# Exact Numbers

- Some numbers do not have any uncertainty. In other words, they weren't measured!

    1) Numbers that were determined by COUNTING!
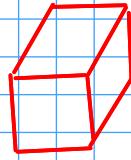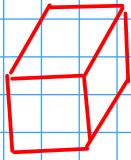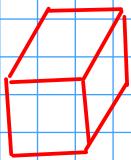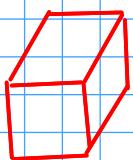
How many blocks are to the left?

exactly 4

    2) Numbers that arise from DEFINITIONS, often involving relationships between units

$$12 \text{ in} = 1 \text{ ft}$$

$$Km = 10^3 m$$

*All metric prefixes are exact!

- Treat exact numbers as if they have INFINITE significant figures!

Example

You'll need to round the answer to the right number of significant figures!
Convert 4.45 m to in, assuming that 2.54 cm = 1 in

$$cm = 10^{-2} m \qquad 1 in = 2.54 cm$$

$$4.45 m \times \frac{cm}{10^{-2} m} \times \frac{1 in}{2.54 cm} = 175.196850 in$$

3 sf $\qquad$ ∞ sF $\qquad$ ∞ sF

(an inch is defined as 2.54 cm)

Report $\boxed{175 in}$

Scientific Notation

-a way to represent large and small numbers

-a way to indicate significant figures

Form:

$$a.aaa.... \times 10^{a}$$

(always ONE digit before the decimal)

$$3.6 \times 10^{4}$$

means

$$3.6 \times 10 \times 10 \times 10 \times 10$$

OR

36000

$$6.21 \times 10^{-3}$$

means

$$6.21 \times \frac{1}{10} \times \frac{1}{10} \times \frac{1}{10}$$

OR

0.00621

Scientific notation removes the need for placeholder zeros, and that's good when you're dealing with very large and very small numbers!

$$4.70 \times 10^{-6} = 0.00000470$$

Scientific notation indicates significant figures without extra decimal points or lines. All numbers in front of the power of ten are significant!

$$3700 = 3.70 \times 10^{3}$$

To write a number in scientific notation, move the decimal point so that it is behind the first nonzero number. The power of ten will be the number of places you moved the decimal. If the number is less than 1, the power of ten is negative. If it's greater than one, the power of ten is positive.

$$0.00765$$
$$7.65 \times 10^{-3}$$

$$14\,000$$
$$1.400 \times 10^{4}$$

6.38×10^5

6.38 000000000 | 000000 0004.20

638000 | 0.00000420

Using scientific notation on a calculator:

6.38×10^5

on a TI-83:

enter

6.38 [EE] 5

calculator displays:

6.38 E5 — this E means
"x10 raised to"

4.20×10^{-6}

enter:

4.20 [EE] [(-)] 6

calculator displays:

4.2 E⁻6 — means
"x10⁻⁶"