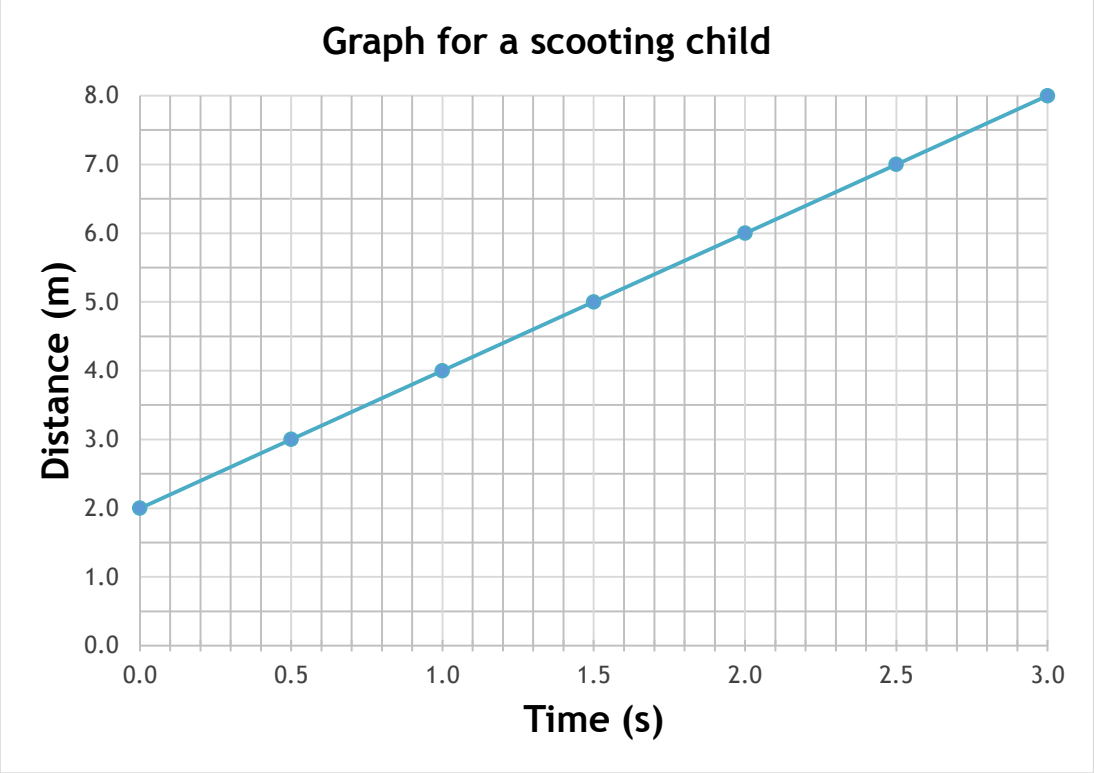
You will need to be able to recall and use equations relating to distance-time and velocity-time graphs.

1. The graph below shows how the motion of a scooting child changes over a few seconds.



a. Tick the box for the statement that matches the motion shown by the graph.

- ☐ Constant acceleration for 3 seconds
- ☐ Constant speed for 3 seconds
- ☐ Scoots 6 metres in the first 2 seconds

b. How far does the child scoot over the time shown?

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c. Use the graph to calculate the speed of the child and scooter.

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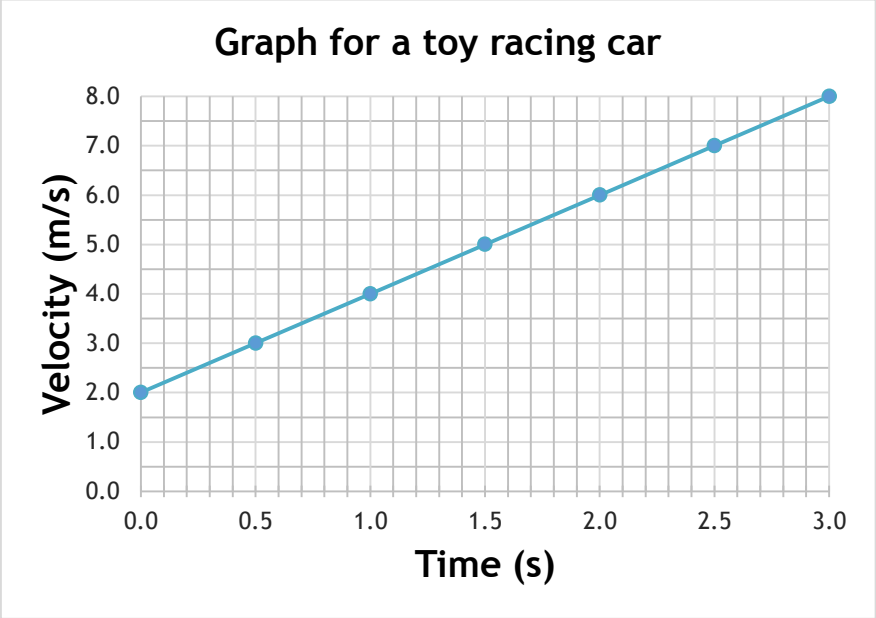
speed = ...unit: .....

2. The graph below shows how the motion of a toy racing car changes over a few seconds.



a. Use the graph to calculate,

i. **[HT]** the distance the car has travelled over the time shown:

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distance = ...unit: .....

ii. the acceleration of the car over the time shown:

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acceleration = ...unit: .....

b. Using data from the graph, together with the equation $v^2 - u^2 = 2as$ and your answer from **(a)(ii)**, find the distance travelled. Show your working.

Hint: this should be the same as your answer to part **(a)(i)**.

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Answers

1.

a. **Constant speed for 3 seconds**

b. The child started at 2 m and ended at 8 m, so over the 3 s, they scooted **6 m**.

c. Speed can be found from the gradient (slope) of the distance-time graph.
Speed = (8–2) ÷ 3 = **2 m/s**

2.

a.

i. The distance travelled is equal to the 'area' under the line.
Method 1: rectangle + triangle
Distance = (2 x 3) + ½ (3 x 6) = 6 + 9 = **15 m**
Method 2: trapezium
Distance = ½ (2 + 8) x 3 = 5 x 3 = **15 m**
Method 3: distance = average speed x time (now compare this to method 2!)
Distance = ½ (2 + 8) x 3 = 5 x 3 = **15 m**

ii. Acceleration is the slope of the line, or can be found using acceleration = change in velocity ÷ time.
a = (8 – 2) ÷ 3 = **2 m/s^2**

b. To use $\boldsymbol{v^2 - u^2 = 2as}$ we first need to identify the different variables:
v = final speed = 8 m/s
u = initial speed = 2 m/s
a = acceleration = 2 m/s^2 (from (a)(ii))
s = distance travelled = ?

$8^2 - 2^2 = 2 \times 2 \times \mathbf{s}$
$64 - 4 = 4 \times \mathbf{s}$
$60 = 4 \times \mathbf{s}$
$60 \div 4 = \mathbf{s}$
s = 15 m