



eClassroom

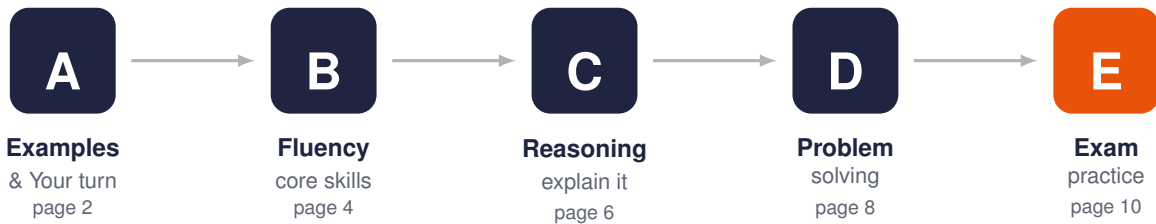
GCSE MATHEMATICS • NUMBER

Order of Operations

Worksheet

Pearson Edexcel GCSE (1MA1) & International GCSE (4MA1) • Calculator only where shown

Free Order of Operations worksheet for GCSE and iGCSE Maths, with full worked solutions



Tap a section to jump straight to it

By the end of this worksheet you can: use the correct order of operations (BIDMAS) • work with brackets, powers, roots, negatives and fraction bars • insert brackets to make a statement true • use a calculator accurately • *Higher:* evaluate formulae with two answers, work backwards through squares, and reason about structure.

Which questions are for me?

FOUNDATION Everyone starts here. These skills appear on both tiers.

HIGHER The same skills where Higher papers use them: formulae with two answers, working backwards through powers, and proving how a calculation behaves.

Every section has both, clearly labelled. Questions get harder as you go, and every skill in Sections A to D is needed in Section E.

Track your progress

Section	B	C	D	E
Foundation marks	37	14	18	22
Higher marks	8	10	15	13
My score				

Full worked solutions

Number revision engine

Free courses

Formula sheet builder

Name

Class

Date



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

A

Worked examples & Your turn

Read each example carefully. Cover it up, then answer the question beside it using the same method.

FOUNDATION

Everyone starts here

Worked example A1

Work out $(8 - 3)^2 + 12 \div 4$

Brackets first, then the power.

$$(8 - 3)^2 = 5^2 = 25$$

Division next, then addition.

$$12 \div 4 = 3 \quad 25 + 3 = 28$$

28

Your turn A1

Work out $(2 + 4)^2 - 18 \div 3$

Worked example A2: inserting brackets

Write brackets in this statement to make it correct.
You may use more than one pair.

$$4 + 2 \times 6 - 1 = 30$$

Without brackets the answer is $4 + 12 - 1 = 15$. We need something bigger, so make the addition and the subtraction happen first.

$$(4 + 2) \times (6 - 1) = 6 \times 5 = 30$$

$$(4 + 2) \times (6 - 1) = 30$$

Your turn A2

Write brackets in this statement to make it correct.
You may use more than one pair.

$$3 + 5 \times 4 - 2 = 16$$

Worked example A3: fraction bars and roots

Work out $\frac{6^2 - 4 \times 5}{\sqrt{49} + 1}$

A fraction bar acts like brackets. Work out the top and the bottom separately, then divide.

$$\text{Top: } 36 - 20 = 16 \quad \text{Bottom: } 7 + 1 = 8$$

$$16 \div 8 = 2$$

2

Your turn A3

Work out $\frac{5^2 + 3 \times 5}{\sqrt{64} - 3}$



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk

Worked example A4: negative numbers and powersWork out $(-3)^2 - 4 \times (-2)$ *The power applies to everything in the bracket.*

$$(-3)^2 = (-3) \times (-3) = 9$$

Multiply before subtracting. Take care with the signs.

