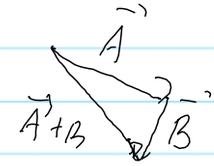
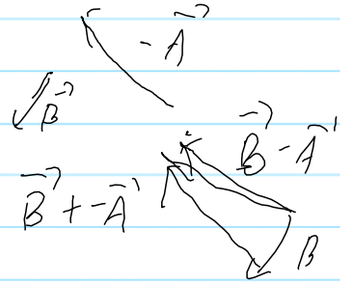
HW Solutions
HW #2 Part I

1.

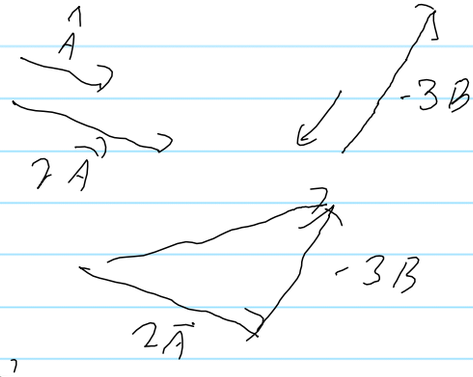
a) $\vec{A} + \vec{B}$



c) $\vec{B} - \vec{A}$

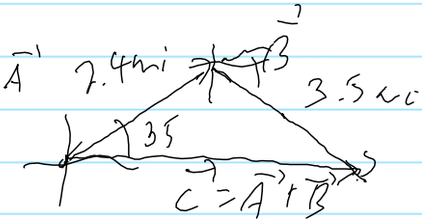


c) $2\vec{A} - 3\vec{B}$



$2\vec{A} + -3\vec{B}$

2.



