

Real Numbers

- Natural $\rightarrow 1, 2, 3, \dots$
- Whole $\rightarrow 0, 1, 2, 3, \dots$
- Integers $\rightarrow -1, 0, 1, 2, \dots$
- Irrational $\rightarrow x(\frac{a}{b})$

Rational $\sqrt{(\frac{a}{b})}$

Standard Form

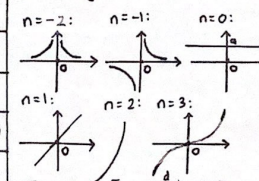
$A \times 10^n$, where
 $1 \leq A < 10$
 $n = \text{integer}$
 A in 3sf. if applicable

Tetra	10^{12}	Milli	10^{-3}
Giga	10^9	Micro	10^{-6}
Mega	10^6	Nano	10^{-9}
Kilo	10^3	Pico	10^{-12}

Graphs

Formula	$a(x-h)^2+k$	$a(x-p)(x-q)$
Shape	$a > 0 \rightarrow \cup, a < 0 \rightarrow \cap$	
Min./Max. pt	(h, k)	$(\frac{p+q}{2}, y)$
x-intercept	Sub $y=0$	$(p, 0), (q, 0)$
y-intercept	Sub $x=0$	

$[y = a(x+b)^n + c]$
 assuming $b \neq 0, c \neq 0, a \neq 1$



Transformations

- [Translations]
 $b > 0$: shift left by b units
 $c > 0$: shift up by c units
 $\uparrow |k| \leftrightarrow \uparrow \text{steepness}$
- [Reflection]
 $k = -k$: reflect in x -axis
 $d = -d$: reflect in y -axis

Number Line

$a < x < b$, not $b > x > a$
 $0 < < >$
 $0 \leq < >$

Ratio

- Constant part
- Constant total
- Constant diff.
- Everything changed
- Area scale $\rightarrow 1:n^2$

Vectors

$\vec{AB} = (x, y)$, where
 $x > 0$ if x increases to the right
 $y > 0$ if y increases upwards
 $|\vec{AB}| = \text{magnitude of } \vec{AB}$
 $x=0, y=0$ if no change in x & y
 Equal vectors: $\vec{AB} = \vec{CD}$ if $|\vec{AB}| = |\vec{CD}|$ & $\vec{AB} \parallel \vec{CD}$
 Negative vectors: $\vec{AB} = -\vec{BA}, \vec{a} = -\vec{a}$
 Vector addition: $\vec{AB} + \vec{BC} = \vec{AC}$
 Scalar multiplication: If $\vec{b} = k\vec{a} \rightarrow \vec{AB} = k\vec{AD}, k \neq 0$
 Translation: $\vec{AB}, \vec{D}$ are collinear
 Figure + Translation Vector = Image

Prime Factorisation

Perfect square $\rightarrow$ power of all factors must be multiples of $\dots 2$

Perfect cube $\rightarrow$ of $\dots 3$

HCF $\rightarrow$ multiply common factors

LCM $\rightarrow$ multiply highest power of all factors

Percentage

% change = $\frac{\text{new} - \text{initial}}{\text{initial}} \times 100\%$

Rate

Avg. rate = $\frac{\text{total amt}}{\text{total time}}$

Proportion

Direct $\rightarrow y = kx$

Indirect $\rightarrow y = \frac{k}{x}$ where k is a constant

Significant Figure

- Significant: Non-0 digits, 0 between non-0, 0 after non-0 digits & decimal point
- Insignificant: 0 before non-0
- Depending on s.f. specified, 0 after non-0 but before decimal point may/may not be

Number Pattern

$x \ y \ z$
 $T_n = T_1 + (n-1)d$
 $w \ x \ y \ z$
 $T_n = T_1(r^{n-1})$
 $T_1 \ T_2 \ T_3 \ T_4 \dots$
 $T_n = T_1 + (n-1)d + \dots + \frac{1}{2}(n-1)(n-2)d_2$

Coordinate Geometry

$y = mx + c$, where
 m is gradient
 c is y -intercept

- $m = 0 \rightarrow$ horizontal line
- $m = \infty \rightarrow$ vertical line
- $m > 0 \rightarrow$ upward-sloping
- $m < 0 \rightarrow$ downward-sloping
- line $\frac{y_2 - y_1}{x_2 - x_1}$ segment = $\sqrt{(x_2 - x_1)^2 + (y_2 - y_1)^2}$

order: $\begin{pmatrix} a & b \\ c & d \end{pmatrix} \rightarrow m \begin{pmatrix} e & f \\ g & h \end{pmatrix}$
 for $m \times n$ matrix $k \begin{pmatrix} a & b \\ c & d \end{pmatrix} = \begin{pmatrix} ka & kb \\ kc & kd \end{pmatrix}$

matrix multiplication:
 $(n \times m \text{ matrix})(m \times p \text{ matrix})$, where
 no. of columns = no. of rows
 $= (n \times p \text{ matrix})$
 multiply n th row of 1st matrix with
 n th column of 2nd matrix

Zero matrix: all elements are zero
 Square matrix: $n \times n$
 Identity matrix: e.g. $\begin{pmatrix} 1 & 0 & 0 \\ 0 & 1 & 0 \\ 0 & 0 & 1 \end{pmatrix}$

Indices

$a^m \times a^n = a^{m+n}$ $a^0 = 1$
 $a^m \div a^n = a^{m-n}$ $a^{-m} = \frac{1}{a^m}$
 $a^m \times b^m = (ab)^m$ $\frac{a^m}{b^m} = (\frac{a}{b})^m$
 $a^m \div b^m = (a/b)^m$ $= (\frac{1}{b/a})^m$
 $(a^m)^n = a^{mn}$
 If $a^n = a^m$, then $n = m$