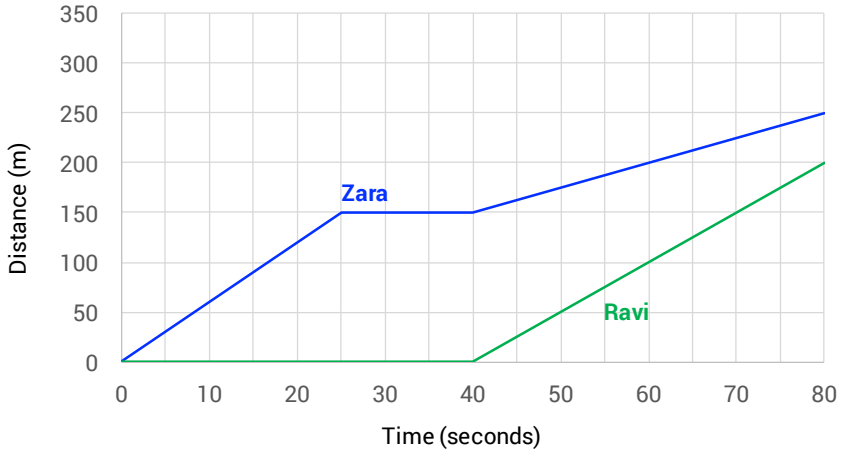
0 1

Zara is preparing for an athletics competition. She first sprints 150 m in 25 seconds, stops to do some stretches for 15 seconds, then walks a further 100 m to the finish line in a time of 40 seconds.

0 1 . 1

Using the axes below, draw a distance-time graph for her entire journey.



0 1 . 2

Calculate the speed at which she **sprints** during the above journey.

v = s ÷ t = 150 ÷ 25 = **6 m/s**

0 1 . 3

Calculate the speed at which she **walks** during the above journey.

v = s ÷ t = 100 ÷ 40 = **2.5 m/s**

0 1 . 4

Calculate her **average speed** for the entire journey journey.

v = s ÷ t = 250 ÷ 80 = **3.125 m/s**

Remember that *average* speed = *total* distance ÷ *total* time

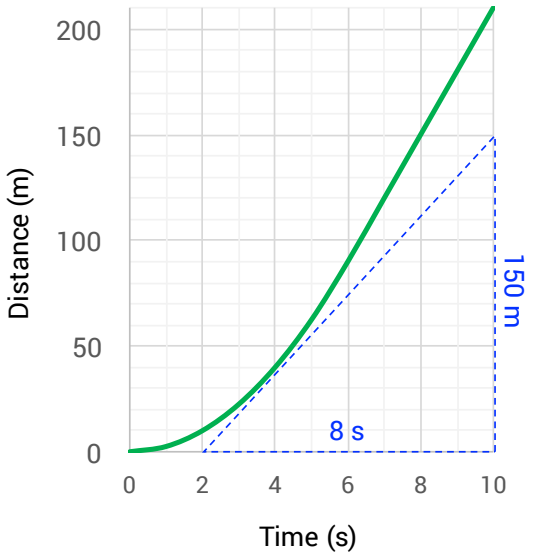
0 1 . 5

Before Zara started to sprint, she was standing beside her friend, Ravi. Ravi remains at rest for the first 40 seconds of her journey, but as soon as she starts walking towards the finish line, he tries to catch up by jogging towards her at a steady speed of 5 m/s. Sketch his distance-time graph using the above axes.

40 seconds remaining (between t = 40 and t = 80 seconds)
Distance travelled, s = v t = 5 × 40 = 200 m
(Ravi does not catch up with Zara before she reaches the finish line)

0 2

The below graph shows how the distance travelled by a car changes over the first 10 seconds of its motion.



0 2 . 1

Describe the motion of the car over the first 10 seconds of its motion.

The car starts from rest (the graph is initially flat / its gradient is zero) [1]. It then accelerates between 0 and 6 seconds (the gradient is increasing) [1] and from 6 seconds onwards it is travelling with constant speed (the gradient of the distance-time graph is constant, i.e. the car covers the same distance each second) [1].

0 2 . 2

Calculate the speed at which the car is travelling at t = 4 seconds.

Drawing of appropriate tangent at t = 4 seconds (as shown above) [1].
Correct measurement of change in distance and change in time from 'triangle' (e.g. 150 m and 8 s as shown above) [1].
Correct calculation, e.g. v = 150 ÷ 8 = **18.75 m/s**.
Allow answers in range 17.5 – 20.0 m/s.

0 2 . 3

Show that the car is travelling at 30 m/s from t = 6 seconds onwards.

Use same tangent method as previous question or direct use of values from graph, e.g. between t = 8 and t = 9 seconds, distance travelled was (180 – 150) = 30 m and time taken = 1 second, so **v = 30 m/s**.

0 2 . 4

If the car was to continue travelling at this speed, how long would it take it to cover a distance of 81 km?

v = 30 m/s and s = 81 km = 81,000 m
t = s ÷ v = 81,000 ÷ 30 = 2700 seconds
t = 45 minutes

Time = **45** minutes

Be careful here: the unit for the answer is minutes, so we have to divide our answer of 2700 seconds by 60.