

## Converting to and from Standard Form

### Starter

1. (Review of last lesson)

Find the value of: (a)  $7^{-2}$  (b)  $\left(3\frac{2}{5}\right)^{-2}$

**Working:** (a)  $7^{-2} = \frac{1}{7^2} = \frac{1}{49}$

(b)  $\left(3\frac{2}{5}\right)^{-2} = \left(\frac{17}{5}\right)^{-2} = \left(\frac{5}{17}\right)^2 = \frac{5^2}{17^2} = \frac{25}{289}$

2. (Review of last lesson) Simplify: (a)  $y^{17} \div \frac{1}{y^3}$  (b)  $p^{-5} \times \frac{1}{p^{-11}}$

**Working:** (a)  $y^{17} \div \frac{1}{y^3} = y^{17} \div y^{-3} = y^{17-(-3)} = y^{20}$

(b)  $p^{-5} \times \frac{1}{p^{-11}} = p^{-5} \times p^{11} = p^{-5+11} = p^6$

3. (Review of previous material)

Write down the value of: (a)  $10^3$  (b)  $10^{-2}$

**Working:** (a)  $10^3 = 1000$

(b)  $10^{-2} = \frac{1}{100}$

4. (Review of previous material)

Express these numbers as a power of 10: (a) 1000000 (b) 0.001

**Working:** (a)  $1000000 = 10^6$

(b)  $0.001 = 10^{-3}$

**E.g. 1** Decide whether the following are written in standard form. For those that are not, give a reason for your answer.

(a)  $7956 \times 10^2$  (b)  $6.4 \times 10^5$  (c)  $4 \times 10^{-8.5}$  (d)  $0.05 \times 10^6$

**Working:**

(a)	$7956 \times 10^2$	Incorrect because 7956 is not greater than or equal to 1 and less than 10.
(b)	$6.4 \times 10^5$	Correct
(c)	$4 \times 10^{-8.5}$	Incorrect because the power must be an integer.
(d)	$0.05 \times 10^6$	Incorrect because 0.05 is not greater than or equal to 1 and less than 10.

**E.g. 2** Write these standard form numbers as ordinary numbers:

(a)  $8 \times 10^5$  (b)  $6 \times 10^3$  (c)  $5.9 \times 10^3$  (d)  $4.21 \times 10^6$

**Working:**

(a)	$8 \times 10^5 = 8 \times 100000 = 800000$
(b)	$6 \times 10^3 = 6 \times 1000 = 6000$
(c)	$5.9 \times 10^3 = 5.9 \times 1000 = 5900$
(d)	$4.21 \times 10^6 = 4.21 \times 1000000 = 4210000$

**E.g. 3** Write these standard form numbers as ordinary numbers:

(a)  $7 \times 10^{-5}$  (b)  $2 \times 10^{-4}$  (c)  $2.3 \times 10^{-4}$  (d)  $1.80 \times 10^{-6}$

**Working:**

(a)	$7 \times 10^{-5} = 7 \times \frac{1}{100000} = \frac{7}{100000} = 0.00007$
(b)	$2 \times 10^{-4} = 2 \times \frac{1}{10000} = \frac{2}{10000} = 0.0002$
(c)	$2.3 \times 10^{-4} = 2.3 \times \frac{1}{10000} = \frac{2.3}{10000} = 0.00023$
(d)	$1.80 \times 10^{-6} = 1.80 \times \frac{1}{1000000} = \frac{1.80}{1000000} = 0.0000018$

**E.g. 4** Change these ordinary numbers to standard form:

- (a) 900                      (b) 40000                      (c) 45000                      (d) 10600000

**Remember:**  $A \times 10^n$  where  $1 \leq A < 10$  and  $n$  is an integer.

- Working:**
- (a)  $900 = 9 \times 100 = 9 \times 10^2$
- (b)  $40000 = 4 \times 10000 = 4 \times 10^4$
- (c)  $45000 = 4.5 \times 10000 = 4.5 \times 10^4$
- (d)  $10600000 = 1.06 \times 10000000 = 1.06 \times 10^7$

**E.g. 5** Rewrite these decimals in standard form:

- (a) 0.00006                      (b) 0.008                      (c) 0.0087                      (d) 0.000713

**Remember:**  $A \times 10^n$  where  $1 \leq A < 10$  and  $n$  is an integer.

- Working:**
- (a)  $0.00006 = 6 \div 100000 = 7.83 \div 10^5 = 7.83 \times 10^{-5}$
- (b)  $0.008 = 8 \div 1000 = 8 \div 10^3 = 8 \times 10^{-3}$
- (c)  $0.0087 = 8.7 \div 1000 = 8.7 \div 10^3 = 8.7 \times 10^{-3}$
- (d)  $0.000713 = 7.13 \div 10000 = 7.13 \div 10^4 = 7.213 \times 10^{-4}$

**E.g. 6** Rewrite these numbers in standard form.

- (a)  $572 \times 10^{18}$                       (b)  $0.0061 \times 10^{-4}$   
(c)  $8923 \times 10^{11}$                       (d)  $0.000001324 \times 10^{-7}$

- Working:**
- (a)  $572 \times 10^{18} = 5.72 \times 100 \times 10^{18}$   
 $= 5.72 \times 10^2 \times 10^{18}$   
 $= 5.72 \times 10^{2+18}$   
 $= 5.72 \times 10^{20}$
- (b)  $0.0061 \times 10^{-4} = 6.1 \div 1000 \times 10^{-4}$   
 $= 6.1 \div 10^3 \times 10^{-4}$   
 $= 6.1 \times 10^{-3} \times 10^{-4}$   
 $= 6.1 \times 10^{-3+-4}$   
 $= 6.1 \times 10^{-7}$
- (c)  $8923 \times 10^{11} = 8.923 \times 1000 \times 10^{11}$   
 $= 8.923 \times 10^3 \times 10^{11}$   
 $= 8.923 \times 10^{3+11}$   
 $= 8.923 \times 10^{14}$
- (d)  $0.000001324 \times 10^{-7} = 1.324 \div 1000000 \times 10^{-7}$   
 $= 1.324 \div 10^6 \times 10^{-7}$   
 $= 1.324 \times 10^{-6} \times 10^{-7}$   
 $= 1.324 \times 10^{-6+-7}$   
 $= 1.324 \times 10^{-13}$

**E.g. 7\*** If the number  $8.36 \times 10^{11}$  is written out in full, how many zeros follow the 6?

**Working:**  $8 \times 10^{11}$  would be followed by 11 zeros.  
So  $8.36 \times 10^{11}$  is followed by 9 zeros.

**Video:** [Standard form](#)

[Solutions to Starter and E.g.s](#)

**Exercise**

9-1 class textbook:	p129 M5.3 Qu 1ace..., 2ace..., 3-9, 10ace, 11ace, 12ace
A*-G class textbook:	p121 M5.3 Qu 1ace..., 2ace..., 3-9, 10ace, 11ace, 12ace
9-1 homework book:	p45 M5.3 Qu 1-6
A*-G homework book:	p33 M5.3 Qu 1-6