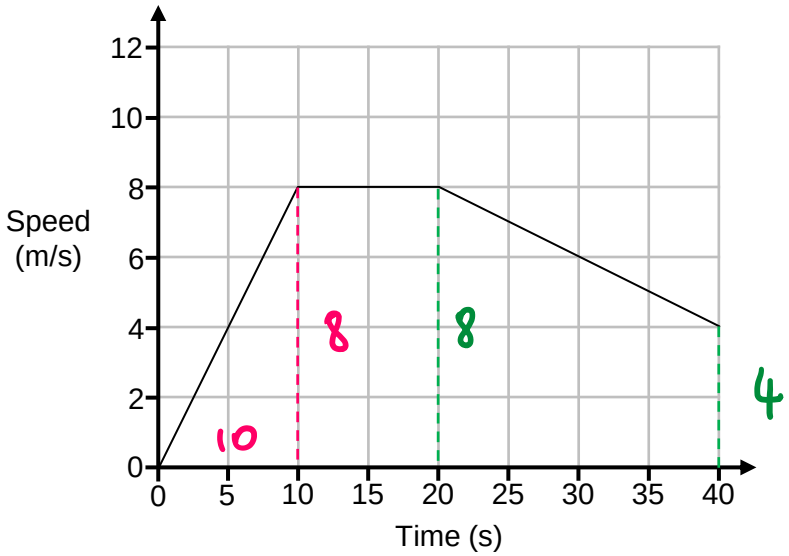
Speed-Time Graphs

SCAN ME

REVISE THIS TOPIC

1 Here is a speed-time graph for a 40 second journey.



1 (a) Work out the acceleration during the first 10 seconds.
State the units of your answer. **[2 marks]**

8
10

Answer 0·8 m/s²

1 (b) Work out the total distance travelled. **[3 marks]**

½ x 8 x 10 = 40 m

8 x 10 = 80 m

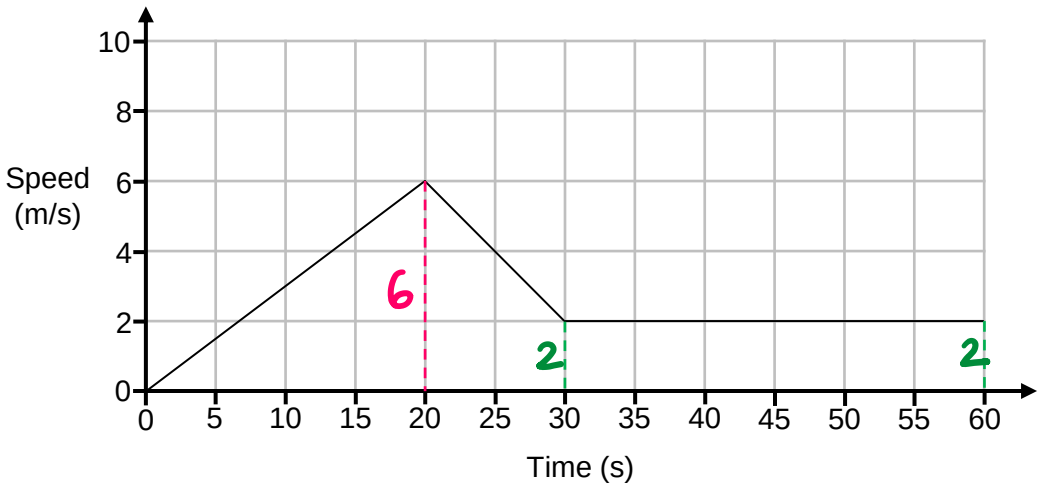
½ (8 + 4) x 20 = 120 m

40 + 80 + 120

Answer 240 m

5

2 Here is a speed-time graph for a 1 minute journey.



2 (a) Write down the acceleration in the second half of the journey. **[1 mark]**

