Recap + CH 2: Kinematics in one Dimension   Febrero 4, 2019

* complete motion diagram → label velocity vectors
  → show acceleration vector anytime $\vec{a}$ changes

⇒ Prefixes

⇒ converting units → multiply by conversion factors (ratios of units that equal one) + Cancel units algebraically.

END

Physics 4A lectures are 75 minutes?
How many microcenturies is this?

$$75\text{min} = \frac{75\,\cancel{\text{min}}}{} \left|\frac{1\,\cancel{\text{hr}}}{60\,\cancel{\text{min}}}\right| \frac{1\,\cancel{\text{day}}}{24\,\cancel{\text{hrs}}} \left|\frac{1\,\cancel{\text{yr}}}{365.25\,\cancel{\text{days}}}\right| \frac{1\,\cancel{\text{century}}}{100\,\cancel{\text{yrs}}} \left|\frac{1\,\mu\,\text{century}}{10^{-6}\,\cancel{\text{century}}}\right| = 1.426\ \mu\,\text{centuries}$$

$$= \boxed{1.4\ \mu\ \text{centuries}}$$

$$15.5\text{km}^2 = 15.5\text{km}^2 \left|\left(\frac{10^3\,\text{m}}{1\,\text{km}}\right)^2\right| = 15.5 \times 10^6\,\text{m}^2$$

$$= 1.55 \times 10^7\,\text{m}^2$$

Ex Show $1\text{g}/\text{cm}^3 = 10^{-3}\,\text{kg}/\text{m}^3$

|| Chapter 2: Kinematics in One Dimension ||

Quick Calculus Review

$Y(x)$ → Y is a function of x

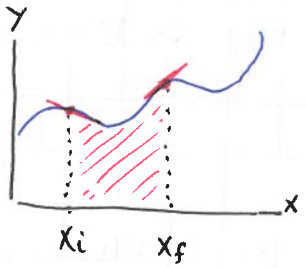
Ex $y(x) = 4x^2 - 3x$

$y(x) = 12x^3 - 4x^2 + 7 = 36x^2 - 8x$

ch 2

February 4, 2019

what does dy/dx represent? → Slope of the Curve of y vs. x



what does $\int_{x_i}^{x_f} y(x)dx$ represent?
↓
area under the curve between x_i and x_f

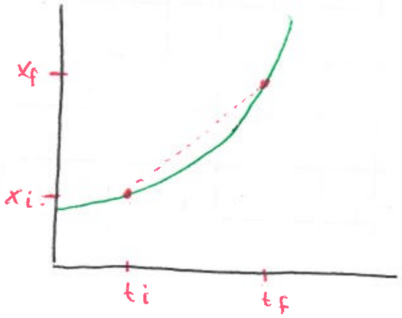
POSITION VS. TIME + UNIFORM MOTION

Preview: graph of position vs. time → Slope of position-vs-time gives velocity
→ area under position-vs-time gives nothing useful

graph of velocity-vs-time → Slope of velocity-vs-time gives acceleration
→ area under velocity-vs-time gives ($\Delta\vec{r}$)displacement

graph of acceleration-vs-time → Slope of acceleration-vs-time give us nothing useful (Jerk)
→ Area under acceleration-vs-time give us Δvelocity ($\Delta\vec{v}$)

$x(t)$
$y(t)$ } Position (x or y) as a function of time



Slope of line connecting two points:

$$\text{Slope} = \frac{\text{rise}}{\text{run}} = \frac{x_f - x_i}{t_f - t_i} = \frac{\Delta x}{\Delta t}$$ = avg. vel. during the time interval Δt

ch 2 Febrero 4, 2019

* Slope of tangent line $V_x = dx/dt$ = Slope of position vs time graph at time t

Velocity-vs-time graphs

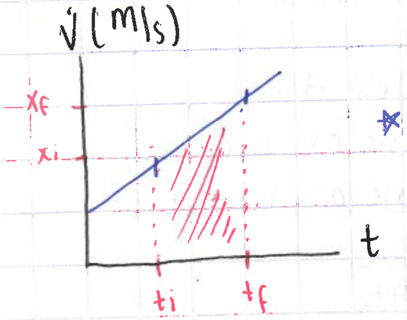
$a = dv/dt$ → acceleration is the slope of the tangent line of velocity-vs-time.

