Unit conversion/Map scale

Area: $(1)^2$ m^2 = $(100)^2$ cm^2
Volume: $(1)^3$ m^3 = $(100)^3$ cm^3
1 litre = 1000 ml = 1000 cm^3
Distance: $(1)^2$ km^2 = $(1000)^2$ m^2
Speed: Km/h → m/s (x $\frac{10}{36}$)
m/s → km/h (x $\frac{36}{10}$)
Time: 2.24 h → 2 h (0.24x60) mins → 2 h 14 min (0.4x60) s
**Map scale always in cm*

Algebra

Expansion: $(a + b)^2 = a^2 + 2ab + b^2$
Factorising: $a^2 – b^2 = (a + b)(a – b)$

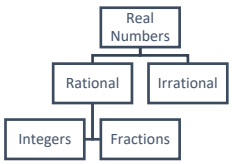
- Cross factorising
- $x = \frac{-b \pm \sqrt{b^2-4ac}}{2a}$
- Completing the square: $(x - \frac{b}{2})^2 + c – (\frac{b}{2})^2$

**There must not be any coefficient of x^2 before completing the square*

Numbers

Order of Operations (+, -, x, ÷)
Step 1: Work out within brackets first
Step 2: Do multiplication and division from left to right
Step 3: Do addition and subtraction from left to right

Multiples, Factors, Prime, Composite Numbers
Multiple: 6 is a multiple of 2 and 3
Factors: Number that divides a large number exactly
Prime: Number only divisible by itself and 1
Composite: Number that is not prime number



Inequality: Swap sign if multiply/ divide both side by negative values

Standard form: A x 10^n (where $1 \leq A < 10$)

Polygons

Polygon	Number of sides
Triangle	3
Quadrilateral	4
Pentagon	5
Hexagon	6
Heptagon	7
Octagon	8
Nonagon	9
Decagon	10

- Sum of exterior angles of any polygon is 360^0
- Sum of interior angles of a polygon with *n* sides is $(n – 2) \times 180^0$
- A regular polygon has equal sides (and equal angles)

Financial Math

% Increase/Decrease: $\frac{Difference}{Original}$ x 100%
Simple interest: I = $\frac{PRT}{100}$
Compound interest: P + I = $P(1 + \frac{R}{100})^T$
Hire Purchase: Pay Deposit of cash price, then deduct from hire purchase price and divided into monthly instalment.
Profit/ Loss as a % of the cost price:
$\frac{Profit/Loss}{Cost\ Price}$ x 100%
% discount = $\frac{Discount}{Marked\ Price}$ x 100

Accuracy

- Answer leaves in 3 s.f if not stated
- Money (2 d.p)
- Bearings (3 digits)
- Ratio (no units)
- Degree (1 d.p)

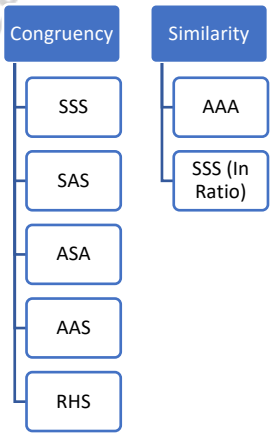
Speed & Distance

S = $\frac{D}{T}$ a = $\frac{v-u}{t}$
Average speed: $\frac{Total\ Distance}{Total\ Time}$
*Distance is area under speed/time graph
*Gradient of speed-time graph is acceleration
*Gradient of distance-time graph is speed

Sets

Definition
Subsets: Every element of a set A is also an element of a set B
Proper Subsets: If A is a subset of B, but A and B are not equal
Finite Set: Finite number of elements
Infinite Set: Infinite number of elements

Union of A and B	$A \cup B$
Intersection of A and B	$A \cap B$
Number of elements in set A	$n(A)$
"...is an element of..."	$\in$
"...is not an element of..."	$\notin$
Complement of set A	A'
The empty set	$\varnothing$
Universal set	U
A is a subset of B	$A \subseteq B$
A is a proper subset of B	$A \subset B$
A is not a subset of B	$A \not\subseteq B$
A is not a proper subset of B	$A \not\subset B$



