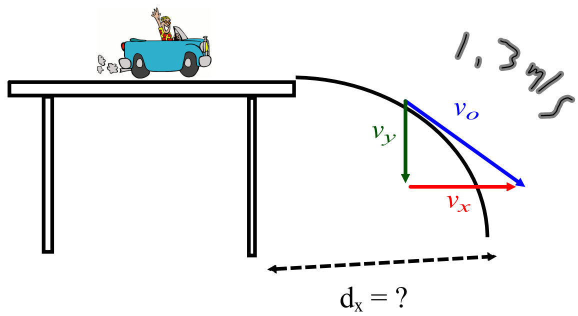
d_y = 9.30 m

Dec 4-7:57 AM

v_{ox} =1.3 m/s

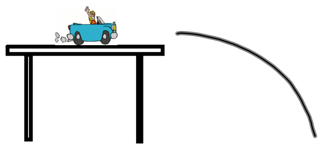
b) d_y = 92 cm

c) d_x = ?



Dec 15-6:45 AM

v_{ox} =1.3 m/s
b) d_y = 92 cm
c) d_x = ?



X

const. vel

$\Sigma F = 0$

v_{ox} =1.3 m/s

d_x = ?

$v_c = d_x/t$

$d_x = v_c(t)$

d_x = 1.3 m/s(.43 s)

d_x = .56 m

Y

accel

force of gravity $\therefore$ $\Sigma F = ma$

d_y = 92 cm

a_y = -9.8 m/s^2

t = ?

$d = 1/2\ at^2$

$t = \sqrt{2d/a}$

$t = \sqrt{[2(.92m)]/-9.8\ m/s^2}$

t = .43 s

Dec 15-6:48 AM

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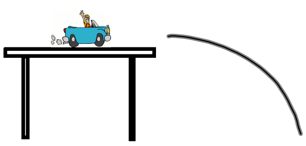
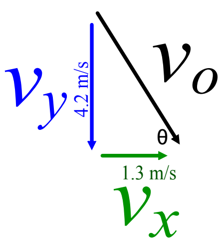
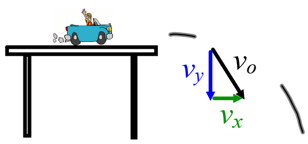
v_{ox} =1.3 m/s
b) d_y = 92 cm
c) d_x = ?



What angle did the little car hit the ground at? .... what velocity?





$v_{y1} = 0$
v_{y2} = ?
a = -9.8 m/s^2
d = -0.92 m

Tan θ = (4.2 m/s)/1.3 m/s
θ = 73^0 above the horizontal

$v_{y2} = \sqrt{2(-9.8\ m/s^2)(-0.92\ m)}$
v_{y2} = -4.2 m/s

$v_o = \sqrt{(4.2\ m/s)^2 + (1.3\ mj/s)^2}$
v_o = 4.4 m/s at 73^0 above the horizontal

Jan 3-6:32 AM

Junior's car is traveling at 65 mph and he drops a test object from 1.7 m above the ground. How far from the drop point does the test object hit the ground?

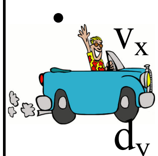
$v_x = 65$ mph

└→ 29 m/s

$d_y = -1.7$ m

d_x ?

Jan 3-7:37 AM



$v_x = 65$ mph

└→ 29 m/s

$d_y = -1.7$ m

d_x ?

Junior's car is traveling at 65 mph and he drops a test object from 1.7 m above the ground. How far from the drop point does the test object hit the ground?

X

const. vel

$\Sigma F = 0$

$v_{ox} = 1.3$ m/s

$d_x = ?$

$v_c = d_x/t$

$d_x = v_c(t)$

$d_x = 29$ m/s(.59 s)

$d_x = 17$ m

Y

accel

force of gravity $\therefore$ $\Sigma F = ma$

$d_y = -1.7$ cm

$a_y = -9.8$ m/s^2

$t = ?$

$d = 1/2\,at^2$

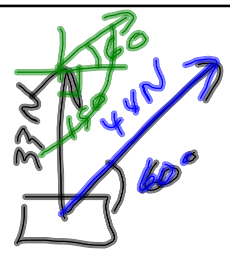
$t = \sqrt{2d/a}$

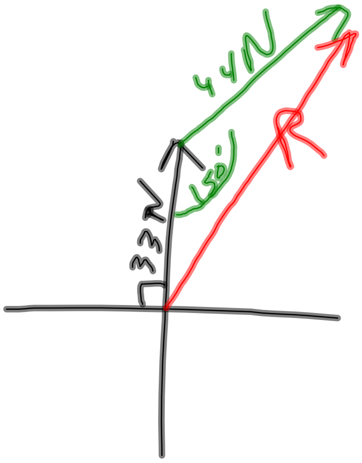
$t = \sqrt{[2(-1.7m)]/-9.8\ m/s^2}$

$t = .59$ s

Nov 21-6:52 AM

(30)





