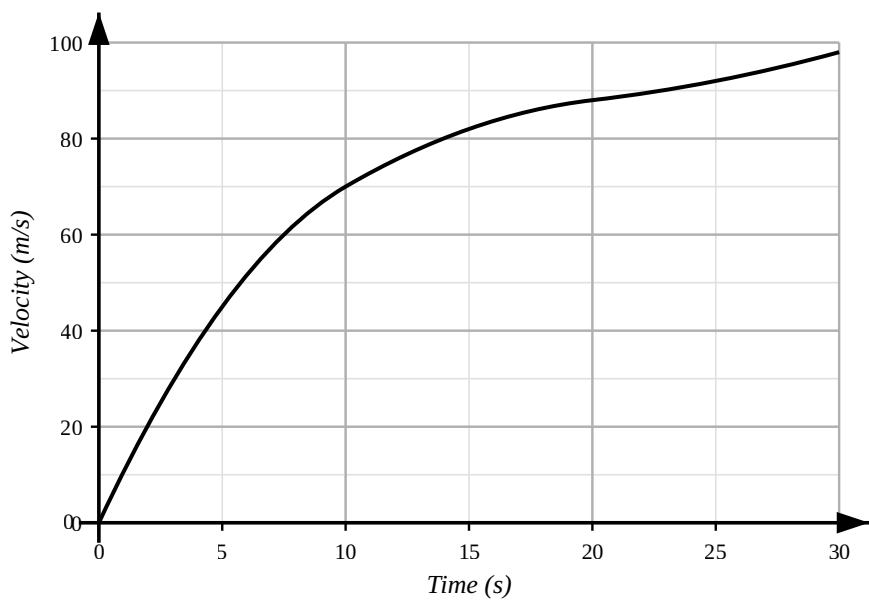


CALCULUS: ESTIMATING DISTANCE FROM VELOCITY-TIME
GRAPHS

Best Guess Mastery Worksheet (Target Grade 5/6)

I Do

Here is a velocity-time graph for a rocket.



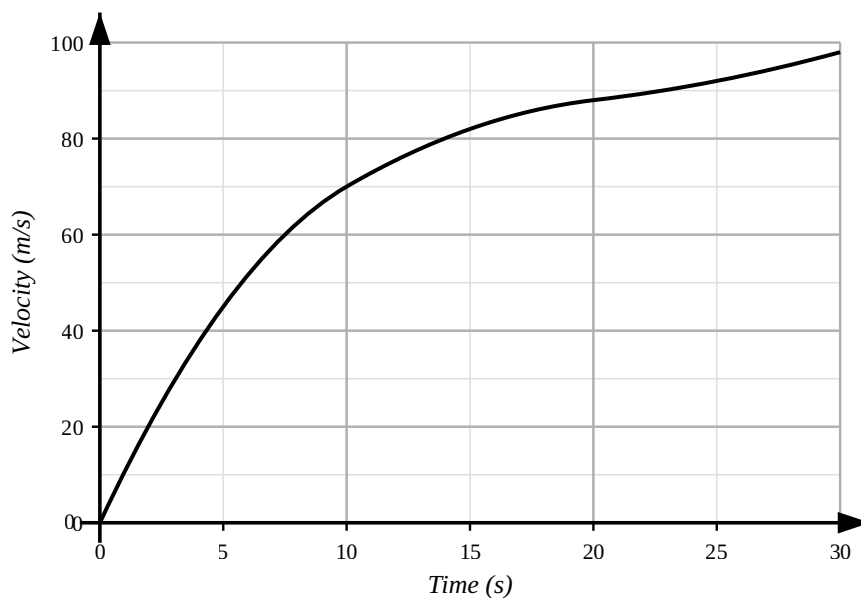
Work out an estimate for the distance the rocket travelled in the first 30 seconds.
Use 3 strips of equal width.

CALCULUS: ESTIMATING DISTANCE FROM VELOCITY-TIME GRAPHS

Best Guess Mastery Worksheet (Target Grade 5/6)

We Do

Here is a velocity-time graph for a speedboat.



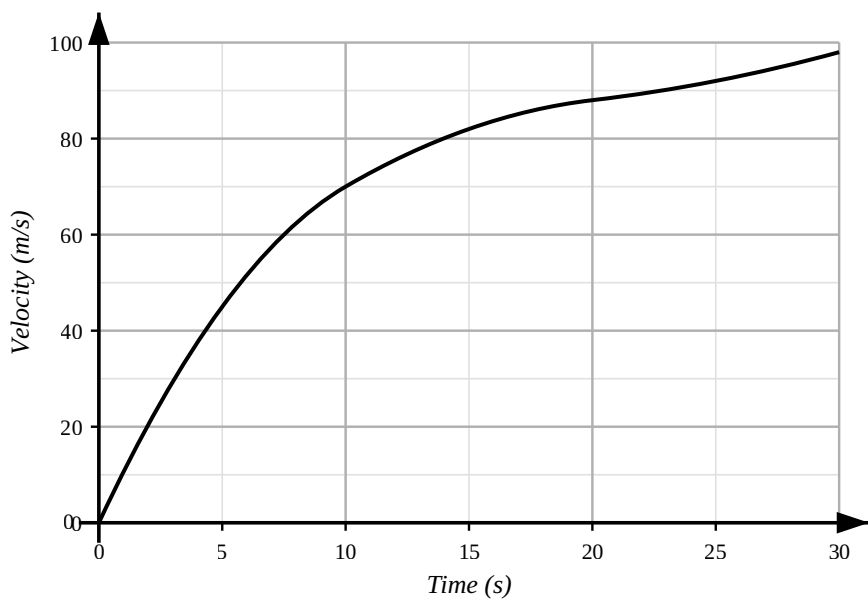
Work out an estimate for the distance the speedboat travelled in the first 30 seconds.
Use 3 strips of equal width.