Answer 0 m/s²

2 (b) Work out the acceleration during the first 20 seconds. **[1 mark]**

$\frac{6}{20}$

Answer 0.3 m/s²

2 (c) Work out the total distance travelled. **[3 marks]**

$\frac{1}{2} \times 6 \times 20 = 60\text{m}$

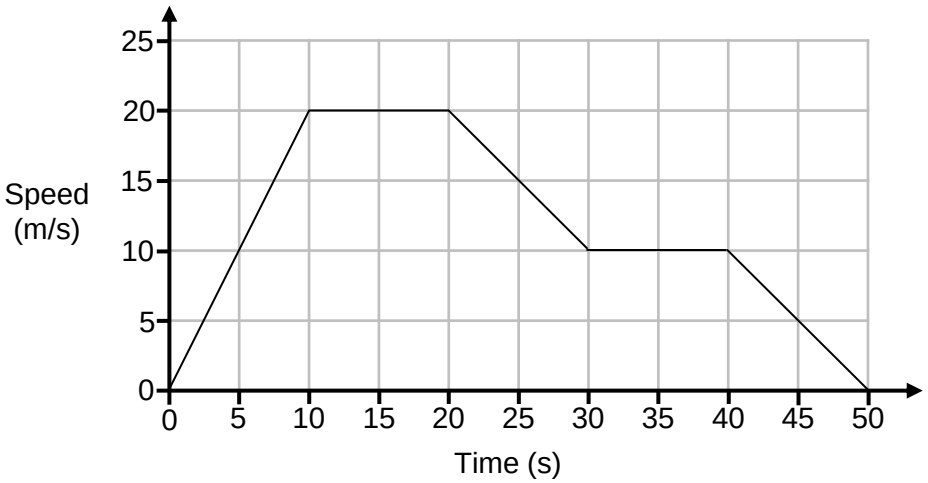
$\frac{1}{2}(6+2) \times 10 = 40\text{m}$

$30 \times 2 = 60\text{m}$

$60 + 40 + 60$

Answer 160 m

3 Here is a speed-time graph for a 50 second journey.



Negative	Zero	Positive
Decreasing	Increasing	

Use words from the box above to complete each of the statements below.
You may use a word more than once.

[5 marks]

Between 0 and 10 seconds the speed is positive and increasing

Between 0 and 10 seconds the acceleration is positive

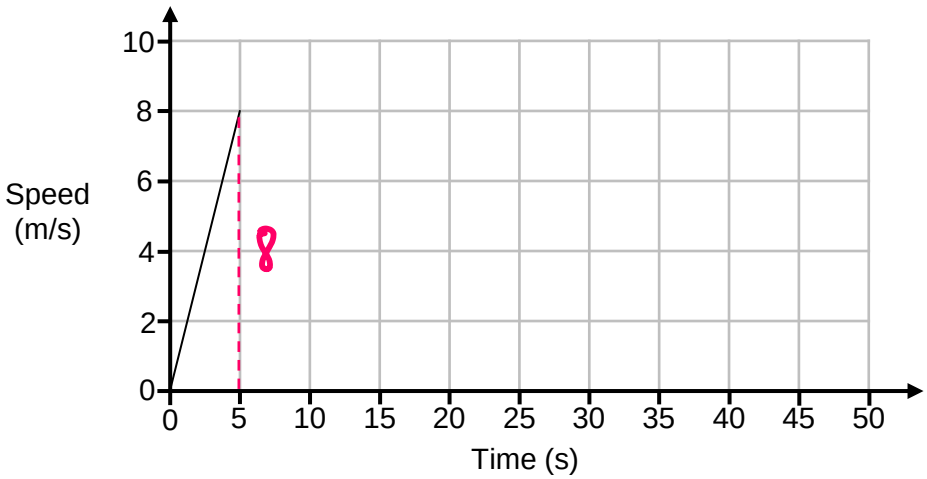
Between 10 and 20 seconds the acceleration is zero

Between 20 and 30 seconds the acceleration is negative

Between 20 and 30 seconds the speed is positive and decreasing

10

4 Here is part of a speed-time graph for an athlete in a 400 metre race.



4 (a) Work out the acceleration of the athlete in the first 5 seconds. **[1 mark]**

$\frac{8}{5}$

Answer 1·6 m/s²

4 (b) After the first 5 seconds the athlete runs at a constant speed to the end of the race.

