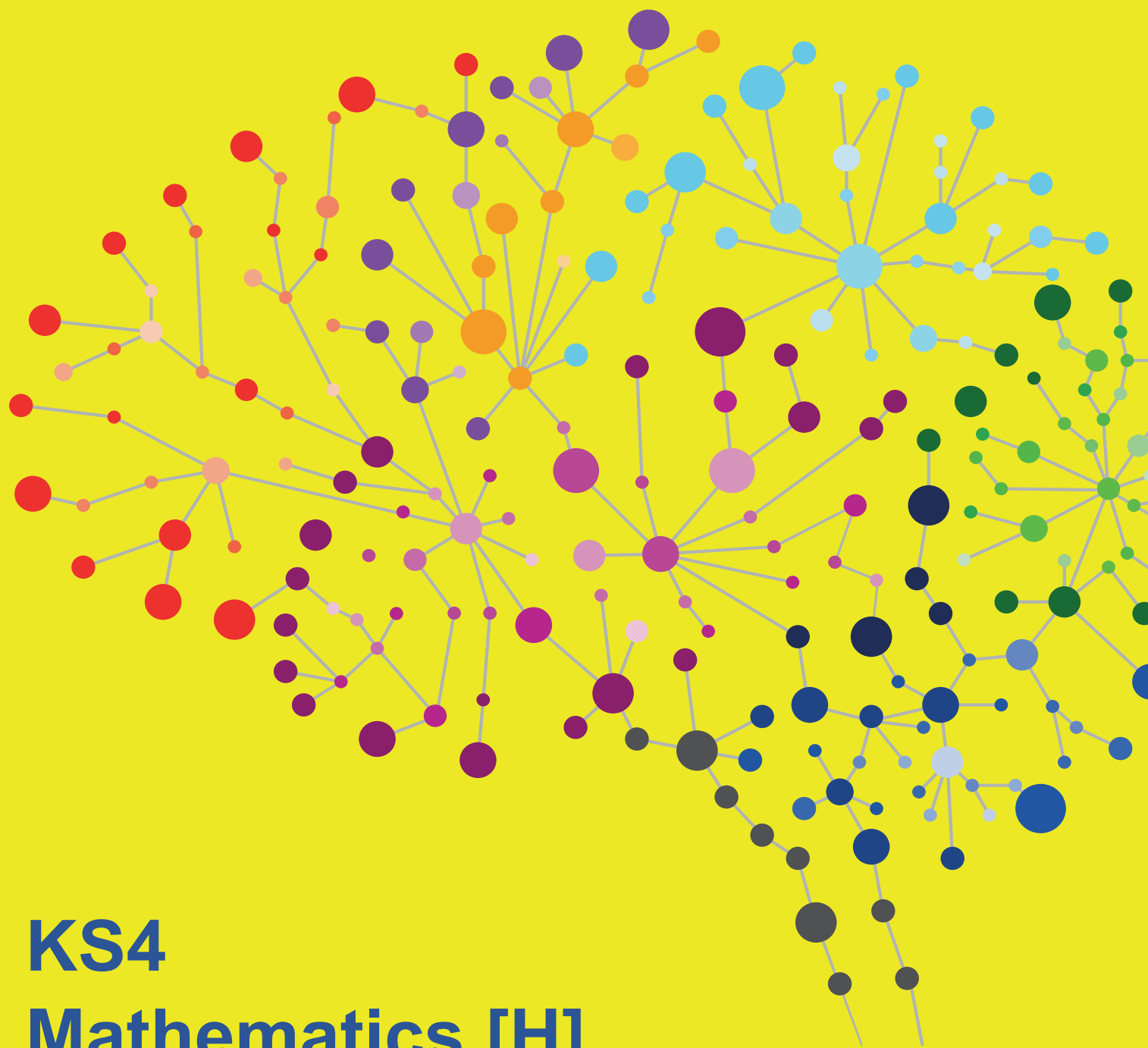




KS4 Mathematics [H] Knowledge Book

Name: _____

Teacher: _____

Form: _____



Saint Benedict
A Catholic Voluntary Academy



Love, Belief, Integrity, Knowledge



OUR VALUES

**BE WHO GOD MEANT YOU TO BE AND YOU
WILL SET THE WORLD ON FIRE.**

LOVE

As we know we are loved by God, we will learn to love ourselves and care for our own body mind and soul.

