Chapter 2

Types of numbers

Learn the ideas below, follow each worked example, then attempt the practice before checking the answers.

2.1 Natural numbers and whole numbers

In this course, natural numbers are the counting numbers 1, 2, 3 and so on. Whole numbers include zero as well. Some books include zero among the natural numbers, so check the convention being used. A whole number has no fractional part.

Worked example 7 is both natural and whole. Zero is whole but is not natural under our convention. 2.5 is neither natural nor whole.

2.2 Integers and opposite numbers

Integers are negative whole numbers, zero and positive whole numbers. Every positive integer has a negative opposite equally far from zero. Zero is neither positive nor negative. Absolute value means distance from zero, so it is never negative.

Worked example The opposite of 8 is −8. Both are 8 units from zero, so $|8| = 8$ and $|-8| = 8$. A temperature of −3°C is represented by an integer.

2.3 Rational numbers

A rational number can be written as $\frac{p}{q}$, where p and q are integers and q is not zero. Every integer is rational because it can be written over 1. Terminating decimals and repeating decimals are rational. A fraction is undefined when its denominator is zero.

Worked example $5 = \frac{5}{1}$, $0.75 = \frac{3}{4}$, and $0.333\ldots = \frac{1}{3}$. All three are rational, although their written forms look different.

2.4 Irrational and real numbers

An irrational number cannot be written as a ratio of two integers. Its decimal continues forever without a repeating pattern. Examples include π and $\sqrt{2}$. Rational and irrational numbers together form the real numbers. A square root of a perfect square is rational.

Worked example $\sqrt{49} = 7$ is rational. $\sqrt{50}$ is irrational because 50 is not a perfect square. The finite decimal 3.14 is rational and is only an approximation to π.

2.5 Even odd prime and composite numbers

An even integer is divisible by 2. An odd integer is not. A prime is an integer greater than 1 with exactly two positive factors. A composite is an integer greater than 1 with more than two positive factors. The number 1 is neither prime nor composite.

Worked example 2 is the only even prime. 15 is odd and composite because its positive factors are 1, 3, 5 and 15. Zero is even because $0 = 2 \times 0$.

Chapter 2 practice

Work in your notebook. Show your method and include units where needed.

1. Classify −12 as integer, rational or irrational.
2. Is √81 rational? Explain.
3. Is 0.454545… rational?
4. List the primes between 10 and 20.
5. Which of 0, 1, 2 and 9 are composite?

Answers with methods

1. −12 is an integer and rational because $-12 = \frac{-12}{1}$. It is not irrational.

2. Yes. √81 = 9, and 9 can be written as $\frac{9}{1}$.

3. Yes. The block 45 repeats, so it is a repeating rational decimal.

4. 11, 13, 17 and 19. Each has exactly two positive factors.

5. Only 9 is composite. Zero and 1 are neither prime nor composite; 2 is prime.

Common mistake to avoid

A decimal that never ends is not automatically irrational. A repeating decimal such as 0.121212… is rational.