CHEAT SHEET # 010 January 2025

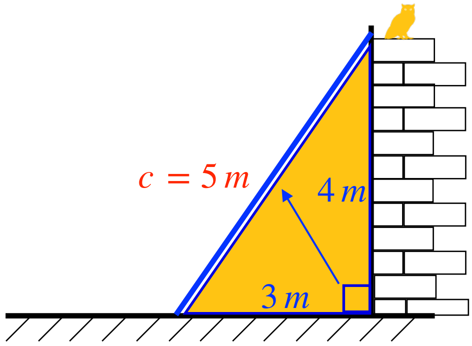
Australian Curriculum Cheat Sheet Year 8 Mathematics

Free and always will be!

Aim: A cheat sheet for Year 8 Mathematics under the Australian Curriculum, focusing on the key areas of study with examples, formulas, and tips:

Year 8 Units Overview

Term 1 **Unit 1** - Indices, Scientific Notation, Rational Numbers, and Surds. **Unit 2** - Expanding and Factorising.
Term 2 **Unit 3** - Linear Equations, Inequalities, and Linear Relationships. **Unit 4** - Ratio, Rates, Proportion, and Pythagoras.
Term 3 **Unit 5** - Volume, Surface Area, and Transformations. **Unit 6** - Angle Relationships, Congruence, and Similarity.
Term 4 **Unit 7** - Data Representation and Interpretation. **Unit 8** - Probability, Tree Diagrams, and Venn diagrams.



$(1\,km = 1{,}000\,\not{m} \times 100\,cm/\not{m} = 100{,}000\,cm)$
or
$(100{,}000\,cm = 1\,km)$

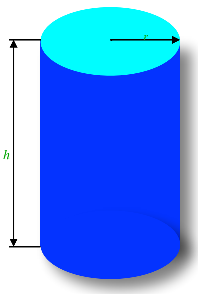
$$a(b + c) = ab + ac$$

Rotaion Coordinate Rules (around the origin)

90° counterclockwise or 270° clockwise
$(x, y) \rightarrow (-y, x)$

180° clockwise or 180° counterclockwise
$(x, y) \rightarrow (-x, -y)$

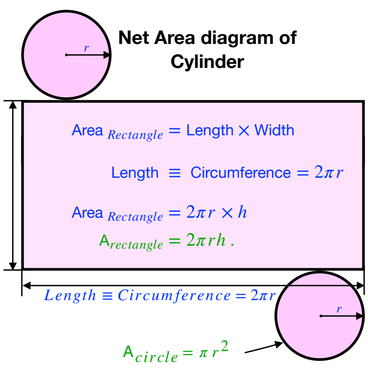
90° clockwise or 270° counterclockwise
$(x, y) \rightarrow (y, -x)$

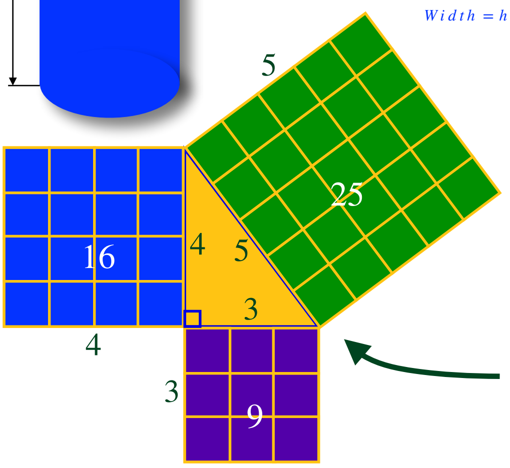


Multiplication: $a^m \times a^n = a^{m+n}$.

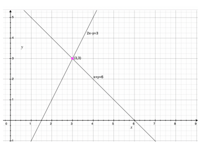
Division: $\frac{a^m}{a^n} = a^m \div a^n = a^{m-n}$.

