

HW2-2 Soln)

N.B.: 2 minutes is 120 seconds.

Let D be the length of the race in meters, T be the duration of the race in seconds. Then,

$$v_{\text{Tortoise}} = \frac{\Delta x_{\text{Tortoise}}}{\Delta t_{\text{Tortoise}}} = \frac{D}{T} = 0.2 \text{ m/s} \rightarrow D = 0.2T ,$$

and

$$v_{\text{Hare}} = \frac{\Delta x_{\text{Hare}}}{\Delta t_{\text{Hare}}} = \frac{D - 0.3}{T - 120} = 3 \text{ m/s} \rightarrow D - 0.3 = 3(T - 120) .$$

We get these expressions from the facts that the hare runs for two minutes less than the duration of the race, and travels 0.3 meters short of the full distance of the race.

(These types of equations are called *simultaneous equations*. We shall be dealing with them often, and there are several techniques which can be applied, such as substitution, rearranging the eqs and setting them equal to each other, subtraction of the eqs, division of the equations, matrix solutions, graphical techniques, *et c.* During the course of the year, we shall probably use each of these approaches.)

Now, substitute to eliminate D .

$$D - 0.3 = 3(T - 120)$$

$$0.2T - 0.3 = 3T - 360$$

$$360 - 0.3 = 3T - 0.2T$$

$$359.7 = 2.8T$$

$$T = \frac{359.7}{2.8} = 128.5 \text{ seconds}$$

and then,

$$D = 0.2T = 0.2(128.5) = 25.7 \text{ m} .$$