$A_x = 2.4\text{ mi} \cos 35°$

$A_y = 2.4\text{ mi} \sin 35°$

$B_x = 3.5\text{ mi} \cos 28°$

$B_y = -3.5\text{ mi} \sin 28°$

$A_x = 1.97\text{ mi}$

$A_y = 1.38\text{ mi}$

$B_x = 3.09\text{ mi}$

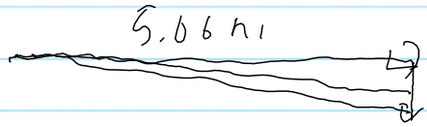
$B_y = -1.64\text{ mi}$

$C_x = A_x + B_y = 1.97\text{mi} + 3.09\text{ mi}$

$C_y = A_y + B_y = 1.38\text{mi} + -1.64\text{ mi}$

$C_x = 5.06\text{ mi}$

$C_y = -.26\text{ mi}$



$$c = \sqrt{c_x^2 + c_y^2} = \sqrt{(5.06\,mi)^2 + (-.26\,mi)^2}$$

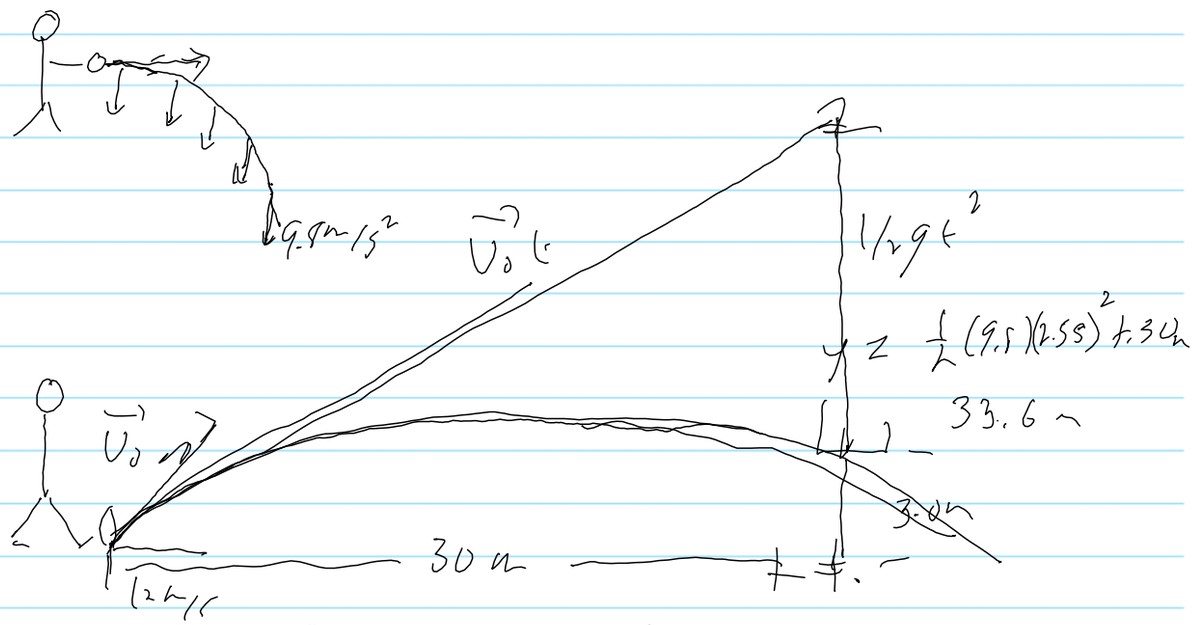
$$c = 5.1\ mi$$

$$\tan\theta = \frac{-.26\,mi}{5.06\,mi} \qquad \theta = \tan^{-1}\left(\frac{-.26}{5.06}\right) = -2.9^\circ$$

Net displacement = 5.1 mi 2.9° S of E

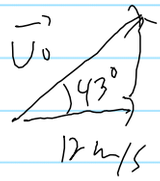
3.

4.



$$\frac{30\,m}{12\,m/s} = \frac{12\,m/s\ t}{12\,m/s} \qquad t = 2.55$$

$$\tan\theta = \frac{33.6\,m}{30.0\,m} \qquad \theta = \tan^{-1}\left(\frac{33.6}{30.0}\right) = 48^\circ$$



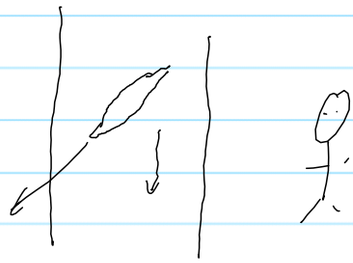
$$\tan 48^\circ = \frac{v_{0y}}{12\,m/s} \qquad v_{0y} = 12\,m/s \cdot \tan 48^\circ$$

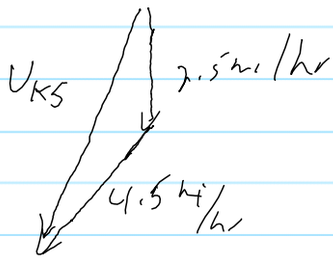
$$= 13.5\,m/s$$

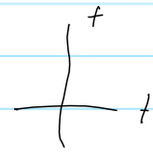
$V_0 = \sqrt{(12\ m/s)^2 + (13.5\ m/s)^2}$

$V_0 = 18\ m/s$

5.







