



## Rounding

### SEQUENCE 1

Age group	10-12
Prior knowledge	Knowledge about the decimal system, place values (ones, tens, hundreds)
Material needed	Rounding box
Subjects	Mathematics
Skills involved	Rounds a natural number to a given precision.
Time to carry out the sequence	1 h

#### Step 1: Introduction

Ask pupils about their previous knowledge of the decimal system and places values (ones, tens, hundreds, thousands). Lead a discussion about exact numbers. Ask them how easy it is to remember exact big numbers like 5678 or 6789012.

After discussing exact and rounded numbers, it is good to show students the first three rounded numbers, then three exact numbers no bigger than 999, and three bigger exact numbers and ask them to remember these numbers.

The list of numbers can be like this:

The first three numbers

200



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400

700

The second three numbers

123

419

876

The third three numbers

32456

87659

1927953

After each three numbers, ask students to say what they remembered.

## Step 2: Discussion: For what rounding is good?

It is easier to remember large numbers when there are fewer non-zero digits in the number, which is why they are often rounded. For example, it is cumbersome to remember that the circumference of the Earth along the equator is 40 076 km. It is easier to remember the rounded figure of 40,000 km. The two numbers are approximately equal and are combined by the sign  $\approx$ .

$$40\,076 \approx 40\,000$$

Figures are sometimes rounded because they change rapidly. Ones, tens and sometimes hundreds have little meaning in our daily lives.

In this section is helpful to show students examples in pictures where the rounding is useful.

Earth's equator circumference is  $40\,076\text{ km} \approx 40\,000\text{ km}$ .



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<https://openverse.org/image/519f445f-4987-4487-a927-4d7117c53096?q=earth>

Area of Europe 10,180,000 km<sup>2</sup> - is it exact or almost equal to?

Population of Europe(2021) 745 173 774  $\approx$  745 000 000



<https://openverse.org/image/de67e0a4-afe0-48a2-9173-45c051c044c8?q=map%20of%20europe>

It is good to show to class information about Earth's population.



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Or show a picture of the 10 biggest countries by population:

# ↓↑	Country (or dependency) ↓↑	Population (2023) ↓↑
1	<a href="#">India</a>	1,428,627,663
2	<a href="#">China</a>	1,425,671,352
3	<a href="#">United States</a>	339,996,563
4	<a href="#">Indonesia</a>	277,534,122
5	<a href="#">Pakistan</a>	240,485,658
6	<a href="#">Nigeria</a>	223,804,632
7	<a href="#">Brazil</a>	216,422,446
8	<a href="#">Bangladesh</a>	172,954,319
9	<a href="#">Russia</a>	144,444,359
10	<a href="#">Mexico</a>	128,455,567

Ask pupils: How good is it to remember these big numbers? If their answer is no, ask them to tell you how many first digits it would be wise to remember.

## Step 3: Discovering the content of the box

Ask pupils to open the box and familiarise themselves with its contents. Let them discover when we round down and when we round up. Then, let them formulate their rules for rounding.



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## Step 4: Storytelling

Pupils read the story about Grace Hopper.

After reading the story, let pupils discuss what they have read. Ask them different questions:

- What can You remember about Grace Hopper?
- What is “debugging”?
- Can “bugs” be in computer calculations?
- What did Grace do to teach computers to round up?

## Step 5: Practicing rounding

At first, students round with the numbers from the box. They write their answers on the labels.

Next, show the class the table of the population of the EU

<https://www.worldometers.info/population/countries-in-the-eu-by-population/>

and ask them to choose from there 5-10 different countries and let them round to the highest possible figure.



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## SEQUENCE 2

Age group	10-12
Prior knowledge	Knowledge about rounding of natural numbers, rounding to the nearest tens, hundreds, and thousands.
Material needed	Rounding box
Subjects	Mathematics, coding
Skills involved	Rounds decimal fractions to a given precision.
Time to carry out the sequence	1 h

### Step 1: Discovering the content of the box

With the help of a box let pupils remember about rounding of natural numbers and for what rounding is good. The Rounding Coaster helps pupils remember when to round up and when to round down.

### Step 2: Storytelling

Pupils read the story about Grace Hopper.

Ask them different questions:

- What can You remember about Grace Hopper?
- What is “debugging”?
- Can “bugs” be in computer calculations?
- What did Grace do to teach computers to round up?



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## Step 3: Rounding in programming

As Grace Hopper worked as a programmer, it is good to show pupils how rounding works in computer programming. All programming languages are similar, and for rounding, they often use these four codes.

- **round()** - rounds to the nearest whole number using standard mathematical rules.
- **ceil()** or **ceiling()** - rounds up to the next whole number.
- **floor()** - rounds down to the previous whole number.
- **trunc()** or **truncate()** - removes the fractional part of the number, effectively rounding towards zero.

In this sequence, we are only going to work with the **Round()** command from the Python programming language.

Explain to pupils, with the help of examples, how to write code for programming.

### Example 1: Rounding to the Nearest Integer

`print(round(3.7145))` gives answer 4

### Example 2: Rounding to the given precision

`print(round(3.7145, 3))` gives answer 3.715

\*`print`, in this case, means to give to the computer to show us the result of the calculation.

With Example 2 here is good to show to the class the Place Value Table of Numbers and explain what is a meaning of the given precision.



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Millions	Hundred Thousands	Ten Thousands	Thousands	Hundreds	Tens	Ones	Decimal Part	Tenths	Hundredths	Thousandths	Ten-Thousandths	Hundred-Thousandths	Millionths
						3	.	7	1	4	5		

Step 4: Working in groups of three. Create calculations to round decimal fractions.

Form groups. Explain to the pupils the rules for group work. They will be like programmers, computers and compilers.

## I Programmers

All pupils create 10 - 15 calculations of rounding (depending on their ability) with the right answers.

Next, they write questions to their partner.

They give the list to one of the pupils.

## II Computers

All pupils do the calculations as computers.

## III Compilers

After all calculations, they give their answers to another partner. This pupil checks the answers.

## Step 5: Summary

At the end of the lesson, it is good to ask pupils what they have learned and whether they would like to work as programmers.

