

GRADE A TUTORING & LEARNING CENTRE



Maths Facts & Formulae

For SEA Preparation

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We offer classes and one-on-one tutoring, specialising in support for SEA repeaters, homeschoolers and students preparing for SEA.

This free Skill Builders booklet brings useful maths facts and formulae together to support your child's revision.

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SEA Maths Essentials

A simple reference booklet of maths facts and formulae

Grade A Tutoring & Learning Centre

Keep the key facts together. Find the rule you need quickly.

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Number facts

Factors, multiples and divisibility

Term	Meaning
Factor	A whole number that divides a whole number exactly.
Multiple	The result of multiplying a number by a whole number.
Prime number	A whole number greater than 1 with exactly two factors: 1 and itself.
Composite number	A whole number greater than 1 with more than two factors.
Even number	A whole number divisible by 2.
Odd number	A whole number not divisible by 2.

1 is neither prime nor composite. 2 is the only even prime.

Prime numbers less than 100

2, 3, 5, 7, 11, 13, 17, 19, 23, 29, 31, 37, 41, 43, 47, 53, 59, 61, 67, 71, 73, 79, 83, 89, 97.

Divisibility rules

Divisible by	Check
2	The last digit is 0, 2, 4, 6 or 8.
3	The sum of the digits is divisible by 3.
4	The last two digits form a number divisible by 4.
5	The last digit is 0 or 5.
6	The number is divisible by both 2 and 3.
8	The last three digits form a number divisible by 8.
9	The sum of the digits is divisible by 9.
10	The last digit is 0.

Squares and square roots

Read across each row: squaring and square roots undo each other.

Square: multiply a number by itself. Square root: reverse this.

Number	Square	Square root
1	$1 \times 1 = 1$	$\sqrt{1} = 1$
2	$2 \times 2 = 4$	$\sqrt{4} = 2$
3	$3 \times 3 = 9$	$\sqrt{9} = 3$
4	$4 \times 4 = 16$	$\sqrt{16} = 4$
5	$5 \times 5 = 25$	$\sqrt{25} = 5$
6	$6 \times 6 = 36$	$\sqrt{36} = 6$
7	$7 \times 7 = 49$	$\sqrt{49} = 7$
8	$8 \times 8 = 64$	$\sqrt{64} = 8$
9	$9 \times 9 = 81$	$\sqrt{81} = 9$
10	$10 \times 10 = 100$	$\sqrt{100} = 10$
11	$11 \times 11 = 121$	$\sqrt{121} = 11$
12	$12 \times 12 = 144$	$\sqrt{144} = 12$
13	$13 \times 13 = 169$	$\sqrt{169} = 13$
14	$14 \times 14 = 196$	$\sqrt{196} = 14$
15	$15 \times 15 = 225$	$\sqrt{225} = 15$
16	$16 \times 16 = 256$	$\sqrt{256} = 16$

BODMAS

Brackets → Orders (powers and roots) → Division / Multiplication

→ Addition / Subtraction.

Division and multiplication: work from left to right.

Addition and subtraction: work from left to right.

Cubes: multiply a number by itself three times.

$1^3=1$; $2^3=8$; $3^3=27$; $4^3=64$; $5^3=125$; $6^3=216$; $7^3=343$;

$8^3 = 512$; $9^3 = 729$; $10^3 = 1,000$. < less than; > greater than; ≠ not equal.

Fractions, decimals and %

Bold, shaded rows: popular conversions to learn first.

Fraction	Decimal	Percentage
1/100	0.01	1%
1/50	0.02	2%
1/25	0.04	4%
1/20	0.05	5%
1/10	0.1	10%
1/8	0.125	12.5%
1/5	0.2	20%
1/4	0.25	25%
1/3	0.333...	33⅓%
3/8	0.375	37.5%
2/5	0.4	40%
1/2	0.5	50%
3/5	0.6	60%
5/8	0.625	62.5%
2/3	0.666...	66⅔%
3/4	0.75	75%
4/5	0.8	80%
7/8	0.875	87.5%

The dots (...) mean the digit repeats forever.

Fraction → decimal: numerator ÷ denominator.