CALCULUS: ESTIMATING DISTANCE FROM VELOCITY-TIME
GRAPHS

Best Guess Mastery Worksheet (Target Grade 5/6)

You Do 1

Here is a velocity-time graph for a train.



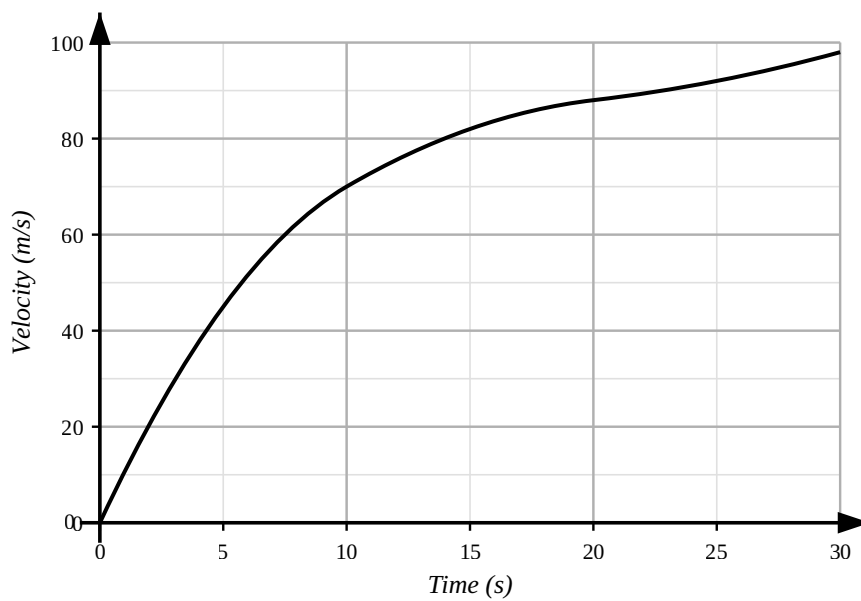
Work out an estimate for the distance the train travelled in the first 30 seconds.
Use 3 strips of equal width.

CALCULUS: ESTIMATING DISTANCE FROM VELOCITY-TIME GRAPHS

Best Guess Mastery Worksheet (Target Grade 5/6)

You Do 2

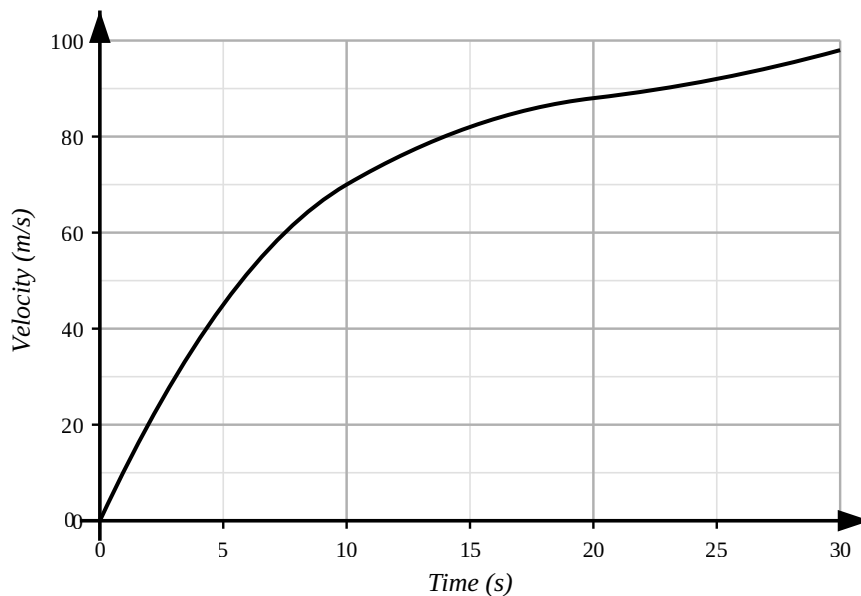
Here is a velocity-time graph for a cyclist.



Work out an estimate for the distance the cyclist travelled in the first 30 seconds.
Use 3 strips of equal width.

CALCULUS: ESTIMATING DISTANCE & ACCELERATION**Best Guess Mastery Worksheet (Target Grade 7/8)****Challenge 1**

Here is a velocity-time graph for a sports car.



