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Physics Midterm

② Estimation Vectors

① a. $\vec{V} = \frac{\Delta x}{\Delta t}$

$\Delta x = 0.5\,km$

$\Delta t = 1.5\,s$

$V = 0.33\,km/s$

b. $\frac{.33\,km}{s} \left| \frac{60\,s}{1\,min} \right| \frac{60\,min}{1\,hour} = 1,188\,km/hr$

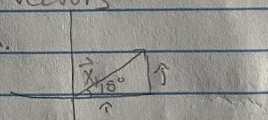
② a $0.25\,m^3 \left| \frac{100\,cm}{1\,m} \right| \frac{100\,cm}{1\,m} \left| \frac{100\,cm}{1\,m} \right| = 250,000\,cm^3$

b. $\frac{100\,km}{hr} \left| \frac{1000\,m}{1\,km} \right| \frac{1\,hr}{3600\,s} = 27.78\,m/s$

c. $\frac{2\,kg\,m}{s^2} \left| \frac{1000\,g}{1\,kg} \right| \frac{100\,cm}{1\,m} \left| \frac{1\,s}{1000\,ms} \right| \frac{1\,s}{1000\,ms} = 0.02\,\frac{g\,cm}{s^2}$

③ Vectors

1a.

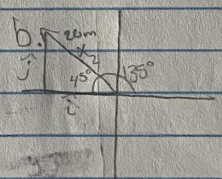


$y\hat{j} = \sin(15^\circ)10 = 2.59$

$x\hat{i} = \cos(15)10 = 9.66$

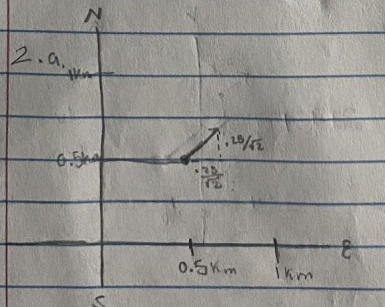
$\vec{x} = 9.66m\hat{i} + 2.59m\hat{j}$

b.



$\vec{x} = -\frac{20}{\sqrt{2}}m\hat{i} + \frac{20}{\sqrt{2}}m\hat{j}$

2.a.



b. $x\hat{i} = 0.5\,km\hat{i} + (0.25/\sqrt{2})\,km\hat{i}$

≈ 0.68

$y\hat{j} = 0.5\,km\hat{j} + (0.25/\sqrt{2})\,km\,\hat{j}$

≈ 0.68

$(0.68, 0.68)$

c. $\sqrt{0.5^4} + 0.25\,km = 0.5\,km$

4. Motion Along a Straight Line

a. $x(-2.0) = -1.0 - 4.0(-2.0)\,m$

$= 7$

$x(2) = -1.0 - 4.0(2.0)\,m$

$= -9$

$7 - -9 = 16\,m$

b. $x(t) = -1.0 - 4.0t\,m$

$x'(t) = -4.0\,m/s$

$v(t) = -4.0\,m/s$

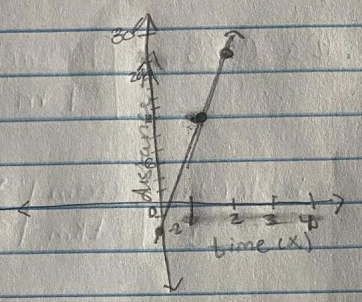
2. a. $v(t) = -2 + 14t\ m/s$

average velocity $= \frac{v(2) - v(0)}{2 - 0}$

$= \frac{(-2+14(2)) - (-2+14(0))}{2-0}$

$= 14\ m/s$

b



c. $v(1) = -2 + 14(1)$

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

d. $v'(t) = 14\ m/s^2$

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

3. a $v = at + v_0$

$10\,m/s = 5.0\,m/s^2\ t + 0$

$t = \frac{10\,m/s}{5.0\,m/s^2}$

$t = 2\ s$

b $\int 5.0\,m/s^2\ t\ dt$

$x(t) = 2.5\,m/s\ t^2 + C \to 0$ assuming start location is 0

$x(2) = 2.5\,m/s\ (2s)^2$

$= 10\,m$

c. $100\,m - 10\,m = 90$

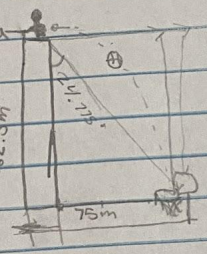
$\frac{90\,m}{10\,m/s} = 9\,s$

11 seconds

24. 775

5 Motion in two and three Dimensions

1. a



b) $\Delta y = -\frac{1}{2}gt^2$

$\Delta y = -162.5m$

$t = \sqrt{\frac{2(-162.5m)}{-9.8m/s^2}} \approx 5.76s$

$\Delta x = v_x \Delta t$

$v_x = 75m/5.76s$

$v_x = 13.02\ m/s$

2. a $R = \frac{V_0^2 \sin(2\theta_0)}{g}$

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

$= 163.1m$

b. $T = \frac{2V_0 \sin(\theta_0)}{g}$

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

$= 8.15s$

6 forces

1. $\vec{F}_{net} = ma$

$\vec{F}_{net_x} = (\vec{F}_{1x} + \vec{F}_{2x})$ - Fractional force

$= (\cos(45°)10 + \cos(30°)8) - 7.5N$

$\vec{F}_{net} = 6.5N$

$\vec{F}_{net} = ma$

$a = \frac{49.0kg}{6.5N}$

$a = 7.54\ m/s^2$