Number sets and signed numbers

Leaving Certificate · Ordinary Level

Understand the idea

How to start

A negative number is below zero. On a number line, numbers get larger as you move right.

1. Read the operation sign separately from the sign of each number.
2. For addition, move right for a positive number and left for a negative number.
3. For multiplication or division, decide the sign first, then calculate the size.

Key terms & definitions

Integer
A whole number, positive, negative or zero.

Reciprocal
The number that multiplies a non-zero number to give 1.

Absolute value
Distance from zero; it is never negative.

Key ideas

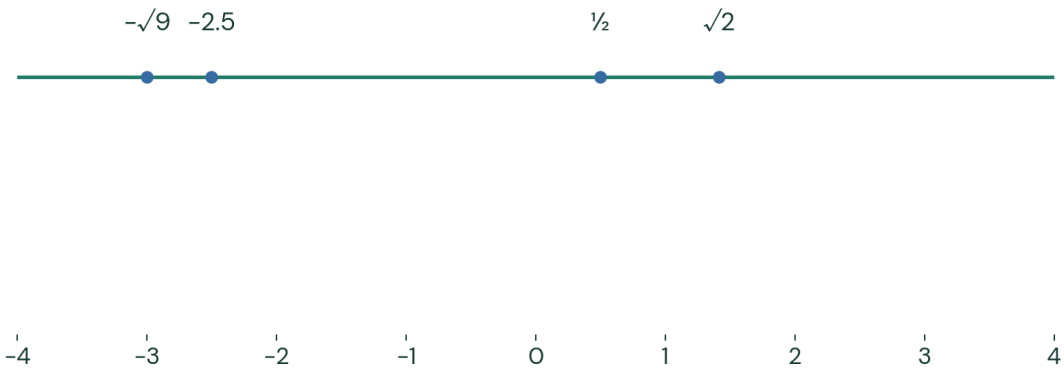
• Natural numbers count whole objects; integers also include negative whole numbers and zero. State whether your convention includes zero in $\mathbb{N}$.

• Rational numbers can be written as $\frac{a}{b}$ with integers a, b and $b \neq 0$. Irrational numbers, such as $\sqrt{2}$ and π, cannot.

• Real numbers include rational and irrational numbers. Place them on a number line to compare their size.

• For mixed operations, do brackets first, then powers, then multiplication and division from left to right, then addition and subtraction from left to right.

• Subtracting a negative is adding its opposite. For multiplication and division, equal signs give a positive result and different signs give a negative result.



Numbers increase from left to right. Negative numbers are to the left of zero.

Quick reminder

• Check the sign before calculating.

• Use brackets around negative numbers in powers.

• Example: $(-3)^2 = 9$, but $-3^2 = -9$.

Worked examples

Example 01 · Adding and subtracting signed numbers

Work out $(-6) + 11$.

Why this method?

Use the number line and the sign of each number to decide what the calculation means before calculating.

$-6 + 6 = 0$	**Step 1** Start at -6. The first 6 steps to the right bring you to zero.
$11 - 6 = 5$	**Step 2** Of the 11 steps, 5 are still left.
$-6 + 11 = 5$	**Step 3** Move the remaining 5 steps right from zero. The answer is positive.

Think about it: Before moving on: which way does the number move when you add a negative number?

Example 02 · Multiplying and dividing signed numbers

Work out $4 \times (-7)$.

Why this method?

Use the number line and the sign of each number to decide what the calculation means before calculating.

$4 \times (-7) = -(4 \times 7)$	**Step 1** A positive times a negative gives a negative result.
$4 \times 7 = 28$	**Step 2** Calculate the size without the negative sign.
$4 \times (-7) = -28$	**Step 3** Put back the negative sign.

Think about it: Before moving on: what sign does a negative times a negative give?

Example 03 · Order and number sets

Order $-\sqrt{9}$, -2.5, $\frac{1}{2}$ and $\sqrt{2}$ from smallest to largest.

Why this method?

Use the number line and the sign of each number to decide what the calculation means before calculating.

$-\sqrt{9} = -3$ and $\sqrt{2} \approx 1.414$.	**Step 1** Simplify or estimate for comparison
$-3 < -2.5 < \frac{1}{2} < \sqrt{2}$.	**Step 2** Place them in order
-3 is an integer; -2.5 and $\frac{1}{2}$ are rational; $\sqrt{2}$ is irrational. All are real.	**Step 3** Use the definitions to distinguish integer, rational and irrational values. All of them belong to the real numbers.

Example 04 · Order signed numbers

Place $-3, 0$ and -1 in increasing order.

-3 lies left of -1.	**Step 1** Farther left means smaller.

$-3 < -1 < 0$	**Final step** Zero is larger than either negative number.

Common mistake

Using the multiplication sign rule when adding: “a negative and a positive make a negative.” Addition depends on their values. For example, $-2 + 7 = 5$, while $-7 + 2 = -5$.

Exam technique

Use brackets when substituting a negative number into a power.

Try it yourself

Work on paper before checking the answers at the end. These questions are for self-checking, not submitted homework.

Question 1

Start at -4 on the number line. Add 7. Where do you finish?



Number line from -6 to 6 with -4 marked.

Question 2

Work out $(-3) \times (-5)$.

Watch an explanation

Corbettmaths — Negatives: addition/subtractions

Cognito — How to use BODMAS

Open the website chapter to load the embedded players. Use the rates and rules in your question for financial examples.

Self-check answers

Question 1

3

Question 2

15

Open the full chapter online