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GCSE MATHEMATICS • NUMBER

Order of Operations

Worked Solutions

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

Full worked solutions for the free Order of Operations worksheet, GCSE and iGCSE Maths



Tap a section to jump straight to it

Full worked solutions for every question on the Order of Operations worksheet, in the same order and with the same question numbers.

How to mark your work. Tick each step you got right, not just the final answer. In the exam, method marks are given for correct working even when the final answer is wrong. If you lost marks, find the *first* line where your working is different from ours. That is the thing to fix.

In Section E: **M** = method mark, **P** = process mark, **A** = accuracy mark, **B** = independent mark, **C** = communication mark.

Question sheet

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A**Your turn answers**

Compare each line of your working with the solution.

FOUNDATION

A1 $(2+4)^2 = 6^2 = 36$ $18 \div 3 = 6$ $36 - 6 = \boxed{30}$

A2 Without brackets the answer is $3 + 20 - 2 = 21$ $\boxed{(3+5) \times (4-2) = 16}$ since $8 \times 2 = 16$

A3 Top: $25 + 15 = 40$ Bottom: $8 - 3 = 5$ $40 \div 5 = \boxed{8}$

A4 $(-4)^2 = 16$ $3 \times (-5) = -15$ $16 - (-15) = 16 + 15 = \boxed{31}$

HIGHER

A5 $b^2 - 4ac = 3^2 - 4 \times 2 \times (-5) = 9 + 40 = 49$ $\sqrt{49} = 7$
 $x = \frac{-3+7}{4} = 1$ or $x = \frac{-3-7}{4} = -\frac{10}{4}$ $\boxed{x = 1 \text{ or } x = -2.5}$

A6 $3(x-2)^2 = 75$ $(x-2)^2 = 25$ $x-2 = 5$ or $x-2 = -5$ $\boxed{x = 7 \text{ or } x = -3}$

B**Fluency solutions**

One mark for each correct part. The notes in italics explain why each sequence was chosen.

FOUNDATION

B1 (a) $6+8 = \boxed{14}$ (b) $10 \times 2 = \boxed{20}$ (c) $24+2 = \boxed{26}$ (d) $6 \times 6 = \boxed{36}$

The same three numbers give four different answers. Only the order and the brackets changed.

B2 (a) $20 - 3 = \boxed{17}$ (b) $8 \div 4 = \boxed{2}$ (c) $5 - 12 = \boxed{-7}$ (d) $20 - 3 \times 2 = 20 - 6 = \boxed{14}$

In (d), division and multiplication are done left to right: $12 \div 4 = 3$ first, then $\times 2$.

B3 (a) $9+4 = \boxed{13}$ (b) $2 \times 25 = \boxed{50}$ (c) $10^2 = \boxed{100}$ (d) $4+3 \times 8 = 4+24 = \boxed{28}$

B4 (a) $5+6 = \boxed{11}$ (b) $\sqrt{25} = \boxed{5}$ (c) $10 - 6 \div 2 = 10 - 3 = \boxed{7}$ (d) $2 \times \sqrt{64} = 2 \times 8 = \boxed{16}$



B5 Work from left to right. (a) $12 + 5 = 17$ (b) $6 \times 2 = 12$ (c) $30 - 10 + 5 = 25$ (d) $12 \div 2 \times 3 = 6 \times 3 = 18$

B6 (a) $-(3^2) = -9$ (b) $(-3) \times (-3) = 9$ (c) $-2 \times 25 = -50$ (d) $-8 - 16 = -24$

B7 (a) $\frac{18}{6} = 3$ (b) $\frac{20}{5} = 4$ (c) $6 + \frac{12}{3} = 6 + 4 = 10$ (d) $\frac{5+9}{8-1} = \frac{14}{7} = 2$

B8 (a) $5 \times (2 + 4) = 30$ (b) $(12 - 4) \times 2 + 1 = 17$ (c) $(2 + 6) \times (3 + 1) = 32$

B9 (a) $\frac{18.99}{4} = 4.7475$ (b) $\sqrt{5.95} = 2.439262184$ (c) $\frac{5.6}{0.84} = 6.666666667$

B10 (a) $20 - (-3)^2 = 20 - 9 = 11$ (b) $(2 - (-5))^2 = 7^2 = 49$ (c) $\frac{(-6)^2}{4} + 4 = \frac{36}{4} + 4 = 9 + 4 = 13$