$V = \frac{dx}{dt}$ → Instantaneous velocity $v = dx/dt$ = Slope of tangent line of position-vs-t

$V = dx/dt$

$Vdt = dx$ → $\int_{t_i}^{t_f} v\,dt = \int_{x_i}^{x_f} dx \rightarrow x\Big|_{x_i}^{x_f} = (x_f - x_i) = \Delta x$

↳ area under curve of velocity-vs-time between t_i and t_f



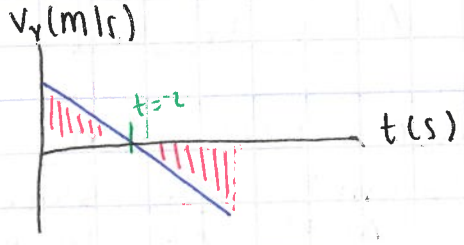
between t_i to t_f

* Area under curve of velocity vs. time gives the displacement during time interval (Δt)

* To get x_f, we need to be given x_i

↳ Area under curve only give us Δx

* Area under curve gives the displacement but not the distance traveled.



Ch 2 + Recap February 5, 2019

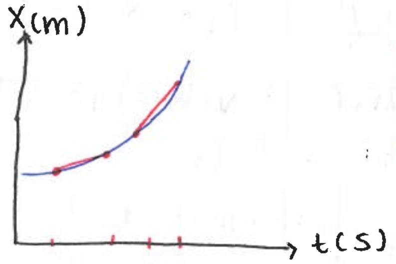
RECAP

→ Converting Units

Chapter 2

quick review of calculus → what is dy/dx
→ what is $\int_{x_i}^{x_f} y(x)\,dx$

Position-vs-time graphs



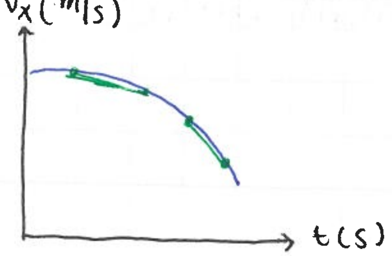
$$\boxed{V_{avg,x} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}}$$

instantaneous Velocity

$$\boxed{V_x = \frac{dx}{dt} = \text{slope of tangent line at time } t}$$

$$= \lim_{\Delta t \to 0} \frac{\Delta x}{\Delta t}$$

Velocity-Versus-time graph



$$\boxed{a_{avg,x} = \frac{\Delta V_x}{\Delta t} = \frac{V_{xf} - V_{xi}}{t_f - t_i}}$$

Instantaneous acceleration

$$\boxed{a_x = \frac{dV_x}{dt} = \lim_{\Delta t \to 0} \frac{\Delta V_x}{\Delta t} = \text{slope of tangent line at time } t}$$

- area under curve of velocity-vs-time graph gives displacement $\Delta x = x_f - x_i$

CH2 February 5, 2019

$V = \frac{dx}{dt}$

$\int_{t_i}^{t_f} v\,dt = \int_{t_i}^{t_f} dx/dt \; dt$ → Area under velocity-vs-time curve between ti + tf

$\int_{t_i}^{t_f} \frac{dx}{dt}\,dt \rightarrow x(t)\Big|_{t_i}^{t_f} = x_f - x_i = \Delta x$

Problem 2.11

for velocity-vs-time graph:

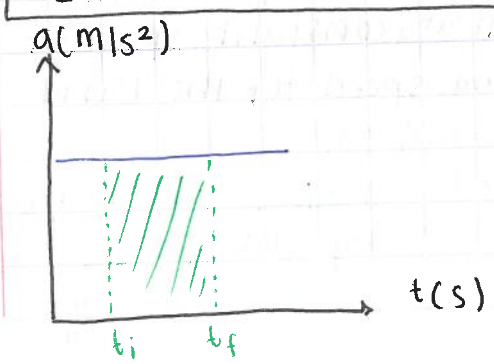
- $x_f = x_i$ + area under curve of v.vs. t.
- V_x -> Read right from graph
- $a_x = dV_x/dt$ → find slope of curve

