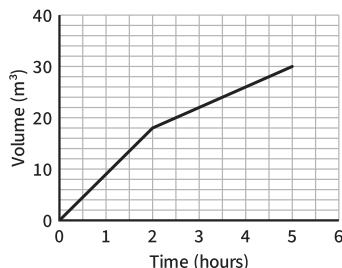


1 Rates from graphs

A pool fills.

- Find the rate in the first 2 hours, in litres per second.
- The pool holds 42 m^3 . At the later rate, when is it full?

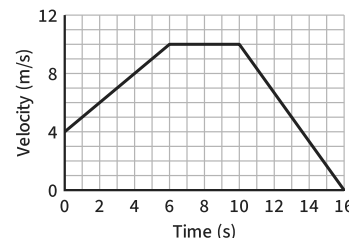


- $18\,000 \text{ litres} \div 7200 \text{ s} = 2.5 \text{ litres per second}$
- $12 \div 4 = 3 \text{ hours more: at 8 hours}$

2 Rates from graphs

A cyclist's speed.

- Find the acceleration in the first 6 s.
- When is the speed 7 m/s? Give both times.

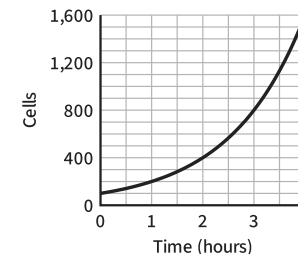


- $6 \div 6 = 1 \text{ m/s}^2$
- $3 \text{ s, and } 10 + 3 \div \frac{5}{3} = 11.8 \text{ s}$

3 Gradient of a curve

Cells in a culture.

- Draw a tangent to estimate the growth rate at 2 hours.
- Show the average rate from 1 to 3 hours is 300 cells per hour. Why is it more than in a)?

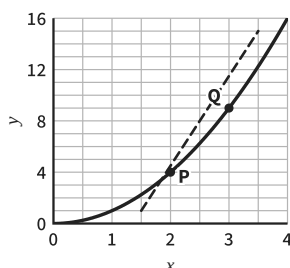


- about 280 cells per hour (240 to 320)
- $600 \div 2 = 300$: the chord is steeper

4 Gradient of a curve

$P(2, 4)$ and $Q(2+h, (2+h)^2)$ lie on $y = x^2$.

- Show that PQ has gradient $4+h$.
- What does this show about the gradient at P ?



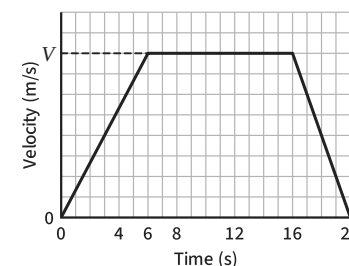
- $(4h + h^2) \div h = 4 + h$
- as h nears 0, PQ becomes the tangent: 4

Pre-calculus revision mat answers

5 Area under a graph

A tram travels 360 m between stops.

- Find V .
- Find the time when it has travelled half the distance.

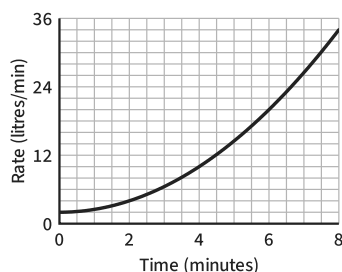


- $15V = 360, V = 24$
- 72 m by 6 s, $108 \div 24 = 4.5$: 10.5 s

6 Area under a graph

Water flows into a tank.

- Estimate the volume after 8 minutes, using 4 strips.
- Estimate when half of it has flowed in.

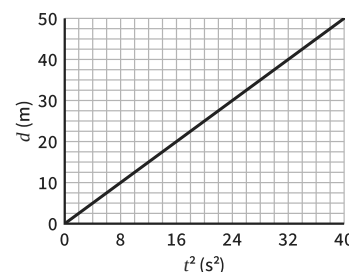


- $6 + 14 + 30 + 54 = 104 \text{ litres}$
- 50 by 6 min: about 6.1 min (6 to 6.2)

7 Direct proportion graphs

The graph shows d plotted against t^2 .

- Write a formula for d in terms of t .
- Find t when $d = 125$.

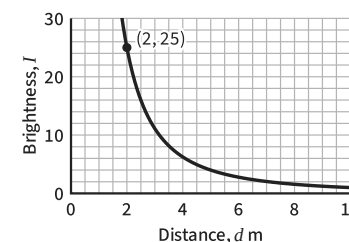


- $20 \div 16 = 1.25, d = 1.25t^2$
- $t^2 = 125 \div 1.25 = 100, t = 10$

8 Inverse proportion graphs

Brightness is inversely proportional to the square of the distance.

- Find a formula for I in terms of d .
- Find d when $I = 8$, to 3 significant figures.



- $25 = \frac{k}{2^2}, I = \frac{100}{d^2}$
- $d^2 = 12.5, d = 3.54 \text{ m}$