Speed is called a **compound measure** because it involves a unit of length *and* a unit of time. Speed is often measured in kilometres per hour, miles per hour or metres per second.

We write 30 kilometres per hour as 30 km/h – the '/' is a sort of division sign showing that speed is distance divided by time.

If a car travels at an average speed of 40 km/h,

the car travels 40 km in 1 hour,

$40 \times 2 = 80$ km in 2 hours,

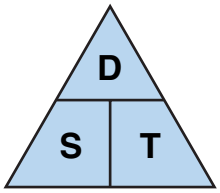
$40 \times 3 = 120$ km in 3 hours and so on.

So **distance = average speed × time**

The time the car takes to travel 120 km at 40 km/h is $\frac{120}{40} = 3$ hours.

So $\textbf{time} = \frac{\textbf{distance}}{\textbf{average speed}}$

Using D to stand for distance, S to stand for average speed and T to stand for time, this diagram shows a way to remember these results.



Just cover the thing you want to work out with your thumb. What's left shows you what do do.

$$\textbf{distance} = \textbf{speed} \times \textbf{time}$$

$$\textbf{speed} = \frac{\textbf{distance}}{\textbf{time}}$$

$$\textbf{time} = \frac{\textbf{distance}}{\textbf{speed}}$$

Example 16

The distance from London to Nottingham is 195 km. Nitesh drives from London to Nottingham in 3 hours. Work out Nitesh's average speed for this journey.

Solution 16

$\text{average speed} = \frac{195}{3} = 65$ km/h

average speed $= \frac{\text{total distance travelled}}{\text{total time taken}}$

The distance is in km and the time is in hours, so the speed is in km/h.

3 The distances in the chart are in kilometres.

Bristol	Hull	Leicester	Lincoln	London	Manchester	York
330						
187	143					
269	71	82				
183	275	156	214			
261	154	142	135	296		
349	65	169	119	312	105	

a Use the distance chart to find the distance between Hull and London.

Kim drives from Hull to London at an average speed of 50 km/h.

b Work out the time her journey takes.

4 Tim sets off from his home at 11 am and goes for a 20 km run. He arrives back at his home at 1 pm. Work out Tim's average speed.

5 How far does Stuart travel in 30 minutes if his average speed is 50 miles per hour?

6 A horse runs 12 km at an average speed of 10 km/h. How long, in hours and minutes, does this take?

7 A racing car travels at 85 m/s. Work out the distance the car travels in 0.4 seconds.

8 Change a speed of 85 m/s to km/h.

9 John drives from his home to visit a friend.
John drives the first 3 hours at an average speed of 40 km/h.

a Work out the distance he drives in the 3 hours.

John then drives the remaining 60 km to his friend's house at an average speed of 30 km/h.

b Work out the time John takes to drive the 60 km.

c Work out

i the total distance that John drives to his friend's house

ii the total time he takes to drive from his home to his friend's house.

d Work out John's average speed for his journey from his home to his friend's house.

10 In an athletics match the 100 m was won in a time of 9.91 s and the 200 m was won in a time of 19.79 s. Which race was won with the faster average speed? You must give a reason for your answer.

Use this chart to answer questions **11** and **12**.

The distances in the chart are in kilometres.

Bristol	Hull	Leicester	Lincoln	London	Manchester	York
330						
187	143					
269	71	82				
183	275	156	214			
261	154	142	135	296		
349	65	169	119	312	105	

11 One morning James drives from his home in Hull to Lincoln and then from Lincoln to York.

a **i** Find the total distance he drives.

ii How much further is this than the direct route from Hull to York?

In the afternoon James returns home by the direct route from York to Hull.
His average speed is 50 km/h in both the morning and the afternoon.

b Work out how many minutes less his afternoon journey takes than his morning journey.