(a) Work out an estimate for the acceleration of the car at $t = 15$ seconds.

You must show how you get your answer on the graph.

..... m/s^2 (3)

(b) Work out an estimate for the distance travelled in the first 30 seconds using 3 strips of equal width.

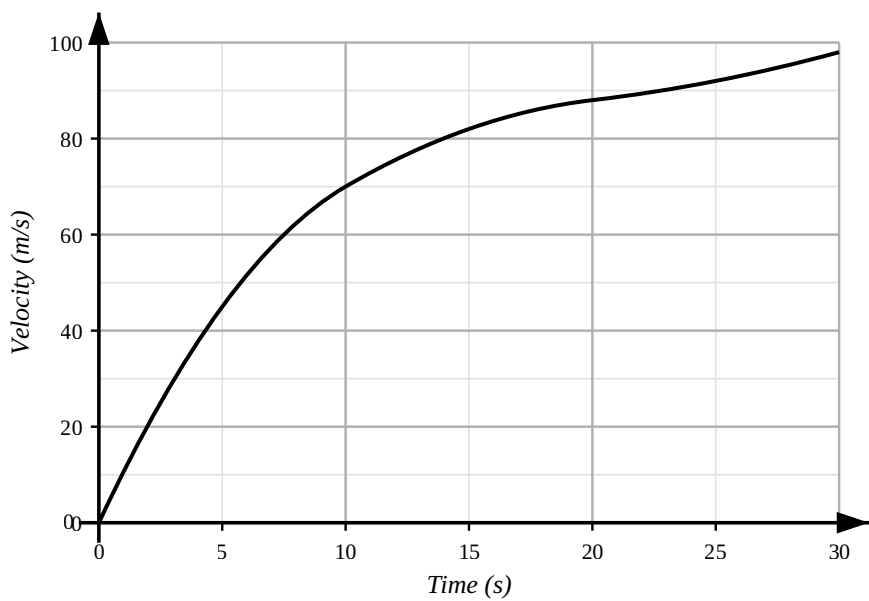
..... m (4)

CALCULUS: ESTIMATING AREA & TRAPEZIUM RULE

Best Guess Mastery Worksheet (Target Grade 7/8)

Challenge 2

Here is a velocity-time graph for a drone.



Work out an estimate for the total distance the drone travelled in the first 30 seconds.
Use the trapezium rule with 6 strips of equal width (width = 5 seconds).
Compare your answer with a 3-strip estimate.

Answers & Worked Solutions

I Do:

- 3 strips of equal width up to $t = 30$ means width $\Delta t = 10$ seconds (intervals: 0 to 10, 10 to 20, 20 to 30).
- Read ordinates (heights) from the curve:
 - At $t = 0$: $v = 0$
 - At $t = 10$: $v \approx 70$
 - At $t = 20$: $v \approx 88$
 - At $t = 30$: $v \approx 95$
- Using Trapezium Rule: $\text{Area} \approx 10 \times [0.5(0 + 95) + 70 + 88] = 10 \times [47.5 + 158] = 10 \times 205.5 = \mathbf{2055 \text{ m}}$ (accept range 2000 – 2150 m).

We Do:

- Width $\Delta t = 10$ seconds.
- Ordinates at $t = 0, 10, 20, 30$: $v = 0, 70, 88, 95$.
- $\text{Area} \approx 10 \times [0.5(0 + 95) + 70 + 88] = \mathbf{2055 \text{ m}}$.

You Do 1:

- Width $\Delta t = 10$ seconds.
- Ordinates at $t = 0, 10, 20, 30$: $v = 0, 70, 88, 95$.
- Area $\approx \mathbf{2055 \text{ m}}$.

You Do 2:

- Width $\Delta t = 10$ seconds.
- Ordinates at $t = 0, 10, 20, 30$: $v = 0, 70, 88, 95$.
- Area $\approx \mathbf{2055 \text{ m}}$.

Challenge 1:

- (a) Draw a tangent to the curve at $t = 15$. Find gradient: $\Delta v / \Delta t \approx (85 - 60) / (22 - 8) = 25 / 14 \approx \mathbf{1.78 \text{ m/s}^2}$ (accept 1.5 – 2.0).
- (b) Distance estimation using 3 strips ($\Delta t = 10$): Area $\approx \mathbf{2055 \text{ m}}$.

Challenge 2:

- 6 strips of width $\Delta t = 5$ seconds (at $t = 0, 5, 10, 15, 20, 25, 30$).
- Ordinates: $v(0)=0, v(5)=45, v(10)=70, v(15)=80, v(20)=88, v(25)=94, v(30)=98$.
- Trapezium rule: $\text{Area} \approx 5 \times [0.5(0 + 98) + 45 + 70 + 80 + 88 + 94] = 5 \times [49 + 377] = 5 \times 426 = \mathbf{2130 \text{ m}}$.

4. The 6-strip estimate is more accurate than the 3-strip estimate because smaller strip widths capture the initial steep curve of acceleration more closely.