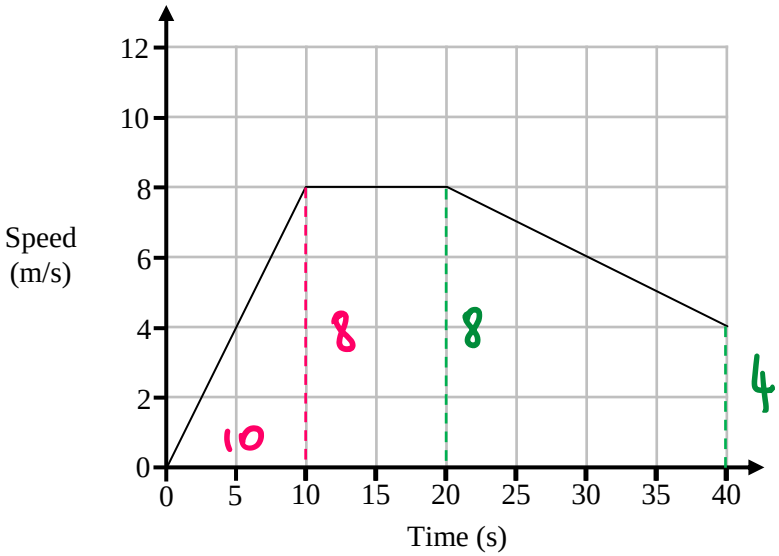
# Speed Time Graphs

SCAN ME

REVISE THIS TOPIC

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




(a) Work out the acceleration during the first 10 seconds.
State the units of your answer.

$\frac{8}{10}$

0.8 m/s²

(2)

(b) Work out the total distance travelled.

$\frac{1}{2} \times 8 \times 10 = 40\text{m}$

$8 \times 10 = 80\text{m}$

$\frac{1}{2}(8+4) \times 20 = 120\text{m}$

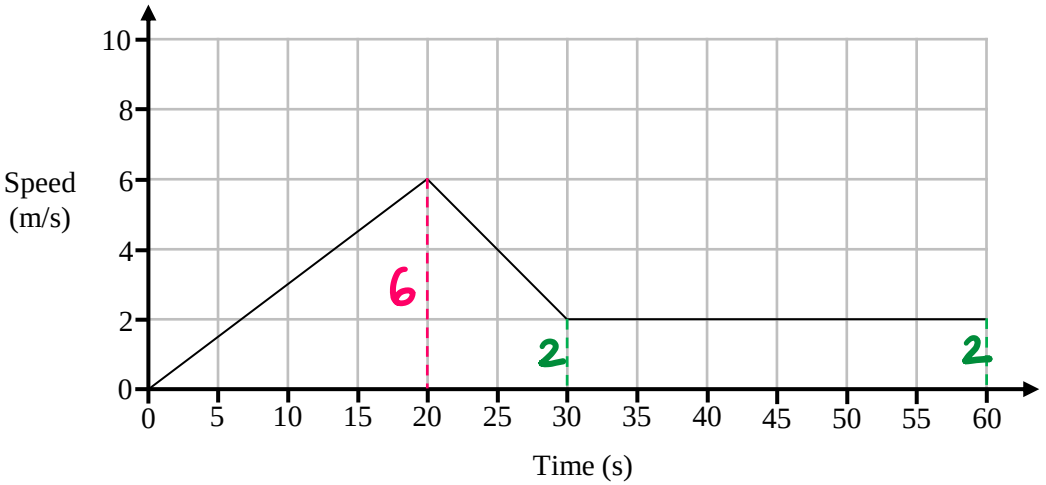
$40 + 80 + 120$

240 m

(3)

**(Total for Question 1 is 5 marks)**

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




(a) Write down the acceleration in the second half of the journey.

0

..... m/s$^2$

**(1)**

(b) Work out the acceleration during the first 20 seconds.

$\frac{6}{20}$

0·3

..... m/s$^2$

**(1)**

(c) Work out the total distance travelled.

