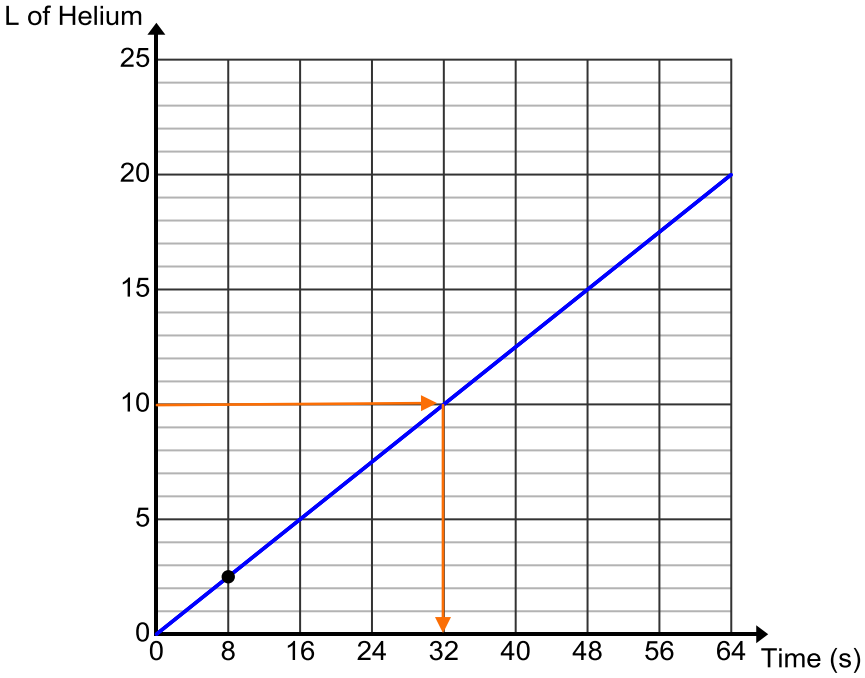
5.4 Slope as a Rate of Change

p. 270 #13
A large party balloon is being filled with helium at a constant rate.
After 8 s, there is 2.5 L of helium in the balloon.

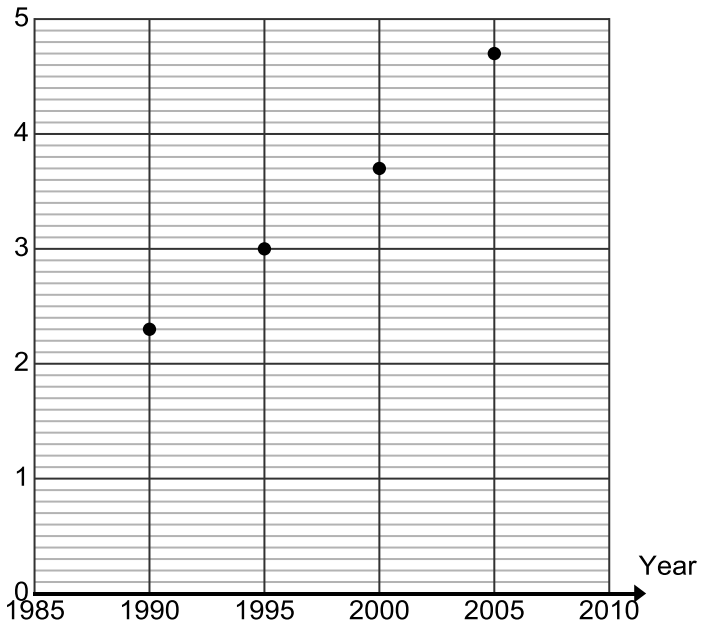
a) Graph the relation.

b) The balloon will burst if there is more than 10 L of helium in it.
How long will it take to fill the balloon with that much helium? Mark this point on your graph.



b)
it will take 32 seconds

15.



p. 270 #16

A scuba tank holds 2.6 m^3 of compressed air. A diver at a shallow depth uses about 0.002 m^3 per breath and takes about 15 breaths per minute.

a) How much air will the diver use in 1 min?

$$\begin{aligned} Air &= \frac{0.002 m^3}{breath} \times \frac{15 breaths}{\min} \times 1 \min \\ &= 0.03 m^3 \end{aligned}$$

b) How long will the air in the tank last at this rate?

$$\begin{aligned} time &= 2.6 m^3 \div \frac{0.03 m^3}{\min} \\ &= 2.6 m^3 \times \frac{\min}{0.03 m^3} \\ &\doteq 86.\overline{6} \min \\ &\doteq 87 \min \end{aligned}$$

c) At a depth of 10 m, the diver is breathing compressed air at 0.004 m^3 per breath. How long will the air last at this depth?

$$\begin{aligned} time &= 2.6 m^3 \div \left(\frac{0.004 m^3}{breath} \times \frac{15 breaths}{\min} \times 1 \min \right) \\ &= 2.6 m^3 \div \frac{0.06 m^3}{breath} \\ &= 2.6 m^3 \times \frac{\min}{0.06 m^3} \\ &\doteq 43.\overline{3} \min \\ &\doteq 43 \min \end{aligned}$$

d) At the maximum depth recommended for sport diving, a diver is breathing air at a rate of 0.01 m^3 per breath. How long will the air last at this depth?

$$\begin{aligned} time &= 2.6 m^3 \div \left(\frac{0.01 m^3}{breath} \times \frac{15 breaths}{\min} \times 1 \min \right) \\ &= 2.6 m^3 \div \frac{0.15 m^3}{breath} \\ &= 2.6 m^3 \times \frac{\min}{0.15 m^3} \\ &\doteq 17.\overline{3} \min \\ &\doteq 17 \min \end{aligned}$$