Ratio & Proportion

Direct & Inverse Proportion
Direct: y = kx
Inverse: y = $\frac{k}{x}$

Areas & Volumes of Similar Figures

$(\frac{A_S}{A_B})$ ⇄ $(\frac{L_S}{L_B})$ ⇄ $(\frac{V_S}{V_B})$

**To convert Area to Volume & Vice versa, first convert to length*

Geometrical Construction

- Angle bisector
- Perpendicular bisector

Indices

- $a^m \times a^n = a^{m+n}$
- $a^{-n} = \frac{1}{a^n}$
- $\sqrt{a} = a^{\frac{1}{2}}$
- $a^m \div a^n = a^{m-n}$
- $a^0 = 1$
- $\sqrt[3]{a} = a^{\frac{1}{3}}$
- $(a^n)^m = a^{nm}$
- $(\frac{a}{b})^{-\frac{1}{2}} = (\frac{b}{a})^{\frac{1}{2}}$

Number Pattern

Arithmetic Sequence: $a_n = a_1 + (n – 1) \times d$

Quadratic Sequence:

- Confirm if its Quad eqn by 2nd diff
- Divide 2nd diff by 2 to get a
- Sub 1 to 3 into an^2
- Find common diff and put it into eqn

Probability

A **and** B → P(A) x P(B)
A **or** B → P(A) + P(B)
A does not occur → 1 - P(A)
**Poker card: 52 cards (includes 4 Ace, 4 kings, 4 Queens, 4 Jacks, 4 Clovers, 4 Spades, 4 Diamonds, 4 Hearts*

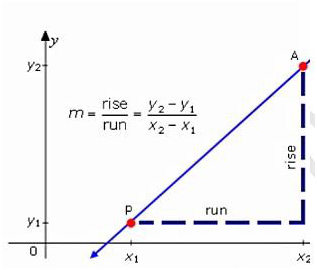
Coordinates Geometry

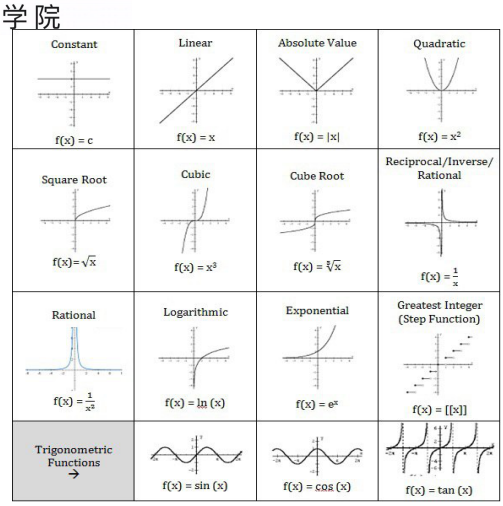
Linear eqn: y = mx + c

m = $\frac{y_2-y_2}{x_2-x_1}$

Distance: $\sqrt{(y_2-y_1)^2+(x_2-x_1)^2}$

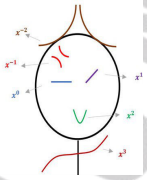
Mid-point: ($\frac{x_1+x_2}{2}$, $\frac{y_2+y_1}{2}$)





Graph sketch

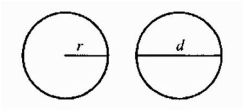
- Completing the square
- Factorising



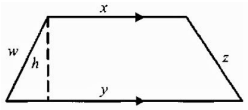
Statistics

Mean: Average
Median: 50%, middle
Lower Quartile: 25%
Upper Quartile: 75%
Range: 100% - 0%
Interquartile range: 75% - 25%
*Lower S.D & IQ range = more consistent
*Higher median & mean = better

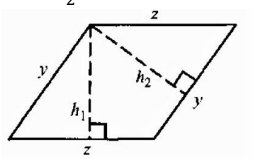
Mensuration



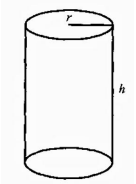
Area: πr^2
Circumference: $2\pi r$ or πd



