

Negative Numbers

Solutions

For Pearson Edexcel GCSE Mathematics (1MA1) • 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 (5 marks)

Work out

(a) $-7 + 3$

Start at -7 on a number line.

Adding 3 means move 3 to the right.

You end up at -4 .

Answer: -4

Tip: Adding a positive number moves you towards zero from -7 . Common wrong answers are -10 and 4 .

(b) $2 - 9$

Start at 2 on a number line.

Subtracting 9 means move 9 to the left.

2 steps takes you to 0, then 7 more steps takes you to -7 .

Answer: -7

(c) $-4 - (-10)$

Subtracting a negative is the same as adding.

$$\text{So } -4 - (-10) = -4 + 10$$

$$= 6$$

Answer: 6

(d) -8×3

First multiply the numbers: $8 \times 3 = 24$

Then the sign: negative $\times$ positive = negative.

Answer: -24

(e) $-36 \div -9$

First divide the numbers: $36 \div 9 = 4$

Then the sign: negative $\div$ negative = positive.

Answer: 4

Tip: The sign rules for dividing are the same as for multiplying: two negatives give a positive.

2 (3 marks)

A supermarket has four freezers, A, B, C and D.

The table shows the temperature inside each freezer at 8 am.

Freezer	Temperature
A	-18°C
B	-21°C
C	-15°C
D	-24°C

(a) Which freezer was the coldest?

The coldest freezer has the temperature furthest below zero.

-24 is lower than -21 , -18 and -15 .

-24°C is freezer D.

Answer: Freezer D

Tip: -24 is colder than -15 even though 24 is bigger than 15.

- (b) The temperature in the shop was 19°C .
How many degrees colder than the shop was freezer B?

Freezer B was -21°C .

Difference = higher – lower.

$$19 - (-21) = 19 + 21$$

$$= 40$$

Or on a number line: 21 degrees up to 0, then 19 more. $21 + 19 = 40$

Answer: 40°C

Tip: From a negative temperature to a positive one you pass through zero, so add the two distances: $21 + 19$. A common wrong answer is $19 - 21 = -2$.

- (c) The door of freezer C was left open.
The temperature inside freezer C went up by 3°C every hour for 4 hours.
Work out the temperature inside freezer C after the 4 hours.

Freezer C started at -15°C .

$$\text{Total rise: } 3 \times 4 = 12^{\circ}\text{C}$$

$$-15 + 12 = -3$$

Answer: -3°C

3 (1 mark)

The number -2 is exactly halfway between -9 and another number.
Work out the other number.

The gap from -9 to -2 is 7.

The other number is the same gap on the other side of -2 .

$$-2 + 7 = 5$$

Check: halfway between -9 and 5 is $(-9 + 5) \div 2 = -4 \div 2 = -2$ ✓

Answer: 5

Tip: Draw a quick number line. -2 must be in the middle, so the other number is to the right of -2 .

4 (2 marks)

Here are some numbers.

-5 3 -2 4 -1

Find the two numbers from the list that have the smallest product.

“Product” means multiply.

The smallest product will be negative, so use one negative and one positive number.

Make it as far below zero as possible: use the biggest numbers after the signs.

$$-5 \times 4 = -20$$

Other products are bigger, e.g. $-5 \times 3 = -15$

Answer: -5 and 4

Tip: “Smallest” means lowest on the number line, so -20 is smaller than 20 . Two negatives give a positive product, so they are no good here.

Marks: 1 mark for trying a pair that gives a negative product. 1 mark for -5 and 4 .

5 (2 marks)

Work out $(-2)^3 + (-4)^2$

Work out each power first.

$$(-2)^3 = (-2) \times (-2) \times (-2) = -8$$

$$(-4)^2 = (-4) \times (-4) = 16$$

Then add: $-8 + 16 = 8$

Answer: 8

Tip: A negative number squared is positive. A negative number cubed is negative.

Marks: 1 mark for -8 or 16 . 1 mark for 8 .

6 (2 marks)

Find the value of $3x - 2y$ when $x = -2$ and $y = -5$

Substitute, putting negative numbers in brackets:

$$3x - 2y = 3 \times (-2) - 2 \times (-5)$$

$$3 \times (-2) = -6$$

$$2 \times (-5) = -10$$

$$\text{So } -6 - (-10) = -6 + 10 = 4$$

Answer: 4

Tip: Put brackets round negative numbers when you substitute. Do the multiplications before the subtraction.

Marks: 1 mark for substituting correctly, e.g. $3 \times (-2) - 2 \times (-5)$. 1 mark for 4.

7 (2 marks)

At 6 am the temperature was -4°C .

By midday the temperature had risen by 11°C .

By midnight the temperature had fallen by 15°C from its midday value.

Work out the temperature at midnight.

Midday: the temperature rose, so add.

$$-4 + 11 = 7$$

Midnight: the temperature fell, so subtract.

$$7 - 15 = -8$$

Answer: -8°C

Marks: 1 mark for 7 (the midday temperature). 1 mark for -8 .

8 (2 marks)

Write down two numbers that multiply to give -12 and add to give 1

The product is negative, so one number is positive and one is negative.

Pairs that multiply to 12: 1 and 12, 2 and 6, 3 and 4.

The sum is $+1$, so the bigger number is positive.

Try 4 and -3 : $4 \times (-3) = -12$ ✓ and $4 + (-3) = 1$ ✓

Answer: 4 and -3

Marks: 2 marks for 4 and -3 . 1 mark for two numbers that multiply to give -12 .

9 (1 mark)

Kira says,

‘ -6 is bigger than -2 because 6 is bigger than 2’

Explain why Kira is wrong.

On a number line, -6 is to the left of -2 .

Numbers further left are smaller.

So -6 is smaller than -2 .

Answer: -6 is further left on a number line, so it is smaller than -2

10 (2 marks)

The table shows the balance of four bank accounts at the start and at the end of one month.

A negative balance means the account is overdrawn.

Account	Balance at start of month	Balance at end of month
P	−£45	£120
Q	£30	−£85
R	−£160	−£20
S	−£75	£95

For which account did the balance change by the greatest amount?

You must show how you get your answer.

Work out the change for each account (the gap between the two balances).

Account P: $120 - (-45) = 165$, so £165

Account Q: $30 - (-85) = 115$, so £115

Account R: $-20 - (-160) = 140$, so £140

Account S: $95 - (-75) = 170$, so £170

The greatest change is £170, for account S.

Answer: Account S (£170)

Tip: When a balance goes from below zero to above zero (or the other way), add the two amounts: e.g. $75 + 95 = 170$. Don't just subtract the numbers you can see.

Marks: 1 mark for at least three correct changes. 1 mark for account S with all the changes shown.

11 (2 marks)

Here are five number cards.

6	-3	-8	2	-1
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- (a) Write a card in each of the first two boxes so that the answer is the **largest** possible.

Write the answer in the last box.

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Start with the largest number: 6.

Subtracting a negative is the same as adding, so subtract the most negative card: -8.

$$6 - (-8) = 6 + 8 = 14$$

Answer: $6 - (-8) = 14$

- (b) Write a card in each of the first two boxes so that the answer is the **largest** possible.

Write the answer in the last box.

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The largest product using the positive cards is $6 \times 2 = 12$.

But negative $\times$ negative = positive.

$$-8 \times (-3) = 24$$

24 is bigger than 12.

Answer: $-8 \times -3 = 24$