Lesson - Negative numbers

Year: Year 4

Hello, I am Otto! Have you ever seen a thermometer that shows a temperature below zero, or pressed a button for a floor underneath the ground in a lift? Those are negative numbers. In this chapter you learn to read, order and compare negative numbers, to count through zero and to find the difference between temperatures.

Starter activity

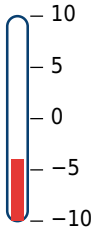
Look at a freezer thermometer. It shows −18 °C. Is that warmer or colder than 0 °C, the temperature at which water freezes? It is much colder, because it is 18 degrees below zero. Now imagine the temperature outside is 3 °C in the morning and falls by 5 degrees by the evening. What is the temperature in the evening? To answer, you have to count down through zero. Let us learn how!

What are negative numbers?

Definition: negative number

A **negative number** is a number that is less than zero. We write it with a minus sign in front, for example −3. We say "minus three" or "negative three". **Positive numbers** are bigger than zero, such as 3. Zero is neither positive nor negative.

We meet negative numbers in many places. On winter nights in the UK the temperature can fall to −5 °C. In a lift in a shopping centre, button 0 is the ground floor and button −1 is the car park below. A diver who is 10 metres under the sea is at a height of −10 m compared with sea level. And in football, a team can have a goal difference of −2 if it lets in more goals than it scores.



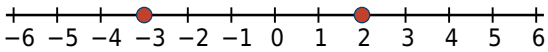
The thermometer shows −4 °C. The scale goes up in steps of 5 degrees. The red liquid is below the 0 mark, so the temperature is below freezing.

The number line

Key fact: negative numbers on the number line

- Zero is in the middle. Positive numbers are to the right of zero and negative numbers are to the left.

- The further left a number is, the smaller it is. So −7 is smaller than −2.
- The numbers get bigger as you move to the right: −3, −2, −1, 0, 1, 2, 3.



This number line goes from −6 to 6. The red dots show −3 and 2. The number −3 is to the left of 2, so −3 is less than 2.

Watch out

Many people think −7 is bigger than −2 because 7 is bigger than 2. This is wrong! With negative numbers the opposite is true. −7 is 7 below zero, which is colder and lower than −2. Think of the number line: −7 is further to the left, so −7 < −2.

Example 1

Which is colder, −3 °C or −7 °C?

On the number line −7 is further to the left than −3, so −7 is smaller. A smaller temperature means a colder temperature, so **−7 °C is colder**.

Ordering and comparing

Method: ordering numbers that include negatives

1. Sketch a quick number line, or imagine one.
2. Put the negative numbers on the left. Among negative numbers the one with the biggest digit part is the smallest, for example −9 is smaller than −4.
3. Put zero in the middle and then the positive numbers on the right.
4. Read the numbers from left to right for smallest first.

Example 2

Put these numbers in order, smallest first: 3, −5, 0, −1, 6, −8.

The negative numbers are −8, −5 and −1. The smallest is −8, then −5, then −1. Next comes 0. Then the positive numbers 3 and 6. The order is **−8, −5, −1, 0, 3, 6**.

Key fact: comparing with signs

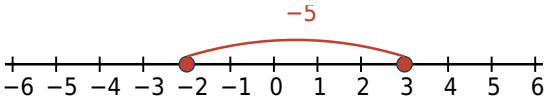
We use > for "is greater than" and < for "is less than". For example, −2 > −6 because −2 is to the right of −6 on the number line. And −4 < 1 because every negative number is less than every positive number.

Counting through zero

When you count up from a negative number you get closer to zero, you pass through zero and carry on into the positive numbers. When you count down from a positive number you pass through zero and go into the negative numbers. A number line is a great tool for this.

Method: counting on and back using a number line

1. Mark the starting number on the number line.
2. To count up, move right. To count down, move left.
3. Count each step carefully, and remember that there is a step from 1 to 0 and from 0 to −1.
4. Write down the number where you land.



Starting at 3 and counting back 5 steps gives 2, 1, 0, −1, −2. So 3 − 5 = −2.

Example 3

The temperature is 2 °C at 6 pm. It falls by 6 degrees overnight. What is the temperature in the morning?

Start at 2 and count back 6: 1, 0, −1, −2, −3, −4. So the temperature in the morning is **−4 °C**.

Example 4

A lift starts at floor −2 and goes up 5 floors. At which floor does it stop?

Start at −2 and count up 5: −1, 0, 1, 2, 3. So the lift stops at **floor 3**.

Finding the difference

Method: the difference between two temperatures

1. Draw a number line or use a thermometer.
2. Count the steps from the lower number up to the higher number.
3. The number of steps is the difference. Remember that you count the steps from the negative number to zero, and then from zero to the positive number.

Example 5

The temperature in London is 4 °C and in Edinburgh it is −3 °C. What is the difference?

From −3 up to 0 is 3 steps. From 0 up to 4 is 4 more steps. Add: 3 + 4 = **7 degrees**.

London is 7 degrees warmer than Edinburgh.

Example 6

The temperature on Monday is −2 °C and on Tuesday it is −9 °C. By how many degrees has it fallen?

Both are negative. From −9 up to −2 is 7 steps (−8, −7, −6, −5, −4, −3, −2). So it fell by **7 degrees**. Check: −2 − 7 = −9.

Did you know?

The coldest temperature ever measured on Earth was about −89 °C, in Antarctica in 1983. In the UK the coldest ever temperature was −27.2 °C, recorded in Scotland in 1995. Some freezers go down to −24 °C. Water freezes at 0 °C and boils at 100 °C. The Celsius scale is named after the Swedish scientist Anders Celsius.

Otto's tip

Always draw a quick number line when you are not sure. Put 0 in the middle, negatives on the left and positives on the right. Then count the steps one by one. And remember: a bigger digit after the minus sign means a smaller number, so −10 is smaller than −1!