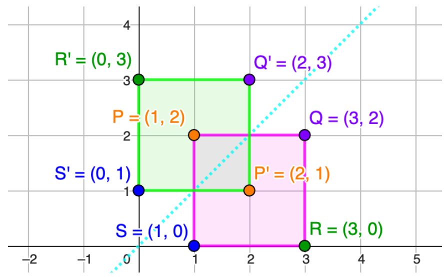
Power of a power: $(a^m)^n = a^{m \times n}$.





$$a^2 + b^2 = c^2$$
$$3^2 + 4^2 = 5^2$$
$$9 + 16 \equiv 25$$





Term 1

Unit 1

1. Number and Algebra

Indices:

Rules of indices, converting to scientific notation.

Example: Simplify $3^2 \times 3^3$.

Solution:
$3^5 = 243$.

Example: Simplify $\frac{5^6}{5^3}$.

Solution:
Using the law of indices for division:
125 .

Example: Simplify 7^0

Solution:
Anything to the power of zero equals one.
1 .

Multiplication: $a^m \times a^n = a^{m+n}$.

Division: $\frac{a^m}{a^n} = a^m \div a^n = a^{m-n}$.

Power of a power: $(a^m)^n = a^{m \times n}$.

Scientific Notation:

Example: Convert $50{,}000$ to scientific notation.

Solution:
5×10^4 .

Example: Multiply $(2 \times 10^3) \times (3 \times 10^2)$.

Solution:
6×10^5

Example: Convert 7.2×10^{-4} to standard form.

Solution:
0.00072.

Rational Numbers:

Example: Perform the division: $\frac{-15}{-5}$.

($-\times-=+$) If signs are:
opposite → change to −
same → change to +

Solution:
Dividing two negative numbers gives a positive result:

$$\frac{-15}{-5}=\frac{15}{5}$$
$$=3.$$

Example: Perform the addition: $\frac{-7}{2}+\frac{3}{4}$.

Solution:
$$\frac{-11}{4}$$

Surds:

Example: Simplify: $\sqrt{64}$.

$Remember, \sqrt{x}=x^{\frac{1}{2}}.$

Solution:
2^3 .

Unit 2

Expanding:

Binomial expansion, factorising common factors.

Example: Expand $3(x-2)$.

($+\times-=-$) If signs are:
opposite → change to −
same → change to +

Solution:
$3x-6$.

Example: Expand $(x+3)(x-2)$.

$$a(b+c)=ab+ac$$

Solution:
$x^2+x-6.$

Factorising:

Example: Factorise $2x+4$.

Solution:
$2(x+2)$.

Example: Factorise $2x^2 + 5x + 2$.

Solution:
$(2x + 1)(x + 2)$.

Example: Factorise $6a^2 + 9a$.

Solution:
$3a(2a + 3)$.

Example: Factorise $x^2 - 9$.

Solution:
$(x - 3)(x + 3)$.

Term 2

Unit 3

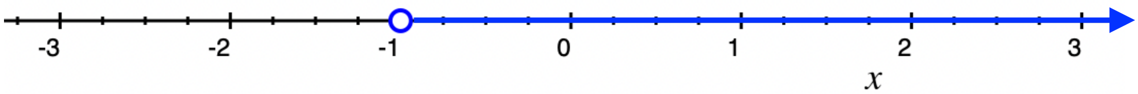
Linear Equations, Inequalities and Linear Relationships:

Solving multi-step equations, inequalities on number lines.
Example: Solve $3x - 5 = 10$.

Solution:
$x = 5$.

Example: Graph the solution to $x > -1$ on a number line.

Solution:
Draw an open circle at -1 and shade all points to the right:



Example: Write an equation representing a linear relationship.

Solution:
$y = 4x + 3$

Example: Solve the inequality $x + 3 < 7$.