Decimal → percentage: × 100. Percentage → decimal: ÷ 100.

Percentage → fraction: write over 100, then simplify.

Fraction of an amount: amount ÷ denominator × numerator.

Measurement conversions

Use the same units before calculating.

Measure	Equivalents
Length	$1 \text{ km} = 1,000 \text{ m} = 100,000 \text{ cm} = 1,000,000 \text{ mm}$ $1 \text{ m} = 100 \text{ cm} = 1,000 \text{ mm}; 1 \text{ cm} = 10 \text{ mm}$ $1 \text{ m} = 1/1,000 \text{ km}$ $1 \text{ mm} = 1/10 \text{ cm} = 1/1,000 \text{ m} = 1/1,000,000 \text{ km}$
Mass	$1 \text{ kg} = 1,000 \text{ g}; 1 \text{ g} = 1/1,000 \text{ kg}$
Capacity	$1 \text{ L} = 1,000 \text{ mL} = 1,000 \text{ cm}^3$ $1 \text{ mL} = 1/1,000 \text{ L} = 1 \text{ cm}^3$
Area	$1 \text{ cm}^2 = 100 \text{ mm}^2; 1 \text{ m}^2 = 10,000 \text{ cm}^2$
Volume	$1 \text{ m}^3 = 1,000,000 \text{ cm}^3 = 1,000 \text{ L}$

Converting units

Larger unit → smaller unit: multiply by the conversion factor.

Smaller unit → larger unit: divide by the conversion factor.

Units tell you what is being measured

Length / perimeter: mm, cm, m, km.

Area: mm^2 , cm^2 , m^2 .

Volume: cm^3 , m^3 .

Capacity: mL, L.

For area, square the length conversion factor. For volume, cube it.

Time and calendars

Hours and minutes use groups of 60.

Unit	Equivalent
1 minute	60 seconds
1 hour	60 minutes = 3,600 seconds
1 day	24 hours
1 week	7 days
1 year	12 months; 365 days
1 leap year	366 days

The months

30 days: April, June, September, November.

31 days: January, March, May, July, August, October, December.

February: 28 days; 29 in a leap year.

Leap years are divisible by 4, except century years, which must be divisible by 400.

A month is not always exactly 4 weeks.

12-hour and 24-hour time

12 midnight = 00:00. 12 noon = 12:00.

From 1 a.m. to 11 a.m., keep the hour.

From 1 p.m. to 11 p.m., add 12 to the hour.

Elapsed time and conversions

Elapsed time = end time – start time, allowing for a change of day.

Hours → minutes: $\times 60$. Minutes → hours: $\div 60$.

Decimal part of an hour → minutes: $\times 60$.

Money and simple interest

Quick rules for prices, VAT, interest and monthly instalments.

What to find	Formula
Profit	Selling price – cost price
Loss	Cost price – selling price
Selling price at a profit	Cost price + profit
Selling price at a loss	Cost price – loss
Cost price	Selling price – profit OR selling price + loss
Discount amount	Discount rate $\div$ 100 $\times$ original price
Discount %	Discount $\div$ original price $\times$ 100%
Price after discount	Original price – discount
VAT amount	Price before VAT $\times$ 1/8
Price including VAT	Price before VAT + VAT amount
Original price	New price + discount

VAT: $12\frac{1}{2}\% = 1/8$. Find one-eighth by dividing by 8.

When discount comes first, calculate VAT on the discounted price.

Simple interest

Interest = principal $\times$ annual rate $\times$ number of years $\div$ 100

Total amount = principal + interest

Principal = total amount – interest

Monthly instalments

Monthly instalment = balance to pay $\div$ number of months

Squares and rectangles

Perimeter, area and missing sides



Square

What to find	Formula
Perimeter (P)	side $\times$ 4
Area (A)	side $\times$ side = s^2
Side from perimeter	$P \div 4$
Side from area	$\sqrt{A}$ (square root of the area)

Rectangle

What to find	Formula
Perimeter (P)	$2 \times (\text{length} + \text{width})$
Area (A)	length $\times$ width
Length from area	$A \div \text{width}$
Width from area	$A \div \text{length}$
Length from perimeter	$P \div 2 - \text{width}$
Width from perimeter	$P \div 2 - \text{length}$

Width is also called breadth. Keep all lengths in the same unit.

