GCSE Maths – Number

Standard Form

Worksheet

WORKED SOLUTIONS

This worksheet will show you how to work out different types of standard form questions. Each section contains a worked example, a question with hints and then questions for you to work through on your own.

Section A

Worked Example

Write 8200 in standard form

Step 1: Work out the base number. The value A in $\boldsymbol{A \times 10^n}$ is the base number.

The base number must be less than 10*, but larger than or equal to* 1*. It is a number that gives the answer when multiplied by* 10^n *for some integer* n*. Here, the base number is* 8.2*.*

Step 2: Work out n, the power of 10 which multiplies with the base number to give the original number.

We now need to work out what we multiply 8.2 *by to get* 8200*. By division:*

$$8200 \div 8.2 = 1000$$

Then, calculate what power of 10 *gives* 1000*.* $10^3 = 1000$*, so* $n = 3$*.*

Step 3: Write the answer in standard form.

$$8200 = \boldsymbol{8.2 \times 10^3}$$

Guided Example

Write 675000 in standard form

Step 1: Work out the base number. The value A in $\boldsymbol{A \times 10^n}$ is the base number.

base number must be less than 10

$6.75 \times 10^n = 675000$

Step 2: Work out n, the power of 10 which multiplies with the base number to give the original number.

Divide 675000 by the base number, 6.75

$675000 \div 6.75 = 100000$ $\quad$ $100000 = 10^5$

Step 3: Write the answer in standard form.

$675000 = 6.75 \times 10^5$

Now it's your turn!

If you get stuck, look back at the worked and guided examples.

1. Write the following numbers in standard form.

a) 3200000

base < 10, so 3.2

6 zeros, so $1000000 = 10^6$

$3200000 \div 3.2 = 1000000$

3.2×10^6

b) 75

base < 10, so 7.5

$75 \div 7.5 = 10$

1 zero so 10^1

7.5×10^1

c) 10.57

base < 10, so 1.057

$10.57 \div 1.057 = 10$

1 zero, so 10^1

1.057×10^1

d) 0.014

base ≥ 1, so 1.4

$0.014 \div 1.4 = 0.01$

2 zeros, but as it is a decimal, the power is negative $= 10^{-2}$

1.4×10^{-2}

e) 0.001002

base ≥ 1, so 1.002

$0.001002 \div 1.002 = 0.001$

3 zeros and a decimal, so a negative power $= 10^{-3}$

1.002×10^{-3}

f) 934.001

base < 10, so 9.34001

$934.001 \div 9.34001 = 100$

2 zeros, so 10^2

9.34001×10^2

g) 100

base < 10, so 1

$100 \div 1 = 100$

2 zeros, so 10^2

1×10^2

h) 0.5532

base ≥ 1, so 5.532

$0.5532 \div 5.532 = 0.1$

1 zero, but it is also a decimal, so the power is negative $= 10^{-1}$

5.532×10^{-1}

Section B

Worked Example

What number is 5.67×10^{-2}?

Step 1: Work out what number the second part, 10^n, is.

$$10^{-2} = \frac{1}{100} = 0.01$$

Step 2: Multiply the base number by the factor of 10 we have just calculated.

$$5.67 \times 0.01 = \mathbf{0.0567}$$

Guided Example

What number is 6.1×10^4?

Step 1: Work out what number the second part, 10^n, is.

$10^4 = 10 \times 10 \times 10 \times 10$

$= 10000$

Step 2: Multiply the base number by the factor of 10 we have just calculated.

$6.1 \times 10000 = 61000$

Now it's your turn!

If you get stuck, look back at the worked and guided examples.

2. Convert these numbers from standard form to ordinary numbers.

a) 4.9×10^3

$10^3 = 10 \times 10 \times 10 = 1000$ ← 3 zeros

$4.9 \times 1000 = 4900$

both have 3 units

4900

b) 1.02×10^6

$10^6 = 1000000$

6 zeros

$1.02 \times 1000000 = 1020000$

6

1020000

c) 7.5×10^{-3}

$10^{-3} = \frac{1}{10 \times 10 \times 10} = \frac{1}{1000} = 0.001$

3 zeros

$7.5 \times 0.001 = 0.0075$

0.0075

d) 6.6×10^{-5}

$10^{-5} = \frac{1}{100000} = 0.00001$

5 zeros

$6.6 \times 0.00001 = 0.000066$

0.000066

Section C

Worked Example

Work out $(6.7 \times 10^3) + (3 \times 10^2)$. Write the final answer in standard form.

Step 1: Convert both parts to ordinary numbers.

$$10^3 = 1000$$
$$6.7 \times 1000 = \mathbf{6700}$$

$$10^2 = 100$$
$$3 \times 100 = \mathbf{300}$$

Step 2: Perform the operation on the ordinary numbers.

$$6700 + 300 = \mathbf{7000}$$

Step 3: Convert the result into standard form.

