(Unit 0)

Estimations and unit

1) $\frac{\Delta X}{\Delta t} = m/s$

(a)

$\frac{.5 - 0}{500m - 0} = 0.001 m/s$

(b) $\frac{0.001m}{1sec} \cdot \frac{1km}{1000m} \cdot \frac{60}{1min} \cdot \frac{60_{min}}{1hour} =$

$= 0.0036$ km/hour

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(2) what is $0.25 m^3$ in cm^3?

a) $0.25 m^3 \left(\frac{10^6 cm}{1m}\right)^3 = \cancel{250,000 cm^3}$ $\boxed{2.5 \times 10^{17} cm^3}$

b) 100 km/hour in m/s $\frac{100 km}{1hour} \cdot \frac{1000 m}{1 km} \cdot \frac{1 hr}{60 min} \cdot \frac{1 min}{60 sec} = 27.7778 m/s$

c) $2 kg \cdot m / s^2$ → $\frac{1000 gm}{1 kg} \cdot \frac{100 cm}{1 m} \cdot \frac{1 s^{-2}}{1,000 ms^{-2}} = 200$ $gm \cdot cm \, ms^{-2}$

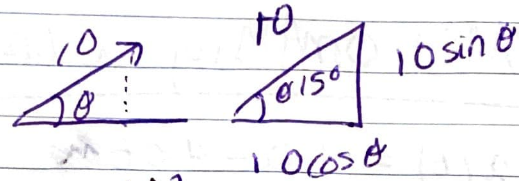
kg → gm

m to cm

s^{-2} to ms^{-2}

vectors

1) a) mag $= 10$ m, angle 15



$x' = (10\sin(15)\hat{i}) + (10\cos(15)\hat{j})$

flip

$\vec{x_1} = (9.6592\hat{i} + 2.588\hat{j})$ km

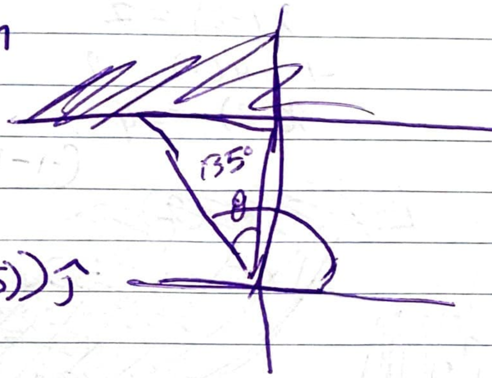
$= (9.66\hat{i} + 2.59\hat{j})$

check sign

b) $\vec{x_2} = (20\cos(135))\hat{i} \; (-)\; (20\sin(135))\hat{j}$

-14.14 $\qquad$ 14.1

$(-14.14\hat{i} + 14.14\hat{j})$



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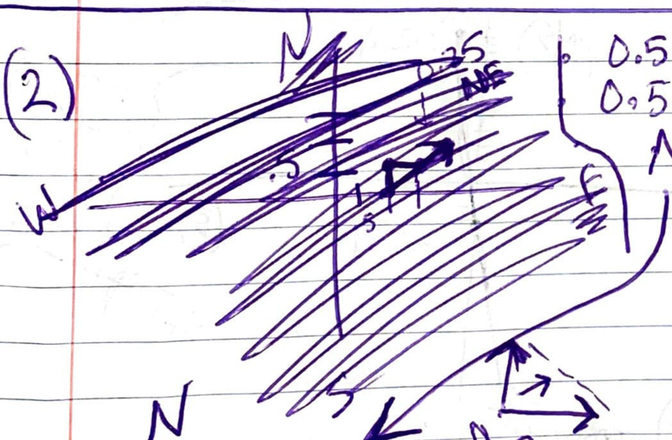
(2)

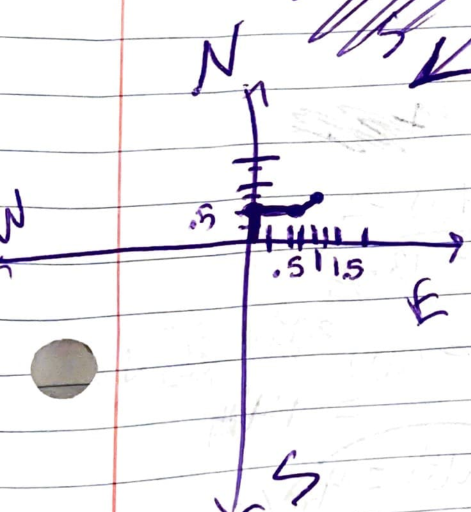


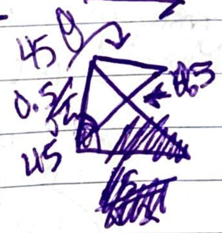
0.5 km N ↑
0.5 km E →
NE ↗ 45° angle 0.25 km

a) Draw
b) final location?
c) Distance from origin? (add up distance)
$\boxed{= 1.25\text{ km}}$

