SPEED CALCULATIONS

Students often have trouble calculating speed,
distance and time, says **Colin Foster**

**In this lesson, students learn how to work out any one of speed,
distance or time, when the other two quantities are given.**

*A scooter travels at a steady speed of 5 km per hour.
How far will it go in 15 minutes?
How long will it take to travel 2 km?*

*Another scooter travels 10 km in 1 hour and 20 minutes.
How fast is it going, on average?*

Students may be unsure how to answer these questions,
or give incorrect answers from 'playing around' with the
numbers, such as $\frac{15}{5}$ = 3 km, or 2 × 5 = 10 minutes, or
10 × 1.2 = 12 km/h.

THE SOLUTION

The key idea for all of these questions is that speed
is a **multiplier** that converts time into distance:
distance = **speed** × time. Speed is how much distance
we get for each unit of time.

It can be helpful to treat this
multiplicative relationship as the basis
for everything, because you can get
either speed or time from this equation
in just one step, without needing to
use 'formula triangles'. If you instead
begin with speed defined as a
quotient, then rearranging to
obtain time will require *two* steps.
Beginning with
distance written
as a product may
therefore be
easier.

We can use this relationship to work out anything we
want. We just need to make sure that the units match.
The questions we started with contained both hours
and minutes, so we'll need to work in just one of those
units – say hours.

To find out how far the scooter will go in 15 minutes, we
have to think of 15 minutes as $\frac{1}{4}$ of an hour. We can work
out that it's $\frac{1}{4}$ by writing $\frac{15}{60} = \frac{1}{4}$, because there are 60
minutes in an hour. The distance travelled will therefore
be 5 × $\frac{1}{4}$ = 1.25 km. Encourage students to always
sensecheck their answers; the answer should be far less
than 5 km, because 15 minutes is much less than an
hour.

To find out how long it will take for the scooter to travel
2 km, we need to **divide by the multiplier** (speed),
because we're using the relationship in the **inverse**
direction. We work out $\frac{2}{5}$ = 0.4 hours. To convert hours
into minutes, we multiply by 60, so we obtain 24
minutes. Again, sense checking, this is a bit less than half
an hour, because 2 km is a bit less than half of 5 km.

To find out the sooter's average speed, this time we
need to divide both sides of the equation by **time**.
We turn 1 hour 20 minutes into $1\frac{1}{3}$ hours – not 1.2 hours,
which would be 1 hour 12 minutes! We then work out
10 ÷ $1\frac{1}{3}$ = 7.5 km/h. (Students may need assistance in
inputting this correctly into the calculator, or doing the
fraction division by hand.)

Checking for understanding
*Make up 6 questions involving speed, distance and time
(two requiring each of the three quantities). Make them
about as difficult as the ones we've looked at today.*

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