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

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

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

$60 + 40 + 60$

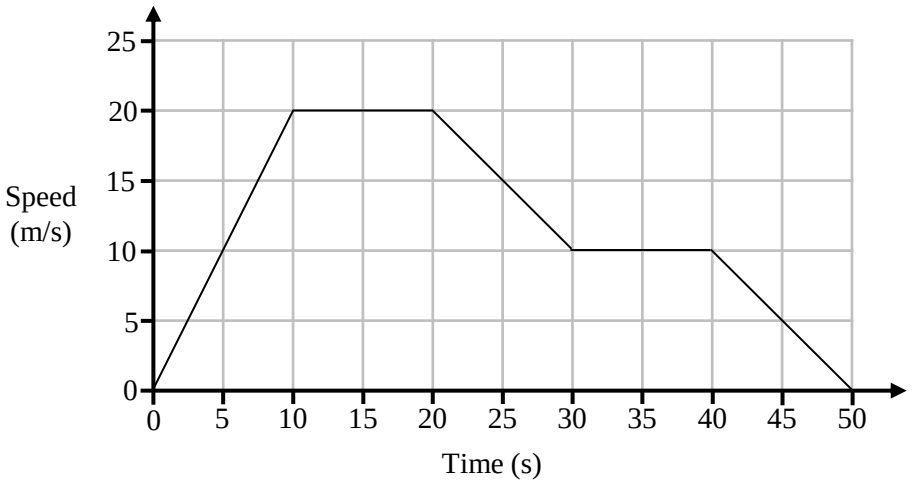
160

..... m

**(3)**

**(Total for Question 2 is 5 marks)**

**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.

Between 0 and 10 seconds the speed is ..... positive ..... and ..... increasing .....

Between 0 and 10 seconds the acceleration is ..... positive .....

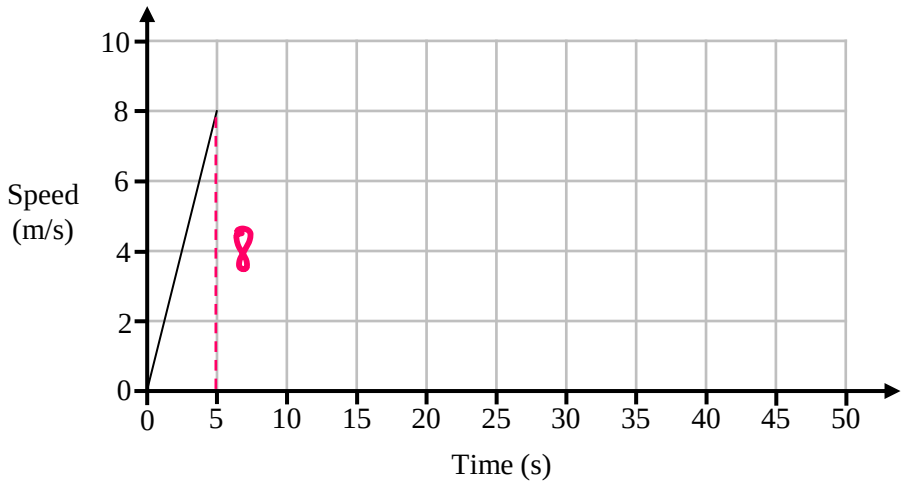
Between 10 and 20 seconds the acceleration is ..... zero .....

Between 20 and 30 seconds the acceleration is ..... negative .....

Between 20 and 30 seconds the speed is ..... positive ..... and ..... decreasing .....

**(Total for Question 3 is 5 marks)**

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




(a) Work out the acceleration of the athlete in the first 5 seconds.

$\frac{8}{5}$

1·6 ..... m/s²

**(1)**

(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.