Perimeter uses length units; area uses square units.

Compound shapes

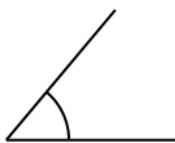
- Choose the formula that matches the measurement.
- Area: split the shape into rectangles or triangles and add their areas.
- For a cut-out, subtract its area from the whole.
- Perimeter: add only lengths on the outside boundary.
- Missing length: subtract the known part from the full length.
- Number of tiles: total area $\div$ area of one tile, using matching units.

Plane figures

Figure	Number of sides
Triangle	3
Quadrilateral	4
Pentagon	5
Hexagon	6
Heptagon	7
Octagon	8

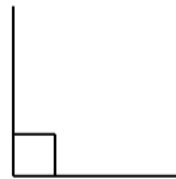
Types of angles

Recognise the shape of each angle and its size.



Acute

$0^\circ < \text{angle} < 90^\circ$



Right

90°



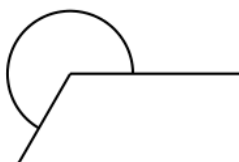
Obtuse

$90^\circ < \text{angle} < 180^\circ$



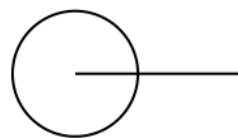
Straight

180°



Reflex

$180^\circ < \text{angle} < 360^\circ$



Full turn

360°

Straight line: angles total 180° . Around a point: 360° .

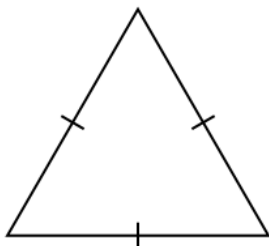
Triangle: angles total 180° . Quadrilateral: angles total 360° .

Vertically opposite angles are equal.

Parallel lines never meet. Perpendicular lines meet at 90° .

Types of triangles

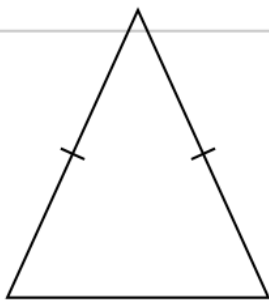
Triangles can be classified by their sides and by their angles.



Equilateral

3 equal sides; 3 equal angles of 60° .

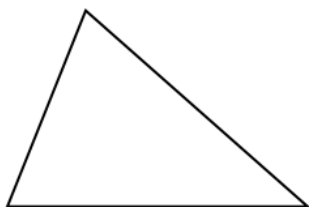
3 lines of symmetry.



Isosceles

2 equal sides; 2 equal base angles.

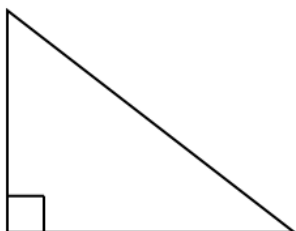
1 line of symmetry (exactly 2 equal sides).



Scalene

All sides and all angles are different.

0 lines of symmetry.



Right-angled

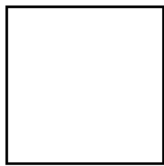
One angle is 90° (a quarter turn).

May also be isosceles or scalene.

Every triangle has three sides, and its angles total 180° .

Quadrilaterals

A quadrilateral has 4 sides. Its angles total 360° .



Square

Square

4 equal sides; 2 pairs of parallel sides.

4 right angles; 4 lines of symmetry.

Diagonals are equal, bisect each other and meet at 90° .



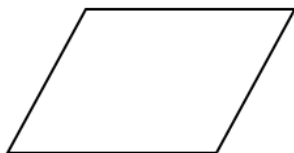
Rectangle

Rectangle

Opposite sides equal; 2 pairs of parallel sides.

4 right angles; 2 lines of symmetry.

Diagonals are equal and bisect each other.



