JAN FEB MAR APR MAY JUN JUL AUG SEP OCT NOV DEC
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31

SUBJECT: physics midterm

2. Estimations and Unit Analysis

1. a) what is the speed of sound in meters per second?

$t = 1.5\,sec \qquad x = 0.5\,km$

$0.5\,km \left| \frac{1000\,m}{1\,km} \right. = 500\,m = d/t$

$500\,m / 1.5 = 333.3\,m/s$

b) what is it in kilometers per hour

$\frac{0.5\,km}{1.5\,sec} \left| \frac{60\,sec}{1\,min} \right| \frac{60\,min}{1\,hour} = 1200\,km/hr$

2. a) what is $0.25\,m^3$ in cm^3?

$25\,m^3 \left| \left(\frac{100\,cm}{1\,m} \right)^3 \right. = 250{,}000\,cm^3$

b) what is 100 km/hour in m/s?

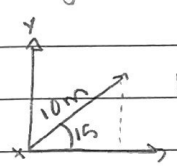
$\frac{100\,km}{1\,hr} \left| \frac{1000\,m}{1\,km} \right| \frac{1\,hour}{60\,min} \left| \frac{1\,min}{60\,sec} \right. = 27.78\,m/s$

c) what is $2\,kg\,m\,s^{-2}$ in $gm\,cm\,ms^{-2}$?

$\frac{2\,kg\,m}{s^2} \left(\frac{1000\,g}{1\,kg} \right) \left(\frac{100\,cm}{1\,m} \right) = 2 \times 10^5\,g\,cm/s^2$

3 Vectors

1 a) $\vec{x}_1$ is a vector w/ a magnitude of 10 meters and makes an angle of 15 degrees w/ respect to y-axis.



$10\sin(15) = 2.59\,m \qquad 10\cos(15) = 9.66\,m$

$\vec{x}_1 = 9.66\,m\hat{i} + 2.58\,m\hat{j}$

b) $\vec{x}_2$ is a vector w/ a magnitude 20 meters that makes an angle 135 degrees w/ respect to x-axis

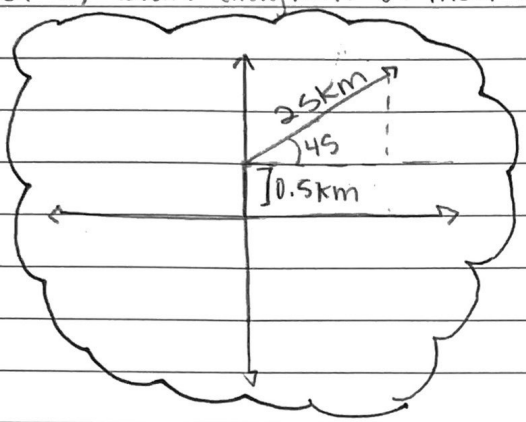
$20\cos(135) = -14.14\,m$

$20\sin(135) = 14.14\,m$

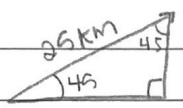
$\vec{x}_2 = -14.14\hat{i} + 14.14\hat{j}$

SUBJECT:

2. a) Draw diagram of their trajectory (E is x-axis, N is y-axis)



b) what is the final location in x-y coordinates?



$(.25)\cos(45) \approx 0.176\hat{i}$

$(.25)\sin(45) = 0.176\hat{j}$

$0.5 + .176 = 0.67$

$x_f = 0.67\text{km}\hat{i} + 0.67\text{km}\hat{j}$

c) what is the distance from the origin?

$\sqrt{0.67^2 + 0.67^2} = \sqrt{c^2}$

$c = 0.95\text{km}$

4. Motion Along a Straight Line

1 a) what is the displacement of the particle btwn $t = -2.0$ sec & $t = -2.0$ sec? $\Delta x = x_f - x_i$

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

$x_f = -1.0 - 4.0(2)\text{m} = -9.0\text{m}$ $\Delta x = -9.0 - 7.0 = -16\text{m}$

$x_i = -1.0 - 4.0(-2\text{m}) = 7.0\text{m}$

b) what is the velocity?

$v = x/t$ $v = -16.0\text{m} / 4\text{sec} = -4\text{m/s}$

SUBJECT:

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

a) what is the average velocity btwn t=0 & t=2 sec?