$\Delta x = x_f - x_i$
x_i + displacement = final

x_i (0) at origin $+ (\;) =$ ___





$\Delta \bar{X}_1 = (0.5)\hat{j}$ km

$\Delta \bar{X}_2 = (0.5)\hat{i}$

$+ 0.5\text{ km} + (0.5\text{ km E}) + \left(\frac{.25}{\sqrt{2}}\hat{i} + \frac{.25}{\sqrt{2}}\hat{j}\right)$ km

pythag theorem to get $|\bar{X}_F| =$

$=$

- almaner
20 min
sweater pro
- ice, exist, william mulholland -

Motion Along a line (straight line)

1) $x(t) = -1.0 - 4.0t$

$-1 - 4(-2) = 7$

$x(-2) = 7$

$-1 - 4(2) = -9$

$x(2) = -9$

$(-1-4(2)) -$

$(-1-4(-2))$

a) $\Delta x = -9 - 7$ Displacement

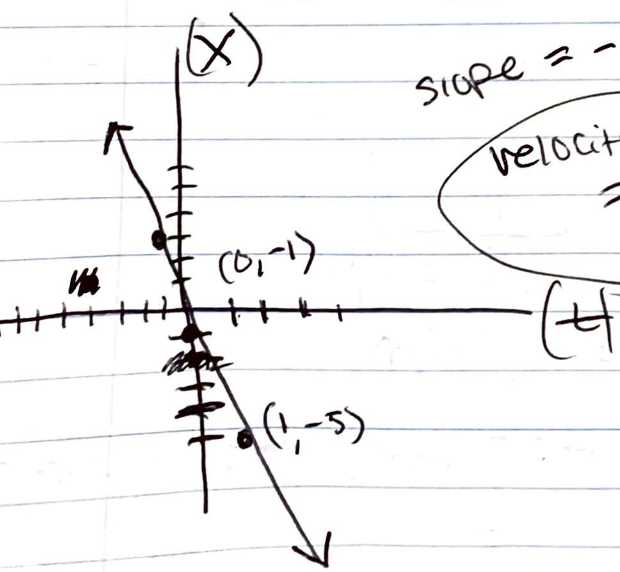
$\Delta x = -16m$

b) velocity ??

$x(t) = -4t - 1.0$

slope $= -4$

velocity $= -4\ m/s$



2) $x(t) = -2t + 7t^2$

position → 1rst derivitive = velocity

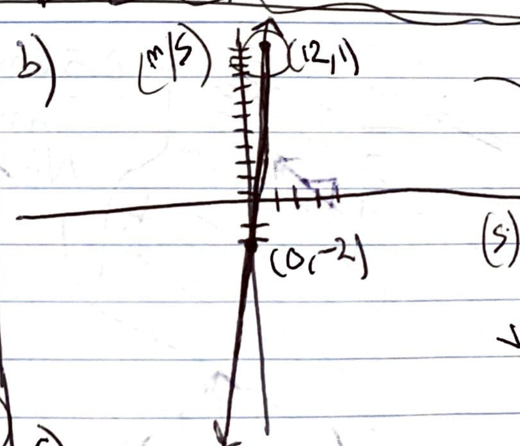
a) V btw $t=0$ & $t=2$

b) graph V

$V = (-2(2) + 7(2)^2) - (\cancel{-2(0) + 7(0)^2})$

a) $V = 24$ m/s between $t=0$ & $t=2$

b)



graph derivative of position = "velocity"