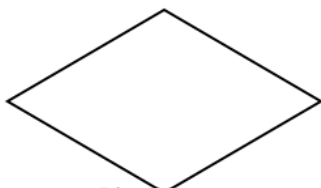
Parallelogram

Parallelogram

Opposite sides equal and parallel; opposite angles equal.

Adjacent angles total 180° ; diagonals bisect each other.

A general sloping parallelogram has 0 lines of symmetry.



Rhombus

Rhombus

4 equal sides; 2 pairs of parallel sides.

Opposite angles equal; diagonals bisect each other at 90° .

A non-square rhombus has 2 lines of symmetry.

How these shapes are related

A square is also a rectangle, rhombus and parallelogram.

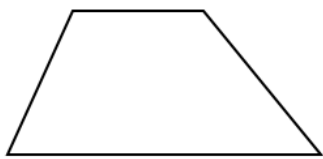
A rectangle is a parallelogram.

A rhombus is a parallelogram.

A rhombus does not need right angles. A parallelogram does not need right angles. The special cases above may have extra symmetry.

Trapeziums and kites

More quadrilaterals and their properties



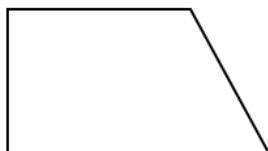
Scalene trapezium

Scalene trapezium
Exactly 1 pair of parallel sides.
The non-parallel sides are unequal.
0 lines of symmetry.



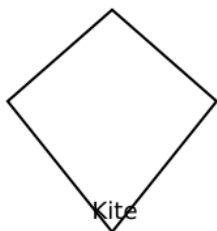
Isosceles trapezium

Isosceles trapezium
Exactly 1 pair of parallel sides; non-parallel sides equal.
Angles at each base are equal; diagonals are equal.
1 line of symmetry.



Right trapezium

Right trapezium
Exactly 1 pair of parallel sides.
2 adjacent right angles.
0 lines of symmetry.



Kite

Kite (shown)
2 pairs of adjacent equal sides; 1 pair of opposite angles equal.
Diagonals meet at 90° ; symmetry diagonal bisects the other.
1 line of symmetry; no parallel sides.

Words to remember

Adjacent: next to each other.

Opposite: across from each other.

Diagonal: joins two non-adjacent vertices.

Bisect: divide into two equal parts.

Line of symmetry: divides a shape into matching mirror halves.

This booklet uses “trapezium” for exactly one pair of parallel sides. The kite shown has two distinct pairs of equal sides.

Solids and volume

Flat faces, curved surfaces, edges and vertices

Solid	Flat faces	Edges	Vertices
Cube	6	12	8
Cuboid	6	12	8
Triangular prism	5	9	6
Triangular pyramid	4	6	4
Square-based pyramid	5	8	5

Flat face: a flat surface. Edge: where faces meet.

Vertex: a corner; the plural is vertices.

Curved solid	Surfaces and other features
Cylinder	2 flat circular faces; 1 curved surface; 2 circular edges; 0 vertices.
Cone	1 flat circular face; 1 curved surface; 1 circular edge; 1 vertex (apex).
Sphere	0 flat faces; 1 curved surface; 0 edges; 0 vertices.

Some school resources call curved surfaces “curved faces”. This table lists flat faces and curved surfaces separately.

Volume formulae

Cuboid: $V = \text{length} \times \text{width} \times \text{height}$.

Length: $V \div (\text{width} \times \text{height})$.

Width: $V \div (\text{length} \times \text{height})$.

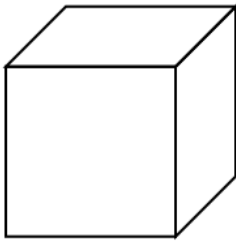
Height: $V \div (\text{length} \times \text{width})$.

Cube: $V = \text{side} \times \text{side} \times \text{side} = s^3$.

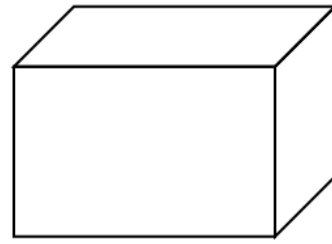
Use the same length unit throughout. Volume uses cubic units.