$V_c = 2.5\ mi/hr\ S$

$V_R = 4.5\ mi/hr\ \ 42°\ S\ of\ W$

$V_{cx} = 0$

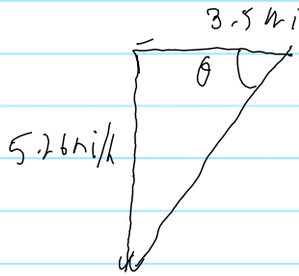
$V_{cy} = -2.5\ mi/hr$

$V_{Rx} = -4.5\ mi/hr\ \cos 42° = -3.56\ mi/hr$

$V_{Ry} = -4.5\ mi/hr\ \sin 42° = -2.76\ mi/hr$

$V_{RSx} = 0_{mi/hr} - 3.56\ mi/h = -3.56\ mi/hr$

$V_{RSy} = -2.5\ mi/hr + -2.76\ mi/hr = -5.26\ mi/hr$



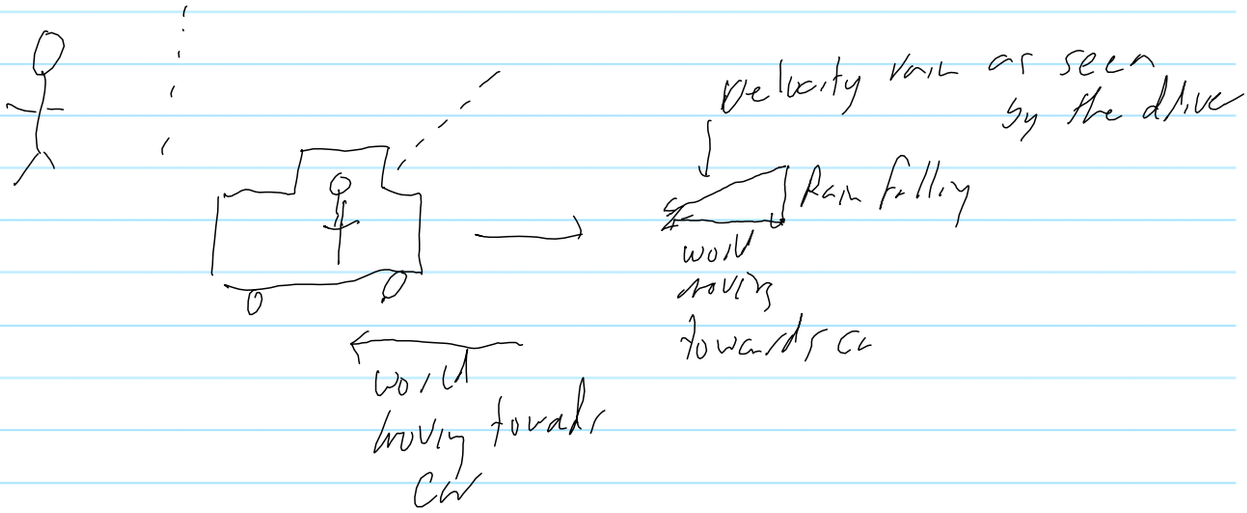
$V_{RS} = \sqrt{(3.56\ mi/hr)^2 + (5.25\ mi/hr)^2}$

$= 6.4\ mi/hr$

$\theta = \tan^{-1}\left(\frac{+5.26\ mi/hr}{+3.56\ mi/h}\right) = 62°\ S\ of\ W$

standard 242°

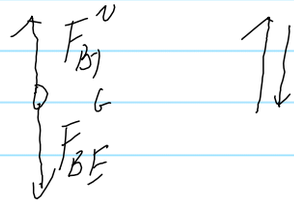
6.



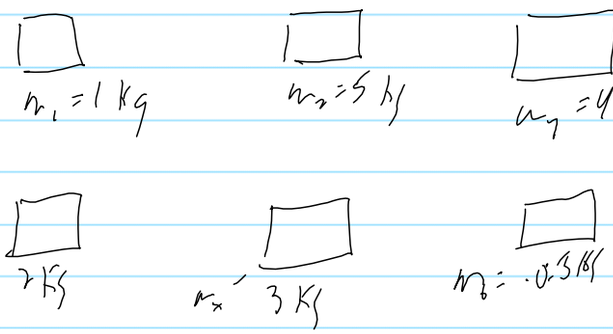
ch. 4

7.

Friend is wrong the net force is 0 which means the forces add up to 0.



8.