½ x 8 x 5 = 20m

400 − 20 = 380m left

380 ÷ 8 = 47·5

47·5 + 5 = 52·5

52·5 ..... seconds

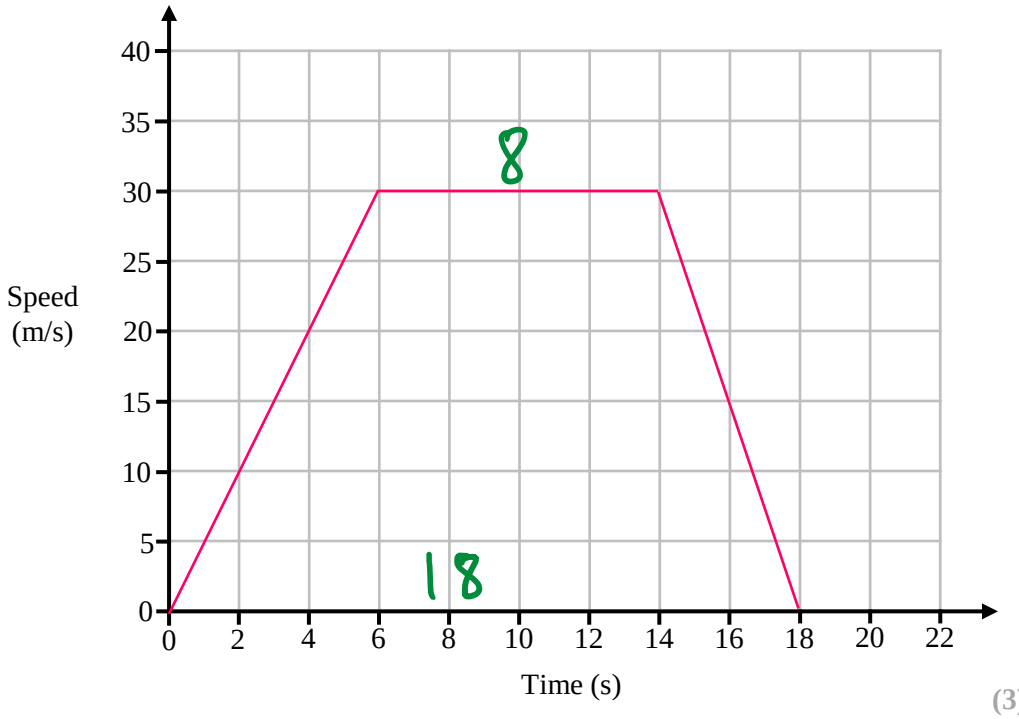
**(3)**

**(Total for Question 4 is 4 marks)**

**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.

(a) Draw a speed-time graph for the car onto the grid below.




**(3)**

(b) Work out the total distance travelled by the car.