Recognising solids

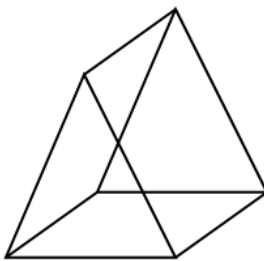
Use these pictures with the properties and nets in this booklet.



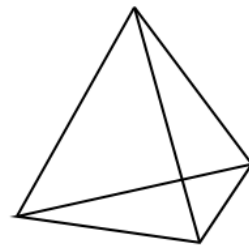
Cube



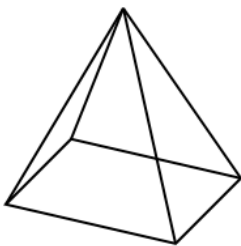
Cuboid



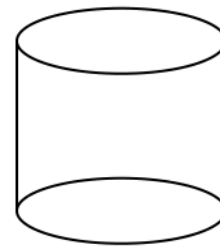
Triangular prism



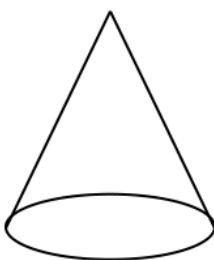
Triangular pyramid



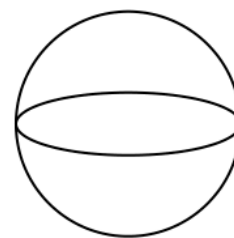
Square-based pyramid



Cylinder



Cone



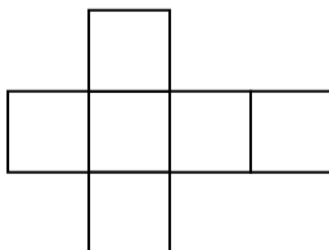
Sphere

Nets of solids

A net is a flat pattern that folds into a solid.

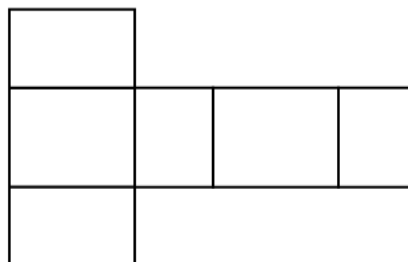
These are examples of valid nets. Many solids have more than one net. Diagrams are schematic; they are not cutting templates.

Cube



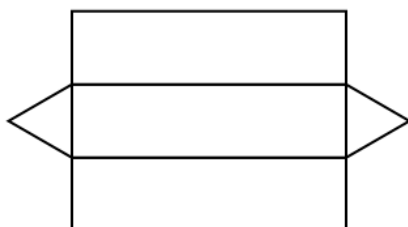
6 equal squares

Cuboid



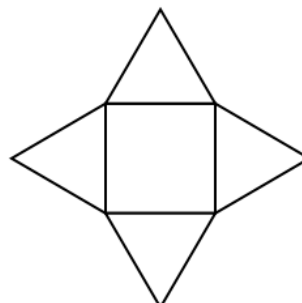
6 rectangles in 3 matching pairs

Triangular prism



3 rectangles + 2 matching triangles

Square-based pyramid



1 square + 4 triangles

Prism: two matching, parallel end faces joined by side faces.

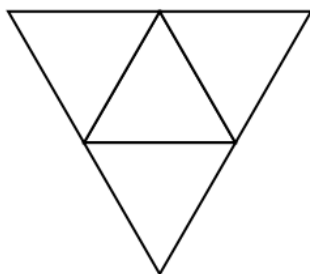
Pyramid: one base; triangular side faces meet at an apex.

A valid net folds without leaving gaps or overlapping faces.

