2: Estimations and Unit Analysis

1.) a) $speed = \dfrac{distance}{time} = \dfrac{.5 \, km}{1.5 \, s} = .33 \, km/s \times \dfrac{1000 \, m}{1 \, km} = \boxed{333.3 \, m/s}$

b) $\dfrac{333 \, m}{s} \times \dfrac{1 \, km}{1000 \, m} \times \dfrac{3600 \, s}{1 \, h} = \boxed{1,198.8 \, km/h}$

2.) a) $.25 \, m^3 \to cm^3 \qquad .25 \, m^3 \times \dfrac{100 \, cm}{1 \, m} \times \dfrac{100 \, cm}{1 \, m} \times \dfrac{100 \, cm}{1 \, m} = \boxed{250,000 \, cm^3}$

b) $100 \, km/h \to m/s \qquad \dfrac{100 \, km}{h} \times \dfrac{1000 \, m}{1 \, km} \times \dfrac{1 \, h}{3600 \, s} = \boxed{27.7 \, m/s}$

c) $2 \, kg \, m \, s^{-2} \to gm \quad cm \quad ms^{-2}$

$\dfrac{2 \, kg \, m}{s^2} \times \dfrac{1000 \, gm}{1 \, kg} \times \dfrac{100 \, cm}{1 \, m} \times \dfrac{1 \, sec}{1000 \, ns} \times \dfrac{1 \, sec}{1000 \, ms} = \boxed{\dfrac{0.2 \, gm \; cm}{ms^2}}$

3: Vectors

1.) a) $\vec{X_1} = \boxed{(9.66 \, \hat{\imath} + 2.59 \, \hat{\jmath}) \, m}$

$10 \, m \cos 15° = 9.66$
$\sin 15° = 2.59$

b) $\vec{X_2} = \boxed{(-14.14 \, \hat{\imath} + 14.14 \, \hat{\jmath}) \, m}$

$20 \, m \cos 135° = -14.14$
$\sin 135° = 14.14$

2.) a)

b) $\vec{X_1} = 0.5 \, \hat{\imath} + 0.5 \, \hat{\jmath}$
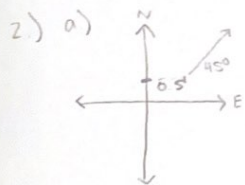
$\vec{X_2} = 0.18 \, \hat{\imath} + .18 \, \hat{\jmath}$
$= \boxed{(.68 \, \hat{\imath} + .68 \, \hat{\jmath}) \, km}$
$.25 \, km \cos 45°$

c) $dist = \sqrt{(1.68)^2 + (.68)^2}$

$\boxed{\vec{X}_{TOT} = 0.96 \, km}$

4: Motion Along a Straight Line

1.) a) $x(2) = -1.0 - 4.0(2)$
$= -1 - 8$
$= -9$

$-9 - 7 = \boxed{-16 \, m}$

$x(-2) = -1 - 4.0(-2)$
$= -1 + 8$
$= 7$

b) $\dfrac{-16}{4} = \boxed{-4 \, m/s}$

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

a) $x(2) = -7(2) + 7(2)^2$
$= -4 + 28$
$= 24$

$x(0) = 0$

$\dfrac{24}{2} = \boxed{12 \, m/s}$

b)

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

d) $\boxed{12 \, m/s}$

3.) a) $v(t) = v_i + at$
$t = \dfrac{v_i}{a}$
$t = \dfrac{10 \, m/s}{5 \, m/s^2} = \boxed{2.0 \, s}$
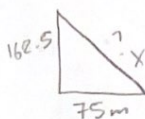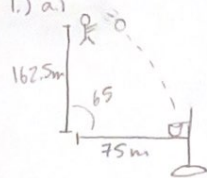
b) $x(2) = \frac{1}{2} 5.0(2)^2 + 10(2)$
$= 10 + 20$
$= \boxed{30 \, m}$

c) $\dfrac{100 \, m}{10 \, m/s} = \boxed{10 \, seconds}$
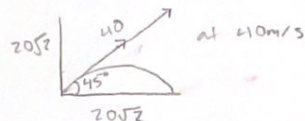
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5: Motion in Two and Three Dimensions

1.) a)

$\frac{\theta}{x} = 0$

162.5m

65

75m

b.)

$\frac{162.5}{75} = 2.1\overline{66}$

$\tan^{-1}(2.1\overline{66}) = \boxed{65.16°}$

2.)

$20\sqrt{2}$ 40 at 40m/s

$45°$

$20\sqrt{2}$

b) $\Delta t = \frac{V_f - V_i}{g} = \frac{0 - 20\sqrt{2}}{-9.8} = 2.88s \times 2 = \boxed{5.77s}$

a.) $20\sqrt{2} \times 5.77s = \boxed{535 ft}$

6: Forces

10 $45°$ $= F_1$ $10\sin 45 = 7.07$
                $10\cos 45 = 7.07$

$\sin = 11.07$
$\cos = 13.99$

$F_{NET} = m\vec{a}$

$a = ?$

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

30 8 $= F_2$ $8\sin 30° = 4$
              $8\cos 30° = 6.92$

$X_{TOT} = \sqrt{(x)^2 + (y)^2}$

$= \sqrt{(13.99)^2 + (11.07)^2}$

$= \sqrt{195.72 + 122.54}$

$X_{TOT} = 17.84$

$a = \frac{-17.84N}{49.00 kg} = \boxed{.36 m/s^2}$