

# MATHEMATICS

## SUPPORT CENTRE

### Title: Standard Form

Target: On completion of this worksheet you should be able to write a number in standard form and be able to calculate with numbers written in standard form.

Standard form is used when numbers are very large or very small.

$$\begin{aligned} 30000 &= 3 \times 10000 \\ &= 3 \times 10^4 \end{aligned}$$

This is now written in standard form.

There are 2 parts: a number between 1 and 10 (not including 10), **3**, and 10 to a power,  **$10^4$** . These are then multiplied together.

If a number is less than 1 then we can still write it in standard form.

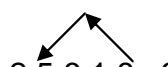
$$\begin{aligned} 0.4 &= \frac{4}{10} \\ &= 4 \times 10^{-1} \end{aligned}$$

The decimal point has moved **1** place to the right and the power of 10 is **-1**

#### Examples

1.  $700 = 7 \times 10^2$
2.  $45000 = 4.5 \times 10^4$
3.  $6031.2 = 6.0312 \times 10^3$

Note that the power of 10 is always the number of places you must move the decimal point so that the first part of the number only has **one** digit before the decimal point.

 2 5 6 1 8 . 3 The decimal point must move **4** places to the left so

$$25618.3 = 2.56183 \times 10^4$$

#### Examples

1.  $0.25 = 2.5 \times 10^{-1}$
2.  $0.00317 = 3.17 \times 10^{-3}$
3.  $0.000007 = 7 \times 10^{-6}$
4.  $0.000102 = 1.02 \times 10^{-4}$

#### Exercise

Write the following in standard form:

- |                |               |
|----------------|---------------|
| 1. 0.6         | 2. 0.0052     |
| 3. 0.000082    | 4. 0.0004108  |
| 5. 0.000000243 | 6. 0.000009   |
| 7. 0.0000608   | 8. 0.03082    |
| 9. 0.0004      | 10. 0.0000148 |

(Answers:  $6 \times 10^{-1}$ ,  $5.2 \times 10^{-3}$ ,  $8.2 \times 10^{-5}$ ,  $4.108 \times 10^{-4}$ ,  $2.43 \times 10^{-7}$ ,  $9 \times 10^{-6}$ ,  $6.08 \times 10^{-5}$ ,  $3.082 \times 10^{-2}$ ,  $4 \times 10^{-4}$ ,  $1.48 \times 10^{-5}$ )

#### Exercise

Write the following in standard form:

- |            |              |
|------------|--------------|
| 1. 6000    | 2. 430       |
| 3. 40300   | 4. 32.38     |
| 5. 7023.5  | 6. 482000000 |
| 7. 9300000 | 8. 7102      |
| 9. 300000  | 10. 103.2    |

(Answers:  $6 \times 10^3$ ,  $4.3 \times 10^2$ ,  $4.03 \times 10^4$ ,  $4.82 \times 10^8$ ,  $9.3 \times 10^6$ ,  $7.102 \times 10^3$ ,  $3 \times 10^5$ ,  $1.032 \times 10^2$ )

To convert a number in standard form back to an ordinary number move the decimal point the number of places given by the power of 10. If the power is positive we are multiplying so the point moves to the right. If it is negative we are dividing so the point moves to the left.

### Examples

1.  $6 \times 10^4 = 60000$  (decimal point moves 4 places right)
2.  $3.7 \times 10^3 = 3700$  (decimal point moves 3 places right)
3.  $2.91 \times 10^{-2} = 0.0291$  (decimal point moves 2 places left)
4.  $7.02 \times 10^{-3} = 0.00702$  (decimal point moves 3 places left)

### Exercise

Change the following numbers from standard form:

- |                        |                           |
|------------------------|---------------------------|
| 1. $5.3 \times 10^4$   | 2. $3.9 \times 10^{-2}$   |
| 3. $2.08 \times 10$    | 4. $6 \times 10^{-4}$     |
| 5. $3.1 \times 10^6$   | 6. $7.123 \times 10^{-3}$ |
| 7. $1.931 \times 10^2$ | 8. $4.7 \times 10^{-1}$   |

(Answers: 53000, 0.039, 20.8, 0.0006, 3100000, 0.007123, 193.1, 0.47)

To enter a number in standard form into your calculator use the button marked

**EXP**

This enters the  $\times 10$  for you.

To enter  $3.6 \times 10^5$  press  
3.6 **EXP** 5

The display shows  $3.6^{05}$  although on some calculators the ' $\times 10$ ' is also shown.

### Examples

1.  $(2.3 \times 10^7) \times (6.4 \times 10^9)$   
The buttons to press are:  
 $2.3 \text{ EXP } 7 \times 6.4 \text{ EXP } 9 =$   
The display shows  $1.472^{17}$   
The answer is  $1.472 \times 10^{17}$

**Remember:** Do not copy the answer down as it appears. The  $\times 10$  must be inserted before the power.

### Exercise

Calculate the following giving your answers in standard form and to 3 significant figures:

1.  $(4.8 \times 10^5) \times (1.3 \times 10^4)$
2.  $(8.21 \times 10^{-4}) \times (3.3 \times 10^7)$
3.  $(2.3 \times 10^9) \times (6.1 \times 10^{-10})$
4.  $(9.1 \times 10^{-3}) \div (4.02 \times 10^{-7})$
5.  $(6.2 \times 10^{11}) \div (5.5 \times 10^2)$
6.  $(1.8 \times 10^{-6}) + (4.12 \times 10^{-3})$
7.  $(8.3 \times 10^9) - (7.5 \times 10^8)$
8.  $(7.2 \times 10^4) \div (4.2 \times 10^6)$
9.  $(3.45 \times 10^{12}) \times (6.27 \times 10^{11})$
10.  $(6.1 \times 10^3) + (2.3 \times 10^2) \times (2 \times 10^2)$

(Answers:  $6.24 \times 10^9$ ,  $2.71 \times 10^4$ , 1.40,  $2.26 \times 10^4$ ,  $1.13 \times 10^9$ ,  $4.18 \times 10^{-3}$ ,  $7.55 \times 10^9$ ,  $1.71 \times 10^{-2}$ ,  $2.16 \times 10^{24}$ ,  $5.21 \times 10^4$ )