

# Number System

CBSE Class 9 Maths · Knowledge organiser

## KEY DEFINITIONS

### Rational number

A number that can be written as  $p/q$ , where  $p$  and  $q$  are integers and  $q \neq 0$ .

### Irrational number

A real number whose decimal never ends and never repeats, such as  $\sqrt{2}$  or  $\pi$ .

### Rationalising

Rewriting a fraction so there is no surd in the denominator.

## KEY FORMULAS

$\mathbb{N} \subset \mathbb{W} \subset \mathbb{Z} \subset \mathbb{Q} \subset \mathbb{R}$ ;  $\frac{p}{q}$  terminates iff  $q$  (lowest terms) has only the primes 2, 5

Recurring decimal, e.g.  $0.\overline{47} = \frac{47}{99}$ ,  $0.1\overline{6} = \frac{15}{90} = \frac{1}{6}$

Surds  $\sqrt{ab} = \sqrt{a}\sqrt{b}$ ,  
 $(\sqrt{a} + \sqrt{b})(\sqrt{a} - \sqrt{b}) = a - b$

Rationalise  $\frac{1}{\sqrt{a} + \sqrt{b}} = \frac{\sqrt{a} - \sqrt{b}}{a - b}$

Exponents  $a^m a^n = a^{m+n}$ ,  $(a^m)^n = a^{mn}$ ,  
 $a^{-m} = \frac{1}{a^m}$ ,  $a^{\frac{p}{q}} = (\sqrt[q]{a})^p$

## YOU SHOULD BE ABLE TO...

- Classify numbers, spot terminating decimals, convert recurring decimals and simplify simple surds and powers.
- Rationalise denominators, simplify expressions with exponents and find rationals between two numbers.
- Prove a number is irrational and work through surd and exponent problems of several parts.
- Handle conjugate surds, exponent equations and mixed reasoning about rational and irrational numbers.

## WORKED EXAMPLE

Write  $2.\overline{3}$  as a fraction.

$$x = 2.333\dots, 10x - x = 21, \text{ so } x = \frac{21}{9} = \frac{7}{3}.$$

## COMMON MISTAKES

- $\times \sqrt{a+b} = \sqrt{a} + \sqrt{b}$  (false:  $\sqrt{9+16} = 5 \neq 7$ ).
- $\times$  Calling a value used for  $\pi$  in a question (such as a fraction) equal to  $\pi$ : it is only a rational approximation;  $\pi$  is irrational.
- $\times a^{-m} = -a^m$  (it is  $\frac{1}{a^m}$ ), and  $a^m \times a^n = a^{mn}$  (it is  $a^{m+n}$ ).
- $\times$  In  $0.1\overline{6}$ , treating the whole of 16 as repeating.