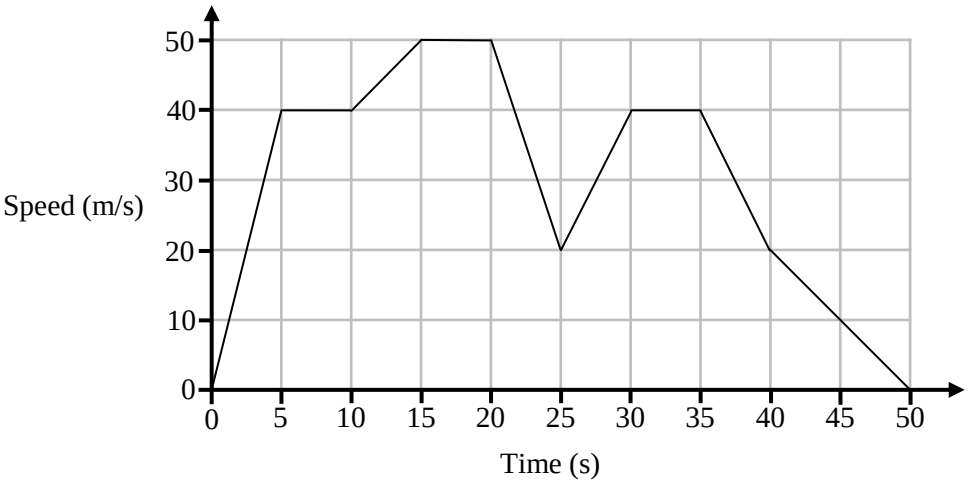
$\frac{1}{2}(8+18) \times 30 = 390$

390 ..... m

**(2)**

**(Total for Question 5 is 5 marks)**

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

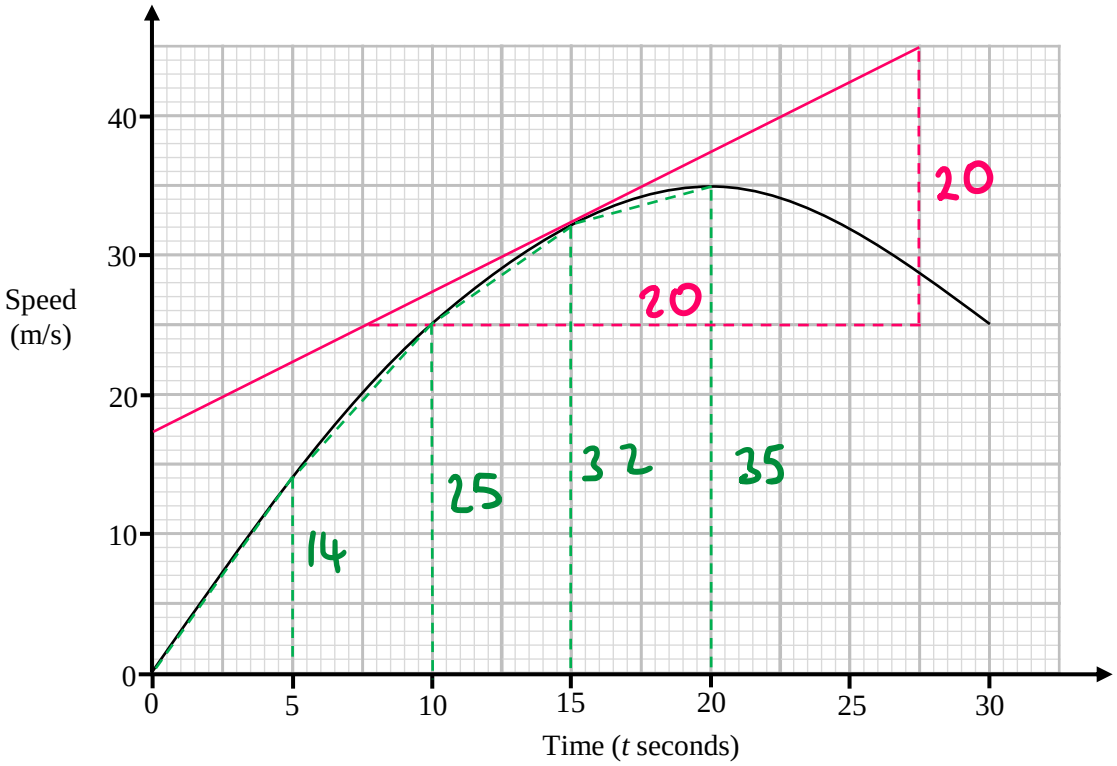



Tick the correct box for each statement below

| | 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. | ☑ | ☐ |

**(Total for Question 6 is 4 marks)**

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




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

$\frac{20}{20}$

answers near to 1

1

..... m/s$^2$

**(2)**

(b) Work out an estimate for the distance travelled in the first 20 seconds.
Use 4 strips of equal width.