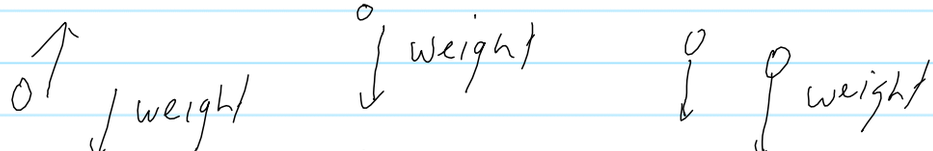
newton's 2nd law

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

since the force is the same on each box, the acceleration for the least mass and least for the greatest ...

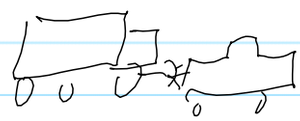
Greatest accelerat $m_8, m_1, m_3, m_5, m_4, m_2$

9. Ignore air resistance



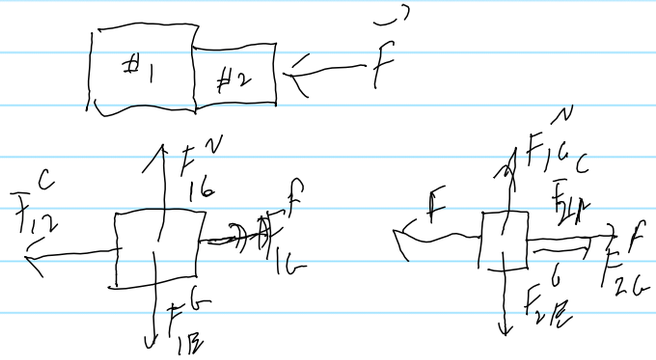
$\vec{F}_{CE} = \text{weight}$

10.

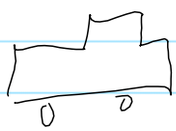


$\vec{F}_{CT} = -\vec{F}_{TC}$ by Newton's third law

11.



13.



velocity is constant Newton's 1st law

$\vec{F}_{net} = 0$

Problem from the book

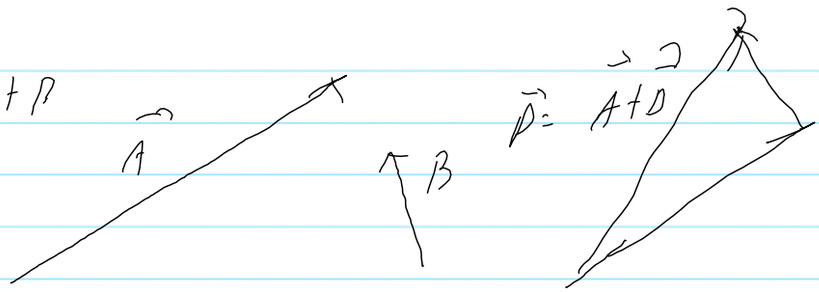
Ch. 3

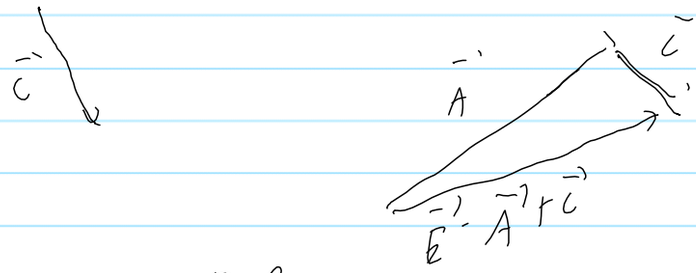
mc #1 d)

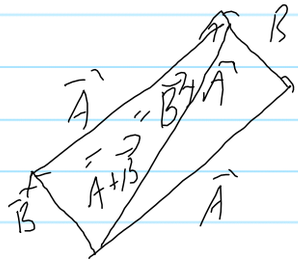
mc #2 b)

mc #4 d)

