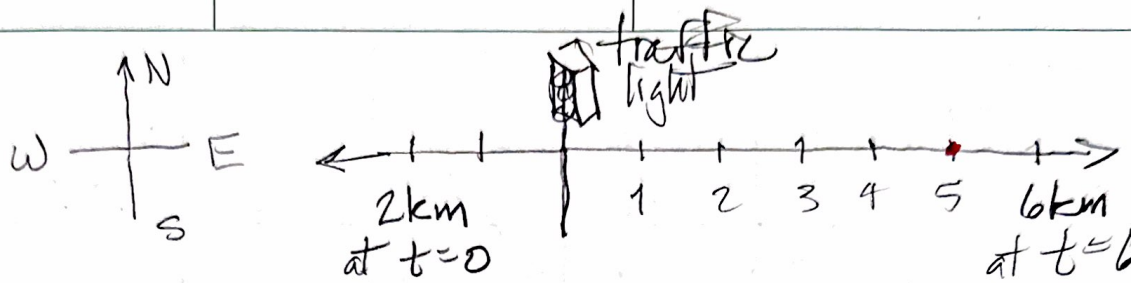
3.25



a) Position vectors:

b) displacement is Δx

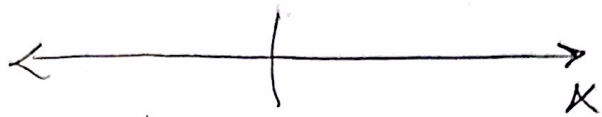
$= x_f - x_i$

$= (5\text{km}) - (-2\text{km})$

$= +7\text{km}$

Wrote down incorrect value!

3.27



Particle moves along x-axis according to $x = 4.0 - 2.0t$, where x is in meters & t is in seconds.

a) Particle crosses origin when $x = 0$, so

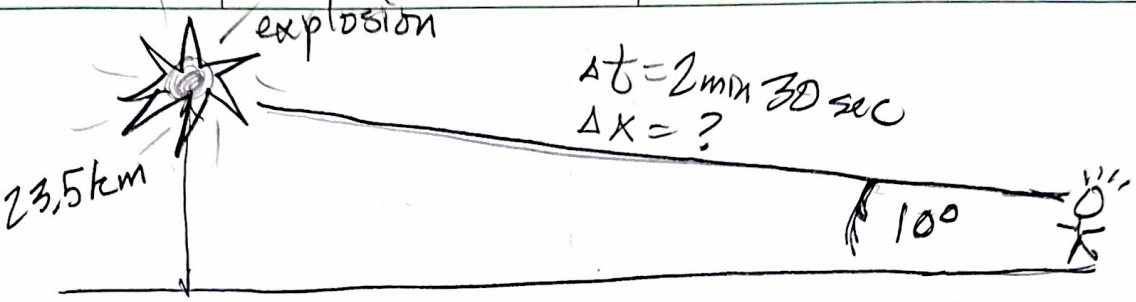
$$0 = 4.0 - 2.0t$$
$$-4.0 = -2.0t$$
$$\frac{-4.0}{-2.0} = \frac{-2.0t}{-2.0}$$
$$t = \boxed{2.0 \text{ seconds}}$$

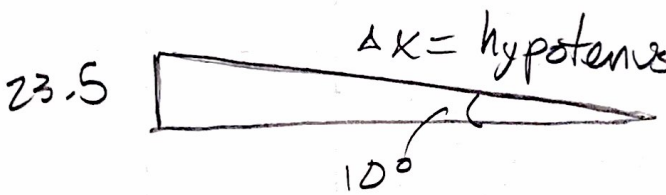
b) Displacement between 3.0s & 6.0s?

$t_i = 3.0$; $t_f = 6.0$

$$\Delta x = x_f - x_i$$
$$= (4.0 - 2.0t_f) - (4.0 - 2.0t_i)$$
$$= (-2.0)(6.0) - (-2.0)(3.0)$$
$$= -12 + 6$$
$$= \boxed{-6.0 \text{ m}}$$

3.29



a) 

Δx = hypotenuse $= \frac{23.5}{\sin 10} = 135 \text{ km}$

$$v = \frac{\Delta x}{\Delta t} = \frac{135 \text{ km}}{2.5 \text{ min}} = 54 \text{ km/min}$$

$$= \frac{54 \text{ km}}{1 \text{ min}} \times \frac{1000 \text{ m}}{1 \text{ km}} \times \frac{1 \text{ min}}{60 \text{ s}}$$

