

CHAPTER 1 SUMMARY

The number sets

- The set of **natural numbers** \mathbb{N} is $\{0, 1, 2, 3, 4, 5, \dots\}$
- The set of **integers** \mathbb{Z} is $\{\dots, -4, -3, -2, -1, 0, 1, 2, 3, 4, \dots\}$.
- The set of **rational numbers** \mathbb{Q} is $\left\{\frac{p}{q} \text{ where } p \text{ and } q \text{ are integers and } q \neq 0\right\}$.
A number is rational if
 - it can be written as a quotient of two integers, or
 - its decimal expansion is finite, or
 - its decimal expansion has a recurring digit or pattern of digits.
- Any number that has a decimal expansion with an infinite number of digits after the decimal point and with no period is an **irrational number**.
- The set of rational numbers together with the set of irrational numbers complete the number line and form the set of **real numbers**, \mathbb{R} .

Approximations and error

- Rounding a number to the **nearest 10** is the same as rounding it to the **nearest multiple of 10**.
- Rounding a number to the **nearest 100** is the same as rounding it to the **nearest multiple of 100**.
- **Rules for rounding**
 - If the digit after the one that is being rounded is less than 5 then keep the rounded digit unchanged and change all the remaining digits to the right of this to 0.
 - If the digit after the one that is being rounded is 5 or more then add 1 to the rounded digit and change all remaining digits to the right of this to 0.
- Rounding a number **correct to one decimal place** is the same as rounding it to the **nearest tenth**.
- Rounding a number **correct to two decimal places** is the same as rounding it to the **nearest hundredth**.
- Rounding a number **correct to three decimal places** is the same as rounding it to the **nearest thousandth**.
- **Rounding rules for decimals**
 - If the digit after the one that is being rounded is less than 5 keep the rounded digit unchanged and delete all the following digits.
 - If the digit after the one that is being rounded is 5 or more then add 1 to the rounded digit and delete all the following digits.
- The number of **significant figures** in a result is the number of figures that are known with some degree of reliability.



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- **Rules for significant figures:**

- All non-zero digits are significant.
- Zeros between non-zero digits are significant.
- Zeros to the left of the first non-zero digit are *not* significant.
- Zeros placed after other digits but to the right of the decimal point are significant.

- **Rounding rules for significant figures**

- If the $(n+1)$ th figure is less than 5 then keep the n th figure unchanged.
- If the $(n+1)$ th figure is 5 or more then add 1 to this figure.
- In both cases all the figures to the right of figure n should be deleted if they are to the right of the decimal point and should be replaced by zeros if they are to the left of the decimal point.

- To **estimate** the answer to a calculation, round all the numbers involved to 1 sf.
- The difference between an **estimated** or **approximated value** and the **exact value** is called the **error**:

$$\text{Error} = v_A - v_E$$

where v_A is the approximated value and v_E is the exact value.

- Percentage error = $\left| \frac{v_A - v_E}{v_E} \right| \times 100\%$

where v_A represents **approximated value** or **estimated value** and v_E represents the **exact value**.

Standard form

- A number is written in **standard form** if it is in the form $a \times 10^k$ where $1 \leq a < 10$ and k is an integer.

SI units of measurement

- In Mathematical Studies the most common **SI base units** used are m, kg and s, and **derived units** are m^2 (area), m^3 (volume), km h^{-1} (velocity), kg m^{-3} (density).
- To avoid writing very small or very large quantities we use **prefix** names and prefix symbols. Some of these are shown in this table.

Factor	Prefix	Symbol	Factor	Prefix	Symbol
10^3	kilo	k	10^{-3}	milli	m
10^2	hecto	h	10^{-2}	centi	c
10^1	deca	da	10^{-1}	deci	d

- There are some units that are **non-SI** units but are accepted for use with the SI because they are widely used in everyday life, for example, min, h, l.
- There are three temperature scales: **kelvin** (K), **Celsius** ($^{\circ}\text{C}$) and **Fahrenheit** ($^{\circ}\text{F}$).