Equilibrium

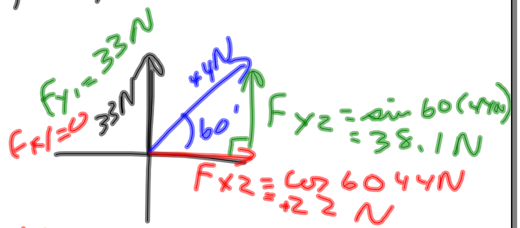
* $\Sigma F = 0$

$R = -E$

graphically.
law of sines/cosines
$\Sigma F_x ; \Sigma F_y$

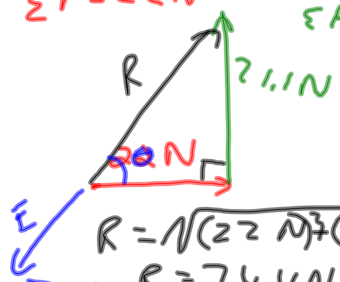
Dec 8 - 10:33 AM

$\Sigma F_x ; \Sigma F_y$



$\Sigma F_x : F_{x1} = 0$
$F_{x2} = +22$
$\Sigma F = +22N$

$\Sigma F_y : F_{y1} = +33N$
$F_{y2} = +38.1N$
$\Sigma F_y = 71.1N$



$R = \sqrt{(22\,N)^2 + (71.1\,N)^2}$

$R = 74.4N$ at $73°$

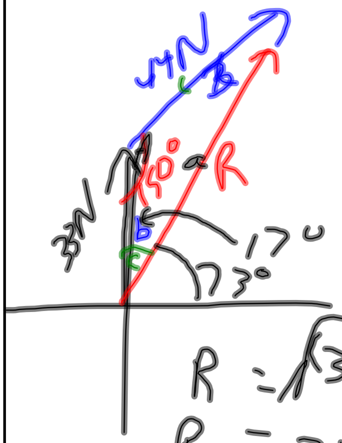
$\tan\theta = \frac{71.1N}{22N}$

$\theta = 73°$

$E = 74.4N$ at $253°$

$73° + 180° = 253°$

Dec 8 - 10:40 AM



$a = \sqrt{b^2 + c^2 - 2bc\cos A}$

$R = \sqrt{(33N)^2 + (44N)^2 - 2(33N)(44N)\cos 150}$

$R = 74N$ at $73°$

$E = -R$ $\quad E = 74N$ at 253 $\quad 180 + 73 = 253$

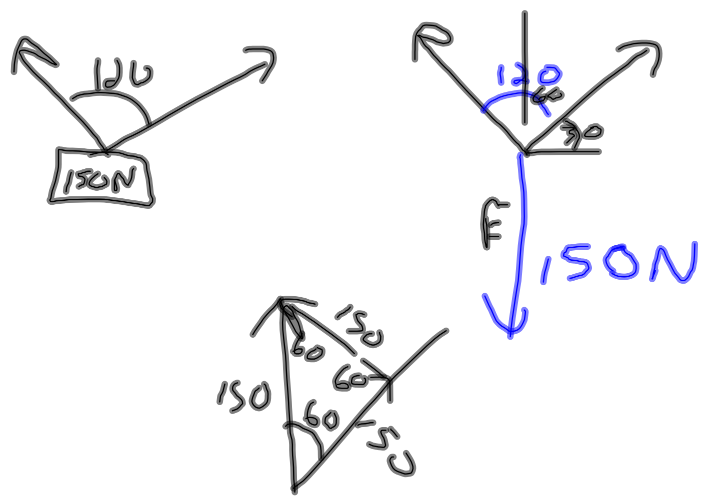
$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$

$\frac{74N}{\sin 150} = \frac{44N}{\sin C}$

$C = 17°$

Dec 8 - 12:39 PM

(31)



