SECONDARY TWO MATHEMATICS CHEAT SHEET

Algebra

$(a+b)^2 = a^2 + 2ab + b^2$

$(a-b)^2 = a^2 - 2ab + b^2$

$(a+b)(a-b) = a^2 - b^2$

Cross Multiplication (=)

$\frac{x+2}{3} = \frac{x}{4}$

Common Denominator (+ or -)

$\frac{x+2}{3} - \frac{x}{4} = 10$

Keep Change Flip/Cancellation (x or ÷)

$\frac{2xy}{3x} \div \frac{x}{y} = \frac{2xy}{3x} \times \frac{y}{x}$

$= \frac{2y^2}{3x}$

Simultaneous Eqns:

1) Elimination

$x + y = 5$ -------- (1)

$x + 2y = 10$ -----(2)

(1) – (2) to get rid of x

Same Sign Minus, Diff Sign Plus

2) Substitution

$x + y = 5$ -------- (1)

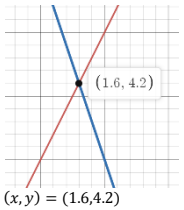
$x + 2y = 10$ -----(2)

From (1),

$x = 5 - y$ -------- (3)

Sub (1) into (2) to find y

3) Graphical Method



$(x, y) = (1.6, 4.2)$

Factorisation Methods:

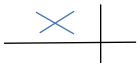
- Grouping

$ax - ay + bx - by = (ax - ay) + (bx - by)$

$= a(x-y) + b(x-y)$

$= (x-y)(a+b)$

- Cross Product



$cx + dy + dx + cy = (cx + cy) + (dx + dy)$

$= c(x+y) + d(x+y)$

$= (x+y)(c+d)$

- Table Method

Simple Interest

$I = \frac{PRT}{100}$

$A = P + I$

P: Principal (Amount invested or borrowed)

R: Interest Rate

T: Time (in years)

I: Interest

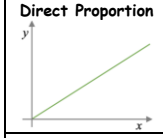
A: Total Amount (Principal + Interest)

Proportion

$y = kx$, $y = \frac{k}{x}$

x increase by 100% $= 2x$

Direct Proportion



Inverse Proportion

Number Patterns

$T_n = an + b$

a : Common Difference

b: Term before 1st Term

Quadratic: $an^2 + bn + c$

Other Seqs:

n^2 : 1, 4, 9,...

n^3: 1, 8, 27, 64, ...

Map Scale

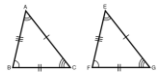
- 1 : n
- Map v.s. Actual
- Area Scale: (1)² : (n)²

Conversion

Congruence and Similarity

Congruent Triangles:

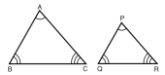
- Same Angles
- Same Side-Lengths
- Identical



$ABC \equiv EFG$

Similar Triangles:

- Same Angles
- Different Lengths
- Same Corresponding Length Ratios



$\frac{AB}{PQ} = \frac{BC}{QR} = \frac{AC}{PR}$

Percentage

$\text{Percentage Increase/Decrease} = \frac{\text{Increase/Decrease}}{\text{Original Value}} \times 100\%$

- Tax Relief
- Commission
- Profit/Discount
- Income Tax/GST

Polygons

Sum of Interior Angles $= (n-2) \times 180°$

Sum of Exterior Angles $= 360°$

1 Interior Angle + 1 Exterior Angle = 180°

Pentagon (5 sides), Hexagon (6 sides), Heptagon (7 sides), Octagon (8 sides), Nonagon (9 sides), Decagon (10 sides)

Inequalities

$x < -2$ $\quad x \geq 2$

Statistics

Median: Middle Value:

Even set: $\frac{x_1 + x_2}{2}$, Odd set: x

Mode: Number with Highest frequency

Stem	Leaf
1	2 4 8
2	2 2 3 5 5 8
3	
4	5 7 8

Pie Charts, Pictograms, Line Graphs, Histograms, Dot Diagrams, Stem-and-Leaf

A graph can be misleading if

- Axes do not start from 0
- Data is not proportionate

Speed

$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$

$\text{Average Speed} = \frac{\text{Total Distance}}{\text{Total Time}}$

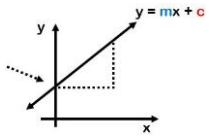
Conversion of Units

$\frac{10 \text{ m}}{1 \text{ s}} = \frac{10 \div 1000}{1 \div 3600} = 36 \text{ km/h}$

Linear Functions/Graphs

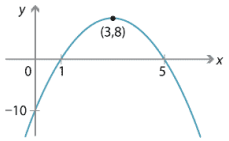
$y = mx + c$

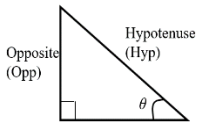
$m = \frac{y_2 - y_1}{x_2 - x_1}$



Graph Sketching

1. Find x-intercept (Sub y = 0)
2. Find y-intercept (Sub x = 0)
3. Find Turning Point (h,k)
   M1: Complete the Square
   M2: $\frac{x_1 + x_2}{2}$, sub into y.
4. Line of Symmetry: x = h





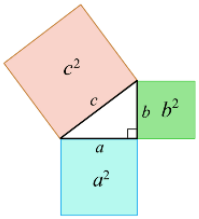
sine of angle θ: $\sin\theta = \frac{Opp}{Hyp}$

cosine of angle θ: $\cos\theta = \frac{Adj}{Hyp}$

tangent of angle θ: $\tan\theta = \frac{Opp}{Adj}$

(TOA CAH SOH)

Pythagoras' Theorem $a^2 + b^2 = c^2$



**Using the Converse of Pythagoras' Theorem, we can prove whether a triangle is a right-angled triangle.

Square

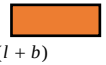
$A = l^2$

$P = 4l$

Rectangle

$A = lb$

$P = 2(l + b)$



Trapezium

$A = \frac{1}{2}(a+b)h$

Parallelogram

$A = bh$

Circle

$A = \pi r^2$

$C = 2\pi r$

Cone

$V = \frac{1}{3}\pi r^2 h$

$SA = \pi r(l + r)$

Cube

$V = l^3$

$SA = 6l^2$

Cuboid

$V = lbh$

$SA = 2(lb + lh + bh)$

Prism

$V = \text{base area} \times h$

Base Area = Cross-Sect. Area.

