

Check-Up

27

Division with decimals

Do not use a calculator.

- a) In the GCSE music examination one year, 0.008 of the candidates were ungraded and 0.992 of the candidates achieved a grade. How many times more candidates achieved a grade than did not achieve a grade?
- b) A sheet of A4 paper has an area of 0.0625 square metres. A sheet of A1 paper has an area of 0.5 square metres. Calculate $0.5 \div 0.0625$ to find how many sheets of A4 can be cut from a sheet of A1.
- c) For an illustration on a worksheet, a teacher wants to reduce a picture so that its height goes from 0.2 metres to 0.09 metres. Evaluate $0.09 \div 0.2$ to find the scale factor to which the photocopier must be set for this reduction.

Answers to check-up 27

- a) 124.
- b) $0.5 \div 0.0625 = 8$, so 8 sheets of A4 can be cut from a sheet of A1.
- c) 0.45.

Discussion and explanation of check-up 27

The most useful principle when dividing numbers involving decimals is that you do not change the answer to a division calculation if you multiply both numbers by the same thing. This is because you keep the ratio between the numbers the same. So you can get rid of the decimals in the question altogether, just by multiplying both numbers by 10, 100 or 1000, and so on. For example, for (a) we have to calculate $0.992 \div 0.008$. Multiply both numbers by 1000: $0.992 \div 0.008 = 992 \div 8 = 124$. That's the answer, as simple as that! Notice that if the data in this question had been presented in percentages (0.8% and 99.2%), the calculation would have started as $99.2 \div 0.8$ and multiplication by 10 would have produced the same result, $992 \div 8$.

For (b), with the second number ending in the digit 5, I guess that the question will get easier if I double both numbers ... and, as it happens, if I go on doubling, this particular question gets easier and easier: $0.5 \div 0.0625 = 1 \div 0.125 = 2 \div 0.25 = 4 \div 0.5 = 8 \div 1 = 8$. So, a sheet of A1 is 8 times the area of a sheet of A4. The reason why you can actually cut 8 sheets of A4 from A1 is that the lengths and widths of the two paper sizes are also in the same proportion. This is true of all the A sizes, of course, with A0 having an area of 1 square metre, A1 being half of that, A2 half of that, and so on.

For (c), the scale factor required for the reduction (which must be less than 1) is $0.09 \div 0.2$. Multiplying both numbers by 100 gets rid of the decimals and produces the equivalent calculation, $9 \div 20$. To work this out, start with $9 \div 2$ (= 4.5) and then divide this by 10 to get $9 \div 20$ (= 0.45). The photocopier will probably display the scale factor as a percentage, i.e. 45% for 0.45.

Notice that when you divide by a larger number (20, rather than 2) you get a smaller answer. So, for example, the answer to $30 \div 0.6$ will be 10 times *larger* than the answer to $30 \div 6$. Check out these sequences, both starting with $30 \div 6$, but one getting larger and the other smaller:

$30 \div 6 = 5 \rightarrow 30 \div 0.6 = 50 \rightarrow 30 \div 0.06 = 500 \rightarrow 30 \div 0.006 = 5000$, and so on.

$30 \div 6 = 5 \rightarrow 30 \div 60 = 0.5 \rightarrow 30 \div 600 = 0.05 \rightarrow 30 \div 6000 = 0.005$, and so on.

Summary of key ideas

- ◆ A division involving decimals (e.g. $0.68 \div 0.002$) can always be changed to an equivalent division with just whole numbers, by multiplying both numbers by 10 or by 100 or by 1000, and so on (e.g. $0.68 \div 0.002 = 680 \div 2$, multiplying both numbers by 1000).
- ◆ You can sometimes simplify the division by multiplying (or dividing) by other numbers (e.g. simplify $2.1 \div 0.35$, by doubling both numbers to give $4.2 \div 0.7$).
- ◆ If the divisor gets larger by a factor of 10, then the answer gets smaller by a factor of 10, and *vice versa* (e.g. $24 \div 4 = 6$, $24 \div 40 = 0.6$, $24 \div 0.4 = 60$).

Further practice

Do not use a calculator.

27.1 A teacher wants to enlarge a picture so that its width increases from 0.09 metres to 0.126 metres. Find the scale factor to which the photocopier must be set.

27.2 Which of the following gives the same result as $0.25 \div 85$?

- a) $0.5 \div 170$ b) $2.5 \div 8.5$ c) $25 \div 8500$ d) $0.025 \div 8.5$

27.3 Given that $34 \div 17 = 2$, write down the values of:

- a) $3.4 \div 1.7$ b) $34 \div 170$ c) $34 \div 0.17$ d) $0.034 \div 17$