We will show love to one another by being patient and kind, not by being rude, boastful or proud.

As one body in Christ, we will ensure that no member of our community is left out or left behind

BELIEF

We will encourage one another and build each other up.

We will let our light shine, making the world a better place for all.

KNOWLEDGE

We will value knowledge: intelligent hearts acquire knowledge, the ears of the wise seek knowledge.

INTEGRITY

We will always strive to make the right choice even when this is the harder path to take.

We will live and work sustainably.

**AT SAINT BENEDICT
WE DEVELOP THE
CHARACTER OF OUR
COMMUNITY THROUGH
OUR CURRICULUM AND
CULTURE.**

Respect

What is Respect?

Showing respect is an important part of life, and how you maintain relationships.

Three types of respect:

1. Respect Yourself
2. Respect Others
3. Respect the Planet

Why is respect important?

Receiving respect from others is important because it helps us to feel safe and to express ourselves. Respecting others helps maintain a peaceful world and encourages others to be better people. Showing respect to our planet allows us to maintain it for future generations.

Key words	Definitions
Respect	Due regard for the feelings, wishes and rights of others
Honour	The quality of knowing and doing what is morally right
Dignity	Sense of pride and self respect
Relationships	The way two or more people or groups connect and behave towards each other
Worthiness	The quality of being good enough

1

Rules and Sanctions

Build up a loving community

Key word	
Conduct	The way in which a person behaves.
Unacceptable	Something that is not suitable or appropriate.
Boundaries	The limits of something.
Sanction	A penalty or action taken when a rule or law has been broken.
Consistent	Acting in the same way overtime to be fair.

Behaviour

Rules and sanctions are things which guide our behaviour. We follow rules and regulations to be fair and consistent. Sanctions occur if we do not follow rules or deliberately break them.

Preparation for life

All aspects of life require us to follow rules. There are rules in school; rules in your family and home; rules to follow when crossing the road and using the bus and so on. Structure and rules allow us all to know what is acceptable and how to conduct ourselves. Rules reassure us

The law

We are all bound by the rules of the law. If we break the law, we face a raft of different sanctions. Ultimately, having rules in schools is about a lifelong understanding about what is right and what is wrong.

2

Kindness

Key word

Empathy	Understand and share feelings of others
Compassion	Concern for misfortune of others
Compliment	Praise or congratulate others
Considerate	Thoughtfulness and sensitivity to others
Generous	Being liberal with things

Treat others how you would want to be treated yourself.

What is Kindness?

The quality of being friendly, generous and considerate

What does it mean to be kind?

To have empathy/sympathy, be compassionate, looking for good in people.

Why is it important to be kind?

Makes you feel happy, feel good about yourself

Builds strong relationships

Inspires others

How can we show kindness?

Smile

Hold the door open for somebody

Say something nice (compliment)

Invite somebody sat on their own to join you

Manners

Listen to somebody

3

Emotions

Key Words

Feelings	An emotional state or reaction.
Relationships	The state of being connected with someone else.
Instinct	A fixed pattern of behaviour.
Intuitive	Using what you feel to be true even without conscious reasoning.
Reaction	Something done, felt or thought in response to a situation or event.
Identification	The act or process of identifying someone or something.

Work and play in harmony

What are emotions?

Emotions are biological states associated with the nervous system.

Thoughts, feelings, behavioural responses, and relationships all generate emotions.

An instinct or, intuitive reaction or feeling can create emotions

Identifying feelings

Making sense of what and how you feel is not always easy. To do this, we need to regularly check in with ourselves, making time to think about the feelings we are having and naming them. To do this, we need to think about our daily lives which may help us to see patterns of behaviour.

Not all feelings or emotions are bad or negative!

It is important to recognise when you feel happy; relaxed and good about yourself. Knowing what has led to these feelings can help us identify things we do not like which may cause us negative feelings.

4

Verbal Communication

Treat each other with dignity and justice

Key Words	
Clarity	Vocal clarity means you do not speak too fast or too slowly. You consider carefully the words you mean and whether your listener can understand you.
Honesty	Honesty is speaking the truth.
Respect	Respect means that you accept somebody for who they are, even when they are different from you or you do not agree with them.
Appropriate	fitting the practical or social requirements of the situation.
Tone	a quality in the voice that expresses your feelings or thoughts, often towards the person being spoken to or the subject being spoken about
Courtesy	politeness, good manners, or consideration for other people.