$$4 \times (-2) = -8 \quad 9 - (-8) = 17$$

17

Your turn A4Work out $(-4)^2 - 3 \times (-5)$ **HIGHER***Higher strategies: these are new ways of thinking, not longer sums***Worked example A5: a formula with two answers**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Find both values of x when $a = 1$, $b = -2$ and $c = -8$ *Work out the part under the root first. It is a hidden bracket.*

$$b^2 - 4ac = (-2)^2 - 4 \times 1 \times (-8) = 4 + 32 = 36$$

Use + and then -.

$$x = \frac{2+6}{2} = 4 \quad \text{or} \quad x = \frac{2-6}{2} = -2$$

 $x = 4 \text{ or } x = -2$ **Your turn A5**

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Find both values of x when $a = 2$, $b = 3$ and $c = -5$ **Worked example A6: working backwards through a square**

$$\text{Solve } \frac{(x+3)^2}{2} - 1 = 17$$

Undo the operations in reverse order.

$$\frac{(x+3)^2}{2} = 18 \quad \text{so} \quad (x+3)^2 = 36$$

A square root has two answers.

$$x+3 = 6 \quad \text{or} \quad x+3 = -6$$

 $x = 3 \text{ or } x = -9$ **Your turn A6**

$$\text{Solve } 3(x-2)^2 + 4 = 79$$



B**Fluency**

Each question is a designed sequence. From one part to the next, ask yourself: what changed, and what did it do to the answer?

FOUNDATION*Everyone starts here***B1** Work out

(a) $6 + 4 \times 2$

(b) $(6 + 4) \times 2$

(c) $6 \times 4 + 2$

(d) $6 \times (4 + 2)$

[4 marks]**B2** Work out

(a) $20 - 12 \div 4$

(b) $(20 - 12) \div 4$

(c) $20 \div 4 - 12$

(d) $20 - 12 \div 4 \times 2$

[4 marks]**B3** Work out

(a) $3^2 + 4$

(b) 2×5^2

(c) $(2 \times 5)^2$

(d) $4 + 3 \times 2^3$

[4 marks]**B4** Work out

(a) $\sqrt{25} + 3 \times 2$

(b) $\sqrt{9 + 16}$

(c) $10 - \sqrt{36} \div 2$

(d) $2 \times \sqrt{100 - 36}$

[4 marks]**B5** Work out

(a) $20 - 8 + 5$

(b) $36 \div 6 \times 2$

(c) $50 - 20 - 10 + 5$

(d) $48 \div 4 \div 2 \times 3$

[4 marks]

FOUNDATION*continued: negatives, fraction bars, brackets and the calculator***B6** Work out

(a) -3^2

(b) $(-3)^2$

(c) $-2 \times (-5)^2$

(d) $(-2)^3 - (-4)^2$

[4 marks]**B7** Work out

(a) $\frac{8+10}{2 \times 3}$

(b) $\frac{4^2+4}{7-2}$

(c) $6 + \frac{12}{1+2}$

(d) $\frac{5+\sqrt{81}}{2^3-1}$

[4 marks]**B8** Write brackets in each statement to make it correct. You may use more than one pair.

(a) $5 \times 2 + 4 = 30$

(b) $12 - 4 \times 2 + 1 = 17$

(c) $2 + 6 \times 3 + 1 = 32$

[3 marks]**B9** (*calculator*) Work out each calculation. Write down all the figures on your calculator display.

(a) $\frac{4.7^2 - 3.1}{2.4 + 1.6}$

(b) $\sqrt{18.2 - 3.5^2}$

(c) $\frac{5.6}{1.2 \times 0.7}$

[3 marks]**B10** Work out the value of each expression.

(a) $5x - y^2$

when $x = 4$, $y = -3$

(b) $(x - y)^2$

when $x = 2$, $y = -5$

(c) $\frac{x^2}{y} + y$

when $x = -6$, $y = 4$

[3 marks]**HIGHER***Higher tier only***B11** Work out the value of each formula.