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

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

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

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

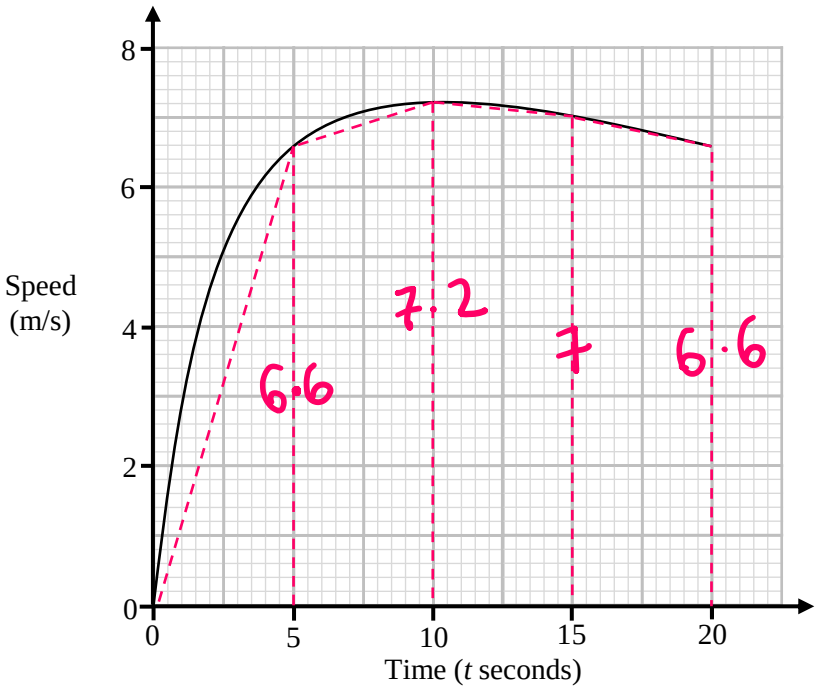
$35 + 97.5 + 142.5 + 167.5 = 442.5$

442.5 ..... m

**(3)**

**(Total for Question 7 is 5 marks)**

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




(a) The athlete finishes the race in 20 seconds.
Work out an estimate for the distance of the race.
Use 4 strips of equal width.

$\frac{1}{2} \times 6 \cdot 6 \times 5 = 16 \cdot 5$

$\frac{1}{2}(6 \cdot 6 + 7 \cdot 2) \times 5 = 34 \cdot 5$

$\frac{1}{2}(7 \cdot 2 + 7) \times 5 = 35 \cdot 5$

$\frac{1}{2}(7 + 6 \cdot 6) \times 5 = 34$

$16 \cdot 5 + 34 \cdot 5 + 35 \cdot 5 + 34$ $120 \cdot 5$ m

(4)

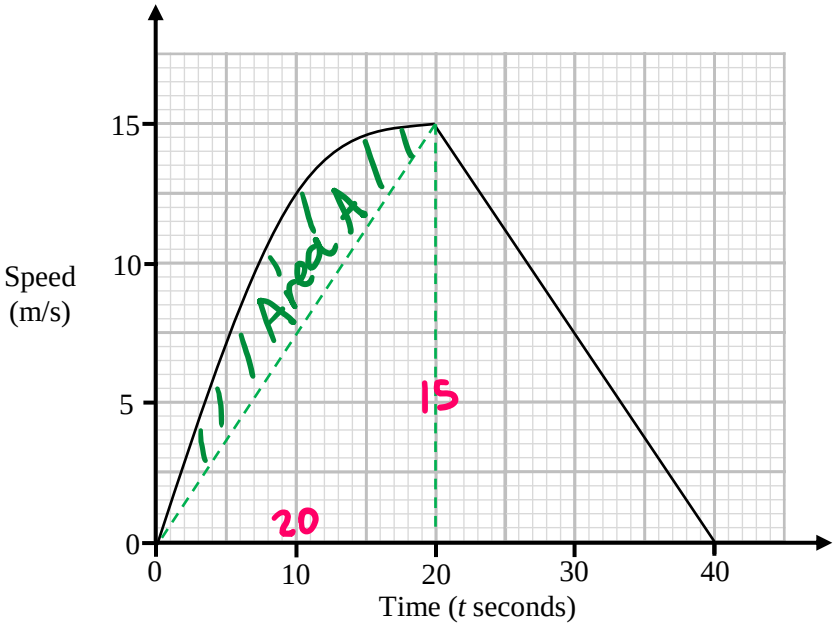
(b) Is your answer to part (a) and underestimate or an overestimate.
Give a reason for your answer.

underestimate as the area between the trapeziums/triangle and the curve would be included in the real distance

(1)

**(Total for Question 8 is 5 marks)**

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




(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.

