Negative numbers

Topic	Arithmetic
Learning objectives	Order of grandeur of negative numbers & basic operations around them
Age group	10-14 years old (to be adapted in each country)
Estimated duration	2h
Activities	Showing the depth of an object, the amount of debt of a person
Related visits	All

Previous knowledge required

Good knowledge of the basic operations: sums, subtractions, multiplications, and divisions.

Step by step: the sequence in the classroom

Step 1: Introducing the topic

Short presentation of the heritage elements in this sequence

Contrary to what you may think, negative numbers are rather recent in history. While many mathematical concepts had been theorised several thousands of years before our time, the first mention of negative numbers seems to date back to… 200 BC in China, and were not used in Europe until much later. Overall, this can look rather surprising: indeed, negative numbers first represented debts or expenses in trade, which could have been used in the Western world too.

The concept of negative numbers was mostly studied by Arab mathematicians in the Middle Ages, and entered Europe with the help of Italian scholars who decided to study them.

Links between these elements and math topics

Negative numbers can be confusing at first, but learning them will allow your pupils to work with the other half of the real number system. Using negative numbers in an operation requires rigour, since it is sometimes very easy to forget the minus symbol. However, negative numbers have become quite prevalent nowadays, and they can be found in sports, economy, temperatures, depths…

Step 2: Class activities

Here are some hands-on activities that you can use in class. You may use them and adapt them as you see fit!

Why are negative numbers important?

Negative numbers allow to express something that is below zero. Although it may sound obvious, handling those numbers can be tricky, since they come up with many rules – some of which you will very rarely use. Still, you may use those numbers when calculating your budget for your next holidays!

The ground rules of negative numbers

Negative numbers are the opposite of their natural number counterpart. Look at the following chart – or draw it on the board – to highlight how those numbers work.

Figure 1 Integers, Twinkl

As you can see, the negative numbers are sorted in the opposite way compared to their positive counterparts. Therefore, -1 is a higher number than -3, and -4 is higher than -5.

Application

Place the < or > sign in the following examples to determine which number is bigger:

-5 ... -3

-1.36 ... -1.84

-27.5 ... -27.55

Adding negative numbers

Adding two negative numbers works the same way as adding two natural numbers, except the end result will be smaller than the two previous numbers. Using the "+" sign before a negative number is the equivalent of subtracting the number to the previous one.

For example: (-6) + (-3) = -6 – 3 = -9

Subtracting negative numbers

Subtracting a negative number to another number is equivalent to adding its opposite.

For example: 3 – (-2) = 3 + 2 = 5

Multiplying and dividing negative numbers

Multiplying or dividing a natural number by a negative number will result in a negative number. Multiplying or dividing two negative numbers will result in a natural number.

For example: 3 * (-4) = -12

-6 * (-2) = 6 * 2 = 12

4 / (-2) = -2

-6 / 3 = -2

-8 / (-2) = 4

Negative fractions

You may encounter negative numbers when observing fractions. Remember that a fraction is another way to represent a division: if the numerator or the denominator has a minus sign, then the fraction as a whole is a negative number.

For example: $\frac{-6}{5} = -\frac{6}{5}$

Just like the division, if both the numerator and the denominator are negative numbers, then the fraction is a positive number.

For example: $\frac{-7}{-3} = \frac{7}{3}$

Application

Find the result of the following operations:

(-3) + 4 – (-2) =

(-6) + (-7) x (-1) =

(-5) + (-6) / 3 =

$\frac{2}{4} \times \frac{-5}{-2} =$

Step 3: Homework and development ideas

Deep dive

Are you ready to explore the secrets of the depths? Many species live in the oceans, yet it is said that we know about space much more than we know about the bottom of the seas. Part of the reasons why is that the depths are not welcoming: they're dark, cold, and have a high pressure that can crush your lungs if you are not careful.

You are using a submarine to go as far as you can in your attempt to reach the bottom of the ocean, which lies at 11 km below the surface in the Mariana Trench.

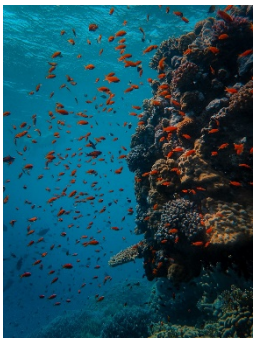

Figure 2 Pixabay

In order to achieve the descent, you need to stop on the following landmarks:

- 1500 m
- 3000 m
- 4500 m
- 6000 m
- 7500 m

And keep stopping every 1500 m until you reach the floor of the ocean.

How many times do you need to stop before reaching the bottom? Can you stop at exactly -11 km?

During your dive, you may come across several species of aquatic life forms, such as fish, crustaceans or even mammals. Which of these species is the most likely to be found near the surface? Which one lives in the deepest part of the ocean? Rank them from the one with the largest habitat to the one with the smallest.

Great white shark (-100 m to -1200 m)
Giant Pacific octopus (-65 m to -2000 m)
Anglerfish (-150 m to -1500 m)
Mariana Snailfish (-6200 m to -8000 m)
Telescope octopus (-150 m to -2000 m)
Frilled shark (-500 m to -1200 m)
Barreleye fish (-600 m to -800 m)

The quiz

You are evaluating the results of various people to a multiple choice question that will determine who, in a specific group of learners, is the best at maths. Contrary to traditional quizzes, multiple choice questions have a specific pattern to count points:

Figure 3 Pixabay

- + 3 points if the answer is correct
- - 1 point if the participant did not answer
- - 4 points if the answer is incorrect

Here are the results:

Candidate	Good answer	No answer	Wrong answer
A	20	2	8
B	16	10	4
C	23	5	2
D	21	7	2
E	19	8	3
F	24	1	5
G	18	5	7

Which of the candidates scored the highest? The lowest?

In order to pass this quiz, the candidates need to score 40 points or more. Who passed? Who did not?

References

Rogers, L. (2008). *The history of negative numbers*. University of Cambridge, Faculty of Mathematics. https://nrich.maths.org/5961

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