8 Numbers and calculations

A Decimals and fractions

A manufacturer is thinking about giving both **metric** measurements (for example, millimetres) and **imperial** measurements (for example, inches) in its product specifications. One of the company's engineers is giving his opinion on the idea in a meeting.

'One problem is, when you convert from metric to imperial you no longer have **whole numbers** – you get long **decimal numbers**. For example, one millimetre is **nought point nought three nine three seven** inches as a **decimal**. So to be manageable, decimals have to be **rounded up** or **down**. You'd probably round up that number **to two decimal places**, to give you **zero point zero four**. Now, you might say the difference is **negligible** – it's so small it's not going to affect anything. But even if it's just a tiny **fraction** of a unit – **one hundredth of** an inch (1/100), or **one thousandth of** an inch (1/1000) – and those numbers are then used in calculations, the **rounding error** can very quickly add up to give bigger inaccuracies.'

Note: See Appendix III on page 100 for a list of metric and imperial units.

1 mm = 0.03937 inches ≈ 0.04 inches

B Addition, subtraction, multiplication and division

During a TV programme about garden design, the presenter is explaining the calculations required to make a large setsquare which can be used for setting out.

To make one of these, you need to use Pythagoras's Theorem. So, a quick geometry lesson. Measure a length of timber for one of the sides adjacent to the right-angle. I've made this 3 feet long. Then **square** that number – 3 **multiplied by** 3 **equals** 9. Then do the same with the other side adjacent to the right-angle. I've made this one 4 feet long. Work out **the square of** that. So, 4 **times** 4 is 16. Then work out **the sum of** those two numbers – so if I **add** 16 to 9 ... 16 **plus** 9 is 25. Then, calculate **the square root of** that. The square root of 25 is 5. That means the longest side – the hypotenuse – needs to be 5 feet long. And it doesn't matter what length you make the two adjacent sides – if the square of the hypotenuse is **equal to** the square of each of the adjacent sides, **added together**, you'll have a perfect right-angle.

A large setsquare for setting out

Now you can also start by making the hypotenuse, square the length of that, then make one of the other sides, square the length of that, and then **subtract** one **from** the other. For this example, that would be 25 **minus** 16. So, 25 **less** 16 is 9. And the square root of 9 is 3, which gives me the remaining side. Alternatively, you can make both the adjacent sides **equal** – make them the same length. So, take the square of the hypotenuse, which is 25, **divide** that **by** 2, which is 12.5, then work out the square root of 12.5, which ... requires a calculator! That's why it's easiest to use a 3-4-5 triangle, like this, which conveniently works with whole numbers. And that's also why I'm measuring **in imperial**, because 3 feet by 4 feet by 5 feet is a practical size to work with.

8.1 Write the numbers in words. Look at A opposite to help you.

1 1.793   _one_   _point_   _seven_   _nine_   _three_

2 1/100 mm   _one_   _hundred_   _of_   _A_   millimetre

3 1/1000 mm   _zero_   _thousands_   _of_   _A_   millimetre

4 0   .... or _nought_

8.2 Complete the descriptions of the numbers using words from A opposite.

1 0.25 = ¼   The first number is a decimal, and the second is a _fraction_ .

2 0.6368 ≈ 0.637   The second number is _rounded_ _up_ to three _decimal_ _places_ .

3 7.5278 ≈ 7.5   The second number is _rounded_ _down_ to one _decimal_ _place_ .

4 8, 26, 154   The numbers aren't fractions or decimals. They're _whole_ numbers.

5 Error: 0.00001%   The error is so small that it's _negligible_ .

6 0.586 kg × 9,000 = 5,274 kg
0.59 kg × 9,000 = 5,310 kg   This difference is the result of a _rounding_ _error_ .

8.3 Complete the calculations using the words in the box. Sometimes there is more than one possible answer. Look at B opposite to help you.

divided	minus	plus	square root	subtract	times
less	multiplied	square	squared	sum	

1 14 + 8 = 22   Fourteen _plus_ eight equals twenty-two.

2 100 × 20 = 2,000   One hundred _times_ twenty is two thousand.

3 7 × 11 = 77   Seven _multiplied_ by eleven equals seventy-seven.

4 400 ÷ 8 = 50   Four hundred _devided_ by eight equals fifty.

5 95 + 2 = 97   The _sum_ of ninety-five and two is ninety-seven.

6 8² = 64   The _square_ of eight is sixty-four.

7 50 − 30 = 20   If you _subtract_ thirty from fifty, it equals twenty.

8 √100 = 10   The _square root_ of a hundred is ten.

9 11² = 121   Eleven _squared_ is a hundred and twenty-one.

10 48 − 12 = 36   Forty-eight _equal_ twelve equals thirty-six.

8.4 Use your knowledge of basic geometry to complete the sentences. Use one or two words from B opposite to fill each gap.

1 The _sum_ of the three angles in a triangle equals 180 degrees.

2 The area of a circle is equal to the _square_ of its radius _multiplied by_ 3.14.

3 The area of a right-angle triangle is equal to the length of one adjacent side, _times_ the length of the other adjacent side, _divided by_ two.

4 The length of each side of a square is equal to the _square root_ of the square's area.

5 If each angle in a triangle is 60°, then the lengths of its sides are _equal_ .

> ## Over to you
> Write down a few examples of some calculations you did recently, or ones that you do frequently, and then explain them.