Sarah Blackmore

# Midterm 1

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1. $\Delta t = 1.5s$ $\Delta$distance $= .5km$

a) speed in m/s? $.5km = 500$ $500/1.5 = 333.\overline{33}\ m/s$

b) speed in km/hr? $1.5s = .0004hr$ $.5/.0004 = 1250\ km/hr$

2. a) $.25\ m^3$ in $cm^3$? $.25m^3 * 1000 * 1000 = 250{,}000cm^3$

b) 100 km/hr in m/s? $100km = 100{,}000m$ $hr = 3600s$

$$\frac{\frac{100000m}{hr}}{\frac{1hr}{3600s}} = 27.78\ m/s$$

c) $2\ kg/m/s^2$ in $gm/cm\ m/s^2$

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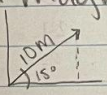
1. Write in component form

a) $\vec{x}_1$, vector with magnitude of 10m, $\angle 15°$ with respect to x-axis




$\sin(15°) = .2588 = \frac{y}{10} = .255 * 10 = y$

$= 2.59$

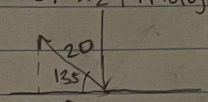
$(2.59)^2 + (x)^2 = 100$

$x^2 = 93.3$

$x = 9.66$

$\vec{x}_1 = 9.66\uparrow + 2.59\uparrow$

b) $\vec{x}_2$, magnitude 20m, $\angle 135°$ respect to x-axis




$\sin(135°) = .707 = \frac{y}{20} = .707 * 20 = y$

$= 14.14$

$\vec{x}_2 = 14.14\uparrow + 2.59\uparrow$

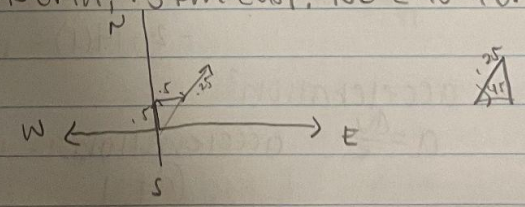
$(14.14)^2 + (x^2) = 400$

$x^2 = 200.06$

$x = 14.14$

2. Person goes .5km North, .5 km East, NE $\angle 45°$ for .25km

a) draw diagram







b) final location in coordinates $45-45-90\ \Delta$ $.25 = x\sqrt{2}$

North $.5 + .18$ km $x = .18$

East $.5 + .18$ km $= (.68, .68)$

c) $(.5)^2 + (.5)^2 = h^2$ $h = .71$

$.71 + .25 = .96$ km

$-1 - 4 \cdot 0(-2)$

$-1 + 8 = 7$

$x(2) = -1 - 4(2)$ displacement is -16.

$-1 - 8$

$= -9$

b) velocity?

$\frac{\Delta \vec{x}}{\Delta t} = \frac{-16}{4} = -4$ m/s

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

a) average velocity between $t=2$ and $t=0$

$-2(0) + 7(0)^2 = 0$ $\quad \frac{24}{2} = 12$ m/s

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

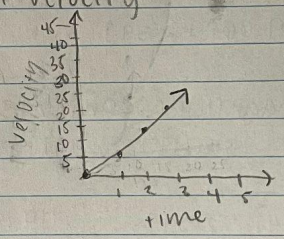
b) draw graph of velocity

$-2(1) + 7(1)^2 = 5$

$\frac{5}{1} = 5$ m/s

$-2(2) + 7(3)^2 = 57$

$\frac{57}{3} = 19$ m/s




c) instantaneous velocity at $t=1$

$\frac{d}{dx} = \frac{d}{dx} -2(t) + 7(t)^2 = -2 + 14t$

$t=1$

$-2 + 14(1) = 12$ m/s @ $t=1$

d) acceleration?

$a = \frac{\Delta v}{t}$ acceleration is the slope of velocity

@ $t=1$

7 m/s

3. acceleration = 5 m/s² constant

a) $v(t) = v_i + at$

$10 = 0 + 5.00(t) \quad t = 2$

b) $x(t) = \frac{1}{2}(5)(2)^2 + 0(2) + 0$

$\frac{1}{2}(5)(4)$

$x(2) = 10$

c) $x(2) = 10 \quad \Delta x = 90$

$x(t) = x_i + vt$

$100 = 10 + 10(t)$

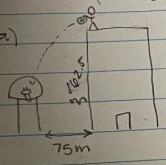
$90 = 10(t)$

$t = 9$

$+ 2$

$t = 11s$

5 1. a)




time

$\Delta y = \frac{1}{2} g t^2$

$\Delta y = 162.5$

$g = 9.81 m/s^2$

$\sqrt{\frac{2\Delta y}{-g}} = t$

$\sqrt{\frac{2(162.5)}{-9.81}}$

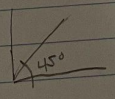
$\sqrt{33.13} = 5.76 = t$ sec

b) $V_x = \frac{\Delta x}{\Delta t}$

$\frac{75}{5.76} = 13.02 m/s$

2. $\angle 45°$ with respect to horizontal at 40 m/s

a) how far away does it land




40m/s

$R = \frac{v^2 \sin(2\theta)}{g} \quad \frac{(40^2)\sin 90}{9.81} \quad \frac{1600}{9.81} = 163.1 m$

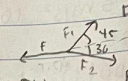
lands 163 m away

b) how long in air?

$T = \frac{2V_0 \sin(\theta)}{g} \quad \frac{2(40)\sin 45}{9.81} \quad \frac{56.57}{9.81} = 5.77s$

6. 1. acceleration of system

mass = 49 kg




$F_1 = 10N$

$F_2 = 8N$

$F = 7.5N$

$a = \frac{F}{m}$ $a = \frac{18}{49}$

$a = \frac{F_{app} - \mu_{sl} mg}{m}$ $\frac{18 - .016(49)(9.81)}{(49)} = \frac{10.31}{49} = .21 m/s$

$\mu_{sl}$

$49 * 9.81 = 480.69$

$7.5 = 480.69 * .016$

$f \quad F_N \quad \mu$

$a = (F - F_f)/m$

$18 - 7.5/49 = .21 m/s$