Assignment #3: Ch 1 – 95, 103, 104, 105

(95) $\vec{v} = \langle 38, 0, -27 \rangle$ m/s

$\vec{p} = m\vec{v} = (0.4\text{ kg}) \times \langle 38, 0, -27 \rangle \text{m/s} = \langle 15.2, 0, -10.8 \rangle$ kg·m/s

$|\vec{p}| = \sqrt{(15.2)^2 + (10.8)^2} = 18.6$ kg·m/s

(103) Assuming the velocity remains constant between the two endpoints (equal to the average velocity):

$$\vec{v} = \vec{v}_{avg} = \frac{\Delta \vec{r}}{\Delta t} = \frac{\vec{r}_f - \vec{r}_i}{\Delta t} = \frac{\langle 6.8, -4.2, 11.2 \rangle \text{m} - \langle 6, -3, 10 \rangle \text{m}}{10\text{s} - 6\text{s}}$$

$$= \frac{\langle 0.8, -1.2, 1.2 \rangle \text{m}}{4\text{s}} = \langle 0.2, -0.3, 0.3 \rangle \text{ m/s}$$

$\vec{r}_f = \vec{r}_i + \vec{v}_{avg}\,\Delta t$ final point is now at $t = 8.5$s

$\vec{r}_f = \langle 6, -3, 10 \rangle \text{m} + [\langle 0.2, -0.3, 0.3 \rangle \text{m/s}] \times (8.5\text{s} - 6\text{s})$

$= \langle 6, -3, 10 \rangle \text{m} + \langle 0.5, -0.75, 0.75 \rangle \text{m}$

$= \langle 6.5, -3.75, 10.75 \rangle \text{m}$

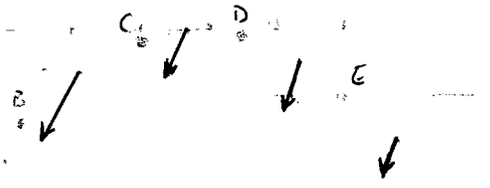
(104) (a) $\vec{p}_C - \vec{p}_B = \langle 2.55, 0.97, 0 \rangle \text{kg·m/s} - \langle 3.03, 2.83, 0 \rangle \text{kg·m/s} = \langle -0.48, -1.86, 0 \rangle$ kg·m/s

$\vec{p}_D - \vec{p}_C = \langle 2.24, -0.57, 0 \rangle - \langle 2.55, 0.97, 0 \rangle = \langle -0.31, -1.54, 0 \rangle$ kg·m/s

$\vec{p}_E - \vec{p}_D = \langle 1.97, -1.93, 0 \rangle - \langle 2.24, -0.57, 0 \rangle = \langle -0.27, -1.36, 0 \rangle$ kg·m/s

$\vec{p}_F - \vec{p}_E = \langle 1.68, -3.04, 0 \rangle - \langle 1.97, -1.93, 0 \rangle = \langle -0.29, -1.11, 0 \rangle$ kg·m/s

(b)




(c) B and C

1.105

$\vec{V} = \langle -20, -90, 40 \rangle$ m/s

$\vec{r}_i = \langle 200, 300, -500 \rangle$ m

$\vec{r}_f = \langle -380, -2310, 660 \rangle$ m

Use one dimension

$$x_f = x_i + V_{avg,x}(t_f - t_i)$$

a) $$t_f - t_i = \Delta t = \frac{x_f - x_i}{V_x} = \frac{-380\text{m} - 200\text{m}}{-20\text{ m/s}}$$

$$\Delta t = \frac{-580\text{ m}}{-20\text{ m/s}} = 29\text{ s} \qquad \text{(get some of } y, z\text{)}$$

b) $$d = |\vec{r}_f - \vec{r}_i| = |\langle -580, -2610, 1160 \rangle|$$

$$= \sqrt{(580)^2 + (2610)^2 + (1160)^2}\text{ m}$$

$$= 2914\text{m}$$

c) $$V = |\vec{V}| = \sqrt{V_x^2 + V_y^2 + V_z^2}$$

$$= \sqrt{(-20)^2 + (-90)^2 + (40)^2}\text{ m/s}$$

$$= 100.5\text{ m/s}$$

d) $$\hat{V} = \frac{\vec{V}}{|\vec{V}|} = \frac{\langle -20, -90, 40 \rangle \text{ m/s}}{100.5\text{ m/s}}$$

$$= \langle -0.199, -0.896, 0.398 \rangle$$