Work out the total time taken for the athlete to complete the 400 metre race. **[3 marks]**

½ x 8 x 5 = 20m

400 − 20 = 380m left

380 ÷ 8 = 47.5

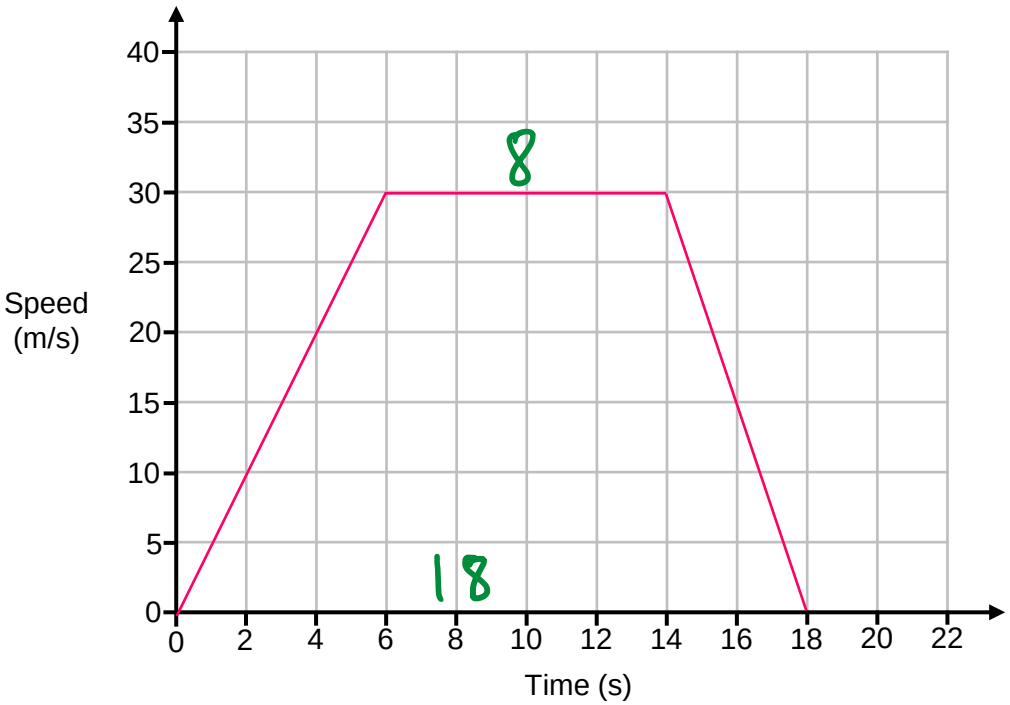
47.5 + 5 = 52.5

Answer 52.5 seconds

5 A car accelerates from rest with a constant acceleration 5 m/s^2 for 6 seconds.

The car then travels at a constant speed for a further 8 seconds before decelerating at 7.5 m/s^2 until it comes to rest.

5 (a) Draw a speed-time graph for the car onto the grid below. **[3 marks]**



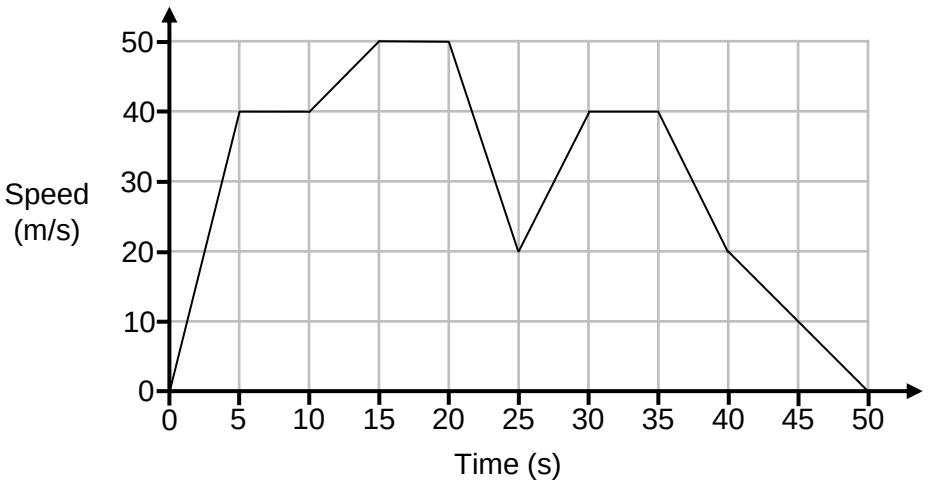
5 (b) Work out the total distance travelled by the car. **[2 marks]**