Solution:
$x < 4$

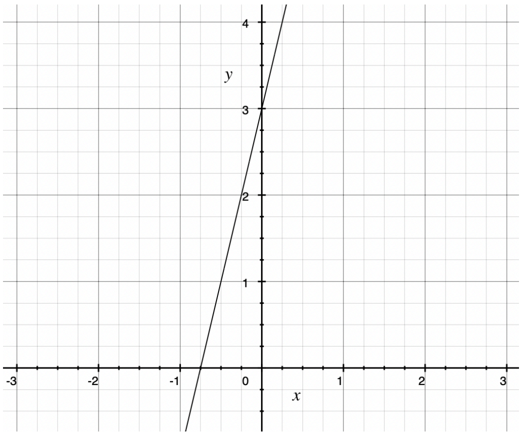
Example: Solve $-3x > 6$.

Solution:
$x < -2$

When multiplying or dividing both sides of an inequality by a negative number, you must reverse the inequality sign.

Example: Graph $y = 4x + 3$ on a cartesian plane.

Solution:



Example: You have $\$20$ to spend on books, each costing $\$4$. Write and solve an inequality to find how many books you can buy.

Solution:
$b \leq 5$. You can buy up to 5 books.

Unit 4

Ratio:

Example: Define ratio and rate. How are they different?

Solution:
Ratio: A comparison of two or more quantities in terms of how many times one contains the other.
Example: $3 : 2$.

Rate: A ratio that compares different kinds of quantities, often time-related, like speed (km/h) .

Difference: Ratios compare similar quantities, while rates compare different units.
Solve problems involving direct and indirect proportions.

Example: Simplify the ratio $15 : 20$.

Solution:
$3 : 4$

Rates:

Example: If 3 apples cost \$1.50, how much for 7 apples?

Solution:
$3.50.

Example: If a car travels $180\, km$ in $3\, hours$, what is its average speed in km/h?

Solution: Speed = Distance ÷ Time
$60\ km/h$

Proportion:

Example: Solve the proportion: $\frac{3}{5} = \frac{x}{20}$.

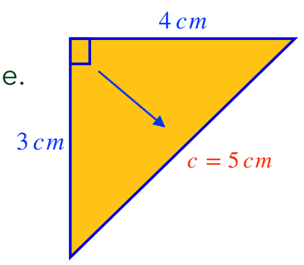
Solution:
$x = 12$.

Example: A map scale is $1 : 50{,}000$. How many $kilometres$ does $2\, cm$ on the map represent?

Solution: $(1\, km = 1{,}000\, m \times 100\, cm/m = 100{,}000\, cm)$ or $(100{,}000\, cm = 1\, km)$
$1\, km$.

Pythagorean Theorem:

Using Pythagoras for right-angled triangles.
Example: If two sides of a right triangle are 3 cm and 4 cm, find the hypotenuse.



Solution: $a^2 + b^2 = c^2$
$c = 5\, cm$.

Example: In a right triangle, the hypotenuse is $10\, cm$ and one side is $6\, cm$, what is the length of the other side?

Solution:
$a = 8\, cm$

Example: Check if $(5, 12, 13)$ is a Pythagorean triplet..

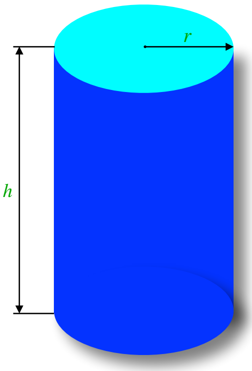
Solution:
$5^2 + 12^2 = 13^2$, $(5, 12, 13)$ is indeed a Pythagorean triple.

Term 3

Unit 5

2. Measurement and Space

Volume:

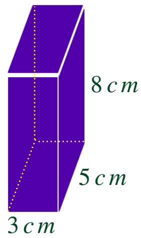


Formulas for prisms, cylinders, cones, and pyramids.

Example: Calculate the volume of a rectangular prism with dimensions $5\,cm$, $3\,cm$, and $8\,cm$.

