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$v = 90 \frac{km}{h}$

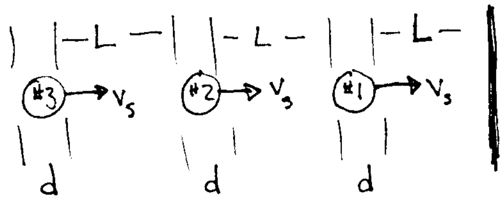
$\Delta t = 0.50\,sec = \frac{0.50}{3600}\,hr$

$\Delta x = v_{ave}\,\Delta t$

$= \left(90 \frac{km}{h}\right)\left(\frac{0.50}{3600}\right) = 1.25\times10^{-2}\,km$

$= 12.5\,m$

2.8



$L = 1.75\,m$
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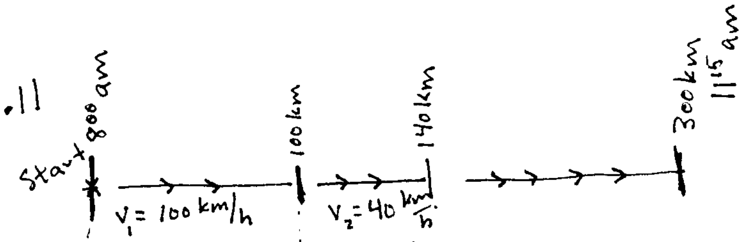


$v_1 = 100\,km/h$ $\quad$ $v_2 = 40 \frac{km}{h}$

$\Delta x_1 = 100\,km$ $\quad$ $\Delta x_2 = 40\,km$

then $\Delta x_1 = v_1 \Delta t_1$ $\quad$ then $\Delta x_2 = v_2 \Delta t_2$

$\Delta t_1 = 1\,h$ $\quad$ $\Delta t_2 = 1\,hr$

8^{00} am $\quad$ 9^{00} am $\quad$ 10^{00} am

One must travel the last 160 km in $\underbrace{1h\,15\,min}_{1.25\,h}$

so $v_3 = \frac{\Delta x_3}{\Delta t_3} = \frac{160\,km}{1.25\,h} = 128 \frac{km}{h}$

2.15 $x(t) = 4 - 12t + 3t^2$

a) $v(t)$ at 1 sec

$V_x(t) = \frac{dx}{dt} = -12 + 6t$

at 1 sec

$V_x = -12 + 6(1) = -6 \text{ m/s}$

b) moving toward negative x-direction

c) speed at $t = 1$ sec is 6 m/s

d) acceleration $a = \frac{dv}{dt} = 6$

→ increasing V_x

e) when is $V_x = 0$? $V_x(t) = -12 + 6t$

at $t = 2$ sec

f) Is V_x ever negative after $t = 3$?

$V_x(t) = -12 + 6t$

NO!

2.18 $x(t) = 12t^2 - 2t^3$

$V_x = \frac{dx}{dt} = 24t - 6t^2$

$a_x = \frac{dv_x}{dt} = 24 - 12t$

At $t = 3$ sec

a) $x(3) = 12 \cdot 3^2 - 2\,3^3 = 54 \text{ m}$

b) $V_x(3) = 24 \cdot 3 - 6 \cdot 3^2 = +18 \text{ m/s}$

c) $a_x(3) = 24 - 12 \cdot 3 = -12 \text{ m/s}^2$

d) & e) What is the maximum positive x?

The particle stops moving when $V_x = 0$

$V_x = 0 = 24t - 6t^2$

$= t(24 - 6t)$

$\rightarrow t = 0, 4 \text{ sec}$

At $t = 0 \Rightarrow x = 12 \cdot 0^2 - 2 \cdot 0^3 = 0$

At $t = 4 \Rightarrow x = 12 \cdot 4^2 - 2 \cdot 4^3 = 64 \text{ m}$

f & g) What is max V_x?

The velocity is maximum when $a_x = 0$.

$a_x = 0 = 24 - 12t$

$\rightarrow t = 2 \text{ sec}$

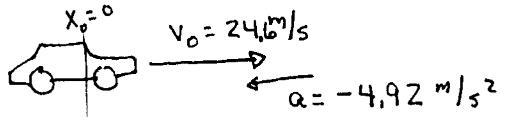
At $t = 2$ sec $\Rightarrow V_x = 24 \cdot 2 - 6 \cdot 2^2 = 24 \text{ m/s}$

h) What is acceleration when $t = 4$?

