

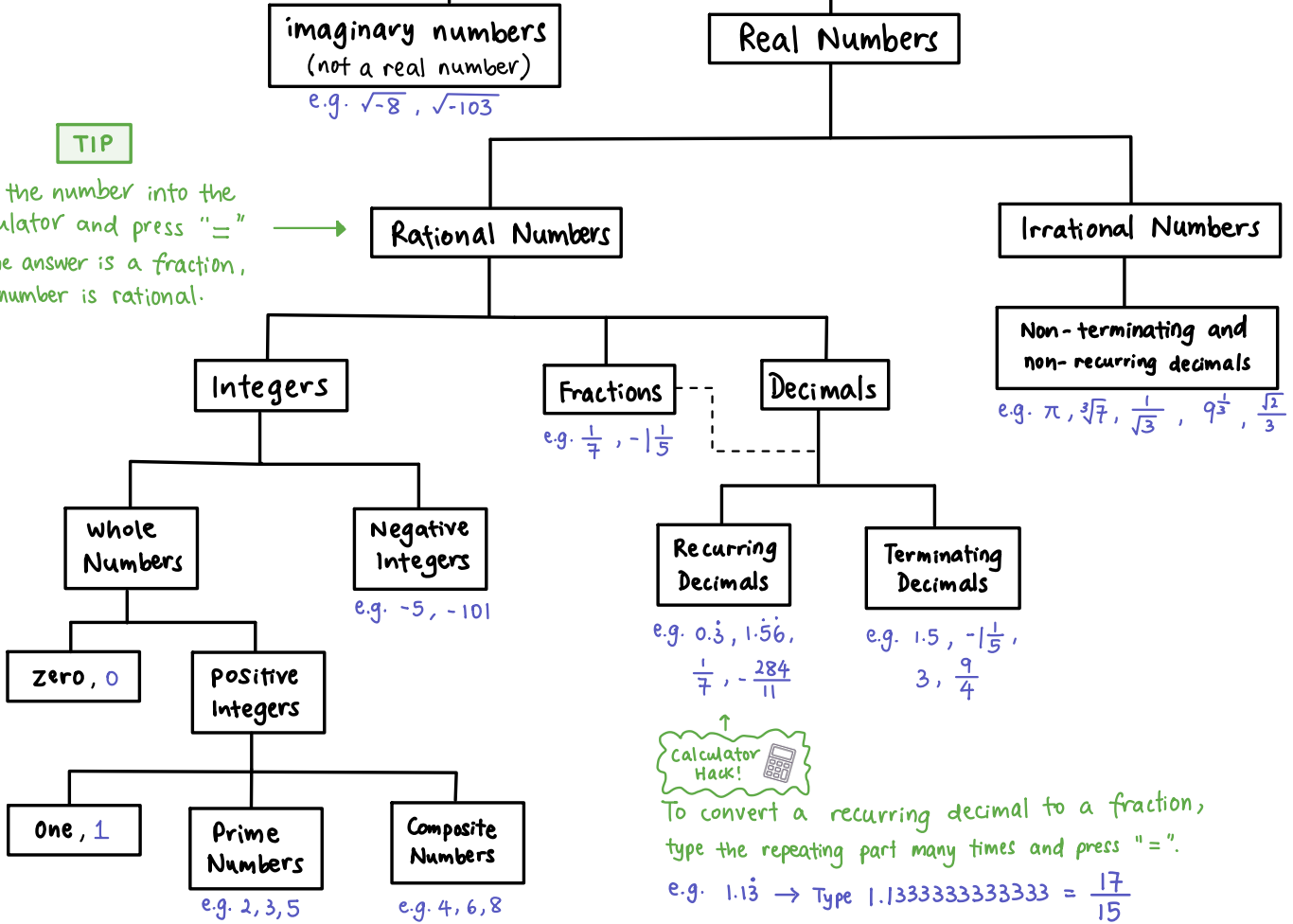
CHAPTER 2

Numbers

Note: Expressions such as  $\frac{8}{0}$ , where the denominator is zero, are undefined.

**TIP**

Key the number into the calculator and press "="  
If the answer is a fraction, the number is rational.



Calculator Hack!