Solution:
$V = 120\ cm^3$.

V_{prism} = Area of Base × Height



Example: Find the volume of a cylinder with radius 2 cm and height 5 cm.

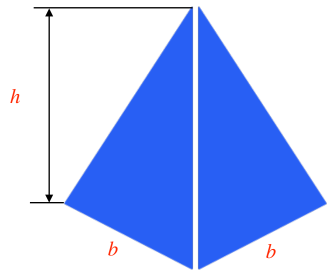
Solution:
$V = 20\pi\ cm^3$.

Example: If a pyramid has a square base with side length $4\,cm$ and height $6\,cm$, what is its volume?

Solution:
$V = 32\ cm^3$.

Volume $= \frac{1}{3}$ × Base Area × Height

$V_{pyramid} = \frac{1}{3}b^2h$ or $V_{pyramid} = \frac{b^2h}{3}$

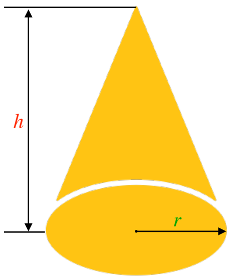


Example: What is the formula for the volume of a cone?

Solution:
$V_{cone} = \frac{1}{3}\pi r^2 h$

Volume $= \frac{1}{3}$ × Area of Base × Height

$V_{cone} = \frac{1}{3}\pi r^2 h$,



Surface Area:

Example: What is the formula for the total surface area of a rectangular prism?

Solution:
Surface Area $= 2lw + 2lh + 2wh$, where l is length, w is width, and h is height.

Example: Calculate the surface area of a cylinder with radius $3\,cm$ and height $10\,cm$.

Solution:
$\approx 245.04\,cm^2$

Transformations (Translation, Reflection, Rotation) and Angle Relationships:

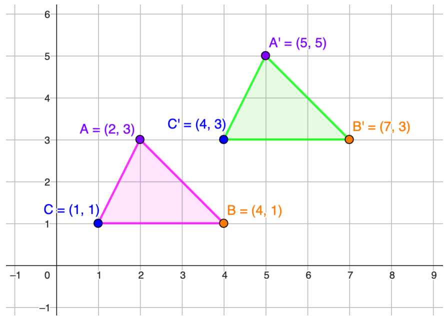
Example: A triangle ABC with vertices $A(2, 3)$, $B(4, 1)$, and $C(1, 1)$ is translated 3 units to the right and 2 units up to form triangle $A'B'C'$.

a) Determine the coordinates of the vertices of triangle $A'B'C'$.

b) Confirm the $\angle CAB$ is the same as $\angle C'A'B'$, by

I) finding the slope of each line then,

II) finding the angles between each.



Solution:

$a)\ A'(5, 5), B'(7, 3),$ and $C'(4, 3)$

$bI)\ slope_1 = -1\ slope_2 = 2$

$bII)$ Both have the same angle : 71.6°

Unit 6

Definitions

Example: Define what an angle is, and list the types of angles based on their measure.

Solution:

An angle is formed when two lines or line segments meet at a point (vertex). Types include:

Acute:	Less than 90°.
Right:	Exactly 90°.
Obtuse:	Between 90° and 180°.
Straight:	Exactly 180°.
Reflex:	More than 180° but less than 360°.
Full:	Exactly 360°.

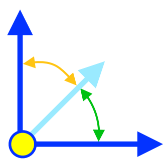
Angle Relationships:

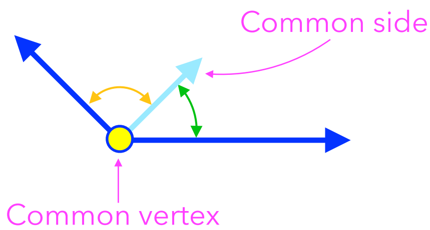
Adjacent, complementary, vertically opposite, and supplementary angles.