The base number will be 7.

$$7000 \div 7 = 1000$$
$$1000 = 10^3$$

$$7000 = \mathbf{7} \times \mathbf{10^3}$$

Guided Example

Work out $(4.7 \times 10^5) - (7.1 \times 10^4)$. Write the final answer in standard form.

Step 1: Convert both parts to ordinary numbers.

$10^5 = 100000$
$4.7 \times 100000 = 470000$

$10^4 = 10000$
$7.1 \times 10000 = 71000$

Step 2: Perform the operation on the ordinary numbers.

$470000 - 71000 = 399000$

Step 3: Convert the result into standard form.

399000
base < 10, so 3.99

5 zeros, so 10^5

$399000 \div 3.99 = 100000$

3.99×10^5

Now it's your turn!

If you get stuck, look back at the worked and guided examples.

3. Calculate the following problems, writing the final answer in standard form.

a) $(1.2 \times 10^3) + (5.4 \times 10^2)$

$10^3 = 1000$

$1.2 \times 1000 = 1200$

$10^2 = 100$

$5.4 \times 100 = 540$

$1200 + 540 = 1740$

base < 10, so 1.74

$1740 \div 1.74 = 1000$

3 zeros, so 10^3

1.74×10^3

b) $(9.6 \times 10^3) - (7.5 \times 10^3)$

$10^3 = 1000$

$9.6 \times 1000 = 9600$

$10^3 = 1000$

$7.5 \times 1000 = 7500$

$9600 - 7500 = 2100$

base < 10, so 2.1

$2100 \div 2.1 = 1000$

3 zeros, so 10^3

2.1×10^3

c) $(2.3 \times 10^{-3}) + (6.6 \times 10^{-3})$

$10^{-3} = \frac{1}{1000} = 0.001$

$2.3 \times 0.001 = 0.0023$

$10^{-3} = 0.001$

$6.6 \times 0.001 = 0.0066$

$0.0023 + 0.0066 = 0.0089$

base ≥ 1, so 8.9

$0.0089 \div 8.9 = 0.001$

3 zeros, but also a decimal so negative power = 10^{-3}

8.9×10^{-3}

d) $(4.5 \times 10^{-1}) - (3.9 \times 10^{-2})$

$10^{-1} = \frac{1}{10} = 0.1$

$4.5 \times 0.1 = 0.45$

$10^{-2} = \frac{1}{100} = 0.01$

$3.9 \times 0.01 = 0.039$

$0.45 - 0.039 = 0.411$

base ≥ 1, so 4.11

$0.411 \div 4.11 = 0.1$

1 zero, and a decimal so negative power = 10^{-1}

4.11×10^{-1}

Section D

Worked Example

Work out $(2 \times 10^3) \times (3 \times 10^2)$. Write the final answer in standard form.

Step 1: Perform the operation on the base numbers.

$$2 \times 3 = \mathbf{6}$$

Step 2: Perform the operation on the index 10^n parts.

If we are multiplying two of the same number (10 in this case) with powers, we simply add the powers!

$$10^3 \times 10^2 = 10^{3+2} = \mathbf{10^5}$$

Step 3: Write the final answer in standard form.

$$(2 \times 10^3) \times (3 \times 10^2) = \mathbf{6 \times 10^5}$$

Guided Example

Work out $(8 \times 10^7) \div (4 \times 10^4)$. Write the final answer in standard form.

Step 1: Perform the operation on the base numbers.

$8 \div 4 = 2$

Step 2: Perform the operation on the index 10^n parts.

$10^7 \div 10^4 = 10^{7-4}$

$= 10^3$

TIP!

$x^a \div x^b = x^{a-b}$

$x^a \times x^b = x^{a+b}$

Step 3: Write the final answer in standard form.

2×10^3

Now it's your turn!

If you get stuck, look back at the worked and guided examples.

4. Calculate the following problems, writing the final answer in standard form.

a) $(5 \times 10^3) \times (7 \times 10^4)$

$5 \times 7 = 35$

$10^3 \times 10^4 = 10^{3+4}$

$= 10^7$

35×10^7

as $35 > 10$, this is not standard form

base = 3.5

$35 \div 3.5 = 10 \leftarrow 10^1$

$10^1 \times 10^7 = 10^{7+1}$

$= 10^8$

3.5×10^8

b) $(9 \times 10^9) \div (3 \times 10^6)$

$9 \div 3 = 3$

$10^9 \div 10^6 = 10^{9-6}$

$= 10^3$

3×10^3

c) $(4 \times 10^{-1}) \times (2 \times 10^2)$

$4 \times 2 = 8$

$10^{-1} \times 10^2 = 10^{-1+2}$

$= 10^1$

8×10^1

d) $(7.2 \times 10^6) \div (3.6 \times 10^{-4})$

$7.2 \div 3.6 \equiv 72 \div 36 = 2$

(×10 ×10)

$10^6 \div 10^{-4} = 10^{6--4}$

$= 10^{6+4}$

$= 10^{10}$

2×10^{10}