What is verbal communication?

Verbal communication is the use of words to share information with other people.

What does it mean to communicate effectively?

Every time you verbally interact with someone you are aiming to develop your understanding of the world; you may be wishing to obtain information, respond to a request or offer support or guidance to another. In every one of these exchanges you are representing your tutor, your family and most importantly yourself.

Why is it important to communicate effectively?

All young people need to develop good speech, language and communication skills to reach their full potential.

Speech, language and communication underpin the basic skills of literacy and numeracy and are essential for you to understand and achieve in all subjects.

How can we communicate effectively?

Make eye contact

Speak honestly

Consider your role within the school

Consider the role of the person you are speaking to

Think carefully why you need to speak to the person you are addressing

Where necessary adapt as your conversation develops

5

Manners

Key Words	
Manners	A person's words or way of behaving towards others.
Respect	A regard for the feelings, wishes, or rights of others.
Listen	To take in what you hear.
Harmony	A time of behaving in one way to produce a pleasing effect.
Vocabulary	The range of words that we know and use.
Gratitude	The quality of being thankful; readiness to show appreciation for and to return kindness.

Loving...harmony...dignity

Treat your neighbour as yourself

The way in which we behave and speak towards others, reflects in their actions and words towards us.

Show the best side of yourself

When you speak to others, always show respect; be polite and thankful. Use the words 'please, thank you, sorry and pardon' when communicating with others.

Manners are for every situation

Every interaction has space for the use of manners: speech, emails, messages. Often when we get upset or angry we don't use manners.

However it does calm a situation if you do.

6

Change

Key Words	Definition
Change	Make or become different
Organised	Make arrangements or preparations for an event or activity
Opportunity	A time set of circumstances that make it possible to do something
Coping	To deal effectively with something difficult
Embrace	Accept (a belief, theory or change) willingly and enthusiastically
Strategies	A plan of action designed to achieve a long term or overall aim

Develop potential to the full

Find the positive

Don't allow yourself to become negative about the changes in your life. Change is good, keep repeating it.

Feeling vulnerable

Facing change can be very overwhelming, leaving you feeling very emotional. Make it your mission to be proactive and respond to it positively.

Talk about it

It's good to talk about change in your life. Focus on problems, solutions and the positives that change will bring. Try to avoid focussing on the negatives and letting emotions take over.

Study Skills – Ways to learn and remember

Self quizzing (look, cover, write)



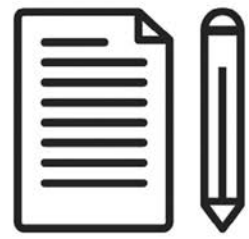
Read through the information in the knowledge book that you want to learn



Cover the information up



Write down as much as you can remember



Use the knowledge book to;

- a) Correct any mistakes
- b) Add any information that you forgot

1

Study Skills – Ways to learn and remember

Spacing



Complete a self quiz of the information you want to learn



Wait for a day or 2 (depending on the deadline)



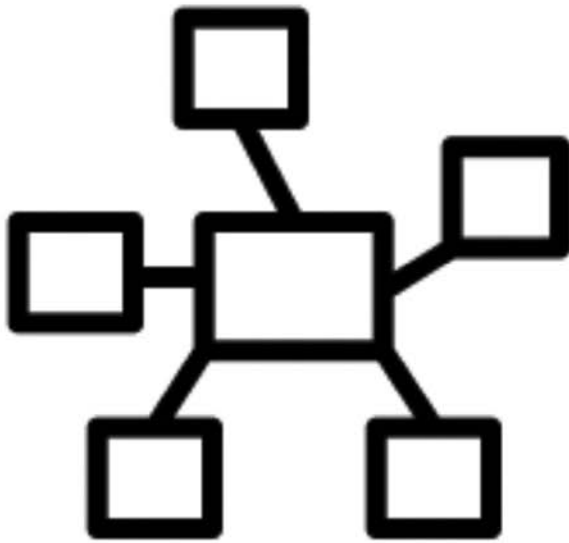
Repeat the self quiz.