$x(0) = -2(0) + 7(0)^2$ $x = 0$ $v = \frac{\Delta x}{\Delta t}$ $\frac{24-0}{2-0} = \frac{24}{2}\ \frac{m}{s}$

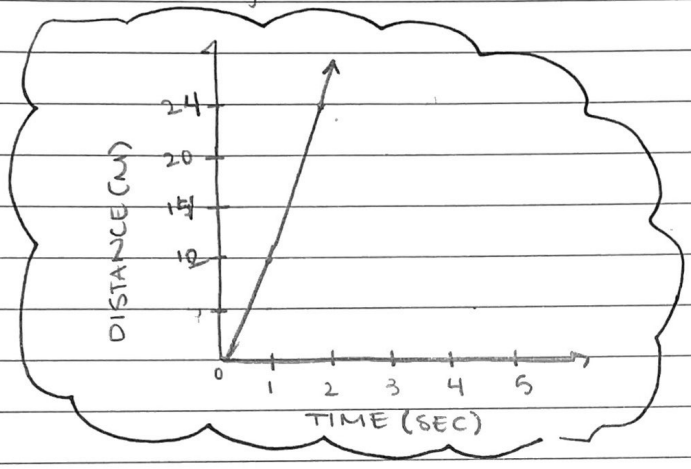
$x(2) = -2(2) + 7(2)^2$ $x = 24$

$-4 + 7(4)$

$-4 + 28$

$= 12\ m/s$

b) Draw a graph of the velocity.



c) what is the instantaneous velocity at t=1 second?

$x(1) = -2(1) + 7(1)^2$

$-2 + 7 = x = 5\ m/s$

d) what is the acceleration?

$a = \Delta v / \Delta t = \frac{12\ m/s}{2\ m/s} = 6\ m/s$

3. a) How long does it take her to reach her top speed of 10.0 m/s?

constant acceleration (a) = $5.0\ m/s^2$

$a = \Delta v / \Delta t$ $\frac{(t)5.0\ m/s^2}{5.0} = \frac{10\ m/s\ (t)}{(t)}$

$5.0\ m/s^2$

$t = 2$ seconds

b) what is her displacement at that time?

$x(t) = \frac{1}{2}(5.0\ m/s^2)(2\ s)^2 + (0) + 0$

$(5)\ (4)$

$\frac{1}{2}(20)$

$x(t) = 10\ m$

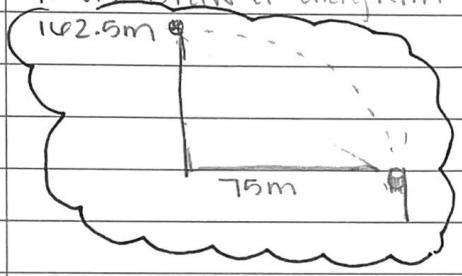
SUBJECT:

c) suppose she is running the 100 m sprint. If she continues at 10.0m/s for the remainder of the race, what will be her total time?

$100m - 20m = 80m / 10m/s = 8s + 2s =$ 10seconds

5 Motion in Two & Three Dimensions

1. a) Draw a diagram of the situation.



b) what is the horizontal velocity required to make the shot?

$a = 9.81 m/s^2$ $\Delta x = 75m$

$\Delta y = -162.5m$ $V_{ox} = ?$

$a_y = -9.81 m/s^2$ $75m = V_{ox}(5.76s)$

$162.5m = 0 + \frac{1}{2}(9.81 m/s^2)t^2$ $V_{ox} = 13.02 m/s$

$t = 5.76s$

2. a) How far away does it land?

$R = \frac{V_0^2 \sin(2\theta)}{g} = (40)^2 \sin 2(45) / 9.81 =$ 63m

b) How long is it in the air?

$T = \frac{2V_0 \sin(\theta_0)}{g} = 2(40) \sin 45 / 9.81 =$ 6 seconds

SUBJECT:

6 Forces

1. Two children pull a third child on a snow saucer sled exerting forces $\vec{F}_1$ & $\vec{F}_2$ as shown from above in Fig. 1 Find the acceleration of the system if the mass of the child and sled together is 49.0kg. Note that the direction of the frictional force is unspecified; it will be in the opposite direction of the sum of $\vec{F}_1$ and $\vec{F}_2$

$\vec{F}_1$ $x = 10\cos 45 = 7.07N$ $y = 10\sin 45 = 7.07N$

$\vec{F}_2$ $x = 8\cos 30 = 6.92N$ $y = 8\sin 30 = -4N$

R $x = 13.99N$ $y = 3.07N$

$R = \sqrt{13.99^2 N + 13.07^2} = 14.32N$

$\tan\theta = 3.07 / 13.99$ $\theta = 12.37°$

$F_{net} = ma_x = 14.32 - 7.5 = 49(a)$

$\frac{6.82}{49} = \frac{49(a)}{49}$ $a = 14 m/s^2$