a) each square has area of (2m/s)(1s) = 2m
between 0 + 2s → 4 squares
$\Delta x = 4 \times 2m = 8m$
$x_f = x_i + \Delta x = 2.0m + 8.0m = 10.0m$

b) $V_x = 2m/s$ at $t = 2.0s$

c) Slope $= \frac{(0m/s - 6m/s)}{(3s - 0s)} = -2\,m/s^2$

Acceleration - vs - time graphs



$a_x = dV_x/dt$

$\int_{t_i}^{t_f} a_x\,dt = \int_{t_i}^{t_f} \frac{dV_x}{dt} = V_x(t)\Big|_{t_i}^{t_f} = \Delta V_x$

$= V_{xf} - V_{xi}$

area under acceleration-vs-time curve between ti + tf

CH2

February 5, 2019

* Area under curve of acceleration-vs-time between t_i and t_f gives ΔV_x

$$V_{xf} = V_{xi} + \Delta V$$ ← Area under curve

- Note about Notation: "your book uses the symbol "s" for a generic axis (it could be x-axis, y-axis, along an inclined plane,...)

$$V_s = ds/dt \rightarrow v_x = dx/dt$$
$$\rightarrow v_y = dy/dt$$

Motion with constant acceleration

Uniform motion → acceleration is zero
(Object traveling at a constant speed

$$V_{avg,x} = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{\Delta t}$$

$$(x_f - x_i) = (V_{avg,x})\Delta x \longrightarrow x_f - x_i = V_x \Delta t$$ (V_x = constant, $V_{avg,x}$)

UNIFORM motion: $X_f = X_i + V_x \Delta t$ → same thing as distance = speed x time

OR

$Y_f = Y_i + V_y \Delta x$

Question: A car travels up a hill at a constant speed of 40 km/hr and returns down the hill at a constant speed of 60 km/hr. What is the avg. speed for the round trip?

less than $50 \frac{km}{hr}$

length of hill = D

$$\text{avg. Speed} = \frac{D+D}{t_{up} + t_{down}} = \frac{D+D}{\frac{D}{40\frac{km}{hr}} + \frac{D}{60\frac{km}{hr}}} \Rightarrow$$

nued ⇒

$$\frac{2\cancel{D}}{\cancel{D}\left(\frac{1}{40\frac{km}{hr}} + \frac{1}{60\frac{km}{hr}}\right)} = 48\frac{km}{hr}$$

CH2 February 5th, 2019

Equations of constant acceleration

↳ Set of equation that relate position, velocity & acceleration

* Apply only if acceleration is constant in both magnitude & direction

$$V = \frac{dx}{dt}$$

$$\int_{t_i}^{t_f} V dt = \int_{t_i}^{t_f} \frac{dx}{dt} dt$$

* V is a function of time so can't be taken out of integral

$$a = dv/dt$$

$$\int_{t_i}^{t_f} a dt = \int_{t_i}^{t_f} \frac{dv}{dt} dt$$

$$\parallel \qquad \parallel$$

$$a \int_{t_i}^{t_f} dt = a\Delta t \qquad v(t)\Big|_{t_i}^{t_f} = V_f - V_i$$

$$a \Delta t = V_f - V_i$$

$$\boxed{V_f = V_i + a\Delta t} \rightarrow V_f = V_i + at$$

$$\int_{t_i}^{t_f} V(t) dt = \int_{t_i}^{t_f} \frac{dx}{dt} dt$$

February 7th, 2019

Equations of Constant Acceleration

→ only aply if $\vec{a}$ is constant in both magnitude & direction.

↳ Relate initial & final positions, initial & final velocities, constant acceleration, & elapapsed time ı 2 February 7, 2019

ıriables used
ı book

Variables used in class

x_0	initial position (position at the start of the time interval)
x	final position (Position at the end of the time interval)
V_{0x}	initial Velocity (velocity at the start of the time interval)
V_x	final velocity (velocity at the end of time interval Δt)
a_x	Constant acceleration
t	Elapsed time

ations

$= V_{ix} + a_x \Delta t \longrightarrow \boxed{V_x = V_{0x} + a_x t}$

$= x_i + V_{ix} \Delta t + 1/2\, a_x (\Delta t)^2 \longrightarrow \boxed{x = x_0 + V_{0x} t + \frac{1}{2} a_x t^2}$