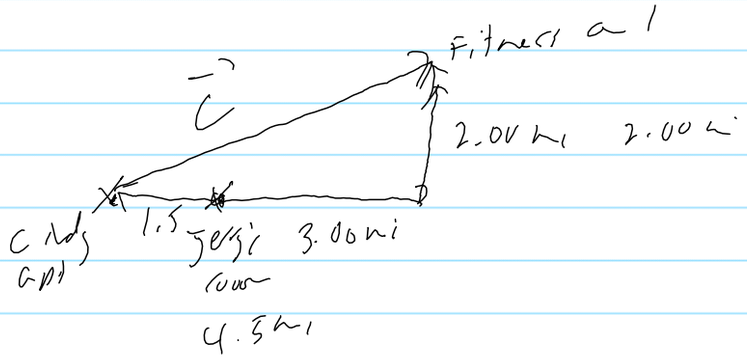
7. $\vec{D} = \vec{A} + \vec{B}$







~~8~~ 25



$C_x = 4.5\,mi$

$C_y = 2.00\,mi$

$C = \sqrt{C_x^2 + C_y^2}$

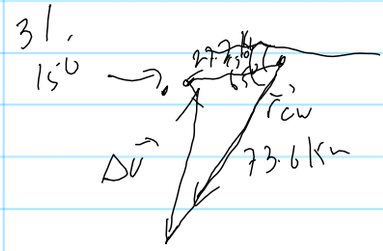
$= \sqrt{(4.5\,mi)^2 + (2.00\,mi)^2}$

$= 4.9\,mi$

$\theta = \tan^{-1}\left(\frac{2.00\,mi}{4.5\,mi}\right)$

$= 27^\circ$ N of E

31.



$\Delta\vec{r} = \vec{r}_{ag} - \vec{r}_{cw}$

$r_{agx} = -27.2\,km \cos 15^\circ = -26.3\,km$

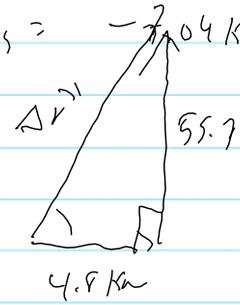
$r_{agy} = -27.2\,km \sin 15^\circ = -7.04\,km$

$r_{cwx} = -73.6\,km \cos 65^\circ = -31.1\,km$

$r_{cwy} = -73.6\,km \sin 65^\circ = -66.7\,km$

$r_x = -26.3\,km - 31.1\,k = 4.8\,km$

$r_y = -7.04\,km - 66.7\,km = 59.7\,km$



$\Delta\vec{r} = \sqrt{(4.8\,km)^2 + (59.7\,km)^2}$

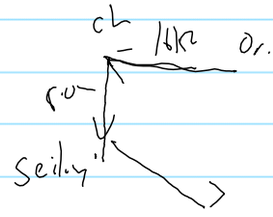
$= 59.9\,km$

$\theta = \tan^{-1}\left(\frac{59.7\,km}{4.8\,km}\right) = 85^\circ$

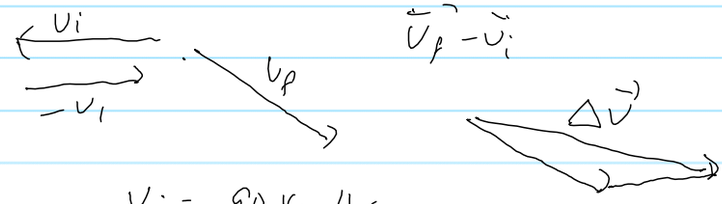
$\vec{v}_{ave} = \frac{\Delta\vec{r}}{\Delta t} = \frac{59.9\,km \;\; 85^\circ N \text{ of } E}{.75\,hr}$

$= 80.\,\frac{km}{hr} \;\; 85^\circ N \text{ of } E$

43.



