Score: 23/25. Well done!

Midterm

2. 1a $s = \frac{d}{t} = \frac{0.5\,km}{1.5\,sec} \left| \frac{1000\,m}{1\,km} \right.$

$= 333.33\,m/s$

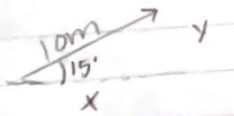
b. $\frac{0.5\,km}{5\,sec} \left| \frac{60\,sec}{1\,min} \right| \frac{60\,min}{1\,hr} = 1200\,km/hr$

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

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

c. $\frac{2\,kg\,m}{s^2} \left| \frac{1000\,g}{1\,kg} \right| \frac{100\,cm}{1\,m} \left| \frac{1\,s}{1000\,ms} \right| \frac{1\,s}{1000\,ms} = \frac{0.2\,g\,cm}{ms^2}$

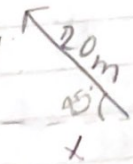
3. 1a



$\sin(15^\circ) = \frac{y}{10} = 2.59m$

$\cos(15^\circ) = \frac{x}{10} = 9.66m$

$9.66\hat{\imath} + 2.59\hat{\jmath}$

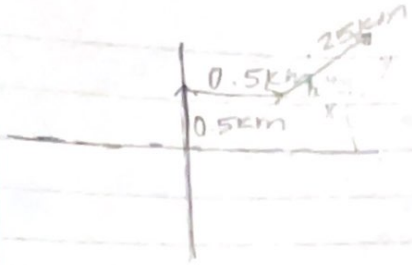


$\sin(45^\circ) = \frac{y}{20} = 14.14m$

$\cos(45^\circ) = \frac{x}{20} = -14.14m$

$-14.14\hat{\imath} + 14.14\hat{\jmath}$

2.



x: 0.5 km y: 0.5 km

$\frac{y}{0.25} = \sin(45)^\circ = 0.18\,km$

$\frac{x}{0.25} = \cos(45^\circ) = 0.18\,km$

x T	y J
0.18km	0.18km
0.5km	0.5km
0.68	0.68

$0.68T + 0.68J$

Distance = 0.5 + 0.5 + 0.25

= 1.25 km

For this one, I meant the magnitude of 0.68 i + 0.68 j, but the total distance is 1.25 km if you follow the path

4. 1 $x(t) = -1.0 - 4.0t\,m$

a) $\Delta x = x_f - x_i$

$x_f = x(2) = -1.0 - 4.0(2)\,m = -9.0m$

$x_i = x(-2) = -1.0 - 4.0(-2)\,m = 7.0m$

$\Delta x = -9.0 - 7.0m = -16.0m$

b) $v = \frac{x}{t} = \frac{-16.0m}{4s} = -4.0\,m/s$

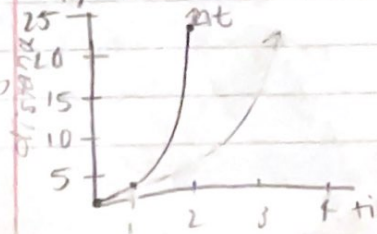
$2 - (-2) = 4$

(-1) The velocity is a linear graph

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

a) $v = \frac{\Delta x}{\Delta t} = \frac{x(2) - x(0)\,m}{2 - 0\,s} = \frac{24m - 0m}{2s} = \frac{24m}{2s} = 12\,m/s$

b)



c) $\frac{-2(1) + 7(1)^2 m}{1s} = 5\,m/s$

a) $a = \frac{\Delta v}{\Delta t} = \frac{12 m/s}{2.0 s} = \boxed{6 m/s^2}$

3.) $a = 5.0 m/s^2 \quad v_i = 0 m/s$

a) $a = \frac{\Delta x}{\Delta t} \quad 5.0 m/s^2 = \frac{10 m/s}{\Delta t} \quad \Delta t = \frac{10 m/s}{5.0 m/s} = \boxed{2 s}$

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

$\boxed{x(t) = 10 m}$

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

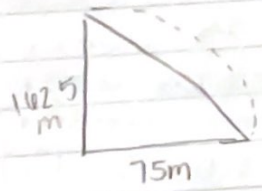
$10 m/s = 90 m/t$

$10x = 90$

$x = 9$

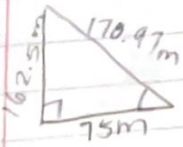
$9 s + 2 s = \boxed{11 s}$

5.) 1.



This solution is technically not right, but it is clever and comes very close to the right result! The trajectory is not straight, but quadratic.

b.



$162.5^2 + 75^2 = x^2$

$x = 178.97$

$\theta \tan(\theta) = \frac{162.5 m}{75 m} = 65.22°$

$R = \frac{V_0^2 \sin(2\theta_0)}{g} \quad 75m = \frac{V_0^2 \sin(2 \cdot 65.22)}{9.8 s}$

$V_0 = 31.08 m/s$

$V_{x,i} = V_0 \cos(\theta)$

$V_{x\uparrow} = 31.08 m/s \cdot \cos(65.22)$

$\boxed{V_{x\uparrow} = 13.08 m/s}$

2

a. $R = \frac{v_0^2 \sin(2\theta_0)}{g} = \frac{(40\ m/s)^2 \sin(2 \cdot 45)}{9.8} = 163.26m$

b) $x(t) = (x_i + v_{xi} t)$

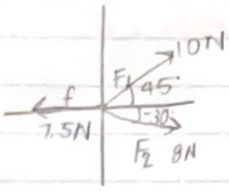
$163.26m = 0m + 40m/s \cdot t$

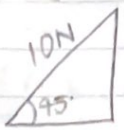
$4.085 = t$

(-1) Use the time of flight formula

6. $m = 49.\ kg$ $\quad \vec{F}_{net} = m\vec{a}$

$\vec{w} = mg$



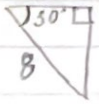


$x = 7.1N + 6.9N = 14N$

$y = 7.1N + (-4.0N) = 3.1N$

$\cos(45^\circ) \cdot 10 = 7.1N$

$\sin(45^\circ) \cdot 10 = 7.1N$



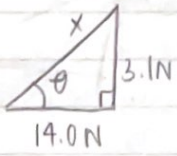
$\cos(30^\circ) \cdot B = 6.9N$

$\sin(30^\circ) \cdot B = -4.0N$

$x^2 = 14.0^2 + 3.1^2$

$x = 14.3N$

$\tan \frac{3.1N}{14.0N}$



$\theta = 12^\circ$

$\frac{14.3 - 7.5}{49.0} = \frac{49.0 - a}{49.0}$

$a = \frac{6.8}{49.0} = 0.14\ m/s^2$

Nicely done!