$= V_{ix}^2 + 2a_x (x_f - x_i) \longrightarrow \boxed{V_x^2 = V_{0x}^2 + 2a_x (x - x_0)}$

$$\boxed{x - x_0 = \frac{1}{2} (V_{0x} - V_x) t}$$

ıvation

$$= \frac{dV_x}{dt}$$

$$ıx\, dt = \int_0^t \frac{dV_x}{dt} \cdot dt \Rightarrow a_x \int_0^t dt = V_x(t) \Big|_0^t \Rightarrow a_x t \Big|_0^t = V_x(t) - V_x(0)$$

$$a_x t = V_x - V_{0x} \Rightarrow \underline{V_x = V_{0x} + a_x t}$$

Ch 2.

February 7th, 2019

Derivation

$$V_x = \frac{dx}{dt}$$

$$\int_0^t V_x\,dt = \int_0^t \frac{dx(t)}{dt}\cdot dt$$

$$= x(t)\Big|_0^t = x(t) - x(t{=}0_s)$$

$$= x - x_0$$

$$\rightarrow \int_0^t V_x\,dt = x - x_0$$

$$\int_0^t (V_{0x} + a_x t)\,dt = \int_0^t V_{0x}\,dt + \int_0^t a_x\,t\,dt \Rightarrow$$

$$\Rightarrow V_{0x}\int_0^t dt + a_x\int_0^t t\,dt \Rightarrow$$

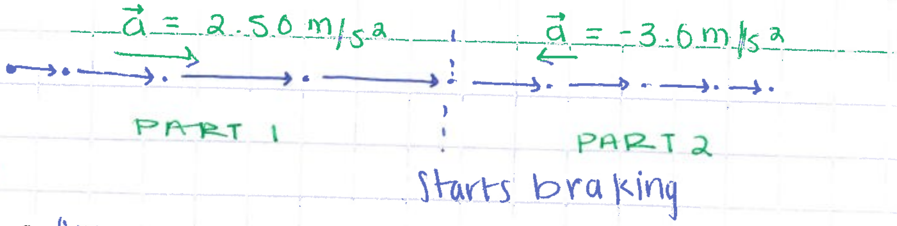
$$V_{0x} = \int_0^t dt + a_x\int_0^t t\,dt = x - x_0$$

$$\Rightarrow V_{0x}t + \tfrac{1}{2}a_x t^2 = x - x_0$$

$$\underline{x = x_0 + V_{0x}t + \tfrac{1}{2}a_x t^2}$$

Ex

A car starts from rest & accelerates at 2.50 m/s² for a distance of 125m. It then hits the brakes & accelerates at -3.0 m/s² until coming to rest. (a) what is total distance traveled? (b) How long is it in motion for?



PART I

$x_0 = 0m$

$x = 125m$

$V_{0x} = 0\ m/s$

$V_x = ?$ 25 m/s

$a_x = 2.50\ m/s^2$

$t = ?$ 10.s

$$V_x^2 = \overset{=0}{V_{0x}^2} + 2a_x(x - \overset{=0}{x_0})$$

$$V_x^2 = 2a_x(x)$$

$$V_x = \pm\sqrt{2a_x x}$$

$$V_x = \sqrt{2(2.50\,m/s^2)(125m)} = \underline{25 m/s}$$

$$V_x = \overset{=0}{V_{0x}} + a_x t \rightarrow V_x = a_x t$$

$$t = \frac{V_x}{a_x} \rightarrow t = \frac{25 m/s}{2.50 \frac{m}{s^2}} = \underline{10.s}$$

Ch 2.

