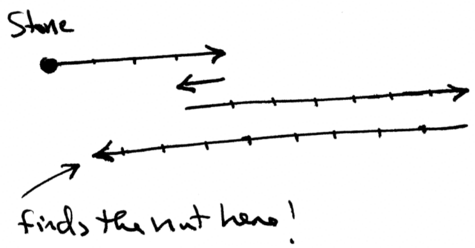
Problems / chapter 2

(2) Let's take left to right to be the positive direction.

Vector diagram



$$\Delta\vec{x} = (+4) + (-1) + (+6.5) + (-8.3) = \boxed{1.2\text{ m to the right}}$$

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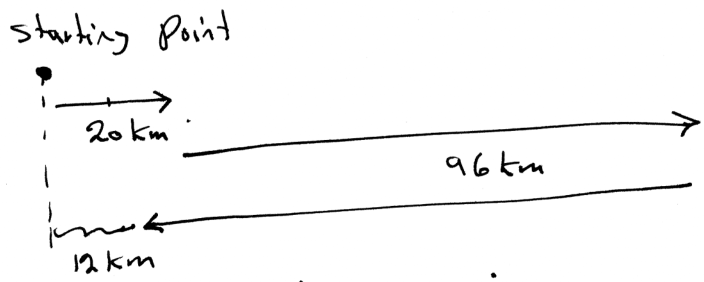
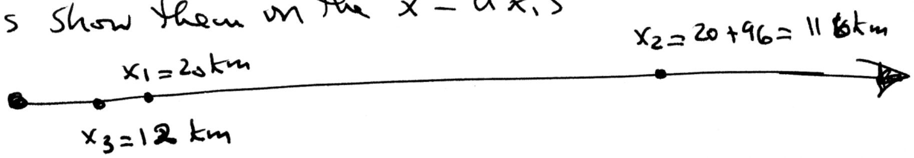
(7) choose South to the right

a)



Let's show them on the x-axis



7 Continues

$$\Delta x = x_3 - x_1 = 12 - 20 = \boxed{-8\text{ km}}$$

or 8 km north of its position at 3 p.m.

b)

$$\Delta x = x_2 - x_0$$

↑ starting point (which = 0)

$$\Delta x = (20 + 96) - 0 = \boxed{116\text{ km}}$$

c)

$$\Delta x = x_3 - x_2 = 12 - 116 = \boxed{-104}$$

104 km north of its position at 4:00 p.m.

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11 When Yaris catches the Jeep, the distance traveled

$$\Delta x_{\text{Yaris}} = 186 + \Delta x_{\text{Jeep}}$$

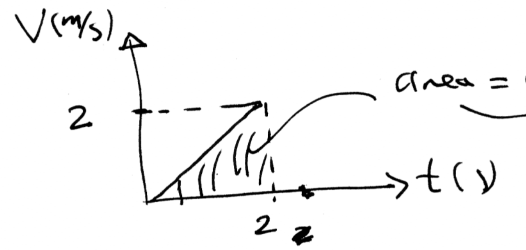
$$(24.4\text{ m/s})\,\Delta t = 186 + (18.6\text{ m/s})\,\Delta t$$

Solve for Δt $\Rightarrow$ $\boxed{\Delta t = 32\text{ s}}$

(13) choose upward direction as Positive:

Each displacement = area under the velocity graph.

Thus from $t = 0$ to $t = 2$ s, $\Delta Y_1 =$



area = displacement $= \frac{(2 \times 2)}{2} = 2$ m

Now follow this idea for other time intervals.

$\Delta Y_1 = 2$ m $\qquad t = 0$ to $t = 2$

$\Delta Y_2 = 12$ m $\qquad t = 2$ to $t = 8$

$\Delta Y_3 = 2$ m $\qquad t = 8$ to $t = 10$

$\Delta Y_4 = 0$ $\qquad t = 10$ to $t = 14$

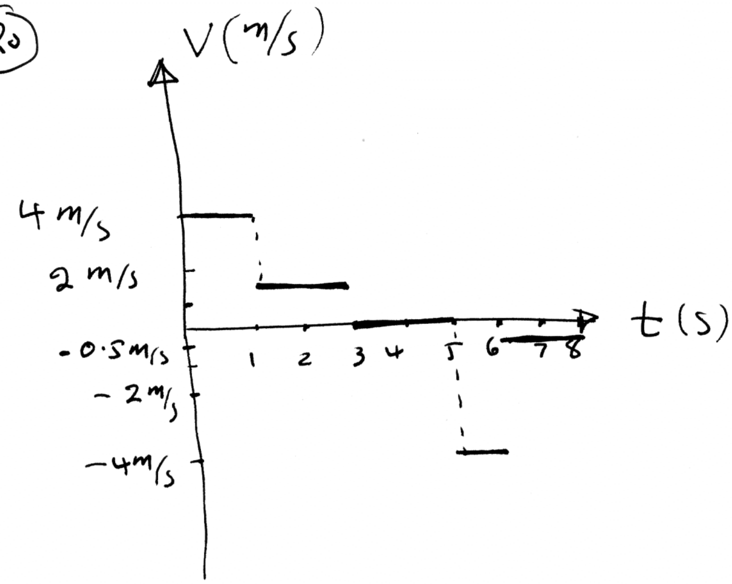
$\Delta Y_5 = -2$ m $\qquad t = 14$ to $t = 16$