$V(t) = 14t - 2$

c) Instantaneous velocity at $t = 1$

is $= 14(1) - 2$

$V(1) = 12\ m/s$

d) acceleration $= a(t)$ 2nd derivative or der. of $V(t)$

$= 14$

$a(t) = 14\ m/s^2$

~~Motion in 2 & 3 Dimension~~

straight line

Motion Question #3

$v_f = v_i + a\Delta t$

$v_i = 0\ m/s$

$v_f = 10\ m/s$

$a = 5.0\ m/s^2$

a) time? 2 seconds

b) displacement? $(\Delta x = \bar{x}_f - \bar{x}_i)$ $20m = \Delta x$

c) total time = 10 seconds for 100m sprint at 10m/s

$$\frac{v_f - v_i}{a} = \Delta t$$

$$\frac{(10)\,m/s - (0)\,m/s}{(5)\,m/s^2} = 2 \text{ seconds} = \Delta t$$

$x(t) = x_i + vt$

$x(2) = 0 + (10)_{m/s} \cdot (2)s,\ x(2) = 20m$

$x(0) = 0 + 0(0) = 0m$

$20 - 0 = \Delta x$

$(100 - 20) = 10\,m/s\,(t)$

= remainder to run

$\frac{80\,m}{10\,m/s}$ $\frac{}{10}$

$8 = t$ (last 80 m) + 2sec (First 20m)

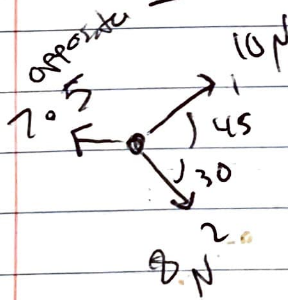
seconds

Force problem

$\vec{F} = ma$ $\quad F/m = a$

$(1^{st}\ 2^{nd}) = 49.0\,kg$ acc?

$(-7.5N)$



$F_{(1,2)} = F_{children} = F_1 + F_2$

$F_1 = 10\cos 45° + 8\cos 30°$

$14.0\,N$

$F_1 = 10\sin 45 + 8\sin 30$

$F_2 = 3.07N$

$$a = \frac{6.83}{49.00\,kg}$$

$a = 0.14\,m/s^2$

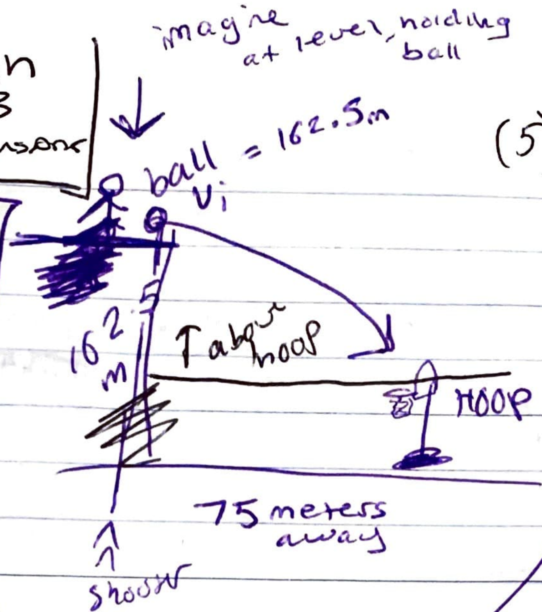
$F = \sqrt{14^2 + 3.07^2} = 14.3N - 7.5N = 6.83N$

(5) MOTION in 2 or 3

Midterm answers

#1

a)



b) Horizontal velocity?

assume vertical $v = 0$

b) $y(t) = -\frac{1}{2}gt^2 + y_i$

$0 = -\frac{1}{2}gt^2 + y_i$

$y_i = \frac{1}{2}gt^2$

$\sqrt{2y_i/g} = t$ sec

(1) ~~1~~

(2) 1, 2 → almost

(3) 3 →

(5) 1 (4) ✓

$\sqrt{\frac{2(162.5)}{9.81}} = \boxed{t\ 5.75 \text{ sec}}$

$V_x = \frac{\Delta x}{\Delta t} = \frac{x_f - x_i}{t_f - t_i}$

$= \frac{x_f - 0}{t_f - 0} = \frac{x_f}{t_f}$

(b) ANSWR $\frac{75\text{m}}{5.75\text{sec}} = 13.0 \text{ m/s} = V_x$

#2

$R = \frac{V^2 \sin(2\theta)}{g}$

a)

$= \frac{(40 \text{ m/s})^2 \sin 2 \cdot 45}{9.81}$

$= (40)^2 / 9.81$

$= 163.098$

163 m

is the distance is lands at

(b) $T = \frac{2 v_0 \sin(\theta)}{g}$

$T = \frac{2(40) \sin(45)}{9.81}$

$T = 80/9.81$

8.15 seconds in the air / duration in air