February 7, 2019

Part 2

$x_0 = 125m$

$x = 0m$

$V_{0x} = 25m/s$

$V_x = 0m$

$a_x = -3.0m/s^2$

$t = ?$ 8.33s

$$\overset{=0}{V_x} = V_{0x} + a_x t$$

$$0 = V_{0x} + a_x t$$

$$t = \frac{-V_{0x}}{a_x}$$

$$t = \frac{-25m/s}{-3.0m/s^2} = \underline{8.33s}$$

$$x = x_0 + V_{0x}t + \frac{1}{2}a_x t^2$$

$$x = 125m + (25m/s)(8.33s) + \frac{1}{2}(-3.0\frac{m}{s^2})(8.33s)^2$$

$\boxed{x = 229}$ Total distance traveled

Total Time: $10s + 8.33s = \boxed{18s}$

Ch 2. + RECAP February 7, 2019

Part 2

$x_0 = 125m$

$x = 0m$

$V_{0x} = 25m/s$

$V_x = 0m$

$a_x = -3.0m/s^2$

$t = ?$ 8.33s

$\overset{=0}{V_x} = V_{0x} + a_x t$

$0 = V_{0x} + a_x t$

$t = \frac{-V_{0x}}{a_x}$

$t = \frac{-25m/s}{-3.0m/s^2} = \underline{8.33s}$

$x = x_0 + V_{0x}t + 1/2\, a_x t^2$

$x = 125m + (25m/s)(8.33s) + 1/2\,(-3.0\frac{m}{s^2})(8.33s)^2$

$\boxed{x = 229}$ Total distance traveled

Total Time: $10s + 8.33s = \boxed{18s}$

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RECAP

x_0

x

V_{0x}

V_x

a_x

t

$V_x = V_{0x} + a_x t$

$x = x_0 + V_{0x}t + \frac{1}{2}a_x t^2$

$V_x^2 = V_{0x}^2 + 2a_x(x - x_0)$

$x - x_0 = \frac{1}{2}(V_{0x} - V_x)t$

PROBLEM SOLVING STRATEGY

0) Read the problem & Visualize
1) Draw a motion diagram (label $\vec{v}$ and $\vec{a}$)
2) Make a table of known & unknown quantities
3) Solve algebraically for the unknown quantity (Plug in zero first)

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4) Plug in known values
5) Make sure your answers seems reasonable

EX

A car start from rest & accelerates at 5.0 m/s² for 10.0 s

· How far does it travel?

$x_0 = 0m$
$x = ?$ 250m
$V_{0x} = 0m$
$V_x = 50 m/s$
$a_x = 5.0 m/s^2$
$t = 10.0s$

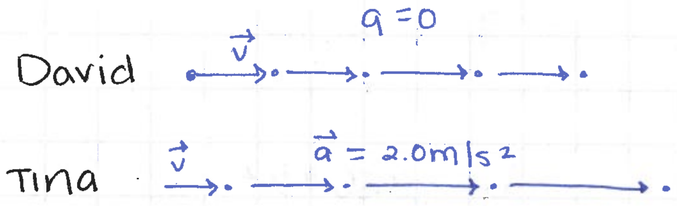
$$V_x = \overset{=0}{V_{0x}} + a_x t$$
$$V_x = a_x t$$
$$V_x = 5.0 m/s^2 (10.0s)$$
$$\underline{V_x = 50 m/s}$$

$$x = \overset{=0}{x_0} + \overset{=0}{V_{0x}} t + \tfrac{1}{2} a_x t^2$$
$$x = \tfrac{1}{2} a_x t$$
$$x = \tfrac{1}{2} (5.0 m/s^2)(10.0s)^2$$
$\underline{x = 250\,m}$ OR $\underline{x = 2.5\times10^2 m}$

Check:

$$V_x^2 = \overset{=0}{V_{0x}^2} + 2a_x(x - \overset{=0}{x_0})$$
$$V_x^2 = 2a_x(x)$$
$$x = \frac{V_x^2}{2a_x} \rightarrow x = \frac{(50 m/s)^2}{2(5.0 m/s^2)} = \underline{2.5\times10^2 m}$$

Problem 2.68



	David	Tina
x_0	0m	0m
x	?	?
V_{0x}	30 m/s	0 m/s
V_x	30 m/s	?
a_x	0 m/s²	2.0 m/s²
t	?	?

a) $x_{David} = x_{Tina}$

$$\overset{=0}{x_0} + V_{0x}t + \tfrac{1}{2}\overset{=0}{a_x} t^2 = \overset{=0}{x_0} + \overset{=0}{V_{0x}} t + \tfrac{1}{2} a_x t^2$$
$$V_{0x} t = \tfrac{1}{2} a_x t^2$$
$$t = \frac{2V_{0x}}{a_x} \rightarrow t = \frac{2(30.0 m/s)}{2.0 m/s^2} = \underline{30.0 s}$$

→

Ch 2. Febroary 11, 2019

Continued...