Example: If one *adjacent angle* measures 30°, and together they form a *straight line*, what is the measure of the other angle?

Solution:

150°.





Example: What are complementary angles?

Solution:

Two angles are complementary if their measures add up to 90°. **E.g.** $A^\circ + B^\circ = 90^\circ$.

Example: What are vertically opposite angles?

Solution:
Vertically opposite angles are formed when two lines intersect. They are opposite each other at the intersection and are equal in measure.

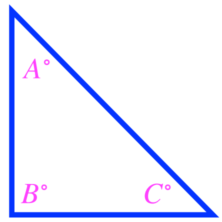
Example: If two angles are supplementary and one is 60° , what's the other?

Solution:

120° (since supplementary angles sum to 180°) .

Triangles and Quadrilaterals

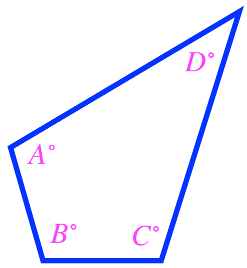
$A^\circ + B^\circ + C^\circ = 180^\circ$.



Example: State the sum of the interior angles in a triangle.

Solution:
The sum of the interior angles of ANY triangle is 180° .

Example: If three angles of a quadrilateral measure $90^\circ, 120^\circ,$ and $80^\circ,$ what is the measure of the fourth angle?



Solution:
Fourth angle $= 70^\circ$.

$A^\circ + B^\circ + C^\circ + D^\circ = 360^\circ$.

Congruence and Similarity:

Conditions for congruence, ratio in similar shapes.
Example: Define what it means for two shapes to be congruent.

Solution:
Two shapes are congruent if they are identical in shape and size, meaning every corresponding angle is equal, and every corresponding side length is equal. They can be moved (translated, rotated, or reflected) but **not** resized.

Example: What is the ratio of similarity?

Solution:
The ratio of similarity between two similar shapes is the scale factor by which one shape can be enlarged or reduced to match the other. It's the **ratio of the lengths of any corresponding sides**.

Example: Two rectangles have side lengths of $2\ cm$ by $3\ cm$ and $4\ cm$ by $6\ cm$. Using the similarity ratio, are they similar?

Solution:
Yes, because the ratio of corresponding sides:
$2:4 = 1:2 \ or \ 3:6 = 1:2$, are the same, making the rectangles similar.

Term 4

Unit 7

3. Statistics and Probability

Data Representation and Interpretation:

Stem-and-leaf plots, histograms, scatter plots.

Example: What are the different types of data (qualitative vs. quantitative)?

Solution:

Qualitative Data: Descriptive data that describes qualities or characteristics (e.g., colour, type).

Quantitative Data: Numerical data that can be measured or counted (e.g., height, number of students).

Example: Construct a stem-and-leaf plot for the data 14, 22, 25, 31, 35.

Solution:

```
Stem | Leaf
  1  |   4
  2  |   2 5
  3  |   1 5
```

Example: What are three common types of graphs used in data analysis?

Solution:

Bar Graphs: Good for comparing quantities.

Histograms: Used for continuous data to show distribution.

Pie Charts: For showing proportions or percentages of a whole.

Mean, median, mode, range, interquartile range.

Example: Define mean, median, and mode.

Solution:

Mean: The arithmetic average of a set of numbers, calculated by summing all values and dividing by the count.

$$\mu = \frac{\sum_{i=1}^{n} x_i}{n} = \text{Mean} = \frac{\text{Sum of scores}}{\text{Number of Scores}}$$

Median: The middle value in an ordered list of data.

Mode: The value that appears most frequently in the data set.

Example: Find the interquartile range for {5, 8, 12, 15, 18, 20}.

Solution:

$Q1 = 8,\ Q3 = 18,\ IQR = 18 - 8 = 10.$

Unit 8

Probability of Events:

Example: What does it mean for an event to have a probability of 0.75 ?