To convert a recurring decimal to a fraction, type the repeating part many times and press "=".

e.g.  $1.1\dot{3} \rightarrow \text{Type } 1.1333333333333333 = \frac{17}{15}$

Definitions	
Real numbers	Numbers that can be represented as a point on a number line.
Rational numbers	Numbers that can be expressed in the form of $\frac{a}{b}$ where $b \neq 0$
Irrational numbers	Numbers that cannot be expressed in the form of $\frac{a}{b}$ .
Terminating decimals	Decimals will stop / end after a few digits.
Recurring decimals	Decimals that never end and have one or more digits that repeat forever.
Non-terminating and non-recurring decimals	Decimals that never end, do not repeat and continue forever.
Prime numbers	Whole numbers that have two factors only, 1 and itself.
Composite numbers	Whole numbers that have more than two factors.

## • Arranging numbers

small to big  
↑

E.g. Arrange the numbers in ascending order.

$$-\pi, 1\frac{3}{7}, (-1.6)^2, \sqrt{2}, 1.4\dot{1}$$

$$-\pi = -3.1415$$

$$1\frac{3}{7} = 1.4285$$

$$(-1.6)^2 = 2.5600$$

$$\sqrt{2} = 1.4142$$

$$1.4\dot{1} = 1.4111$$

$$\text{Ans: } \underline{-\pi}, \underline{1.4\dot{1}}, \underline{\sqrt{2}}, \underline{1\frac{3}{7}}, \underline{(-1.6)^2}$$

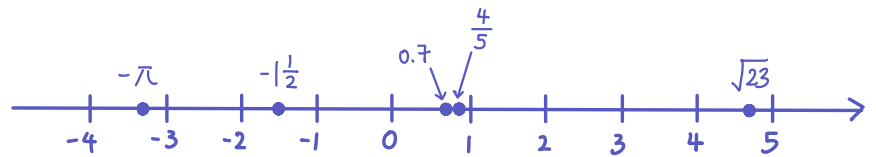
**TIP** 

Use calculator to convert all numbers to decimal.  
Compare the decimals and put original numbers as your final answer.

## • Number line (use dots or cross to mark the numbers)

E.g. Represent the numbers on the number line.

$$0.7, -1\frac{1}{2}, -\pi, \sqrt{23}, \frac{4}{5}$$



## • Multiply / Divide negative numbers

1st sign	2nd sign	Result
+	+	+
+	-	-
-	+	-
-	-	+

## • Inequality signs

Symbol	Meaning	Example
<	less than	$2 < 6$ $x < 7$
≤	less than or equal to	$x \leq 10$
>	more than	$8 > 1$ $x > 12$
≥	more than or equal to	$x \geq 5$

## • Order of operation (BODMAS)

1st to tackle: Brackets



Orders (powers and square roots)



Division / Multiplication  
(from left to right)



Addition / Subtraction  
(from left to right)

$$\begin{aligned} \text{Eg 1: } & \underbrace{(-3)^2} \times 3 - 2[5 \times (-2)] \\ & = 9 \times 3 - 2[5 \times (-2)] \\ & = 9 \times 3 - 2(-10) \\ & = 27 - 2(-10) \\ & = 27 + 20 \\ & = 47 \end{aligned}$$

**TIP**

Always check your answer by keying the question exactly into your calculator.

$$\begin{aligned}
 \text{Eg 2: } & (-4)^3 - 72 \div [-6 - \sqrt{64} + 2] \\
 & = -64 - 72 \div (-6 - 8 + 2) \\
 & = -64 - 72 \div (-12) \\
 & = -64 + 6 \\
 & = -58
 \end{aligned}$$

$$\begin{aligned}
 \text{Eg 3: } & [15 + (-4)^2] + 3 \times (2-5)^2 \div (-3) \\
 & = [15 + 16] + 3 \times (-3)^2 \div (-3) \\
 & = 31 + 3 \times 9 \div (-3) \\
 & = 31 + 27 \div (-3) \\
 & = 31 - 9 \\
 & = 22
 \end{aligned}$$

• Order of operation with fractions involved

- Change mixed numbers to improper fractions when solving.
- Leave final answer in proper / mixed numbers and in the simplest form.

