

Integers and Number Sets

Name: _____

Date: _____

Concepts

- Absolute Value Notation - Secondary 1, 2 and 3
- Arithmetic (theory)
- Ascending and Descending Order
- Expressing Numbers Using Different Types of Notation
- Integers ($\mathbb{Z}$)
- Natural Numbers ($\mathbb{N}$)
- Number Sets - Secondary 1 and 2 (theory)
- Number Systems
- Operations (theory)
- Subtracting Integers
- Writing Numbers (theory)

Absolute Value Notation — Secondary 1, 2 and 3

1. At a diving site on Lac Memphrémagog, every position is measured in metres from the water surface, which counts as 0. A position above the surface is written with a + sign and a position below it with a – sign.

- a) A gull flies at +12, a diver hangs at –8, a marker on the anchor line sits at –3.5 and a float rests at 0. Write the absolute value of each of these four positions.
- b) Explain, in the words of this situation, what the absolute value of a position tells you.
- c) Which of the four is farthest from the surface?
- d) Give a position, other than the diver's, that is exactly 8 m from the surface.

Arithmetic

2. Arithmetic is the branch of mathematics that studies numbers and the rules for calculating with them. Here are five tasks a Secondary 2 student might be given.

- a) List all the divisors of 60.
- b) Find the perimeter of a hexagonal patio.
- c) Work out $15 - (-7)$.
- d) Draw a bar graph of the class's favourite winter sports.
- e) Write 0.6 in fractional notation.

Say which of the five belong to arithmetic. For each of the other two, name the branch of mathematics it belongs to instead, and say in one sentence what that branch studies.

Ascending and Descending Order

3. These were the noon temperatures, in degrees Celsius, one January day.

Town	Temperature ($^{\circ}\text{C}$)
Kuuujuaq	-31
Val-d'Or	-18
Québec	-9
Montréal	-4
Gaspé	-12
Sept-Îles	0

- a) Write the six temperatures in ascending order.
- b) Which town was the coldest, and which was the mildest?
- c) Name every town whose temperature was below -10°C .

Expressing Numbers Using Different Types of Notation

4. Three notations are in play here: fractional notation in lowest terms, decimal notation, and percentage. Each number below is written in one of the three; write it in the other two.

a) $\frac{3}{8}$

b) 0.35

c) 6%

d) $2\frac{1}{4}$

Integers ($\mathbb{Z}$)

5.

- a) Write the integer that describes each situation: three floors below street level in a parking garage; a gain of 12 points in a video game; a temperature of eight degrees below zero; the level of the water surface itself.
- b) Give the opposite of -12 , of 7 and of 0.
- c) Explain why 4.5 is not an integer, while $\frac{12}{4}$ is one.

Natural Numbers ($\mathbb{N}$)

6. The set of natural numbers, written $\mathbb{N}$, is the set of counting numbers $\{0, 1, 2, 3, 4, \dots\}$.
- a) Which of these quantities are always counted with natural numbers: the number of goals a team scores; the temperature in degrees Celsius; the number of students on a bus; the balance of a bank account; the number of pages in a book? Justify the ones you leave out.
 - b) Which of 0, -4 , $\frac{12}{4}$, 7.5 and 91 are natural numbers?
 - c) Explain in one sentence why every natural number is also an integer.

Number Sets — Secondary 1 and 2

7. The symbol $\subset$ means “is contained in”.
- a) Give an integer that is not a natural number, and say in one sentence what puts it outside $\mathbb{N}$.
 - b) True or false, with a reason: every natural number is an integer.
 - c) Complete the statement $\mathbb{N}$ _____ $\mathbb{Z}$ with the symbol $\subset$, and write out in words what the completed statement says.

Number Systems

8. Our everyday number system is positional and uses base 10: the value of a digit depends on the column it sits in.

- a) Write 3407 in expanded form, showing the place value of each digit.
- b) A computer stores a small counter as 10110 in base 2, where the columns are worth 16, 8, 4, 2 and 1. What is this number in base 10?
- c) Our clocks use base 60: an hour is 60 minutes and a minute is 60 seconds. How many seconds are there in 2 h 35 min 40 s?

Operations

9. An operation combines numbers, called the operands, using an operator symbol, and the result has a name of its own.

- a) For each of $24 + 9 = 33$, $40 - 15 = 25$, $7 \times 6 = 42$ and $45 \div 9 = 5$: name the operation and give the correct name for the result.
- b) $12 \div 5 = 2.4$. Is 2.4 still called a quotient, even though it is not a whole number? Explain.

Subtracting Integers

10. Subtracting a number is the same as adding its opposite.

- a) $-6 - 9$
- b) $4 - (-11)$
- c) $-13 - (-5)$
- d) A survey drone hovers 45 m above the ground, and a gallery of an old mine runs 78 m below the ground. What is the vertical distance between the drone and the gallery? Write the subtraction you used.

Writing Numbers

11. The same quantity can be written in several ways, and one way is often more useful than another. A recipe calls for 0.75 L of milk.

- a) Write this quantity in fractional notation, in lowest terms.
- b) Write it as a percentage of a litre.
- c) Write it in words.
- d) A measuring jug is marked with graduations. Which of the three forms would you print beside the graduations, and why?

Synthesis — drawing on several sheets in this topic

12. A survey team records the position of five objects at a dive site, in metres from the water surface (0).

Object	Position (m)
Buoy	+2
Diver	-18
Drone	+37
Anchor	-45
Trout	-6

- a) Write the five positions in ascending order.
- b) Which object is farthest from the surface? Use absolute values to justify your choice, then explain why the first position in an ascending list is not always the one farthest from the surface.
- c) What is the vertical distance between the drone and the anchor? Write the subtraction you used.
- d) One pair of objects is exactly 20 m apart. Which pair?

Want the harder problems and the worked solutions?

The *Challenge Problems* set and the *Answer Keys* for Integers and Number Sets — with the reasoning written out in full — are available at tutorinmontreal.ca.