$\frac{1}{2}(8+18) \times 30 = 390$

Answer 390 m

9

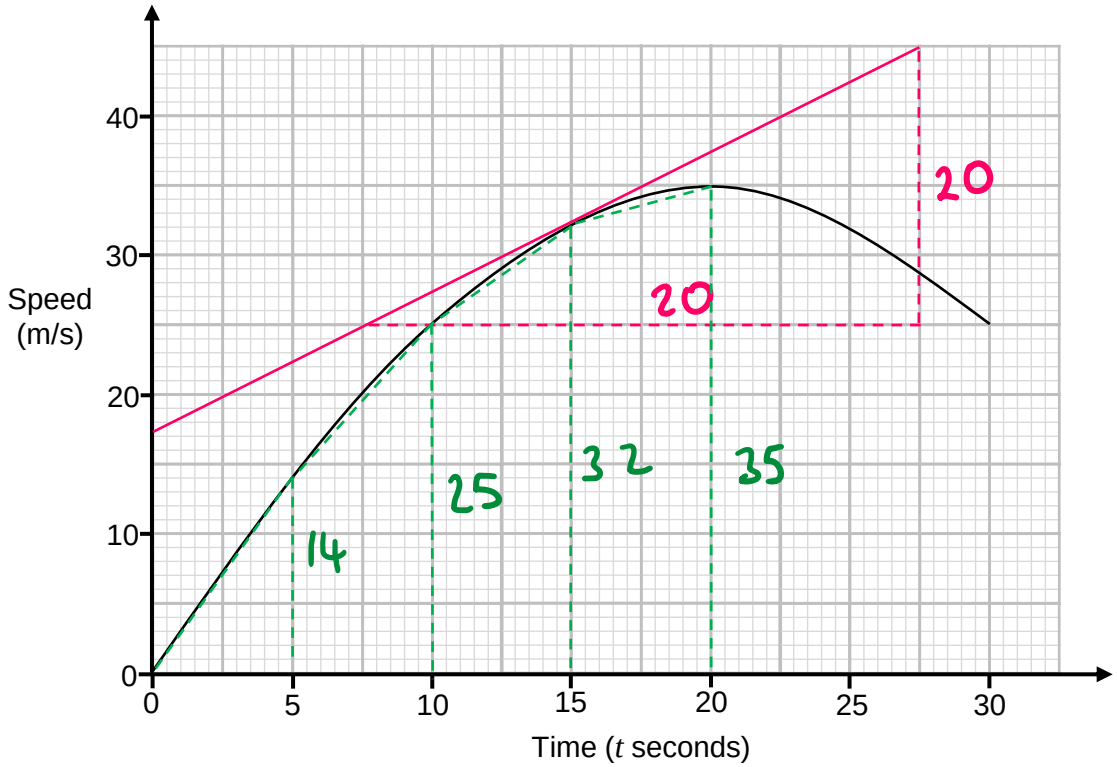
6 Here is a speed-time graph for a 50 second journey.



Tick the correct box for each statement below **[4 marks]**

	True	False
The acceleration is greatest between 15 and 20 seconds.	☐	☑
The acceleration between 15 and 20 seconds is the same as the acceleration between 30 and 35 seconds.	☑	☐
The acceleration between 25 and 30 seconds is the same as the acceleration between 35 and 40 seconds.	☐	☑
The distance travelled in the first 5 seconds is the same as the distance travelled in the last 10 seconds.	☑	☐

7 Here is a speed-time graph for a 30 second journey.



7 (a) Work out an estimate for the acceleration when $t = 15$ seconds. **[2 marks]**

$\frac{20}{20}$

answers near to 1

1

Answer _____ m/s^2

7 (b) Work out an estimate for the distance travelled in the first 20 seconds. **[3 marks]**