Cylinder

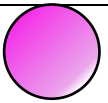
$V = \pi r^2 h$

$SA = 2\pi r(r + h)$

Sphere

$V = \frac{4}{3}\pi r^3$

$SA = 4\pi r^2$



Pyramid

$V = \frac{1}{3}(\text{base area})h$

$SA = \text{base area} + \text{faces}$

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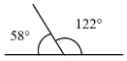
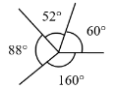
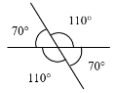
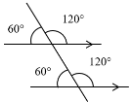
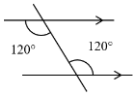
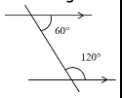
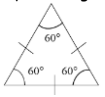
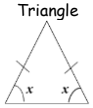
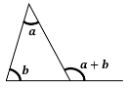
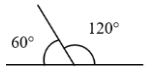
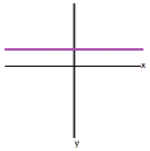
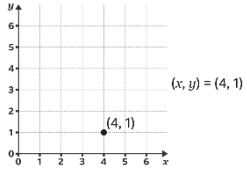
Angle Properties

Angles on str. line	Angles at a pt.	Vert. Opp. Angles	Corr. Angles	Alt. Angles	Int. angles	Equi. Triangle	Isos. Triangle	Sum of Int. Angles	Complementary	Supplementary
										

Graphs

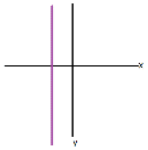
Horizontal Graphs:
$m = 0$





- x-coordinate first, then y.
- origin is (0,0)

Vertical Graphs:
m is undefined



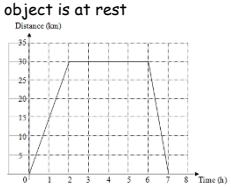
"Using a scale of 2 cm to represent 1 unit on both axes"

Every 2 cm on the graph paper is 1 unit.

1 cm is 5 small boxes,
2 cm is 10 small boxes.

Other Graphs:

- Distance-Time Graph
- Gradient = Speed
- Flat parts of graph: 0 gradient, 0 speed, object is at rest



Probability

$P(A) + P(A') = 1$

Sample Space:

- List of all possible outcomes
- No repeated outcomes

Eg: Sample Space of rolling a fair dice: $\{1, 2, 3, 4, 5, 6\}$

P(A) = 1 (Certain Event)

P(A) = 0 (Impossible Event)

Recurring Decimals

- Can be expressed as fractions (Rational)
- Dot above repeating numbers

$$0.\dot{3} = 0.3333333 \ldots = \frac{1}{3}$$

$$0.\dot{1}\dot{4}\dot{2}\dot{8}\dot{5}\dot{7} = 0.142857142857 \ldots = \frac{1}{7}$$

Terminating Decimals

- Has an ending digit
- Rational
- Does not go on forever
- Eg: 0.5, 0.128, 3.14

Rational Numbers

- Can be expressed as fractions
- All integers
- Recurring Decimals
- $4,5,\frac{1}{2},0.\dot{3}=0.333\ldots$

Irrational Numbers

- Cannot be expressed as fractions
- $\sqrt{2},\sqrt{7},\pi$

Prime Numbers

- Only 2 factors, 1 and itself
- 1 is NOT prime

Composite Numbers

- More than 2 factors
- 1 is NOT composite

Prime Factorisation

2	200
2	100
2	50
5	25
5	5
	1

$200 = 2^3 \times 5^2$

Perfect Cube: Powers multiple of 3
Perfect Square: Powers multiple of 2

Highest Common Factor
Stop when both numbers have no more common factors

2	36, 72
2	18, 36
3	9, 18
3	3, 6
	1, 2

Lowest Common Multiple
Go ALL THE WAY until all numbers become 1

2	6	12	18
2	3	6	9
3	3	3	9
3	1	1	3
	1	1	1

Find k such that 200k is a perfect square:

$200k = 2^3 \times 5^2 \times k$
k = 2

The result will be perfect square.

Find k such that 200k is a perfect cube:

$200k = 2^3 \times 5^2 \times k$
k = 5

The result will be perfect cube.

Significant Figures (Rules)

#1 All non-zero digits are significant

#2 All zeroes between non-zero digits are significant

#3 For decimals, all zeroes before a non-zero digit are not significant

#4 For decimals, all zeroes after a non-zero digit are not significant

#5 For whole numbers, the zeroes at the end may or may not be significant, depending on how the number is rounded off.

Ratio

1) Convert to Same Units
Eg: 1000 g : 2 kg
1000 g : 2000 g
1 : 2

2) Common Ratio Method
a : b : c
1 : 2
3 : 2
3 : 6
6 : 4
3 : 6 : 4

Rate

- Hire Purchase (Deposit + Monthly Instalments)
- Income Tax
- Tax Relief
- GST (Government-Service Tax)
- Commission (eg: Agent earns a % of sale price of a house)

Exchange Rate

SGD$1 = RM$3
Find the cost of a RM$30 handbag in Singapore.
$RM\$30 \div 3 = SGD\$10$