$\Delta Y_6 = -4$ m $\qquad t = 16$ to $t = 18$

$\Delta Y_7 = -2$ m $\qquad t = 18$ to $t = 20$

$\Rightarrow \Delta Y = \Delta Y_1 + \dots + \Delta Y_7 = \boxed{8 \text{ m}}$

(20)



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(26)

a) a_x = slope of velocity $= \dfrac{\Delta V}{\Delta t} = \dfrac{14-4}{11-6} = \boxed{2\ m/s^2}$

b) $v_{ave,x} = \dfrac{V_1+V_2}{2} = \dfrac{4+14}{2} = 9\ m/s$

c) For this we use $v_{ave,x} = \dfrac{\Delta x}{\Delta t}$. We need Δx.

Δx = area under v_x curve = ... = 195 m

$v_{ave,x} = \dfrac{195\ m}{20\ s} = 9.8\ m/s$

d) At $t = 10\ s$, $v_1 = 12\ m/s$

At $t = 15\ s$, $v_2 = 14\ m/s$ $\rightarrow \boxed{\Delta v = 2\ m/s}$

e) Δx = area under v_x from $t=10$ to $t=15$.

Δx = area = 69 m

(30) $v_{ix} = 0$ $v_{fx} = 45\ m/s$

$a_x = 5\ m/s^2$ $\Delta t = ?$

$$v_{fx} = v_{ix} + a_x \Delta t$$

$$45 = 0 + 5\,\Delta t \rightarrow \boxed{\Delta t = 9\,s}$$

The length of the runway does not enter into the calculations. In other words, the plane is not at the end of runway after reaching speed of $45\ m/s$.

We can calculate the distance:

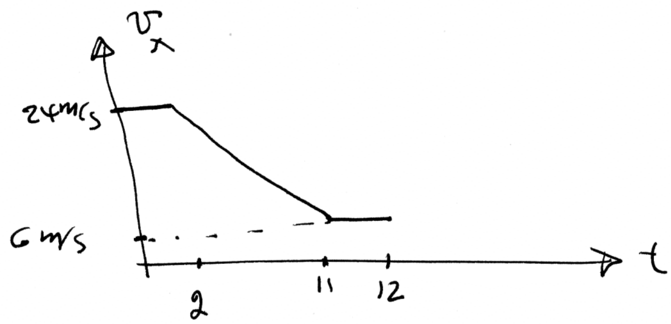
$$\Delta x = v_{ix}\Delta t + \frac{1}{2} a_x \Delta t^2$$

$$= 0 + \frac{1}{2}(5)(9)^2 = 202.5\ m$$

which is less than the length of the runway.

35 $v_{ix} = 24\,m/s$ $v_{fx} = 6\,m/s$ $\Delta t = 9$

a)



b) $v_{fx} = v_{ix} + a_x \Delta t$

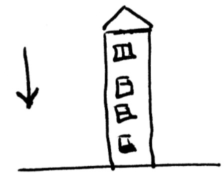
$$a_x = \frac{-24+6}{9} = -2\ m/s^2$$

c) $\Delta x = v_{ix}\Delta t + \frac{1}{2} a_x \Delta t^2$

$$\Delta x = (24)(9) + \frac{1}{2}(-2)(9)^2$$

$$= \boxed{135\ m}$$

(44) $\begin{cases} \Delta y = 369\ m \quad a_y = 9.8\ m/s^2 \quad v_{fy} = ? \\ v_{iy} = 0 \end{cases}$



$$v_{fy}^2 - v_{iy}^2 = 2 a_y \Delta y$$

$$v_{fy}^2 - 0 = 2(-9.8)(-369) \rightarrow \boxed{v_{fy} = -85\ m/s}$$

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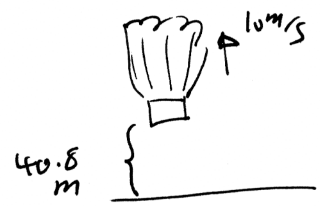
(49) $v_y = 10\ m/s$



for the bag:

$\begin{cases} v_{iy} = +10\ m/s \quad \text{(upward)} \\ v_{fy} = ? \\ \Delta y = 40.8\ m \end{cases}$

$a_y = -9.8\ m/s^2$ (downward)

$$v_{fy}^2 - v_{iy}^2 = 2 a_y \Delta y \rightarrow v_{fy}^2 - (10)^2 = 2(-9.8)(-40.8)$$

$$\boxed{v_{fy} = -30\ m/s} \downarrow$$