The more times you can repeat this process, the more you will be able to remember without the book

2

Study Skills – Ways to learn and remember

Elaboration



Think about the topic that you are studying

Ask questions such as who, what, why, where, when how. Try to find the answers

See how these ideas connect - a mind map will be useful for this

3

Study Skills – Ways to learn and remember

Concrete Examples

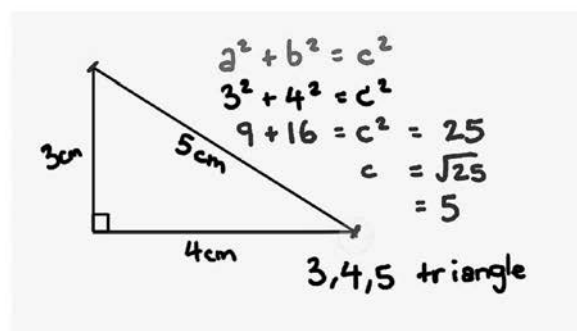


Pythagoras theorem example

If you tried to explain Pythagoras's theorem to someone verbally, it would be quite hard to understand.

By using a concrete example that shows exactly how to use Pythagoras theorem, it is much easier to remember, understand and use

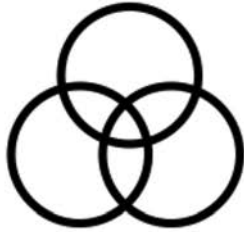
A concrete example is an clear example of an abstract idea



4

Study Skills – Ways to learn and remember

Interleaving



Research says we will actually learn more effectively if we mix our study skills up rather than using the same techniques all the time

1. Try to use different study skills rather than just one technique.

2. When revising for exams, prepare a revision timetable and try to revise more than one subject during a session

5

Study Skills – Ways to learn and remember

Dual Coding



As well as **writing** information down, **create an icon/ drawing** too for individual facts. This helps your brain to remember the information

6

Knowledge Book Mathematics

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Multiplication

X	1	2	3	4	5	6	7	8	9	10
1	1	2	3	4	5	6	7	8	9	10
2	2	4	6	8	10	12	14	16	18	20
3	3	6	9	12	15	18	21	24	27	30
4	4	8	12	16	20	24	28	32	36	40
5	5	10	15	20	25	30	35	40	45	50
6	6	12	18	24	30	36	42	48	54	60
7	7	14	21	28	35	42	49	56	63	70
8	8	16	24	32	40	48	56	64	72	80
9	9	18	27	36	45	54	63	72	81	90
10	10	20	30	40	50	60	70	80	90	100



Ten Thousandths	
Thousandths	
Hundredths	
Tenths	
Decimal Point	•
Units	
Tens	
Hundreds	
Thousands	

Two signs together		Replace with
+	+	+
-	-	+
+	-	-
-	+	-

Multiplication and Division Rule	
Signs of Two Numbers	Sign of the Answer (Product or Quotient)
the same	positive (+)
different	negative (−)

Inequalities

$$a > b$$

a is greater than b

$$a \geq b$$

a is greater than or equal to b

$$a < b$$

a is less than b

$$a \leq b$$

a is less than or equal to b

$$a < b < c$$

a is less than b which is less than c

Brackets

B

Indices

I

Divide

D

Multiply

M

Add

A

Subtract

S



Factors and Multiples

Factor: An integer that a number can be divided by to leave no remainder.
It will be the same size or lower than the given number.

Multiple: An integer that a number will multiply into.
It will be found in the number's times table.
It will be the same size or greater than the given number.

Highest Common Factor

The largest factor that goes into both numbers

Lowest Common Multiple

The smallest multiple both numbers go into.

Prime Numbers

Prime

A number with exactly 2 factors

Primes:

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

	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

Square Numbers

The result when a number is multiplied by itself.