$x_{David} = (30.0 m/s^2)(30.0 s) = \underline{900m}$

$x_{Tina} = \frac{1}{2}(2.0 m/s^2)(30.0 s)^2 = \underline{900m}$

$v_x = \cancelto{0}{v_{0x}} + a_x t$

$v_x = a_x t$

$v_x = (2.0 m/s^2)(30.0 s) = \underline{60 m/s}$

$\boxed{\text{Free Fall}}$ → (one-dimensional) motion

Where gravity is the only force acting on the object (No air resistance)

* In free fall, all objects accelerate at the same rate

$\boxed{a_y = -9.80 m/s^2 = -g}$

$\boxed{g = 9.80 m/s^2}$ *g is always a + number; you will never use -9.80 m/s² for g.

acceleration due to gravity = 9.80 m/s² straight downward

= -9.80 m/s²

= -g

Equations for Free Fall:

$\boxed{v_y = v_{0y} + a_y t}$

$\boxed{y = y_0 + v_{0y}t + \frac{1}{2}a_y t^2}$

$\boxed{v_y^2 = v_{0y}^2 + 2a_y(y - y_0)}$

$\boxed{y - y_0 = 1/2(v_{0y} + v_y)t}$

$a_y = -9.80 m/s^2$

(9.80 m/s² Straight downward)

Ch 2. February 11, 2019

Ex A ball is thrown straight upwards at 30.0 m/s $\rightarrow$ $V_y = 0$ m/s
a) How long does it take to reach the highest point?
b) How long is it in the air for? (Assuming it is caught at the same height it is release from?

a) $Y_0 = 0m$
$Y = ?$
$V_{oy} = 30.0\,m/s$
$V_y = 0\,m/s$ at highest point
$a_y = -9.80\,m/s^2$
$t = ?$ $\rightarrow$ 3.1s (to highest point)

$$\overset{=0}{V_y} = V_{oy} + a_y t$$
$$0 = V_{oy} + a_y t$$
$$t = \frac{-V_{oy}}{a_y} = \frac{-30.0\,m/s}{-9.80\,m/s^2} \Rightarrow \underline{t = 3.1s}$$

b) $Y_0 = 0m$
$Y = 0m$
$V_{oy} = 30.0\,m/s$
$V_y = ?$
$a_y = -9.80\,m/s^2$
$t = ?$ 6.2s

$$\overset{=0}{Y} = \overset{=0}{Y_0} = V_{oy}t + \tfrac{1}{2}a_y t^2$$
$$0 = V_{oy}t + \tfrac{1}{2}a_y t^2$$
$$-V_{oy}t = \tfrac{1}{2}a_y t^2$$
$$t = \frac{-2V_{oy}}{a_y}$$
$$t = \frac{-2(30.0\,m/s)}{-9.80\,m/s^2} = \underline{6.2s}$$

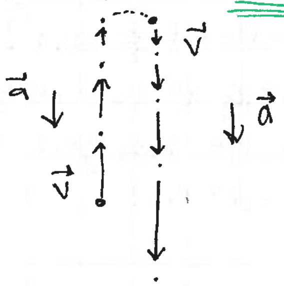
Free Fall

- * At the highest point, $V_y = 0\,m/s^2$ ($a_y = -9.80\,m/s^2$)
- * Time up = time down (assuming $y = y_0$)
  (time in air = 2x time to highest point)
- * Free Fall motion is symmetric - at a given height, Speed is the same (velocities are opp.)