First half = ½ × 20 × 15 + "Area A"
= 150m + "Area A"
Second half = ½ × 20 × 15
= 150m

**(2)**

(b) Work out the average acceleration for the first half of the journey.

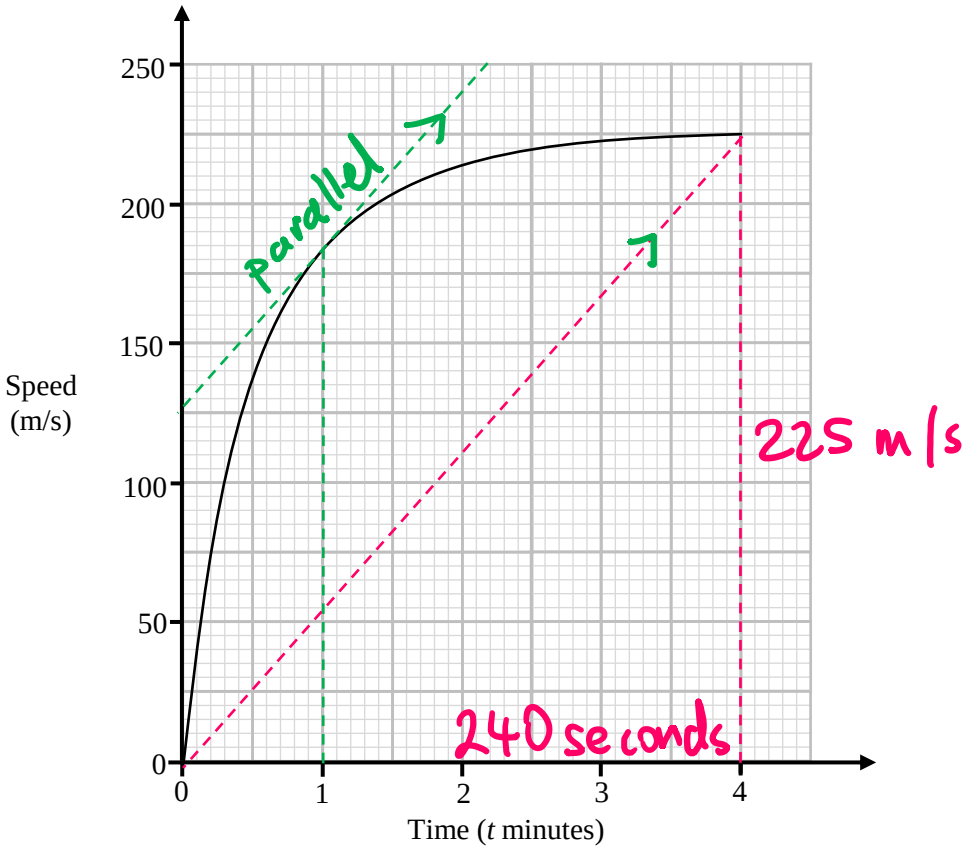
$\frac{15}{20}$

0·75 ..... m/s²

**(2)**

**(Total for Question 9 is 4 marks)**

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




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

$\frac{225}{240}$

0·9375 m/s²

(2)

(b) How many seconds into the flight was the acceleration of the aeroplane equal to the average acceleration for the first 4 minutes.