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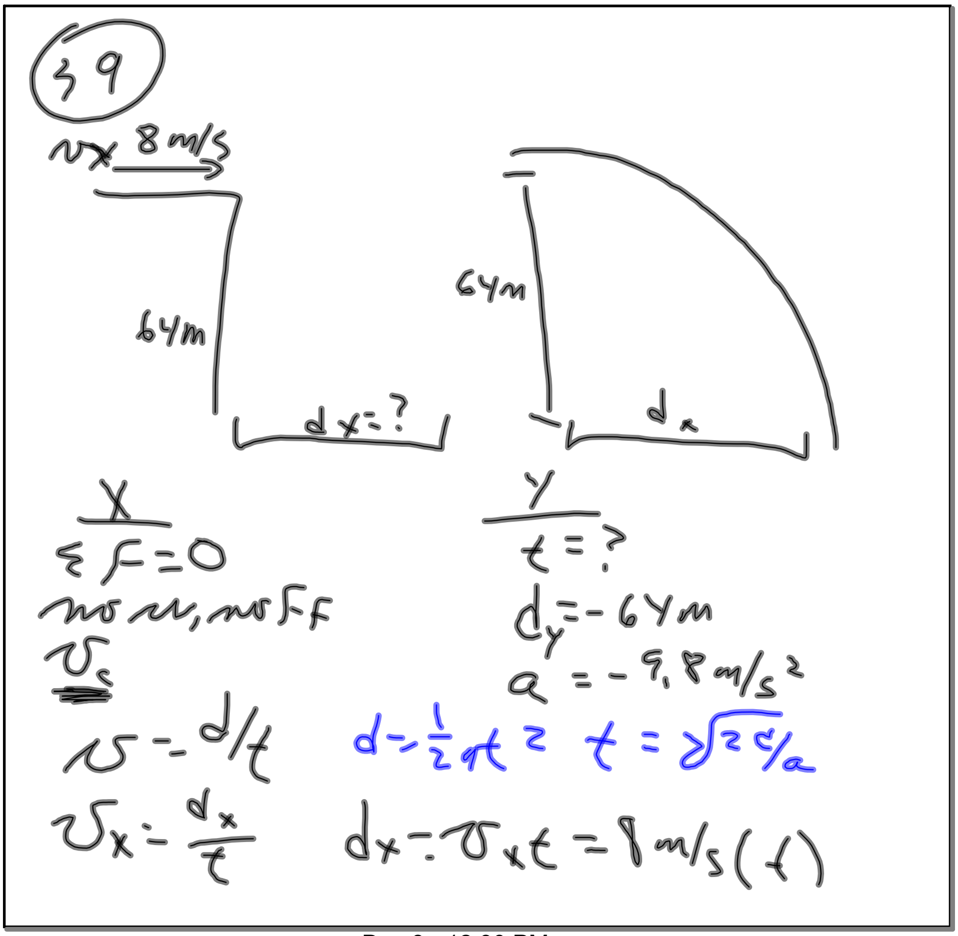

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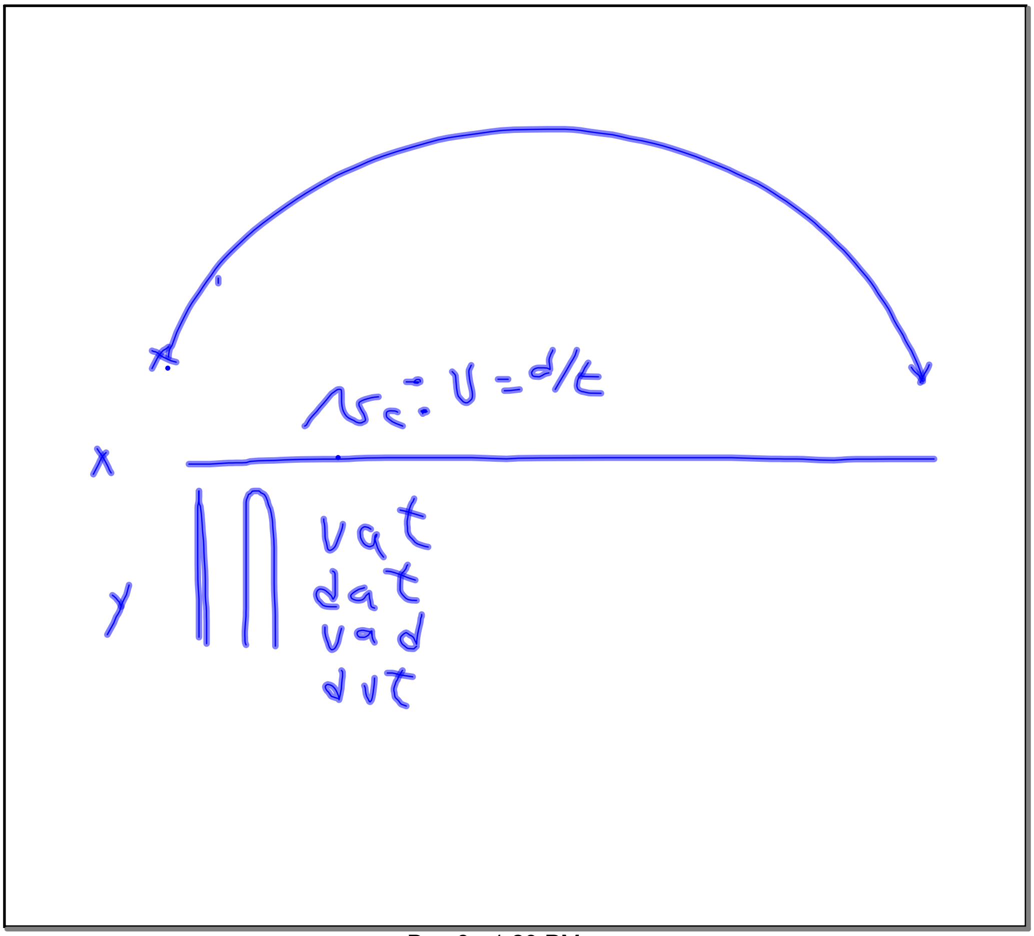

Dec 8 - 1:29 PM