(a) $v = u + at$ when $u = 5$, $a = -2$, $t = 6$

(b) $s = \frac{1}{2}(u + v)t$ when $u = 4$, $v = -10$, $t = 3$

(c) $E = \frac{1}{2}mv^2$ when $m = 4$, $v = -3$

(d) $y = \frac{x^2 - 1}{x - 3}$ when $x = -2$

[4 marks]

B12 $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$

Find both values of x when

(a) $a = 1$, $b = -5$, $c = 6$

(b) $a = 2$, $b = 1$, $c = -6$

[4 marks]

C**Reasoning**

Show your working and explain your thinking. A correct answer without a reason does not score full marks.

FOUNDATION

Everyone starts here

- C1** Amy and Ben work out $8 + 2 \times 5$

Amy gets 50 and Ben gets 18.

Who is correct? Explain the mistake the other person made.

[2 marks]

- C2** Zoe says, " $12 \div 4 \times 3 = 1$ because you do the multiplication first."

Explain why Zoe is wrong, and work out the correct answer.

[2 marks]

- C3** Use each of the numbers 3, 4 and 5 once, with +, $\times$ and brackets, to make

(a) 27 (b) 35

[2 marks]

- C4** Here is a calculation.

$$2 \times 3 + 4^2 - 5$$

(a) Write **one** pair of brackets in the calculation so that the answer is 33

(b) Write **one** pair of brackets in the calculation so that the answer is as large as possible. Write down this answer.

[3 marks]

- C5** Tia types -5^2 into her calculator. She expects 25 but the display shows -25

Explain why the calculator is correct.

[2 marks]

- C6** Here is Finn's working for $(6 - 2 \times 5)^2 \div 4 + 3$

$$\begin{array}{lll} 6 - 2 = 4 & 4 \times 5 = 20 & 20^2 = 400 \\ 400 \div 4 = 100 & 100 + 3 = 103 & \end{array}$$

(a) Explain Finn's mistake. (b) Work out the correct answer.

[3 marks]



HIGHER*Higher tier only***C7** $a = 2$ and $b = -3$

Write these in order of size. Start with the smallest.

$$ab^2 \quad (ab)^2 \quad a - b^2 \quad (a - b)^2$$

[3 marks]**C8** n is a positive whole number.

Alex says, " $n + n \times n$ is equal to $(n + n) \times n$."

Show algebraically that this is true for only one value of n .

[3 marks]**C9** Here is a calculation.

$$8 - 4 \div 2 + 2$$

One pair of brackets is written into the calculation.

Show that there are only three different answers that can be made.

[4 marks]

D**Problem solving**

You decide the method. Read the whole question first, and show every step.

FOUNDATION

Everyone starts here

- D1** A family buys 3 adult tickets at £12 each and 4 child tickets at £7 each. They have a voucher for £5 off the total.
Write down **one** calculation for the total cost, and work it out. [3 marks]
- D2** A taxi fare is £2.80 plus £1.30 for each mile. Four friends share the fare equally for a journey of 8 miles.
Work out how much each friend pays. [3 marks]
- D3** $F = \frac{9C}{5} + 32$
Work out the value of F when (a) $C = 25$ (b) $C = -10$ [3 marks]
- D4** Lena thinks of a positive number. She adds 4, squares the result, and then divides by 5
Her answer is 20
Work out the number Lena was thinking of. [3 marks]
- D5** (*calculator*) A phone contract costs £15 a month. This includes 200 minutes of calls. Each extra minute costs 8p.
In March, Jay uses 275 minutes. Work out Jay's bill for March. [3 marks]
- D6** $s = ut + \frac{1}{2}at^2$
Work out the value of s when $u = 12$, $t = 4$ and $a = -3$ [3 marks]



HIGHER*Higher tier only*

D7 (calculator) $T = 2\pi\sqrt{\frac{L}{g}}$

Work out the value of T when $L = 1.5$ and $g = 9.8$

Give your answer correct to 3 significant figures.