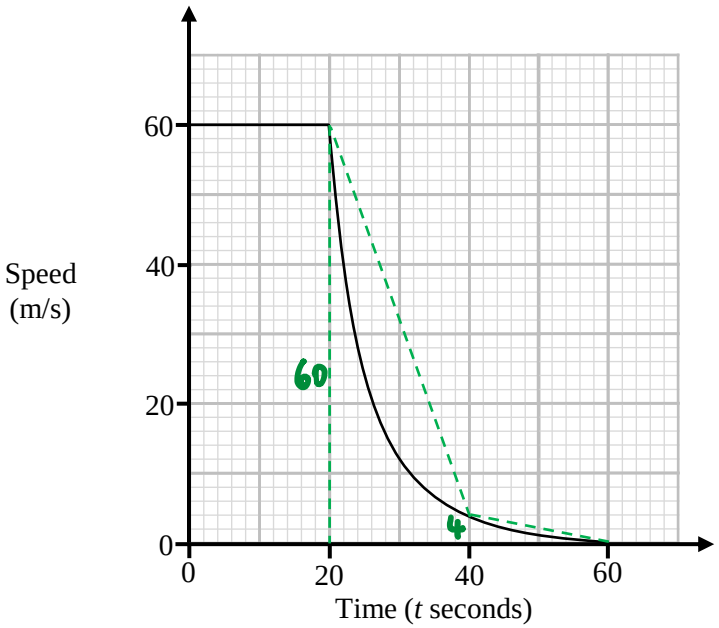
1 minute

60 seconds

(2)

**(Total for Question 10 is 4 marks)**

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




(a) Write down the acceleration of the train in the first 20 seconds.

0 m/s$^2$

**(1)**

(b) Work out an estimate for the distance the train travels between 0 and 60 seconds.

$20 \times 60 = 1200\text{m}$

$\frac{1}{2}(60+4) \times 20 = 640\text{m}$

$\frac{1}{2} \times 4 \times 20 = 40\text{m}$

$1200 + 640 + 40$

1880 m

**(3)**

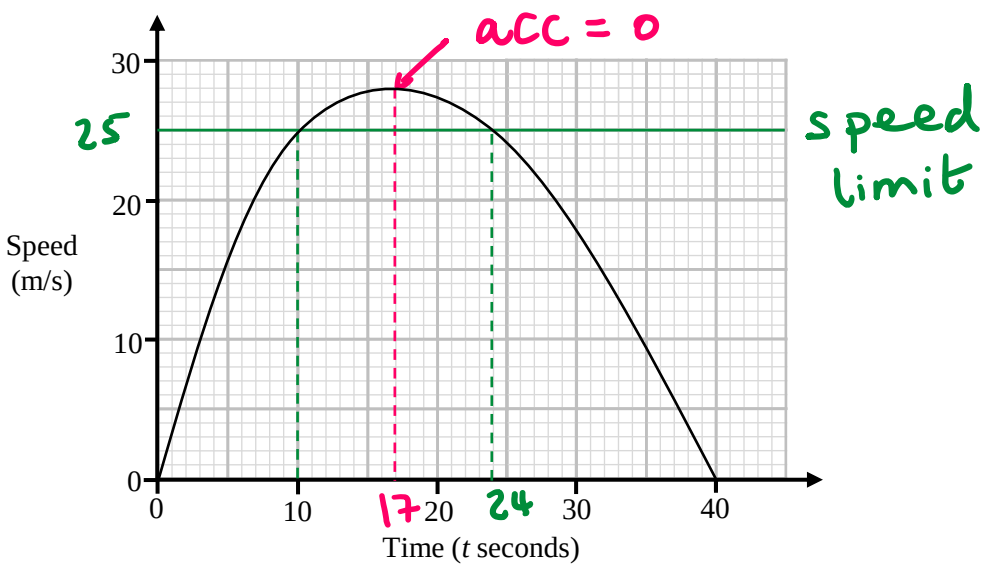
(c) Is your answer to part (b) and underestimate or an overestimate.
Give a reason for your answer.

overestimate as the trapeziums include extra area above the curve.

**(1)**

**(Total for Question 11 is 5 marks)**

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




(a) After how many second was the acceleration zero?

17 seconds

**(1)**

(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.

