Scientific notation is sometimes referred to as *standard form*, *standard index form*, *floating point notation*, or *powers of ten notation*.

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Powers in general, including those that are not whole numbers, are discussed elsewhere in *FLAP*. See the *Glossary* for details.

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The *reciprocal* of a quantity a is the quantity $1/a = a^{-1}$.

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Throughout *FLAP* we have used the convention of writing long strings of digits in blocks of three. Thus ten million is written 10 000 000. Some authors like to insert commas into the gaps as in 10,000,000 but we will not do so.

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Calculators are not all identical, so the precise combination of key strokes that you need to use may differ slightly from those given here.

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‘EE’ or ‘EXP’ stands for ‘exponent’, an alternative word for ‘power’.

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Although *modulus* has been introduced in the context of scientific notation the idea is used widely and will be encountered in many different settings.

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Inequalities are more fully discussed elsewhere in *FLAP*. See the *Glossary* for details.

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With experience you will probably find the following is a better interpretation ‘the modulus of r is less than 10 but greater than or equal to 1’. It is $|r|$ which can vary, not ‘one’.

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The three dots, technically known as an *ellipsis*, indicate that the number continues in the same way. If the length l was known to be 6.00 mm it would still be correct to write $l = 6.0$ mm, though to do so would be to deliberately ignore valid information about l. This may sometimes be desirable, but not usually.

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The term *precision* is used here in its everyday sense. However, you should be aware that it also has a technical meaning; see the *Glossary* for details.

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You can extend this discussion to cover division by finding the *ratio* of the sides of the rectangle using the same ranges of values for l and b.

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Note that rounding may have a knock-on effect on more than one digit, for example if an answer displayed as 4.98 has only two significant figures it must be written 5.0 as a consequence of adding 1 to the 9.

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Notice that in estimating the order of magnitude of an expression you should *not* substitute order of magnitude approximations to each term. Doing so can easily produce an answer that is wrong by several orders of magnitude.

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For a discussion of numbers that are *not* real, you will need to turn to the *FLAP* modules dealing with the *complex numbers* that belong to the set $\mathbb{C}$.

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Notice that we are not saying that measurable quantities *must* be expressed in terms of real numbers, only that they can be.

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The irrational number e is discussed more fully in the *FLAP* modules that deal with *exponential functions* and *logarithms*.

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These seven basic units have been agreed by convention — others could have been chosen.

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The abbreviation nm stands for nanometre. It arises from the combination of the prefix *nano* (Table 3) and the basic unit *metre* (Table 2). 1 nm = 10^{-9} m.

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This convention will be used throughout *FLAP*.

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This equation was used earlier, in Question T13.

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The main points contained in this subsection are repeated in the physics strand of *FLAP*.

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$[q]$ should be read as ‘the dimensions of q.’

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You can confirm the dimensions of force by examining the definition of the newton in Table 4.

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Note that even if both sides of an equation have the same dimensions it does not follow that the equation is correct, only that the equation is *plausible* in dimensional terms.

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Note that the *italic* letter *T* represents a physical quantity while the *roman* letter T stands for the dimension of time.

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If $p + q = 0$ and $-2q = 1$, $T = L^0 \times T^1$ as consistency requires.

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✧

Your calculator should have displayed 10^7
or 1.00 E 7, 1 07, 1^7 or 1^{07}
(or something similar). ❑

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✧

The display should have read 3.00 E 7,
3 07, 3^7 or 3^{07}. ❑

✧

$3^7 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 2\,187$,
which is clearly *not* the same as
3×10^7. ❑

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✧

The numbers in the display should look exactly the same as in the previous exercises. ❑

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✧

You have entered 10×10^7, i.e. 10^8. The mistake probably arises because a natural response to seeing the 10 written down as part of 10^7 is to key in the figure 10. ❑

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✧

The first method should produce 3.00 E − 7 (or similar) but the second will probably give − 4 (which may be displayed as − 4 EE 00). ❑

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✧

‘One is less than or equal to the modulus of r, and the modulus of r is less than ten.’ ❑

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✧

(a) $A = 20.602\,5\,\mathrm{m}^2$,
(b) $A = 21.562\,5\,\mathrm{m}^2$. ❑

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✧

If we write the numbers in scientific notation and collect together the powers of ten, then

$$y = \frac{2\pi \times 3.21 \times 8.64 \times 10^5 \times 10^2}{2.04 \times 7.7 \times 10^2 \times 10^1}$$

If we work to two significant figures,

$$y \approx \frac{2 \times 3.1 \times 3.2 \times 8.6 \times 10^4}{2.0 \times 7.7}$$

The crudity of the approximation in the following steps is a matter of taste. Personally, as a crude calculator, I would be happy to say that the 2s cancel, that 3.1×3.2 is about 10 and that 8.6/7.7 is about 1.1, ☞
so $y \approx 1.1 \times 10^5$ and, as an order of magnitude estimate, $y \sim 10^5$. ❑

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✧

λ (nm) could be interpreted as meaning $\lambda \times$ nm. So if, say, $\lambda = 567$ nm, then $\lambda\,(\text{nm}) = 567\,\text{nm}\,\text{nm} = 567\,\text{nm}^2$, which implies λ is an area rather than a length and is therefore clearly nonsense. This style of labelling used to be widely used but is now strongly disfavoured. ❑

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