

Time, Distance and Speed

The aim of today's revision session is to remind you how to calculate the time, distance or speed for a journey. First we will look at some basic calculations where the time is a whole number of hours. Next we will look at how to convert a number of minutes into a decimal fraction of an hour. Finally, we will calculate speed, distance or time using both hours and minutes e.g. a car travel at an average speed of 47mph for 3 hours 19 minutes.....

Basic Calculations

Speed	Distance	Time
A train travels 369 miles in 3 hours. Calculate its average speed.	A plane flies at 480km/h for 5 hours. How far does it travel?	A cyclist cycles at an average speed of 11 mph. How long will it take her to complete a journey of 44 miles?
$\text{Speed} = \frac{\text{Distance}}{\text{Time}} = \frac{369}{3} = 123\text{mph}$	$\begin{aligned}\text{Distance} &= \text{Speed} \times \text{Time} \\ &= 480 \times 5 \\ &= 2\,400\text{km}\end{aligned}$	$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{44}{11} = 4 \text{ hours}$

Notice that, for each calculation we have: -

- Formula
- Working
- Answer with correct units

If the speed is in mph the distance must be in miles and the time in hours.

If the speed is in metres per second the distance must be in metres and the time in seconds.

If the speed is in cm per minute the distance must be in cm and the time in minutes. (and so on.....)

Now try these examples: -

- 1) A car travels 112 miles in 2 hours. Calculate its average speed.
- 2) A motorbike travels at an average speed of 58mph for 4 hours. How far does it travel?
- 3) How long will it take a lorry to travel 300km at an average speed of 75km/h?
- 4) A bus travels at an average speed of 38 mph for 5 hours. How far does it travel?
- 5) Jo runs at an average speed of 7mph. How long will it take her to complete a 21mile run?
- 6) A balloon drifts 84km in 3 hours. Calculate its average speed.

7) A snail crawls at an average speed of 10 cm per minute. How long will it take to crawl 50cm?

8) A bullet travels at 500 metres per second. How long will it take to travel 2000m?

9) A glacier moves 120cm in 6 days. Calculate its speed in cm per day.

10) A ship sails at an average speed of 25 mph. How many days will it take to complete a voyage of 3000 miles?

Converting minutes to a decimal fraction of an hour (and vice versa)

You may remember from S1 that:-

$$15 \text{ minutes} = \frac{1}{4} \text{ hour} = 0.25 \text{ hours}$$

$$30 \text{ minutes} = \frac{1}{2} \text{ hour} = 0.5 \text{ hours}$$

$$45 \text{ minutes} = \frac{3}{4} \text{ hour} = 0.75 \text{ hours}$$

This means that: -

$$3 \text{ hours } 15 \text{ minutes} = 3.25 \text{ hours}$$

$$7 \text{ hours } 30 \text{ minutes} = 7.5 \text{ hours}$$

$$1 \text{ hour } 45 \text{ minutes} = 1.75 \text{ hours}$$

In S2 we want to be able to deal with any number of minutes so we need to learn to divide by 60: -

$$27 \text{ minutes} = \frac{27}{60} = 0.45 \text{ hours}$$

$$54 \text{ minutes} = \frac{54}{60} = 0.9 \text{ hours}$$

$$23 \text{ minutes} = \frac{23}{60} = 0.38333\text{.....hours}$$

Also: -

$$18 \text{ minutes} = \frac{18}{60} = 0.3 \text{ hours so } 7 \text{ hours } 18 \text{ minutes} = 7.3 \text{ hours}$$

$$47 \text{ minutes} = \frac{47}{60} = 0.78333\text{... so } 1 \text{ hour } 47 \text{ minutes} = 1.78333\text{...hours}$$

Now convert these times in hours and minutes to decimal fractions of hours.

If necessary round your answers to three decimal places.

1) 24 minutes

2) 57 minutes

3) 20 minutes

4) 17 minutes

5) 6 hours 12 minutes

6) 3 hours 51 minutes

7) 9 hours 21 minutes

8) 1 hour 36 minutes

9) 2 hours 19 minutes

10) 4 hours 11 minutes

11) 7 hours 52 minutes

12) 56 minutes

When calculating time it will be necessary to convert a time in decimal form back into hours and minutes.

For example:-

$$1.85 \text{ hours} = 1 \text{ hour } 51 \text{ minutes } (0.85 \times 60 = 51)$$

$$7.4 \text{ hours} = 7 \text{ hours } 24 \text{ minutes } (0.4 \times 60 = 24)$$

$$0.5678 \text{ hours} = 34 \text{ minutes } (0.5678 \times 60 = 34.068, \text{ rounded to nearest minute})$$

Now convert these decimal amounts into hours and minutes, rounding to the nearest minute if necessary.

13) 2.6 hours

14) 3.95 hours

15) 0.45 hours

16) 1.1234 hours

17) 0.3 hours

18) 1.65 hours

19) 3.9 hours

20) 0.7891 hours

21) 10.2 hours

22) 1.55 hours

23) 0.7 hours

24) 9.8765 hours

Calculating time, distance and speed

Sometimes it is necessary to convert the time to a decimal fraction before starting the calculation, for example: -

A truck travels at an average speed of 48mph for 3 hours 27 minutes. How far does it go?

$$3 \text{ hours } 27 \text{ minutes} = 3.45 \text{ hours } (27 \div 60 = 0.45)$$

$$\text{Distance} = \text{Speed} \times \text{Time} = 48 \times 3.45 = 165.6 \text{ miles}$$

At other times it is necessary to convert a time in decimal form back to hours and minutes, for example: -

How long will it take to complete a 10-mile hike walking at an average speed of 2.9mph?

$$\text{Time} = \frac{\text{Distance}}{\text{Speed}} = \frac{10}{2.9} = 3.44827 \dots \text{ hours}$$

$$3.44827 \dots \text{ hours} = 3 \text{ hours and } 27 \text{ minutes } (0.44827 \dots \times 60 = 26.896 \dots, \text{ rounded to nearest minute})$$

Now try these questions: -

1) A bin lorry travels 2 miles in 42 minutes. Calculate its average speed.

Remember to round your answer to one decimal place.

2) A jogger runs at an average speed of 9km/h for 1 hour 12 minutes. How far does she run?

3) A bird flies at an average speed of 16mph. How long will it take to fly 20 miles?

Give your answer in hours and minutes.

4) A tram travels at an average speed of 20km/h for 3 hours and 48 minutes. How far has it gone?

5) How long will it take a cyclist to cover 50 miles at an average speed of 15mph?

Give your answer in hours and minutes.

6) A machine drills a 5m of tunnel in 9 minutes. Calculate the speed of the machine in metres per hour.

7) Ian leaves home at 10:00am. He travels 70 miles at an average speed of 55mph.

What time does he arrive at this destination?

8) Jen runs at 8mph for 2 hours and 12 minutes. Joe cycles at 12 mph for 1 hours 42 minutes.

Who covered the greater distance, and by how many miles?

9) A car travels 15 miles in 12 minutes. The speed limit is 70mph. Did the car break the speed limit?

10) Kerry is due to attend a meeting at 3:00pm. She leaves her house at 2:00pm and travels 62 miles at an average speed of 54mph. By how many minutes does she miss the start of the meeting?

11) Why this question more difficult than those above?

How long does it take a car to travel 67 miles at 70km/h?