a) Add / Subtract fractions  $\rightarrow$  Make denominators the same then combine fractions.

$$\text{Eg: } \frac{4}{5} + 2\frac{1}{2} = \frac{4}{5} + \frac{5}{2} = \frac{8}{10} + \frac{25}{10} = \frac{33}{10} = 3\frac{3}{10}$$

b) Multiply fractions  $\rightarrow$  Numerator  $\times$  Numerator, denominator  $\times$  denominator

$$\text{Eg: } \frac{4}{5} \times 2\frac{1}{2} = \frac{4}{5} \times \frac{5}{2} = \frac{4}{2} = 2$$

c) Divide fractions  $\rightarrow$  Keep, change, flip and multiply the fractions.

$$\text{Eg: } \frac{4}{5} \div 2\frac{1}{2} = \frac{4}{5} \div \frac{5}{2} = \frac{4}{5} \times \frac{2}{5} = \frac{8}{25}$$

d) Square or square root fractions  $\rightarrow$  square / square root both the numerator and denominator

$$\text{Eg: } \left(\frac{2}{5}\right)^2 = \frac{4}{25} \quad \left(-\frac{2}{3}\right)^2 = \frac{4}{9} \quad \left(-\frac{2}{3}\right)^3 = -\frac{8}{27}$$

$$\sqrt{\frac{4}{9}} = \frac{\sqrt{4}}{\sqrt{9}} = \frac{2}{3} \quad \sqrt[3]{-\frac{27}{64}} = \frac{\sqrt[3]{-27}}{\sqrt[3]{64}} = \frac{-3}{4} = -\frac{3}{4}$$

$$\begin{aligned}
 \text{Eg 1: } & (-2)^2 + \left(5 - \frac{1}{2} \times 7 - \frac{2}{3}\right) \\
 & = 4 + \left(5 - \frac{7}{2} - \frac{2}{3}\right) \\
 & = 4 + \left(\frac{30}{6} - \frac{12}{6} - \frac{4}{6}\right) \\
 & = 4 + \frac{14}{6} \\
 & = \frac{24}{6} + \frac{14}{6} \\
 & = \frac{38}{6} \\
 & = 6\frac{1}{3}
 \end{aligned}$$

$$\begin{aligned}
 \text{Eg 2: } & 2\frac{1}{6} - \left(-7\frac{1}{3}\right) - \left(-\frac{3}{4}\right)^2 \\
 & = \frac{13}{6} - \left(-7\frac{1}{3}\right) - \frac{9}{16} \\
 & = \frac{13}{6} + \frac{22}{3} - \frac{9}{16} \\
 & = \frac{13}{6} + \frac{44}{6} - \frac{9}{16} \\
 & = \frac{57}{6} - \frac{9}{16} \\
 & = \frac{456}{48} - \frac{27}{48} \\
 & = \frac{429}{48} \\
 & = 8\frac{15}{16}
 \end{aligned}$$

### Commonly tested Word Problems

Eg 1: The altitudes of some places are as follows:

[Source: Presbyterian High School / 2023 / WA1 / Q2]

Location	Altitudes
Dead Sea	-430 m
Lake Assal	-153 m
Mexico City	2240 m
Mount Everest	8848 m
Westmorland	-48 m

(a) List the places above sea level.

Mexico City and Mount Everest.

(b) Calculate the difference in altitude between Lake Assal and Dead Sea.

$$\begin{aligned} \text{Difference} &= -153 - (-430) && \text{use bigger number} - \text{smaller number} \\ &= 277 \text{ m} \end{aligned}$$

Eg 2: In March, the minimum temperature is  $-19^{\circ}\text{C}$  while the maximum temperature is  $28^{\circ}\text{C}$ .

(a) Find the difference between the minimum and maximum temperature.

$$\begin{aligned} \text{Difference} &= 28 - (-19) \\ &= 47^{\circ}\text{C} \end{aligned}$$

(b) In April, the minimum temperature is  $24^{\circ}\text{C}$  colder than the minimum temperature in March. Find the minimum temperature in April.

$$\begin{aligned} \text{Minimum temperature in April} &= -19 - 24 \\ &= -43^{\circ}\text{C} \end{aligned}$$