HIGHER

B11 (a) $5 + (-2) \times 6 = 5 - 12 = -7$ (b) $\frac{1}{2} \times (4 - 10) \times 3 = \frac{1}{2} \times (-6) \times 3 = -9$
 (c) $\frac{1}{2} \times 4 \times (-3)^2 = 2 \times 9 = 18$ (d) $\frac{(-2)^2 - 1}{-2 - 3} = \frac{3}{-5} = -\frac{3}{5}$

B12 (a) $b^2 - 4ac = 25 - 24 = 1$ $x = \frac{5 \pm 1}{2}$ $x = 3 \text{ or } x = 2$
 (b) $b^2 - 4ac = 1 + 48 = 49$ $x = \frac{-1 \pm 7}{4}$ $x = 1.5 \text{ or } x = -2$

C

Reasoning solutions

Your wording can be different. Check that your reason makes the same point.

FOUNDATION

C1 Ben is correct. $2 \times 5 = 10$ first, then $8 + 10 = 18$. Amy added first: $(8 + 2) \times 5 = 50$.

C2 Division and multiplication have equal priority, so work from left to right: $12 \div 4 = 3$, then $3 \times 3 = 9$



C3 (a) $(4+5) \times 3 = 27$ (b) $(3+4) \times 5 = 35$

C4 (a) $2 \times (3+4^2) - 5 = 2 \times 19 - 5 = 33$

(b) $(2 \times 3 + 4)^2 - 5 = 10^2 - 5 = 95$ The largest answer comes from squaring the largest possible number. (Compare $2 \times (3+4)^2 - 5 = 93$.)

C5 Powers come before the negative sign, so -5^2 means $-(5^2) = -25$. To square negative five she must type $(-5)^2$.

C6 (a) Inside the bracket he subtracted before multiplying. He should work out 2×5 first.

(b) $(6-10)^2 \div 4 + 3 = (-4)^2 \div 4 + 3 = 16 \div 4 + 3 = 4 + 3 = 7$

HIGHER

C7 $ab^2 = 2 \times 9 = 18$ $(ab)^2 = (-6)^2 = 36$ $a - b^2 = 2 - 9 = -7$ $(a - b)^2 = 5^2 = 25$

$a - b^2$, ab^2 , $(a - b)^2$, $(ab)^2$

C8 $n + n \times n = n + n^2$ $(n + n) \times n = 2n \times n = 2n^2$

If they are equal: $n + n^2 = 2n^2$ $n = n^2$ $n^2 - n = 0$ $n(n - 1) = 0$

So $n = 0$ or $n = 1$. Since n is positive, $n = 1$ only

C9 List every position for one pair of brackets:

$(8 - 4) \div 2 + 2 = 4$ $8 - (4 \div 2) + 2 = 8$ $8 - 4 \div (2 + 2) = 7$

$(8 - 4 \div 2) + 2 = 8$ $8 - (4 \div 2 + 2) = 4$ $(8 - 4 \div 2 + 2) = 8$

Only 4, 7 and 8 are possible.

D

Problem solving solutions

There is often more than one correct method. Any complete, correct method scores full marks.

FOUNDATION

D1 $3 \times 12 + 4 \times 7 - 5 = 36 + 28 - 5 = 59$



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D2 $(2.80 + 1.30 \times 8) \div 4 = (2.80 + 10.40) \div 4 = 13.20 \div 4 = \boxed{\text{£}3.30}$

D3 (a) $\frac{9 \times 25}{5} + 32 = 45 + 32 = \boxed{77}$ (b) $\frac{9 \times (-10)}{5} + 32 = -18 + 32 = \boxed{14}$

D4 Work backwards with inverse operations: $20 \times 5 = 100$ $\sqrt{100} = 10$ $10 - 4 = \boxed{6}$ Check: $(6 + 4)^2 \div 5 = 20$

D5 Extra minutes: $275 - 200 = 75$ $15 + 0.08 \times 75 = 15 + 6 = \boxed{\text{£}21}$

D6 $s = 12 \times 4 + \frac{1}{2} \times (-3) \times 4^2 = 48 + \frac{1}{2} \times (-3) \times 16 = 48 - 24 = \boxed{24}$