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

24 − 10 = 14 seconds

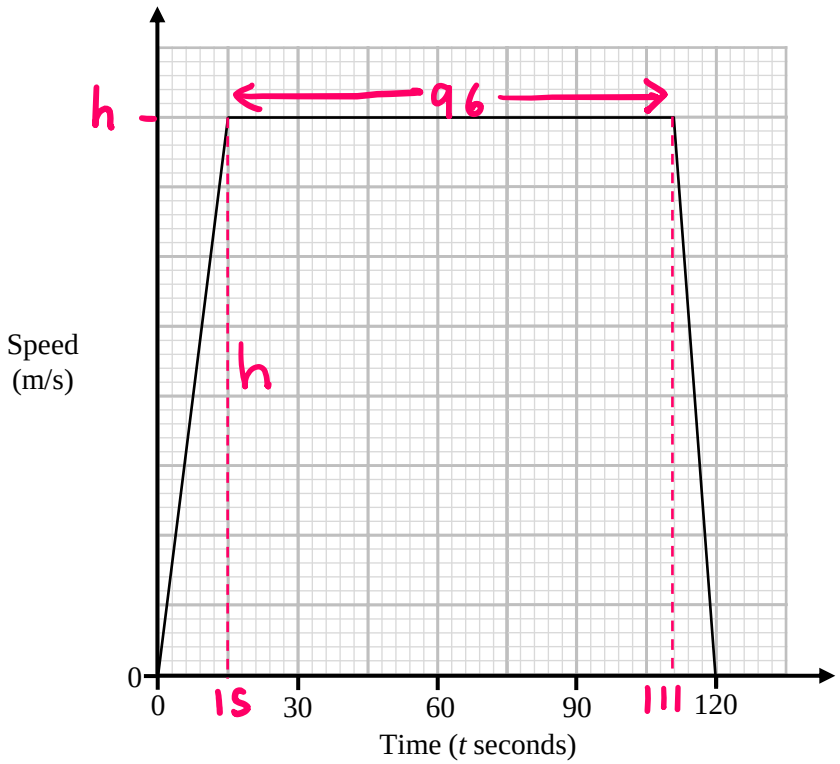
$\frac{14}{40} \times 100 = 35$

35 %

**(4)**

**(Total for Question 12 is 5 marks)**

**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.

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

$108h = 8640$

$h = 80$ m/s

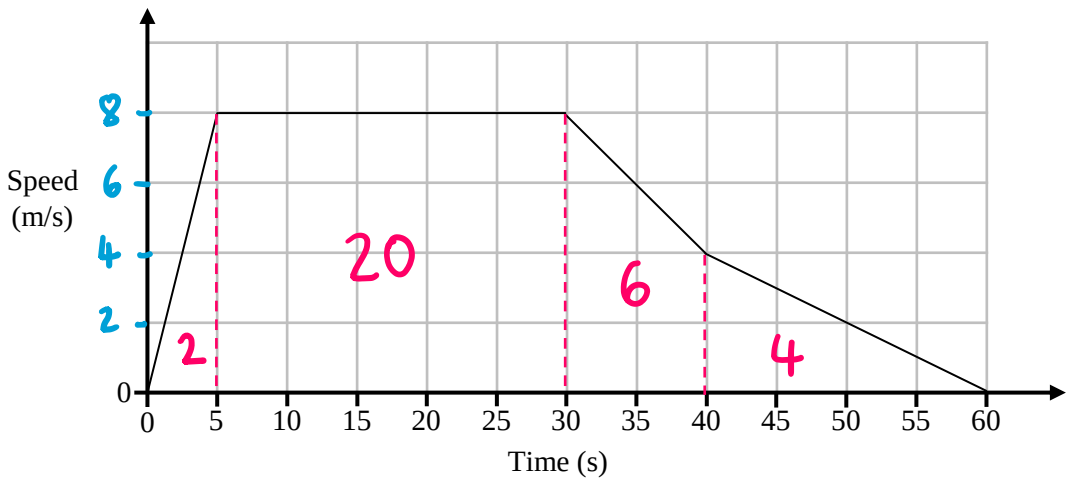
acceleration $= \frac{80}{15}$

$= 5.\dot{3}$

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

**(Total for Question 13 is 4 marks)**

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




(a) At what time is Tommy halfway between his house and the docks?

(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

22.5 ..... seconds

**(4)**

(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.

32 squares = 320m
1 square = 10m
10 ÷ 5 = 2 m/s
2 × 4 = 8 m/s

8 ..... m/s

**(3)**

**(Total for Question 14 is 7 marks)**