

Powers of 10

Year 8 About 60 minutes No calculator 48 marks



Hints online, answers free with an account:
mathswariz.uk/worksheets/ks3-year-8-powers-of-10/

Date _____

A Do Now

Quick questions to start.

- A1** Needed today [1 mark] **A2** Needed today [1 mark]
 Work out 0.47×1000 . Work out $36 \div 10\,000$.

Answer

Answer

- A3** Last lesson [1 mark] **A4** From chapter 7 [1 mark]
 Factorise $x^2 - 81$. Work out $\frac{3}{4} - \frac{2}{5}$.

Answer

Answer

B Example, then your turn

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Your teacher works through each example with you. Then try the one beside it.

EXAMPLE 1

Work out

- (a) 0.0384×10^4
 (b) $52.6 \div 10^3$.

Hint Multiplying by 10^4 moves every digit 4 places to the left. Dividing by 10^3 moves every digit 3 places to the right.

- B1** Work out [2 marks]

- (a) 0.6125×10^3
 (b) $7.9 \div 10^4$.

Answer (a) (b)

EXAMPLE 2

Work out

- (a) 4.6×10^{-2}
 (b) 0.38×10^{-3}
 (c) $7.5 \div 10^{-2}$.

Hint $10^{-2} = 0.01$, so multiplying by 10^{-2} is the same as dividing by 100. Dividing by 10^{-2} undoes that: it is the same as multiplying by 100.

- B2** Work out [3 marks]

- (a) 83.2×10^{-1}
 (b) 0.57×10^{-4}
 (c) $0.042 \div 10^{-3}$.

Answer (a) (b) (c)

EXAMPLE 3

1 micrometre = 10^{-6} metres and 1 gigawatt = 10^9 watts.

(a) Write 0.000045 metres in micrometres.

(b) Write 3.2 gigawatts in watts.

Hint To change metres into micrometres, divide by 10^{-6} : that is the same as multiplying by 1 000 000.

B3 1 nanosecond = 10^{-9} seconds [2 marks]
and 1 megabyte = 10^6 bytes.

(a) Write 0.00000008 seconds in nanoseconds.

(b) Write 2.7 megabytes in bytes.

Answer (a) ns (b) bytes

EXAMPLE 4

1 kilometre = 10^3 metres and 1 micrometre = 10^{-6} metres. How many micrometres are there in 1 kilometre? Give your answer as a power of 10.

Hint Divide the size of the big unit by the size of the small unit. When you divide powers of 10, subtract the indices.

B4 1 centimetre = 10^{-2} metres [2 marks]
and 1 nanometre = 10^{-9} metres. How many nanometres are there in 1 centimetre? Give your answer as a power of 10.

Answer $10^{\dots}$

EXAMPLE 5

An island has an area of 2600 km². It has a population of 120 000 people.

(a) Work out the average land area for each person, in km². Give your answer correct to 2 significant figures.

(b) 1 km² = 10^6 m². Write the area for each person in m², correct to 2 significant figures.

Hint Area for each person = total area ÷ number of people. Round only at the end.

B5 A country has an area of 5100 km². It has a population of 900 000 people. [4 marks]

(a) Work out the average land area for each person, in km². Give your answer correct to 2 significant figures.

(b) 1 km² = 10^6 m². Write the area for each person in m², correct to 2 significant figures.

Answer (a) km² (b) m²

C Practice

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- C1** Find the missing power. [2 marks]
- (a) $0.27 \times 10^{\square} = 2700$
- (b) $615 \times 10^{\square} = 0.615$

Answer (a) (b)

- C3** Write each number as a decimal. [2 marks]
- (a) 10^{-5}
- (b) 2.06×10^{-3}

Answer (a) (b)

- C5** Two of these calculations give 0.064. The other two give 640. Sort them into the two pairs. [2 marks]
- P: 6.4×10^{-2} Q: $6.4 \div 10^2$
- R: $6.4 \div 10^{-2}$ S: 6.4×100

Answer

- C2** Work out [2 marks]
- (a) 46.8×0.01
- (b) 5.3×0.001

Answer (a) (b)

- C4** Write these numbers in order of size. Start with the smallest. [2 marks]
- 0.4×10^{-1} , 35×10^{-3} ,
 0.0038×10 , 3.6×10^{-2}

Answer

D Exam-style questions

GCSE Foundation

- D1** Answer each part.
- (a) Write down the value of 10^0 . [1 mark]

Answer

- (b) Work out 0.703×10^3 . [1 mark]

Answer

- (c) Work out 18×10^{-2} . [1 mark]

Answer

Total for D1: 3 marks

- D2** Ben says, "To work out 0.62×10^{-3} you move the decimal point 3 places to the right, so the answer is 620." [2 marks]

Explain why Ben is wrong. Work out the correct answer.

- D3** A grain of pollen is 2.5×10^{-5} metres wide.
- (a) Write 2.5×10^{-5} as an ordinary number. [1 mark]

Answer

- (b) Grains of pollen are laid in a straight line, touching. The line is 1 cm long. Work out how many grains of pollen are in the line. [2 marks]

Answer

- (c) 1 micrometre = 10^{-6} metres. Write the width of one grain in micrometres. [1 mark]

Answer

Total for D3: 4 marks

- D4** Island P has a population of 3.6×10^5 and an area of 1.2×10^3 km².
Island Q has a population of 84 000 and an area of 400 km².
- (a) Work out the average number of people for each km² on island P. [2 marks]

Answer

- (b) Work out the average number of people for each km² on island Q. [1 mark]

Answer

- (c) Which island is more crowded? Give a reason for your answer. [1 mark]

Answer

- (d) $1 \text{ km}^2 = 10^6 \text{ m}^2$. Work out the average land area for each person on island Q, in m^2 . Give your answer correct to 2 significant figures. [2 marks]

Answer

Total for D4: 6 marks

- D5** A memory card holds 64 gigabytes. A photo uses 4 megabytes. [3 marks]
 $1 \text{ gigabyte} = 10^9 \text{ bytes}$ and $1 \text{ megabyte} = 10^6 \text{ bytes}$.
Work out the number of photos that the memory card can hold. You must show your working.

Answer

E Extension

Stretch

No route is given. The hints are at the end of the sheet. Use one at a time.

- E1** Light travels 3×10^8 metres in one second. A computer chip carries out one [3 marks]
step every 0.4 nanoseconds ($1 \text{ nanosecond} = 10^{-9} \text{ seconds}$). Work out how far
light travels during one step. Give your answer in centimetres.

Answer

Extension hints

Cover these with paper. Uncover one at a time.

- E1** **Hint 1** Write the time for one step in seconds, then use
distance = speed $\times$ time.
Hint 2 $0.4 \text{ nanoseconds} = 0.4 \times 10^{-9} = 4 \times 10^{-10} \text{ seconds}$.
Hint 3 $3 \times 10^8 \times 4 \times 10^{-10} = 12 \times 10^{-2} = 0.12 \text{ m}$, and $0.12 \text{ m} = 12 \text{ cm}$.

How did it go?

Colour one circle on each line: not yet, nearly, yes.

I can multiply and divide by positive and negative powers of 10. ☐ ☐ ☐

I can change units that use prefixes such as micro, nano, mega and giga. ☐ ☐ ☐

I can work out an amount for each person and round it to 2 significant figures. ☐ ☐ ☐