

Order of Operations

Solutions

For AQA GCSE Mathematics (8300) • Foundation tier

Each question is shown in grey, followed by the working, one step per line. The final answer is in a box. *Marks* shows how the marks are usually given in the exam, and **Tip** points out a common mistake.

1 (4 marks)

Work out

(a) $3 + 4 \times 5$

Multiply before you add.

$$4 \times 5 = 20$$

$$3 + 20 = 23$$

Answer: 23

Tip: Do not work from left to right here. $3 + 4 = 7$, then $7 \times 5 = 35$, is wrong.

(b) $(3 + 4) \times 5$

Work out the brackets first.

$$3 + 4 = 7$$

$$7 \times 5 = 35$$

Answer: 35

(c) $20 - 12 \div 4$

Divide before you subtract.

$$12 \div 4 = 3$$

$$20 - 3 = 17$$

Answer: 17

(d) 2×3^2

Work out the power (index) first.

$$3^2 = 3 \times 3 = 9$$

$$2 \times 9 = 18$$

Answer: 18

Tip: Only the 3 is squared, not 2×3 . So it is 2×9 , not 6^2 .

2 (1 mark)

Circle the value of $10 - 2 \times 3 + 1$

Options: 25, 5, 3, 15

Multiply first: $2 \times 3 = 6$

Then add and subtract from left to right:

$$10 - 6 = 4$$

$$4 + 1 = 5$$

Answer: 5

3 (1 mark)

Circle the calculation that has an answer of 12

Options: $2 + 2 \times 3$, $(2 + 2) \times 3$, $2 \times 2 + 3$, $2 \times (2 + 3)$

Work out each one, using the correct order.

$$2 + 2 \times 3 = 2 + 6 = 8$$

$$(2 + 2) \times 3 = 4 \times 3 = 12 \quad \checkmark$$

$$2 \times 2 + 3 = 4 + 3 = 7$$

$$2 \times (2 + 3) = 2 \times 5 = 10$$

Answer: $(2 + 2) \times 3$

4 (2 marks)

Work out $\frac{18 + 6}{4 \times 2}$

A fraction line acts like brackets round the top and round the bottom.

Top: $18 + 6 = 24$

Bottom: $4 \times 2 = 8$

Then divide: $24 \div 8 = 3$

Answer: 3

Tip: Work out the whole top and the whole bottom before you divide.

Marks: 1 mark for 24 or 8. 1 mark for 3.

5 (1 mark)

Jack says,

$$'8 + 2 \times 5 = 50'$$

Is Jack correct? Tick a box.

Give a reason for your answer.

Multiplication comes before addition.

$$2 \times 5 = 10$$

$$8 + 10 = 18$$

Jack added first ($8 + 2 = 10$, then $10 \times 5 = 50$), which is wrong.

Answer: No, the answer is 18

6 (2 marks)

Put one pair of brackets into each calculation to make it correct.

(a) $5 + 6 \times 2 - 3 = 19$

Without brackets: $5 + 12 - 3 = 14$, which is too small.

Try adding first by putting brackets round $5 + 6$:

$$(5 + 6) \times 2 - 3 = 11 \times 2 - 3$$

$$= 22 - 3 = 19 \quad \checkmark$$

Answer: $(5 + 6) \times 2 - 3 = 19$

(b) $12 \div 3 + 1 \times 4 = 12$

Without brackets: $4 + 4 = 8$, which is wrong.

Try brackets round $3 + 1$:

$$12 \div (3 + 1) \times 4 = 12 \div 4 \times 4$$

$$= 3 \times 4 = 12 \quad \checkmark$$

Answer: $12 \div (3 + 1) \times 4 = 12$

7 (2 marks)

Work out $(7 - 3)^2 + \sqrt{25}$

Brackets first: $7 - 3 = 4$

Then the power: $4^2 = 16$

And the square root: $\sqrt{25} = 5$

Then add: $16 + 5 = 21$

Answer: 21

Tip: 4^2 means $4 \times 4 = 16$, not 4×2 . And $\sqrt{25}$ is 5, not half of 25.

Marks: 1 mark for 16 or 5. 1 mark for 21.

8 (3 marks)

- (a) Use your calculator to work out $\frac{4.2 + 3.6^2}{\sqrt{5.3 - 1.7}}$

Write down all the figures on your calculator display.

Work out the top: $4.2 + 3.6^2 = 4.2 + 12.96 = 17.16$

Work out the bottom: $\sqrt{5.3 - 1.7} = \sqrt{3.6} = 1.897366 \dots$

Divide: $17.16 \div 1.897366 \dots = 9.044114 \dots$

Answer: 9.044114...

Tip: On a calculator, use the fraction button, or put brackets round the whole top and the whole bottom. Typing it all in one line without brackets gives the wrong answer.

Marks: 1 mark for 17.16 or 1.897.... 1 mark for 9.044114...

- (b) Give your answer to part (a) to 1 decimal place.

9.044 ...

The second decimal place is 4, which is less than 5.

So round down: 9.0

Answer: 9.0

9 (2 marks)

Using each of the numbers 2, 3 and 4 once, and any operations and brackets, make the number 20

Think about which numbers multiply to give 20: $4 \times 5 = 20$

Can you make 5 from 2 and 3? Yes: $2 + 3 = 5$

So $(2 + 3) \times 4 = 20$

Other answers are possible.

Answer: e.g. $(2 + 3) \times 4$

Marks: 2 marks for any correct calculation that uses 2, 3 and 4 once each.

10 (2 marks)

Work out $6 + 3 \times (8 - 5)^2 \div 9$

Brackets first: $8 - 5 = 3$

Then the power: $3^2 = 9$

Now the calculation is $6 + 3 \times 9 \div 9$

Multiply and divide from left to right: $3 \times 9 = 27$, $27 \div 9 = 3$

Then add: $6 + 3 = 9$

Answer: 9

Marks: 1 mark for a correct first step, e.g. $(8 - 5)^2 = 9$, with the correct order after that. 1 mark for 9.

11 (1 mark)

Amy and Ben work out $24 \div 4 \times 2$

Amy says the answer is 3

Ben says the answer is 12

Who is correct? Give a reason for your answer.

Multiplication and division are equally important.

So work from left to right.

$$24 \div 4 = 6$$

$$6 \times 2 = 12$$

Ben is correct. Amy worked out 4×2 first.

Answer: Ben, because you work left to right: $24 \div 4 = 6$, $6 \times 2 = 12$

Tip: In BIDMAS, D and M have the same priority, and so do A and S. When they are next to each other, work from left to right.

12 (2 marks)

Write the numbers 3, 4 and 5 in the boxes to make each calculation correct.
Use each number once in each calculation.

(a) $\boxed{} + \boxed{} \times \boxed{} = 19$

The multiplication is done first, then one number is added.

Try each number as the one added:

$$3 + 4 \times 5 = 3 + 20 = 23$$

$$4 + 3 \times 5 = 4 + 15 = 19 \quad \checkmark$$

$$(5 + 3 \times 4 = 5 + 12 = 17)$$

Answer: $4 + 3 \times 5 = 19$ (or $4 + 5 \times 3$)

(b) $(\boxed{} + \boxed{}) \times \boxed{} = 27$

$$27 = 9 \times 3$$

$$4 + 5 = 9$$

$$\text{So } (4 + 5) \times 3 = 27$$

Answer: $(4 + 5) \times 3 = 27$ (or $(5 + 4) \times 3$)