$\Delta\vec{v} = \vec{v}_f - \vec{v}_i = 100\,km/hr \;\; 45^\circ S \text{ of } E - 90\,km/hr \; W$



$v_{ix} = 90\,km/hr$

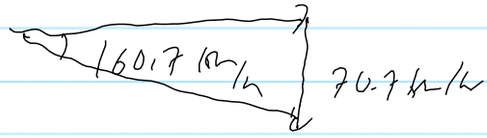
$v_{iy} = 0$

$v_{fx} = 100\,km/hr \cos 45^\circ = 70.7\,km/hr$

$v_{fy} = -100\,km/hr \sin 45^\circ = -70.7\,km/hr$

$v_{fx} + (-v_{ix}) = 70.7\ km/h + 150\ km/h = 160.7\ km/h$

$v_{fy} + (-v_{iy}) = -70.7\ km/h + 0 = -70.7\ km/h$

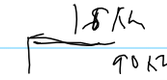


$\Delta v = \sqrt{(160.7\ km/h)^2 + (70.7\ km/h)^2}$

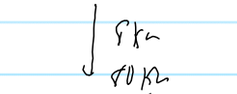
$= 175\ km/hr$

$\theta = \tan^{-1}\left(\frac{-70.7\ km/hr}{160.7\ km/hr}\right) = 24\ S\ of\ E$

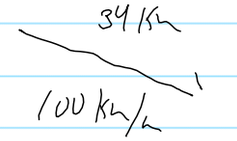
$\vec{a}_{ave} = \frac{\Delta \vec{v}}{\Delta t}$



$t_1 = \frac{\Delta x}{v} = \frac{18\ km}{90\ km/h} = .178\ hr$



$t_2 = \frac{\Delta x_2}{v} = \frac{5\ km}{90\ km/hr} = .1\ h$

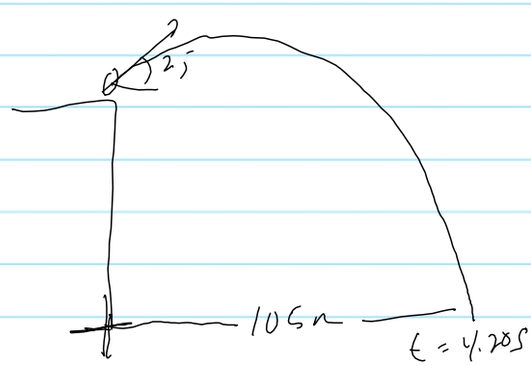


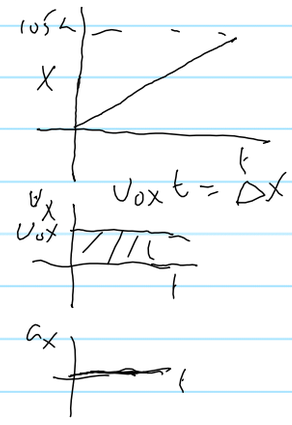
$t_3 = \frac{34\ km}{100\ km/hr} = .34\ h$