More nets

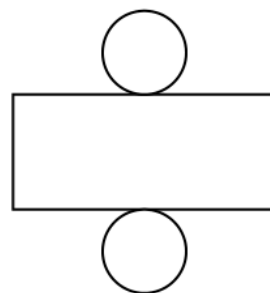
Pyramids and curved solids

Triangular pyramid



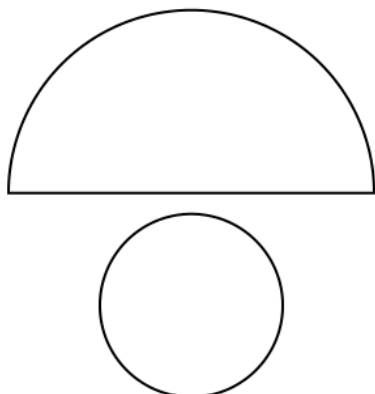
4 triangles

Cylinder



1 rectangle + 2 equal circles

Cone



1 circular sector + 1 circle

Sphere

A sphere has no exact flat net.

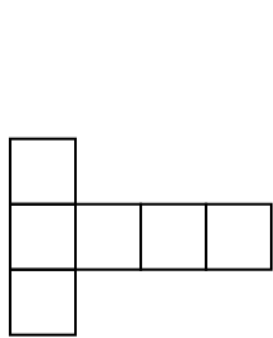
Its curved surface cannot be flattened into a plane without distortion.

Cylinder: the rectangle wraps around the curved surface. Its length matches the circumference of the base circle.

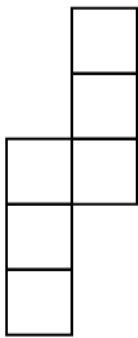
Cone: the sector wraps around the curved surface. Its curved arc matches the circumference of the base circle.

The 11 nets of a cube

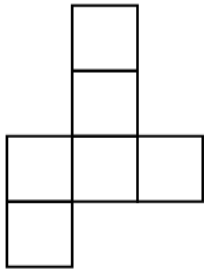
Each pattern contains six equal squares and folds into a cube.



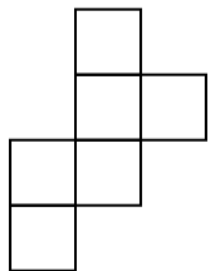
Net 1



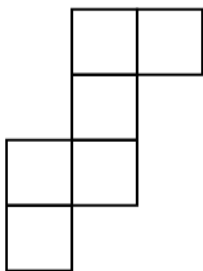
Net 2



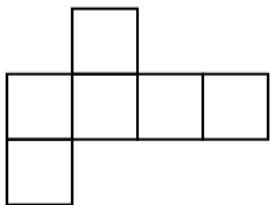
Net 3



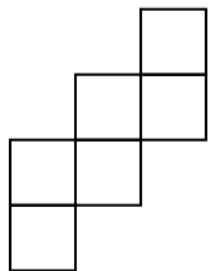
Net 4



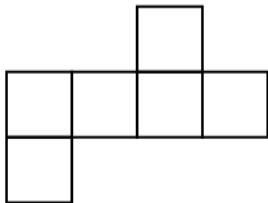
Net 5



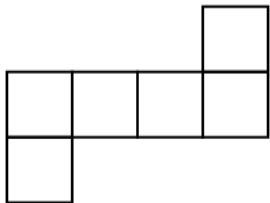
Net 6



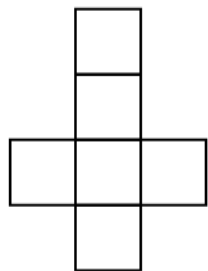
Net 7



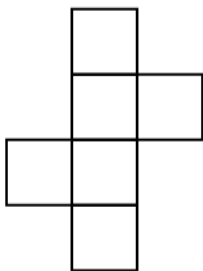
Net 8



Net 9



Net 10



Net 11

Rotations and reflections of a net count as the same pattern.

Statistics and data

Use these rules to describe a set of numbers.

Mean (average)

Mean = sum of the numbers $\div$ number of numbers

Add all the numbers, then divide by how many numbers there are.

Sum (total)

Sum = mean $\times$ number of numbers

Number of numbers

Number of numbers = sum $\div$ mean (when the mean is not zero)

Range

Range = largest number – smallest number

Mode

The number that appears most often.

There can be more than one mode, or no mode.

Median

Put the numbers in order, then find the middle number.

If there are two middle numbers, add them and divide by 2.

Reading charts

Check the title, labels, units and scale.

Pictograph: use the key to find the value of each symbol.

Frequency: how often a number or category occurs.

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