CH2 + Recap

February 11, 2019

Problem 2.21



$Y_0 = 2.0m$
$Y = 0m$
$V_{0y} = 15m/s$
$V_y = ?$
$a_y = -9.80 m/s$
$t = ?$

$t = (-B \pm \sqrt{B^2 - 4AC})/2A$
$A = 1/2 a_y = -4.980 m/s^2$
$B = V_{0y} = 15.0 m/s$
$C = Y_0 = 2.0 m$

$$t = \frac{-B \pm \sqrt{B^2 - 4ac}}{2A}$$

$$t = \frac{-15.0 m/s \pm \sqrt{(15.0 m/s)^2 - 4(-4.90 m/s^2)(2.0 m)}}{2(-4.90 m/s^2)}$$

$$\boxed{\overset{0}{Y} = Y_0 + V_{0y} t + 1/2 a_y t^2}$$

$$\frac{1}{2} a_y t^2 + V_{0y} t + Y_0 = 0$$
$$(Ax^2 + Bx + C = 0)$$

$$\boxed{t = \frac{-B \pm \sqrt{B^2 - 4AC}}{2A}}$$

$t = 3.2 s$
and
$t = $ neg #

February 12, 2019

RECAP

Equations of constant acceleration:

$V_x = V_{0x} + a_x t$
$X = X_0 + V_{0x} t + 1/2 a_x t^2$
$V_x^2 = V_{0x}^2 + 2a_x (X - X_0)$
$X - X_0 = 1/2 (V_{0x} + V_x) t$

} Horizontal motion or motion along an inclined plane
↳ today

Free Fall → Gravity is the only force acting

$V_y = V_{0y} + a_y t$
$Y = Y_0 + V_{0y} t + 1/2 a_y t$
$V_y^2 = V_{0y}^2 + 2a_y (y - y_0)$
$Y - Y_0 = 1/2 (V_{0y} + V_y) t$

} Vertical motion on Free fall

ONLY in Free fall ↗

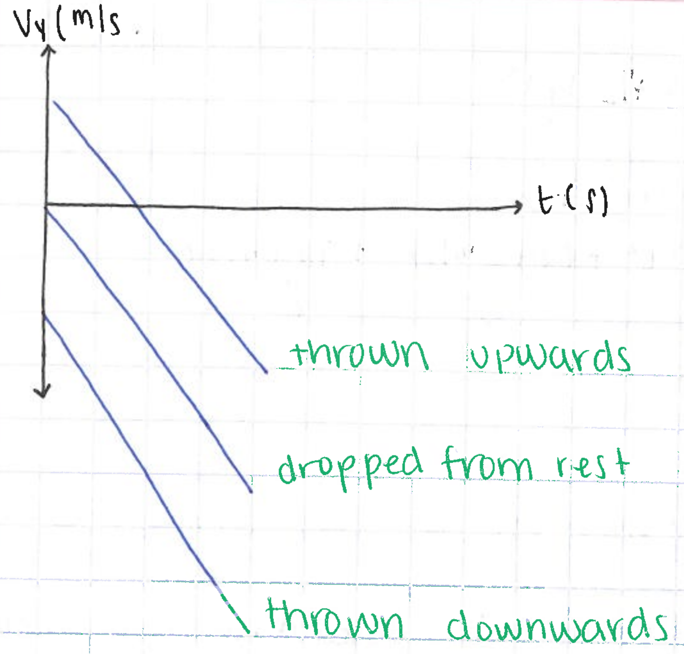
$a_y = -g = -9.80 m/s^2$

$a = -9.80 m/s^2$ → * $V_y = 0 m/s$ at highest point

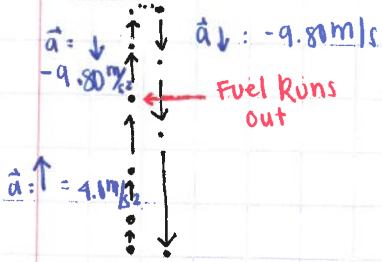
(time in air = 2x time to highest point) → * time up = time down if $y = y_0$

* Motion is symmetric

CH 2. February 12, 2019



PROBLEM 2.C



Part 1 → $a = 4.00 m/s^2$

$y_0 = 0m$
$y = ?$
$V_{0y} : 0m$
$V_y = ?$
$a_y = 4.00 m/s^2$
$t : 6.0s$

$V_y = \overset{=0}{V_{0y}} + a_y t$
$V_y = a_y t$
$V_y = (+4.00 m/s^2)(6.00s)$
$\underline{V_y = 24.0 m/s}$

$Y - \overset{=0}{Y_0} = 1/2(\overset{=0}{V_{0y}} + V_y)t$
$Y = 1/2(+V_y)t$
$Y = 1/2(+24 m/s)(6.00s)$
$\underline{Y = 72.0 m}$