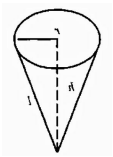
Perimeter: w + x + y + z
Area: $\frac{1}{2}$ (x + y) h



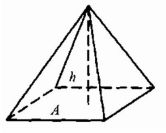
Perimeter: 2y + 2z
Area: (z x h_1) or (y x h_2)



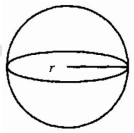
Total S.A (Close): $2\pi r^2 + 2\pi rh$
Total S.A (Open): $\pi r^2 + 2\pi rh$
Volume: $\pi r^2 h$



Total S.A: $\pi rl + \pi r^2$
Volume: $\frac{1}{3}\pi r^2 h$



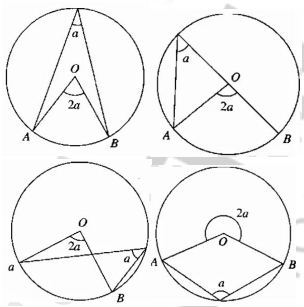
Total S.A: Sum of 4 triangles + base
Volume: $\frac{1}{3}$ x A x h



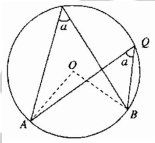
Total surface area: $4\pi r^2$
Volume: $\frac{4}{3}\pi r^3$

Hemisphere
Total S.A (Close): $3\pi r^2$
Total S.A (Open): $2\pi r^2$
Volume: $\frac{2}{3}\pi r^3$

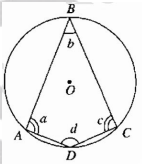
Circle Properties



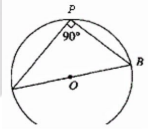
Angle at centre = twice angle at circumference



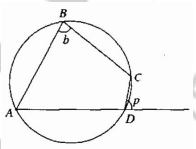
Angles in the same segment



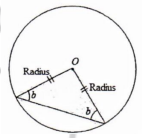
Angles in opp segment are supplementary



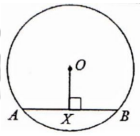
Angle in semi-circle



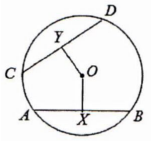
Exterior angle of a cyclic quad



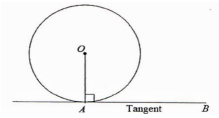
Isosceles Triangle



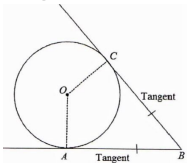
Perpendicular from centre bisect chord



Equal chord, equal distance from centre



Radius perpendicular to tangent



Tangent from external point

Matrices

Row $(a \quad b \quad c)$

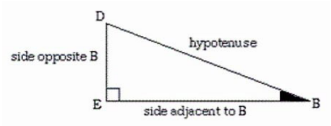
Column $\begin{pmatrix} a \\ b \\ c \end{pmatrix}$

Zero/Null $\begin{pmatrix} 0 & 0 \\ 0 & 0 \end{pmatrix}$

Scalar $\begin{pmatrix} a & 0 \\ 0 & a \end{pmatrix}$

Identity $\begin{pmatrix} 1 & 0 \\ 0 & 1 \end{pmatrix}$

Trigonometry



TOA CAH SOH
***Only used for Right angled Triangle**
Area: $\frac{1}{2}$ x b x h

Sine rule: $\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$ (opp angle to length)
Cosine rule: $a^2 = b^2 + c^2 - 2bc \cos A$ ("Kiap" method)
Area: $\frac{1}{2}$ ab sin C ("Kiap" method)
***For all kinds of triangle**

Arc

S = $\frac{Angle}{360}$ x $2\pi r$ (degree) or S = r Θ (radian)
A = $\frac{Angle}{360}$ x πr^2 (degree) or A = $\frac{1}{2}$ r^2 Θ (radian)
Degree to radian → x$\frac{\pi}{180}$ (vice versa)

Vectors

Subtraction: AB = OB – OA
Addition: AB = A_ + _B
***Same ratio = collinear and/or parallel**