$\frac{1}{2} \times 14 \times 5 = 35$

$\frac{1}{2}(14 + 25) \times 5 = 97.5$

$\frac{1}{2}(25 + 32) \times 5 = 142.5$

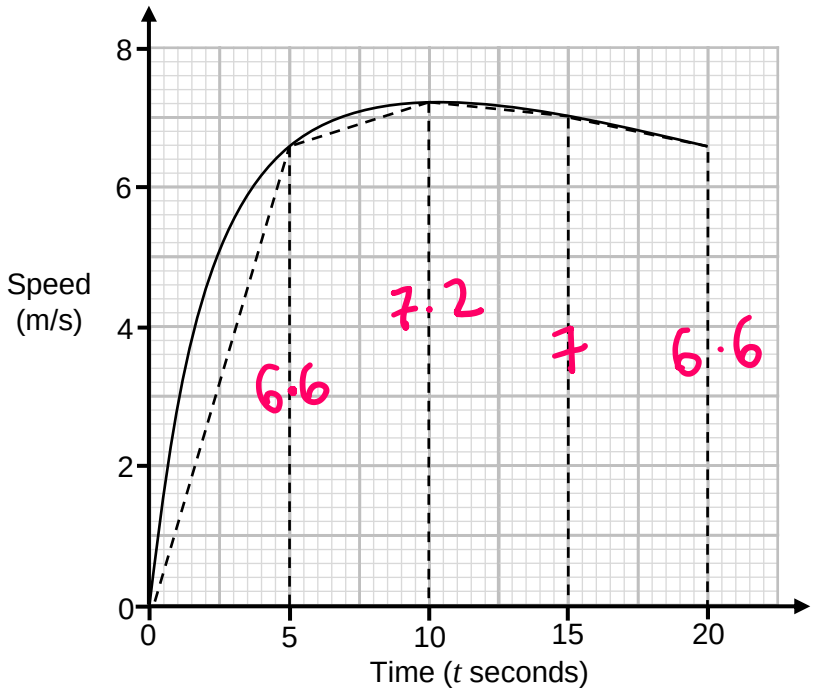
$\frac{1}{2}(32 + 35) \times 5 = 167.5$

$35 + 97.5 + 142.5 + 167.5 = 442.5$

Answer 442.5 m

8

8 Here is a speed-time graph for an athlete during a race.



8 (a) The athlete finishes the race in 20 seconds.
Paul uses a triangle and three trapeziums to estimate the distance of the race.
Work out Paul's estimate for the distance of the race. **[4 marks]**

$\frac{1}{2} \times 6.6 \times 5 = 16.5$

$\frac{1}{2}(6.6 + 7.2) \times 5 = 34.5$

$\frac{1}{2}(7.2 + 7) \times 5 = 35.5$

$\frac{1}{2}(7 + 6.6) \times 5 = 34$

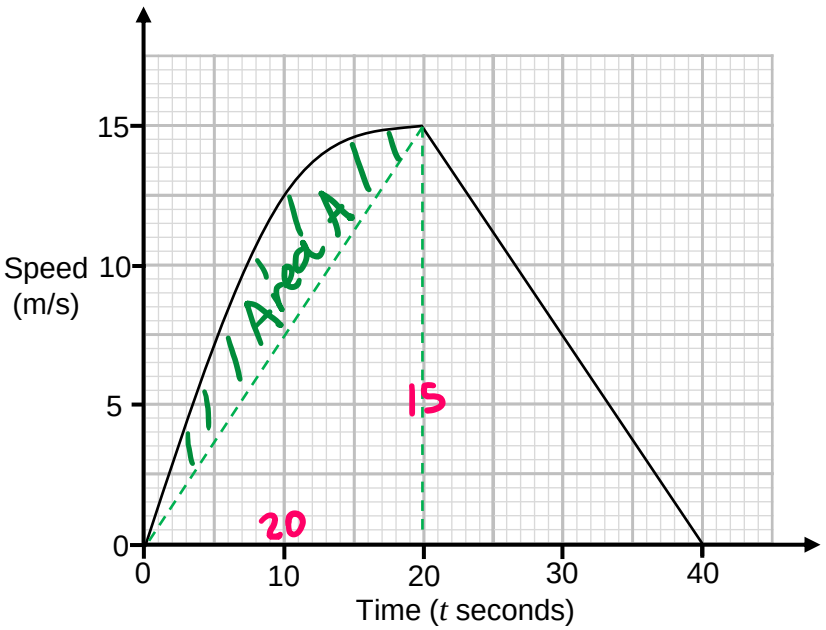
$16.5 + 34.5 + 35.5 + 34$

Answer 120.5 m

8 (b) Is Paul's estimate an overestimate or underestimate for the real distance of the race? **[1 mark]**

Answer underestimate

9 Here is a speed-time graph for a 40 second journey.



9 (a) Show clearly that the distance travelled in the first half of the journey is greater than the distance travelled in the second half of the journey. **[2 marks]**

First half = ½ × 20 × 15 + "Area A"

= 150m + "Area A"

