

**Numbers smaller than 1****Example:** Convert  $7.12 \times 10^{-4}$  to an ordinary number.

Method 1:  $7.12 \times 10^{-4} = 0.0007.12 = 0.000712$

$-4 \Rightarrow$  shift the decimal point 4 places to the **left**.

Method 2: Use your calculator: enter 7.12  -4 =  $\rightarrow$  0.000712

Means 'x 10 to the power'. (Do **not** enter the x sign.)

Convert these to ordinary numbers.

1  $9.4 \times 10^2 =$

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2  $1.42 \times 10^5 =$

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3  $2.69 \times 10^3 =$

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4  $6.111 \times 10^6 =$

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5  $8.0 \times 10^0 =$

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6  $4.5 \times 10^{-2} =$

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7  $9.467 \times 10^{-1} =$

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8  $3.7 \times 10^{-5} =$

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9  $6.2 \times 10^{-3} =$

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10  $1.83 \times 10^{-8} =$

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**Ordinary numbers  $\rightarrow$  standard form****Numbers bigger than 1****Example:** Convert 634 000 to standard form.

Step 1: Shift the decimal point to the **left** until there is exactly **one** non-zero digit on its left:

$6.34000 \rightarrow 6.34$

(This will give you a number between 1 and 10)

Step 2: Multiply by 10 to the power of however many places the decimal point was moved (5):

$6.34 \times 10^5$

**Numbers smaller than 1**

**Example:** Convert 0.00068 to standard form.

Step 1: Shift the decimal point to the **right** until there is exactly **one** non-zero digit on its left:

$$0 \ 0 \ 0 \ 0 \ 6 \ . \ 8 \ \longrightarrow \ 6.8$$

(This will give you a number between 1 and 10)

Step 2: Multiply by 10 to the **negative** power of however many places the decimal point was moved (-4):  $6.8 \times 10^{-4}$

**Check** your answers by reversing the process.

**Beware:** To be in standard form, a number **must** be in the format  $a.b \times 10^{\text{something}}$

For instance: 7.4 in standard form is  $7.4 \times 10^0$   
5 in standard form is  $5.0 \times 10^0$

Convert these to standard form.

1 543 =

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2 1200 =

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3 74.2 =

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4 1.689 =

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5 7 673 000 =

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6 80 050 =

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7 366 600 000 =

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8 1 =

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9 0.51 =

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10 0.00067 =

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11 0.014 =

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12 0.000007 =

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13 0.0001 =

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14 0.00832 =

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15 0.001101 =

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16 0.0000000004 =

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## Calculations using standard form

Use your calculator to find the following answers. Write all answers in standard form.

1  $17(1.9 \times 10^5) =$

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2  $(1.2 \times 10^7) \div 4.9 =$

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3  $(3.8 \times 10^2) \times (2.995 \times 10^6) =$

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4  $(1.3 \times 10^3)^2 \times (1.8 \times 10^7) =$

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5  $(5.3 \times 10^{-4}) \div 6 =$

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6  $(4.8 \times 10^8) \div (1.6 \times 10^2) =$

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7  $7.4 \times 10^{-3} \div 500 =$

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8  $(9.7 \times 10^8) + (1.0 \times 10^6) =$

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9  $1000 - (1.45 \times 10^2) =$

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10  $4.3 \times 10^{-5} \div 1.8 \times 10^{-2} =$

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- 11 A ream of paper consists of 500 sheets, and is 52 mm high. Calculate the thickness of one sheet of paper.

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- 12 About  $5 \times 10^8$  tweets are sent per day. 77% of these are from outside the USA. How many tweets come from inside the USA per day?

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- 13 The mass of a dust particle is about  $7.53 \times 10^{-7}$  g. About how many dust particles are there in the 50 g of dust that I emptied from my vacuum cleaner?

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- 14 There are about  $2.5 \times 10^{22}$  molecules in one cubic centimetre of air. Each time you breathe, you take in about  $5 \times 10^2$  cubic centimetres of air. About how many molecules do you take in with each breath?

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- 15 Light travels one metre in about  $3 \times 10^{-9}$  seconds. How long would it take for light to travel the 493 km from Auckland to Wellington?

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- 16 A handful of soil contains about  $1.0 \times 10^6$  yeasts,  $2 \times 10^5$  moulds and  $1 \times 10^4$  protozoans. About how many yeasts, moulds and protozoans is that in total? (Note: As well as those there are about  $1.0 \times 10^{10}$  bacteria!)

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17 Saturn is about  $1.4 \times 10^{12}$  m from earth. The distance that light can move in a year is known as a light year, and it is about  $9.5 \times 10^{15}$  m. Calculate how many light years Saturn is from earth.

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18 One googol =  $1 \times 10^{100}$ . How many millions are there in one googol?

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19 There are about  $1 \times 10^6$  ants per person on earth. If the population of New Zealand is currently  $4.575 \times 10^6$ , estimate the number of ants in New Zealand.

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20 1 mL of liquid can hold  $5 \times 10^8$  bacteria. How many bacteria could there be in a 200 mL glass of liquid?

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21 Your body produces  $2.5 \times 10^7$  new cells per second. How many new cells could your body have produced in the last hour?

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22 Your ribs move about  $5 \times 10^6$  times per year. Estimate the number of times your ribs have moved in the last 24 hours.

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23 In January 2015, the world population was  $7.28 \times 10^9$  people. New Zealand's population was  $4.5 \times 10^6$  people. Calculate the percentage of the world's population that lives in New Zealand.

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24 The total width of an average plant cell is  $5 \times 10^{-2}$  mm. Its cell walls are  $2 \times 10^{-4}$  mm thick. Calculate the distance between the internal surfaces of the walls.

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25 The mass of one bacterium is  $9.5 \times 10^{-13}$  g. The mass of one red blood cell is  $2.7 \times 10^{-11}$  g. How many bacteria would weigh the same as one red blood cell?

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