$a_x = 24 - 12t = 24 - 12 \cdot 4 = -24 \text{ m/s}^2$

i) $V_{AVE} = \frac{x(3) - x(0)}{3 \text{ sec}} = \frac{54 - 0}{3} = 18 \text{ m/s}$

2.28



Use constant acceleration formula

$$x(t) = x_0 + v_{ox}t + \tfrac{1}{2}a_x t^2$$

$$v_x(t) = v_{ox} + at$$

$$x(t) = 24.6t + \tfrac{1}{2}(-4.92)t^2$$

$$v_x(t) = 24.6 + (-4.92)t$$

a) Car stops when $v_x = 0$

$$0 = 24.6 - 4.92t$$

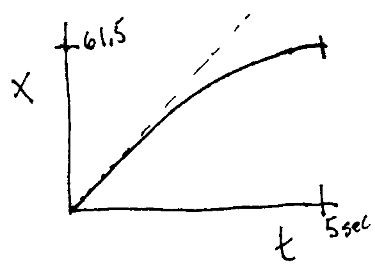
$$t = 5\ sec$$

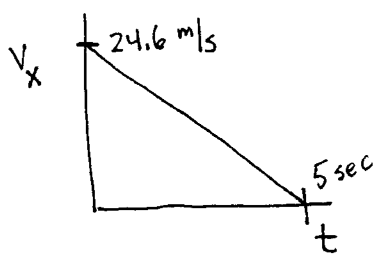
b) How far does it travel?

$$x = 24.6(5) + \tfrac{1}{2}(-4.92)(5)^2$$

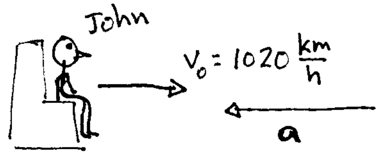
$$= 61.5\ m$$

c)





2.32



time to stop 1.4 s

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We are told $v_x = 0$ at $t = 1.4\ sec$ so only need velocity equation

$$v_x = v_{ox} + a_x t$$

$$v_{ox} = 1020\ \frac{km}{h} = 1020\ \frac{1000\ m}{3600\ s}$$

$$= 283\ m/s$$

$$0 = 283 + a_x\, 1.4$$

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which would be

$$\frac{202}{9.8} = 20.7\ \text{"g's"}$$

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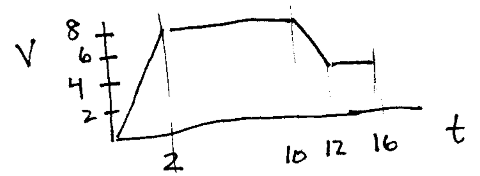

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Each block is worth $2 \cdot 2 = 4\ m$

Count the blocks ..... $2 + 16 + 2 + 1 + 4 = 25$ blks

25 blocks corresponds to 100 m

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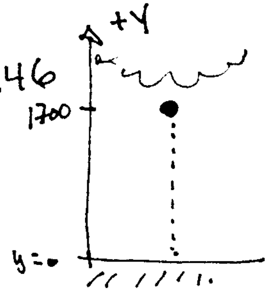

$y_0 = 1700\text{ m}$

$v_{0y} = 0$

$a_y = -9.8\text{ m/s}^2$ Assuming no air drag

$$y(t) = y_0 + v_{0y}t + \tfrac{1}{2}a_y t^2$$

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$$y(t) = 1700 + 0t + \tfrac{1}{2}(-9.8)t^2$$
$$= 1700 - 4.9t^2$$

$$v_y(t) = 0 + (-9.8)t$$
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The raindrops are on the ground at $y=0$

$$y = 0 = 1700 - 4.9t^2$$

$$t = \cancel{-18.6},\ +18.6\text{ sec}$$

Velocity at $t = 18.6\text{s}$

$$V = -9.8t = -9.8(18.6)$$
$$= -183\text{ m/s}$$
$$\approx 408\text{ mph}$$

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$$y_A = y_{A_0} + v_{A_0}t + \tfrac{1}{2}a_A t^2$$

$y_{A_0} = 43.9\text{ m}$

$v_{A_0} = 0$

$a_A = -9.8\text{ m/s}^2$

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$y_{B_0} = 43.9\text{ m}$

$v_{B_0} = ?$

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The amount of time the "B-stone" is in the air is 2.0 sec

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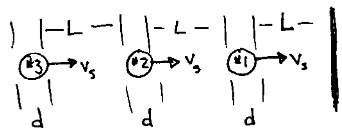

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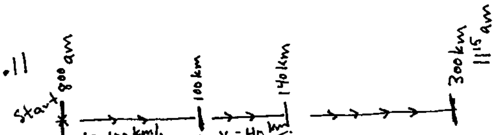

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c) speed at t=1 sec is 6 m/s

d) acceleration $a = \frac{dv}{dt} = 6$

$\rightarrow$ increasing V_x

e) when is $V_x = 0$? $\quad V_x(t) = -12 + 6t$

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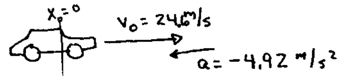
2.28 

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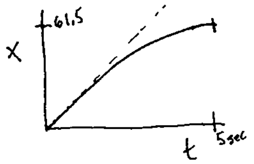
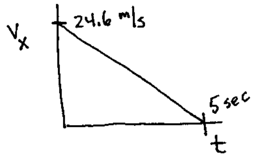
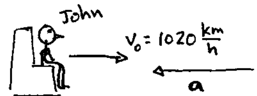
c) 



2.32 

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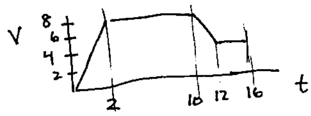
2.69 

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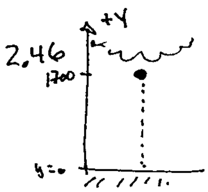
2.46 

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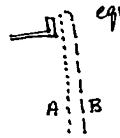

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