Second half = ½ × 20 × 15

= 150m

9 (b) Work out the average acceleration for the first half of the journey. **[2 marks]**

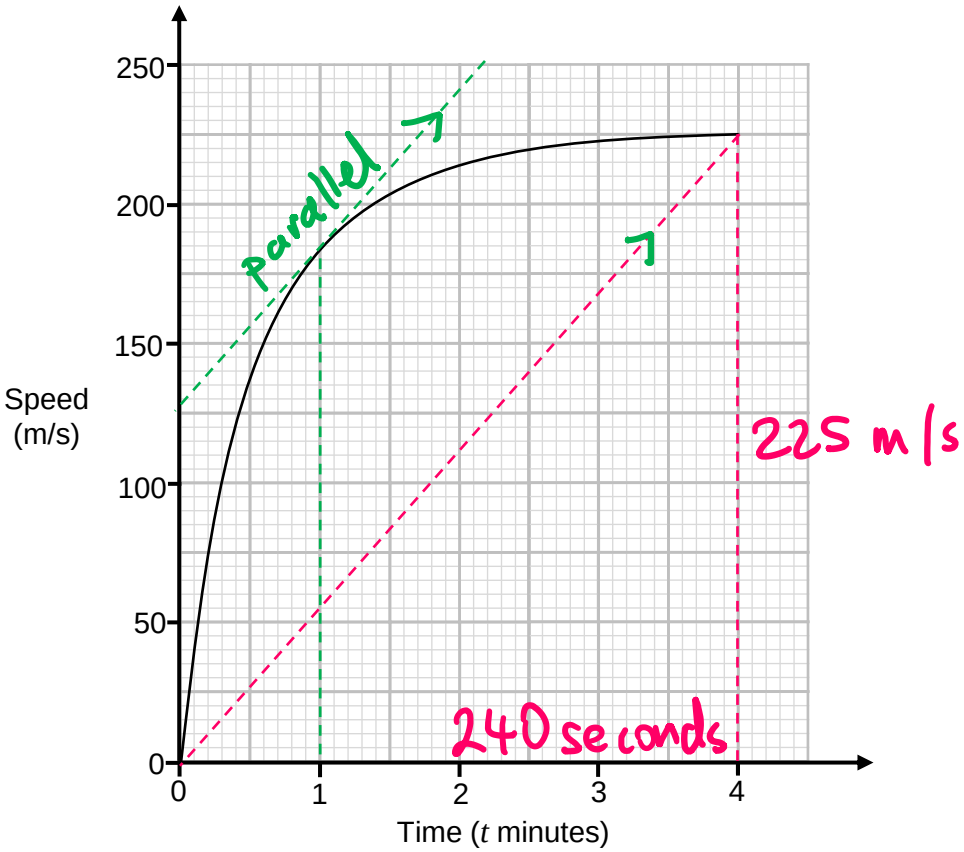
$\frac{15}{20}$

Answer 0·75 m/s²

9

Turn over ►

10 Here is a speed-time graph for the first 4 minutes of an aeroplane's flight.



10 (a) Work out the average acceleration for the first 4 minutes.
Give your answer in **m/s²** **[2 marks]**

$\frac{225}{240}$

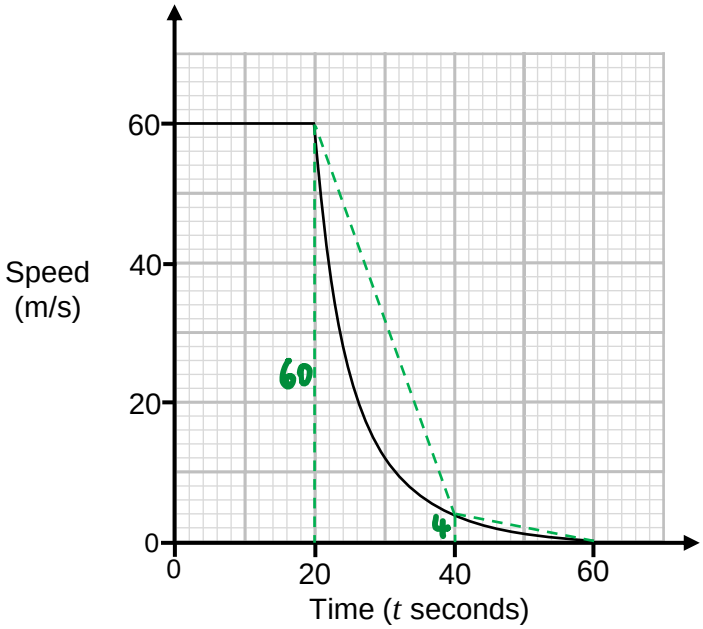
Answer 0·9375 m/s²

10 (b) How many seconds into the flight was the acceleration of the aeroplane equal to the average acceleration for the first 4 minutes. **[1 mark]**