PART 2

$y_0 : 72m$
$y : ?$
$V_{0y} : +24 m/s$
$V_y : 0 m/s$
$a_y : -9.80 m/s^2$
$t : ?$

$\overset{=0}{V_y^2} = V_{0y}^2 + 2a_y(Y - Y_0)$
$0 = V_{0y}^2 + 2a_y(y - y_0)$
$y - y_0 = -\frac{V_{0y}^2}{2a_y}$
$y = y_0 - \frac{V_{0y}^2}{2a_y} \rightarrow y = 72m - \frac{(24 m/s)^2}{2(-9.80 m/s^2)}$
$\underline{y = 101 m}$

2. February 12, 2019

2c

$y = \overset{=0}{y_0} + V_{0y}t + 1/2\, a_y t^2$

.m

n

.0m/s

.80m/s²

$\frac{1}{2} a_y t^2 + V_{0y} t + y_0 = 0$

$\underset{A}{-4.90 m/s^2}\, t^2 + \underset{B}{(24.0 m/s)}\, t + \underset{C}{72.0 m} = 0$

$t = 7.0s$

me: $6.0s + 7.0s = 13.0s$

is released from a balloon that is descending at a constant of 10 m/s....

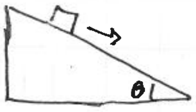
$y + a_y t$

$10 m/s + (-9.80 m/s^2)(20.0s)$

$206 m/s$

is 206 in the neg. direction.

N ALONG A Frictionless Inclined Plane



*acceleration on a frictionless inclined plane is

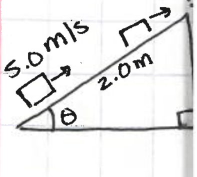
$\boxed{a_x = g\sin\theta \text{ down the plane}}$

$a_x = (9.80 m/s^2) \sin 0°$
$= 0 m/s^2$

$x = (9.80 m/s^2) \sin 90°$
$= 9.80 m/s^2$

Ch. 2.

PROBLE



X_0 : 0m

x : 2.0m

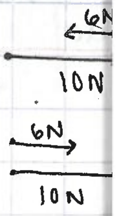
V_{0x}: 5.0

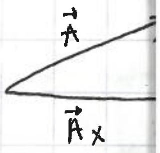
V_x : ?

a_x: − 4.

t: ?

|| Chapte

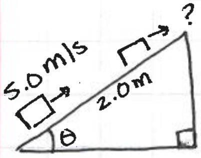




Vector →

Ch. 2. & Ch.3: Vectors & Coord. Systems. February 12, 2019

PROBLEM 2.30



1.0m

$$\theta = \sin^{-1}\left(\frac{1.0m}{2.0m}\right) = 30°$$

$$a_x = g\sin\theta$$
$$= 9.80\,m/s^2\left(\frac{1.0m}{2.0m}\right)$$
$$= 4.90\,m/s^2$$ ← down the incline

x_0: 0m

x: 2.0m

v_{0x}: 5.0m/s

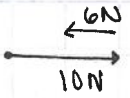
v_x: ?

a_x: −4.90m/s²

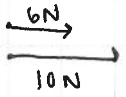
t: ?

$$V_x^2 = V_{0x}^2 + 2a_x(x - \underset{=0}{x_0})$$
$$V_x^2 = V_{0x} + 2a_x(x)$$
$$V_x = \textcircled{\pm}\sqrt{V_{0x}^2 + 2a_x(x)}$$
$$V_x = \sqrt{(5.0m/s)^2 + 2(-4.90\,m/s^2)(2.0m)}$$
$$\underline{V_x = 2.3\,m/s}$$

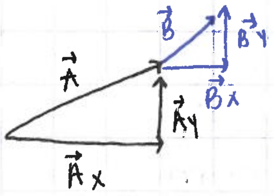
||Chapter 3: Vectors & Coordinate Systems||



Sum = $\overrightarrow{4N}$



Sum = $\overrightarrow{16N}$



Sum $\vec{C}$

$C_x = A_x + B_x$

$C_y = A_y + B_y$

February 14, 2019

Vector → physical quantity with both magnitude and a direction

↳ indicates direction in one-dimension

numbers + units