Square Numbers



$$\begin{aligned}1 \times 1 &= 1 \\2 \times 2 &= 4 \\3 \times 3 &= 9 \\4 \times 4 &= 16 \\5 \times 5 &= 25 \\6 \times 6 &= 36 \\7 \times 7 &= 49 \\8 \times 8 &= 64 \\9 \times 9 &= 81 \\10 \times 10 &= 100 \\11 \times 11 &= 121 \\12 \times 12 &= 144 \\&\text{etc}\end{aligned}$$

Cube Numbers

The result when a number is multiplied by itself and then by itself again

Cube Numbers



$$\begin{aligned}1 \times 1 \times 1 &= 1 \\2 \times 2 \times 2 &= 8 \\3 \times 3 \times 3 &= 27 \\4 \times 4 \times 4 &= 64 \\5 \times 5 \times 5 &= 125\end{aligned}$$

Square Roots

Inverse of calculating a square

$$\begin{aligned}\sqrt{1} &= 1 \\\sqrt{4} &= 2 \\\sqrt{9} &= 3 \\\sqrt{16} &= 4 \\\sqrt{25} &= 5 \\\sqrt{36} &= 6 \\\sqrt{49} &= 7 \\\sqrt{64} &= 8 \\\sqrt{81} &= 9 \\\sqrt{100} &= 10\end{aligned}$$

Other Roots

Inverse other powers

e.g. $\sqrt[3]{64} = 4$

Surds

$$\sqrt{a} \times \sqrt{b} = \sqrt{a \times b}$$

$$\text{also } \sqrt{a} \times \sqrt{a} = a$$

$$\frac{\sqrt{a}}{\sqrt{b}} = \sqrt{\frac{a}{b}}$$

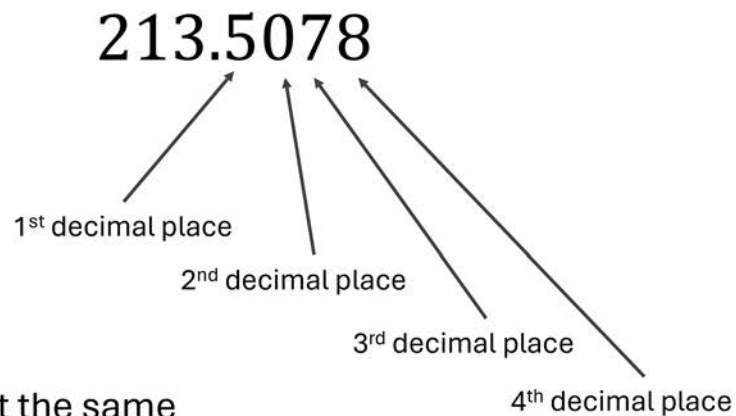
Surds: Rationalising the Denominator

$$\text{For } \frac{a}{\sqrt{b}} \text{ then } \frac{a}{\sqrt{b}} \times \frac{\sqrt{b}}{\sqrt{b}}$$

$$\text{For } \frac{n}{a + \sqrt{b}} \text{ then } \frac{n}{a + \sqrt{b}} \times \frac{a - \sqrt{b}}{a - \sqrt{b}}$$

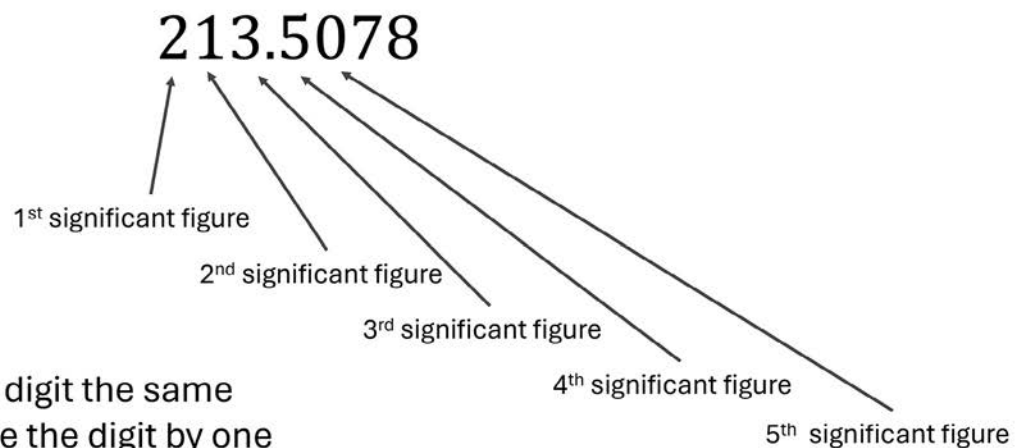
$$\text{For } \frac{n}{a - \sqrt{b}} \text{ then } \frac{n}{a - \sqrt{b}} \times \frac{a + \sqrt{b}}{a + \sqrt{b}}$$