1 minute

Answer 60 seconds

11 Here is a speed-time graph for a train as it arrives to a station.



11 (a) Write down the acceleration of the train in the first 20 seconds. **[1 mark]**

Answer 0 m/s²

11 (b) Work out an estimate for the distance the train travels between 0 and 60 seconds. **[3 marks]**

20 x 60 = 1200m

½(60 + 4) x 20 = 640 m

½ x 4 x 20 = 40 m

1200 + 640 + 40

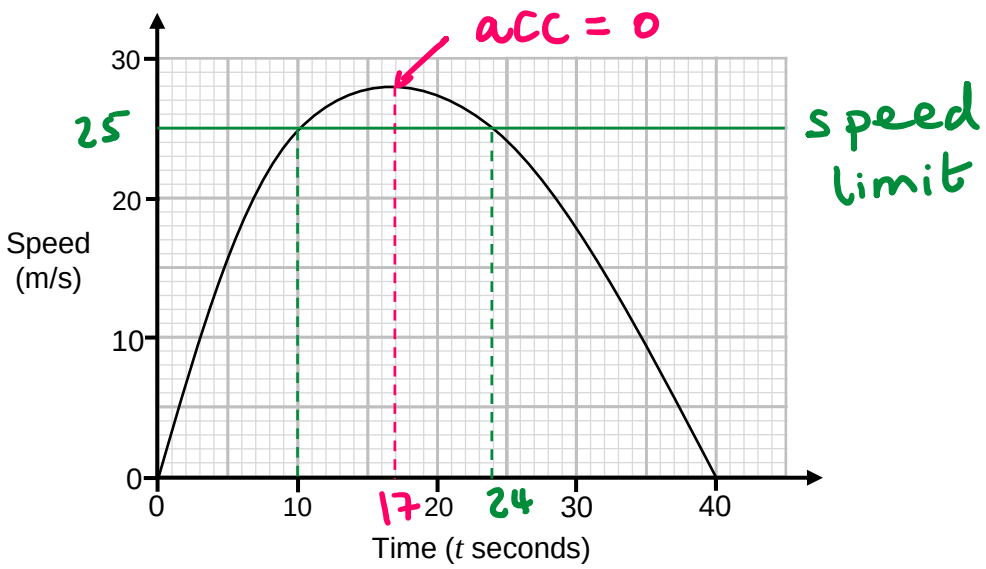
Answer 1880 m

11 (c) Is your answer to part **(b)** an overestimate or underestimate for the real distance that the train travels? **[1 mark]**

Answer overestimate

8

12 Here is a speed-time graph for a 40 second car journey.



12 (a) After how many second was the acceleration zero? **[1 mark]**

Answer 17 seconds

12 (b) The car is travelling on a road with a speed limit of 90 km/h

Work out percentage of the 40 second journey that the car was above the speed limit. **[4 marks]**