HIGHER

D7 $\frac{1.5}{9.8} = 0.15306\dots$ $\sqrt{0.15306\dots} = 0.39123\dots$ $T = 2\pi \times 0.39123\dots = 2.4581\dots$ $\boxed{2.46}$

D8 Work backwards: $35 - 3 = 32$ $32 \div 2 = 16$ square root: 4 or -4
 $x - 5 = 4$ gives $x = 9$ $x - 5 = -4$ gives $x = 1$ $\boxed{1 \text{ and } 9}$

D9 $a = 5$, $b = -20$, $c = 15$ $b^2 - 4ac = 400 - 300 = 100$ $t = \frac{20 \pm 10}{10}$ $\boxed{t = 1 \text{ and } t = 3 \text{ seconds}}$
 Check: $20 \times 1 - 5 \times 1 = 15$ and $20 \times 3 - 5 \times 9 = 15$

D10 Multiplying makes numbers grow fastest, so use the + on the two smallest digits and multiply by the two largest:

$(1 + 2) \times 3 \times 4 = \boxed{36}$

Compare the other bracket positions with the large digits multiplied: $(1 + 3) \times 2 \times 4 = 32$ $(2 + 3) \times 1 \times 4 = 20$ $(1 + 4) \times 2 \times 3 = 30$

Without brackets around the sum the most is $1 + 2 \times 3 \times 4 = 25$, and $(1 + 2 \times 3) \times 4 = 28$. So 36 is the largest.





Exam practice solutions

Marks are shown on the right of each line.

FOUNDATION

Foundation and Higher crossover

E1	(a) $7 + 12 =$ 19	B1
	(b) $8^2 \div 4 = 64 \div 4$	M1
	16	A1
	(c) $30 - 3 \times 8 = 30 - 24$	M1
	6	A1
E2	(a) $3 \times (4 + 5) = 27$	B1
	(b) $(20 - 8) \div 4 + 2 = 5$	B1
	(c) $(2 + 3) \times (6 - 4) = 10$	B1
E3	(a) $\frac{70.56 + 3.9}{3.2} = \frac{74.46}{3.2}$	M1
	23.26875	A1
	(b) 23.3	B1 ft
E4	Call-out fees: $3 \times 40 = \text{£}120$	P1
	Hours: $2 + 1.5 + 4 = 7.5$ $7.5 \times 32.50 = \text{£}243.75$	P1
	Total: $120 + 243.75 =$ £363.75	A1
E5	$-8 + 4 \times 9$	M1
	$= -8 + 36 =$ 28	A1
E6	Top: $9 + 16 = 25$	M1
	Bottom: $13 - 8 = 5$	M1
	$25 \div 5 =$ 5	A1
E7	(a) $\sqrt[3]{45.3} = 3.5648\dots$ $2.1^2 - 1.6 = 2.81$	M1
	1.268604986	A1
	(b) 1.27	B1 ft



HIGHER

E8 $v^2 = (-6)^2 + 2 \times 2.5 \times 12.8$ M1
 $= 36 + 64 = 100$ A1
 $v = \sqrt{100} = \boxed{10}$ A1

E9 $qr = (-2) \times (-5) = 10$, so the top is $(3 - 10)^2 = (-7)^2 = 49$ M1
Bottom: $(-2)^2 - (-5) = 4 + 5 = 9$ M1
 $\frac{49}{9} = \boxed{5\frac{4}{9}}$ A1

E10 Without brackets: $12 - 2 + 2 = 12$ P1
To make it large, multiply as much as possible by 2: $(12 - 6 \div 3 + 1) \times 2 = 11 \times 2 = 22$ P1
To make it small, make the first part small: $(12 - 6) \div 3 + 1 \times 2 = 2 + 2 = 4$ P1
Other positions give $12 - (6 \div 3 + 1) \times 2 = 6$, $12 - (6 \div 3 + 1 \times 2) = 8$, $12 - 6 \div (3 + 1) \times 2 = 9$, $12 - 6 \div (3 + 1 \times 2) = 10.8$ and 12.
greatest 22, least 4 A1

E11 $b^2 - 4ac = (-4)^2 - 4 \times 3 \times (-7) = 16 + 84 = 100$ M1
 $x = \frac{4 - 10}{6}$ M1
 $x = \boxed{-1}$ A1