Solution:

An event with a probability of 0.75 has a $75\,\%$ chance of occurring, OR it is three times more likely to happen than not to happen.

P(likely to happen) $= \frac{3}{4}$, P(not likely to happen) $= \frac{1}{4}$.

Including complementary events and two-way tables.

Example: If $P(A) = 0.4$, what's $P(not\ A) = P(A')$?

Solution:

$P(not\ A) = P(A') = 1 - P(A) = 0.6.$

Example: What is the probability of drawing a spade from a standard deck of cards?

Solution:

$$P(\text{Event}) = \frac{\text{Number of Favourable Outcomes}}{\text{Total Number of Outcomes}}$$

$$= \frac{1}{4}, = 0.25\,, = 25\,\%\,.$$

Example: If $P(A) = 0.3$ and $P(B) = 0.5$, and A and B are mutually exclusive, what is $P(A\ or\ B)$?

Solution:

$P(A\ or\ B) = 0.8$

Example: If you draw two cards without replacement from a deck, what is the probability of getting two aces?

Solution:

First draw: $\frac{4}{52}$ (4 aces out of 52 cards).

Second draw: $\frac{3}{51}$ (3 aces left out of 51 cards).

$$P(\text{one event AND another event}) = P(1 \cap 2)$$
$$= P(\text{event one}) \times P(\text{event two})$$
$$= \frac{1}{221}\,.$$

Tree-Diagrams, Two-way Tables, and Venn diagrams:

Including probability from each.

Example: A student is packing their lunch and has the following choices:

Main item: Sandwich (S) or Burger (B)

Drink: Juice (J) or Water (w)

Draw a tree diagram and list the four possible choices for lunch:

Solution:

A tree diagram visually represents the combinations by branching out from the first event (Main item) to the second event (Drink).

Tree diagram:

```
        Start
       /     \
      S       B
     / \     / \
    J   w   J   w
```

Possible outcomes: (S, J) (S,w) (B, J) (B,w)

Example: A student is packing their lunch and has the following choices:

Main item: Sandwich (S) or Wrap (W)

Drink: Juice (J) or Water (T)

Draw a a two-way table

Solution:

		Drink	
		Juice (J)	**Water (T)**
Main Item	**Sandwich (S)**	S, J	S, T
	Wrap (W)	W, J	W, T

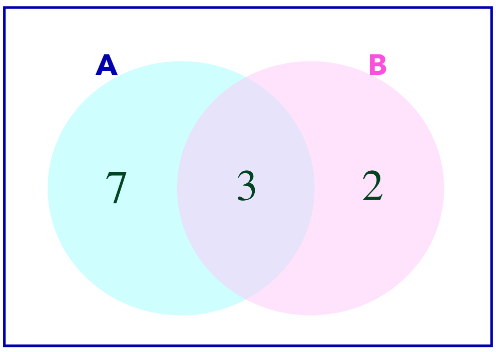
Example: Draw a Venn diagram for two sets, A and B, where:

Set A has 10 elements

Set B has 5 elements

3 elements are in both A and B

Solution:



General Tips

Estimation: Improve estimation skills for complex calculations.
Logical Reasoning: Use logic to solve problems, especially in algebra and geometry.
Units: Be vigilant with units, especially in measurement questions.
Problem-Solving: Break down problems into manageable parts, consider different strategies.

Additional Tips

Technology Use: Employ calculators for complex calculations, but understand the process.
Real-World Applications: Apply math to real-life contexts like scaling maps, budgeting, or analysing data in sports.
Common Errors: Be careful with negative numbers in equations, ensure all parts of a problem are considered in probability questions.

This cheat sheet should serve as a quick reference, but mastering Year 8 Maths requires a lot of practice, understanding of concepts, and application to various types of problems. For further study, consider resources like the Australian Curriculum's own materials or educational websites and apps tailored for Year 8 students.