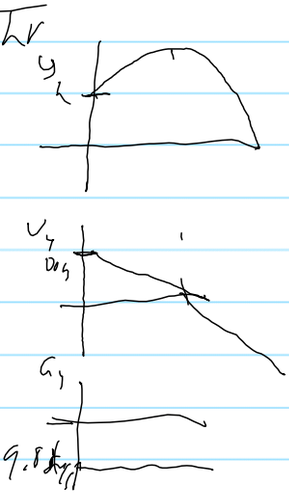
total $t_h = .62\ hr$

$a_{ave} = \frac{175\ km/hr}{.62\ hr} = 282\ \frac{km}{hr}$

55

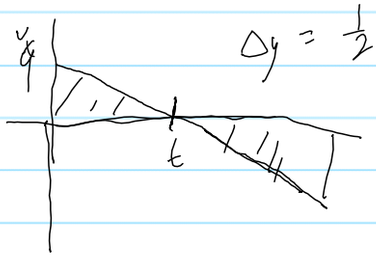




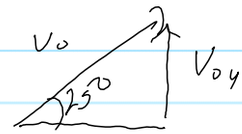


$U_{0x} \cdot 4.205 = 105\,m$

$U_{0x} = \frac{105\,m}{4.205} = 25.0\,m/s$

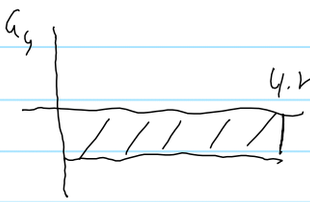


$\Delta y = \frac{1}{2} t V_{0y} + (4.205 - t)\frac{1}{2} V_y$



$U_{0x} = 25\,m/s$

$\frac{V_{0y}}{U_{0x}} = \tan 25^\circ$



$V_y - V_{0y} = -9.8\,m/s^2 \cdot 4.205$

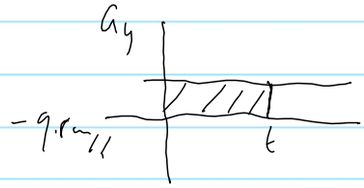
$V_{0y} = 25.0\,m/s \tan 25^\circ$

$V_y \Rightarrow 11.7\,m/s = -9.8\,m/s^2 \cdot 4.205$ $\quad V_{0y} = 11.7\,m/s$

$V_y = 29.9\,m/s$

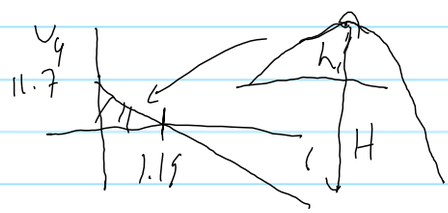
time at the top

$V_y = 0$



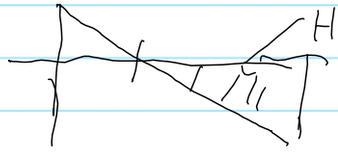
$-9.8\,m/s^2 \cdot t = 0 - 11.7\,m/s$

$t = \frac{11.7\,m/s}{9.8\,m/s^2} = 1.195$



$h' = \frac{1}{2} 11.7\,m/s \cdot 1.195 = 6.98\,m$

total area is net displacement



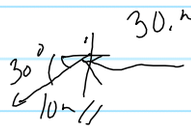
$H = \frac{1}{2}(4.205 - 1.19)^2 \cdot 29.9\,m/s$

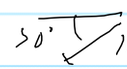
$= -45.0\,m$

So the max height above the ground is 45.0 m and the height of the building is

45.0 m − 6.98 m = 38.0 m

71.

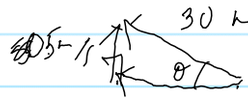




$V_{wx} = 10 m/s \cos 30^\circ = 8.66 m/s$

$V_{wy} = -10 m/s \sin 30^\circ = -5 m/s$

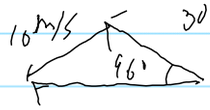
Her new heading needs to have a y component of +5 m/s



$\frac{5 m/s}{10 m/s} = \sin\theta$

$\theta = \left(\frac{1}{6}\right) = 9.6^\circ$

New heading 9.6° N of W.

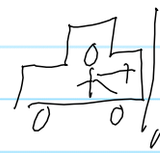


$V_{px} = 30 m/s \cos 9.6^\circ = 29.6 m/s$

$V_{gx} = V_{px} + V_{wx} = 29.6 m/s + 8.7 m/s$

$= 38.3 m/s$

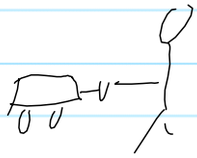
ch 4
con question #1

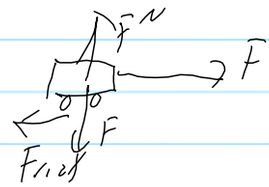


car stops abruptly, inertia of passenger keeps passenger moving in the car and having w/ car interior. Seatbelt help to prevent the harmful second collision of passeng & car interior.

8. No, if in free fall the net force is not 0, and thus the object can't be in equilibrium

13.





as long as $F^a \geq$ friction the wagon will move.

1. b)

14.