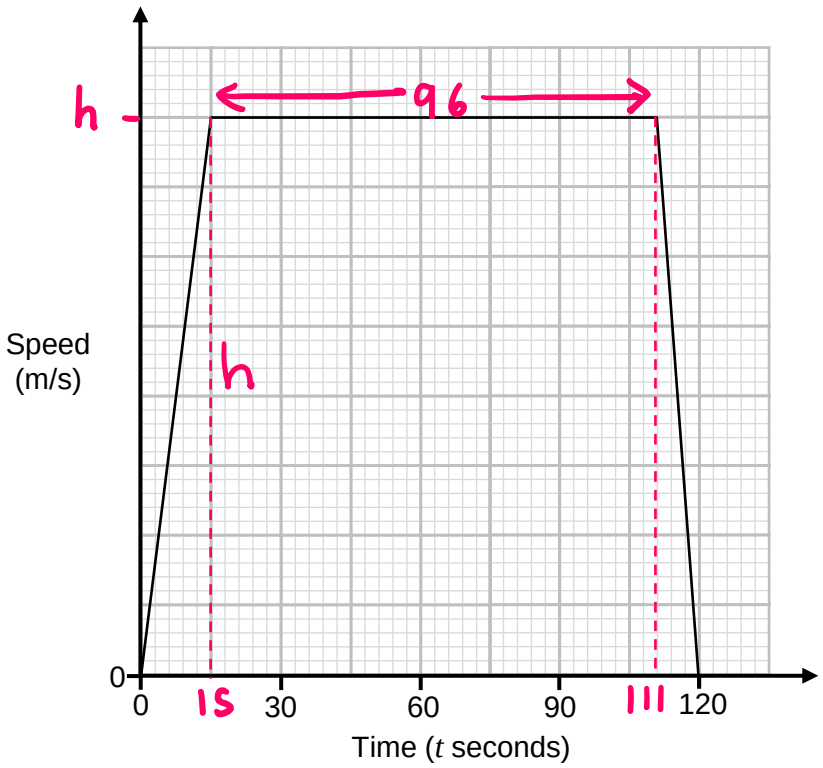
90 km/h = 90000 m/h ÷ 60
= 1500 m/min ÷ 60
= 25 m/s

24 − 10 = 14 seconds

$\frac{14}{40} \times 100 = 35$

Answer 35 %

13 Here is a speed-time graph for a super car during a 2 minute journey.



The total distance travelled by the super car is 8.64 km

Work out the acceleration of the super car in the first 15 seconds. **[4 marks]**

$\frac{1}{2}(96+120) \times h = 8640$

$108h = 8640$

$h = 80$ m/s

acceleration $= \frac{80}{15}$

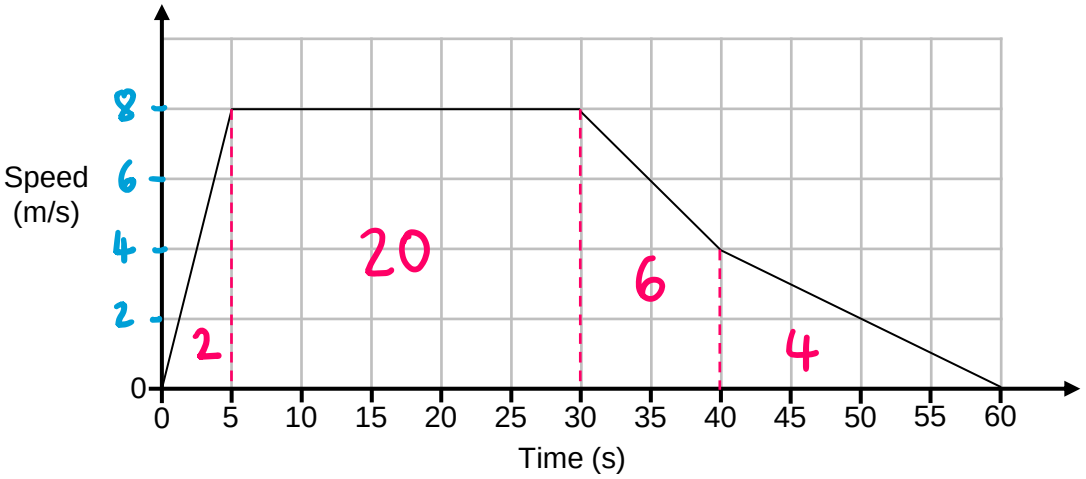
$= 5.\dot{3}$

Answer $5.\dot{3}$ m/s^2

9

Turn over ►

14 Here is a speed-time graph for Tommy as he goes from his house to the docks.



14 (a) At what time is Tommy halfway between his house and the docks? **[4 marks]**

(wooah)

Total area = 32 squares

Halfway there = 16 squares

5 seconds = 2 squares

10 seconds = 6 squares

20 seconds = 14 squares

25 seconds = 18 squares

Answer 22.5 seconds

14 (b) The total distance between Tommy's house and the docks is 320 metres.

Work out the maximum speed that Tommy reaches on his way to the docks. **[3 marks]**

32 squares = 320m

1 square = 10m

10 ÷ 5 = 2 m/s

2 × 4 = 8 m/s

Answer 8 m/s

7