[3 marks]

D8 Sam thinks of a number. He subtracts 5, squares the result, multiplies by 2 and then adds 3
His answer is 35

Find the **two** possible numbers Sam could have been thinking of.

[4 marks]

D9 A ball is thrown upwards. Its height, h metres, after t seconds is given by $h = 20t - 5t^2$

The ball is 15 metres high when $5t^2 - 20t + 15 = 0$

Use $t = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ to find the two times when the ball is 15 metres high.

[4 marks]

D10 Kofi uses each of the digits 1, 2, 3 and 4 exactly once. He uses $+$ once and $\times$ twice. He may use brackets.
For example, $1 + 2 \times 3 \times 4 = 25$

Find the largest answer Kofi can make. You must show how you know it is the largest.

[4 marks]



E**Exam practice**

Exam-style questions. Write your answers in the spaces. Aim for about one minute per mark.

FOUNDATION*Foundation and Higher crossover***E1** Work out

(a) $7 + 2 \times 6$

.....
(1)

(b) $(5 + 3)^2 \div 4$

.....
(2)

(c) $30 - 3 \times 2^3$

.....
(2)

(Total for Question E1 is 5 marks)

E2 Write brackets in each statement to make it correct. You may use more than one pair of brackets in each statement.

(a) $3 \times 4 + 5 = 27$

(1)

(b) $20 - 8 \div 4 + 2 = 5$

(1)

(c) $2 + 3 \times 6 - 4 = 10$

(1)

(Total for Question E2 is 3 marks)



E3 (calculator) (a) Work out $\frac{8.4^2 + 3.9}{\sqrt{10.24}}$

Write down all the figures on your calculator display.

.....
(2)

(b) Write your answer to part (a) correct to 3 significant figures.

.....
(1)

(Total for Question E3 is 3 marks)

E4 (calculator) A plumber charges a call-out fee of £40 for each job, plus £32.50 for each hour worked.

One week she does three jobs, taking 2 hours, $1\frac{1}{2}$ hours and 4 hours.

Work out the total she charges that week.

£

(Total for Question E4 is 3 marks)



E5 Work out $(-2)^3 + 4 \times (-3)^2$

.....
(Total for Question E5 is 2 marks)

E6 Work out $\frac{3^2 + 4^2}{\sqrt{169} - 2^3}$

.....
(Total for Question E6 is 3 marks)

E7 (calculator) (a) Work out $\frac{\sqrt[3]{45.3}}{2.1^2 - 1.6}$

Write down all the figures on your calculator display.

.....
(2)

(b) Write your answer to part (a) correct to 2 decimal places.

.....
(1)
(Total for Question E7 is 3 marks)



HIGHER*Higher tier only*

E8 $v^2 = u^2 + 2as$

Work out the positive value of v when $u = -6$, $a = 2.5$ and $s = 12.8$

.....
(Total for Question E8 is 3 marks)

E9 $p = 3$, $q = -2$ and $r = -5$

Work out the value of $\frac{(p - qr)^2}{q^2 - r}$

Give your answer as a mixed number.

.....
(Total for Question E9 is 3 marks)



E10 Here is a calculation.

$$12 - 6 \div 3 + 1 \times 2$$

One pair of brackets is written into the calculation.

Find the greatest possible answer and the least possible answer. You must show your working.

greatest least

(Total for Question E10 is 4 marks)

E11 $x = \frac{-b - \sqrt{b^2 - 4ac}}{2a}$

Work out the value of x when $a = 3$, $b = -4$ and $c = -7$

$x = \dots\dots\dots$

(Total for Question E11 is 3 marks)

Finished? Mark your work with the **full worked solutions**, fill in your scores on the front page, then keep the skill sharp with unlimited questions on the **Number revision engine**.



Join students already acing their exams.

Book your FREE lesson at www.eclassroom.org.uk