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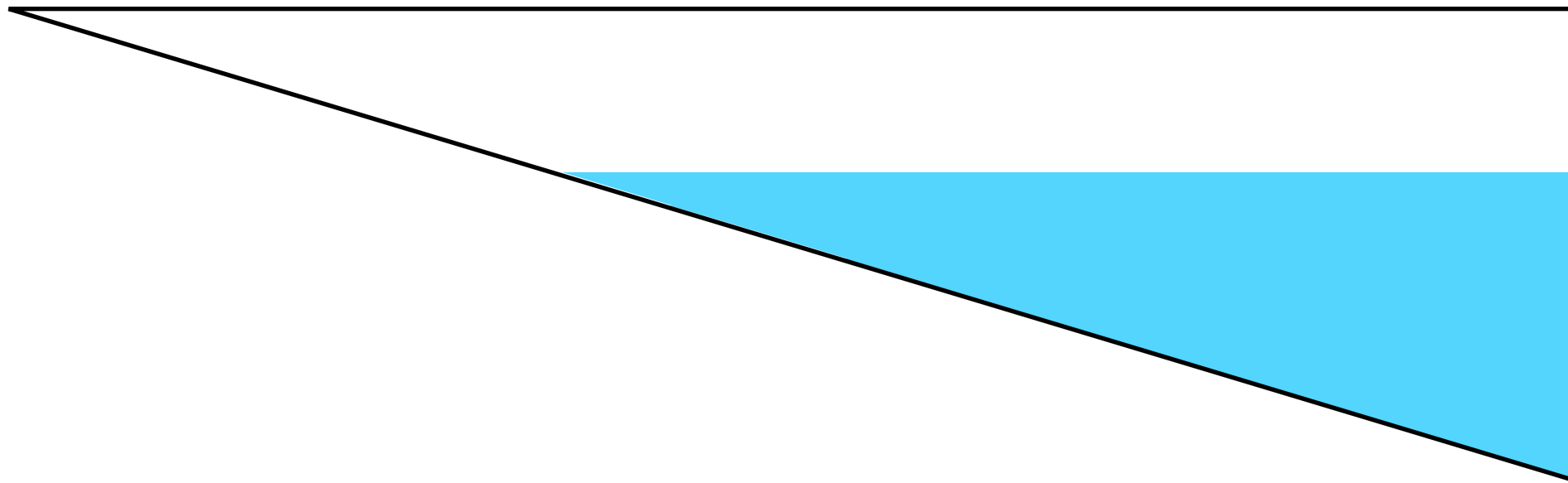
# MATHS METHODS

PODCAST

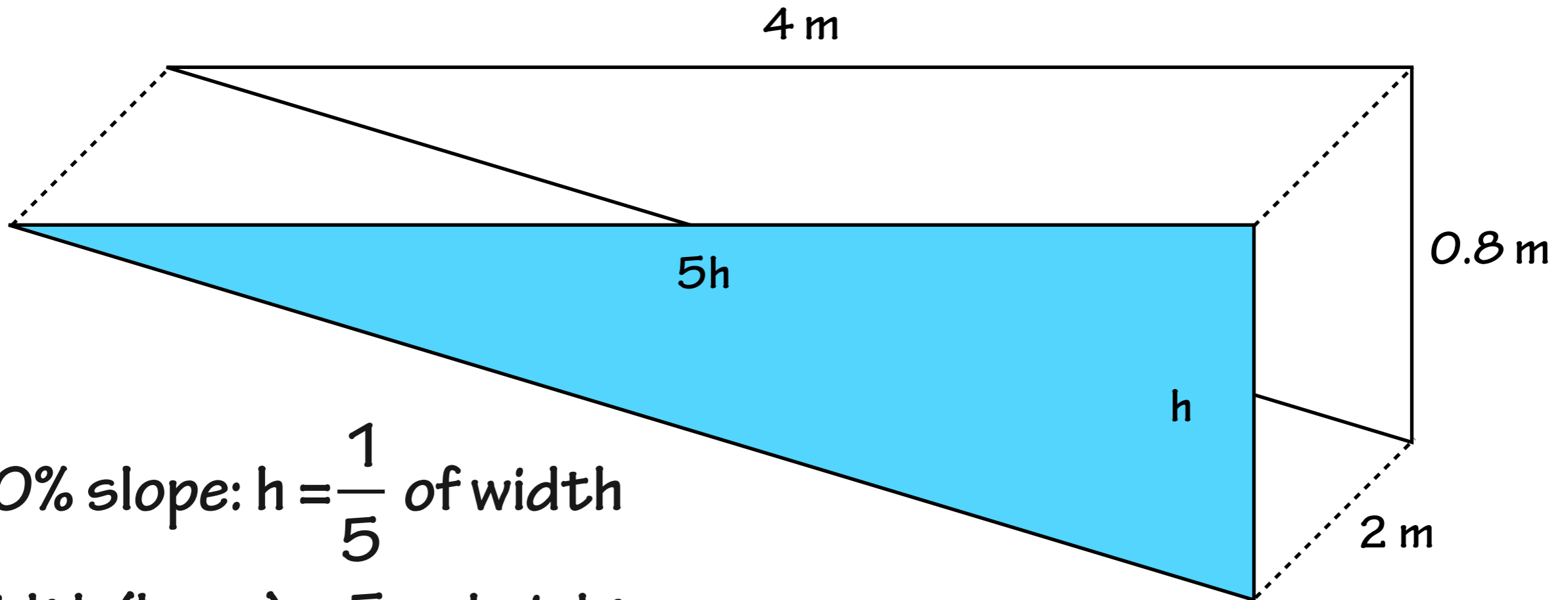


# Related rates of change

- An angled pool (4m long x 2m wide x 80 cm high) is being filled at a rate of 100 litres per minute.
- What is the rate of change of height (cm / min) when the water level is 10 cm high?
- What is the rate of change of height when the water level is 70 cm high?



# Related rates of change



20% slope:  $h = \frac{1}{5}$  of width

width (base) =  $5 \times$  height

$$A = \frac{1}{2}bh = \frac{1}{2} \times (5h) \times (h) = \frac{5h^2}{2}$$

$$V = A \times 2 = 5h^2$$

# Related rates of change

$$\frac{dV}{dt} = 100L/min = 0.1m^3/min$$

$$\frac{dV}{dt} = \frac{dV}{dh} \times \frac{dh}{dt}$$

$$\frac{dh}{dt} = \frac{dV}{dt} \div \frac{dV}{dh}$$

$$V = 5h^2$$

$$\frac{dV}{dh} = 10h$$

$$\text{At } h = 0.1m, \frac{dV}{dh} = 10 \times 0.1m = 1m^3/m$$

# Related rates of change

$$\frac{dh}{dt} = \frac{dV}{dt} \div \frac{dV}{dh}$$

At  $h = 10$  cm:

$$\frac{dh}{dt} = \frac{\left(\frac{dV}{dt}\right)}{\left(\frac{dV}{dh}\right)} = \frac{0.1\text{m}^3/\text{min}}{1\text{m}^3/\text{m}} = 0.1\text{m}/\text{min} = 10\text{cm}/\text{min}$$

At  $h = 70$  cm:

$$\frac{dh}{dt} = \frac{0.1\text{m}^3/\text{min}}{7\text{m}^3/\text{m}} = 0.014\text{m}/\text{min} = 1.4\text{cm}/\text{min}$$

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