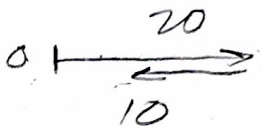
$$= \boxed{900 \text{ m/s}}$$

b) For comparison, this is $\frac{900 \text{ m/s}}{343 \text{ m/s}} = \boxed{2.6 \text{ times the speed of sound}}$

...or... $\frac{900 - 343}{343} \times 100 = \boxed{162\% \text{ of the speed of sound}}$

3.30 Woodchuck (?) runs +20 m in 5 s, then −10 m in 3 s.

Vectors



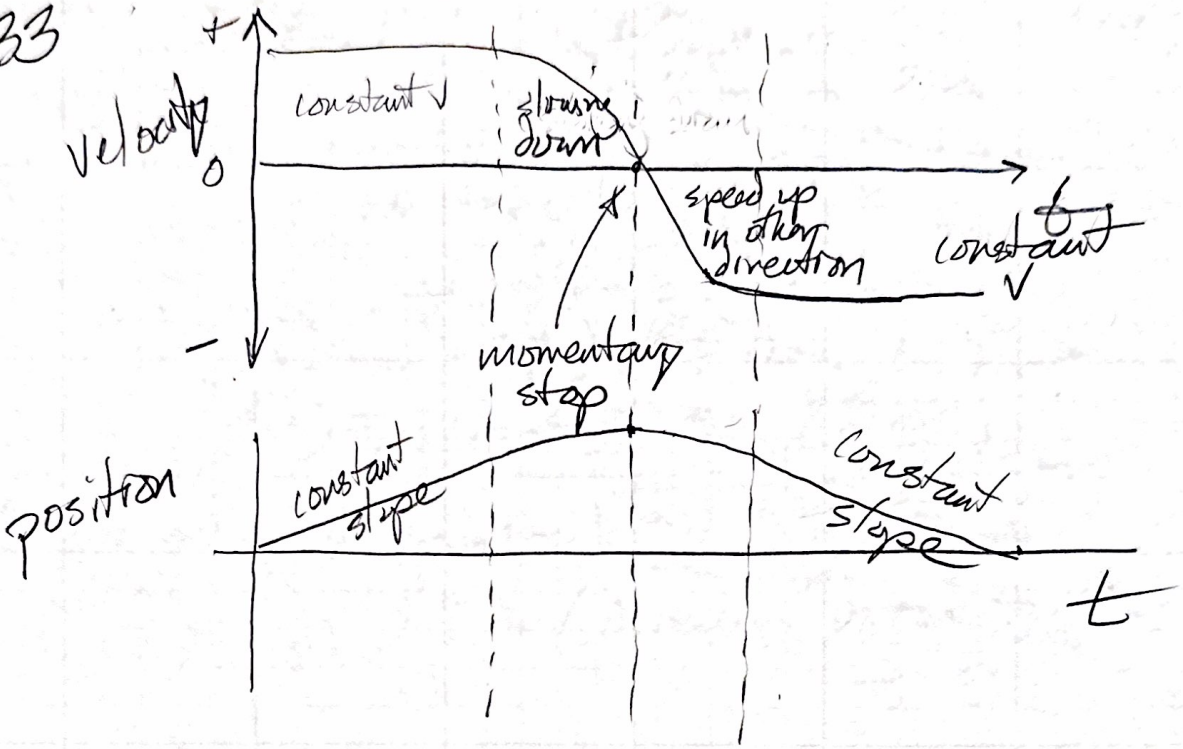
a) $v_{avg} = \bar{v} = \frac{x_f - x_i}{\Delta t}$

$= \frac{10 - 0}{8\,s} =$ +1.25 m/s "right"

b) speed = $\frac{\text{total distance}}{\text{total time}} = \frac{20 + 10}{5 + 3}$

$= \frac{30}{8} =$ 3.75 m/s

3.33



3.35 $x = 10t - 2t^2$

a) $v_{inst} = \frac{dx}{dt} = \frac{d}{dt}(10t - 2t^2)$

$= \underline{10 - 4t}$

$v(2s) = 10 - 4(2) = \boxed{+2.0\ m/s}$

$v(3s) = 10 - 4(3) = \boxed{-2.0\ m/s}$

b) Instantaneous speed = $\boxed{2.0\ m/s \text{ \& } 2.0\ m/s}$

(direction doesn't matter)

c) Average velocity = $v_{avg} = \frac{x_f - x_i}{t_f - t_i}$

$= \frac{(10t_i - 2t_i^2) - (10t_f - 2t_f^2)}{t_f - t_i}$

$= \frac{10 \cdot 3 - 2(3)^2 - (10 \cdot 2 - 2(2)^2)}{3 - 2}$

$= (30 - 18) - (20 - 8)$

$= 12 - 12 = \boxed{0\ m/s}$