Rounding to decimal places



0,1,2,3,4 then keep digit the same
5,6,7,8,9 then increase the digit by one

Rounding to significant figures



0,1,2,3,4 then keep digit the same
5,6,7,8,9 then increase the digit by one

Rounding to significant figures

0.0035678

1st significant figure

2nd significant figure

3rd significant figure

4th significant figure

5th significant figure

0,1,2,3,4 then keep digit the same

5,6,7,8,9 then increase the digit by one

Standard Form

Number
between
1 and 10

×

Power of
Ten

Midpoint of two numbers

For two numbers a and b

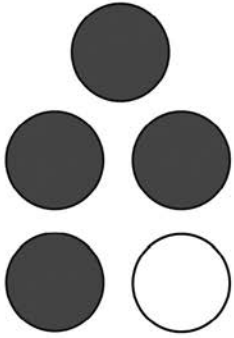
$$\textit{Midpoint} = \frac{a + b}{2}$$

Product of Prime Factors

A multiplication involving only prime numbers that will multiply out to give a number.

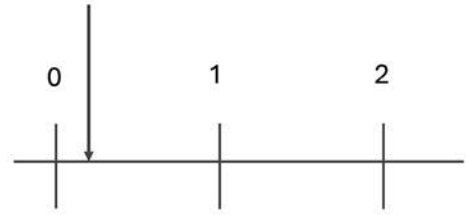
Each number has a unique product of prime factors.

Fractions are



Part of a whole

$$\frac{1}{5}$$



Numbers on a number line

$$5 \overline{) 1}$$

Division

Fractions

$$\frac{4}{5}$$

← Numerator

← Denominator

Proper Fraction
Numerator < Denominator

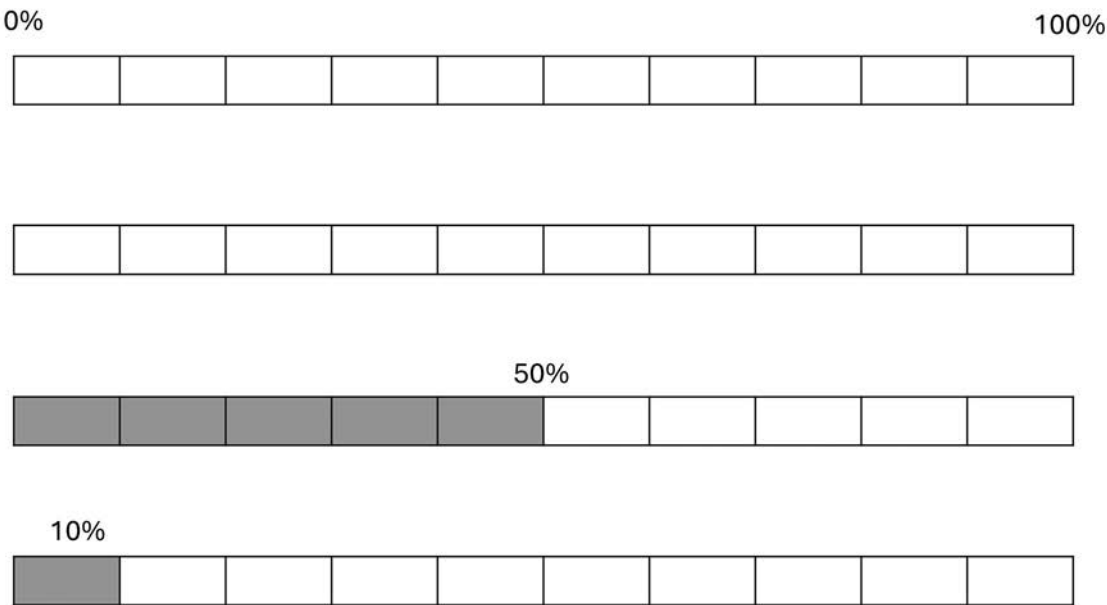
$$\frac{7}{2}$$

Improper Fraction
Numerator > Denominator

$$3 \frac{2}{9}$$

Mixed Number

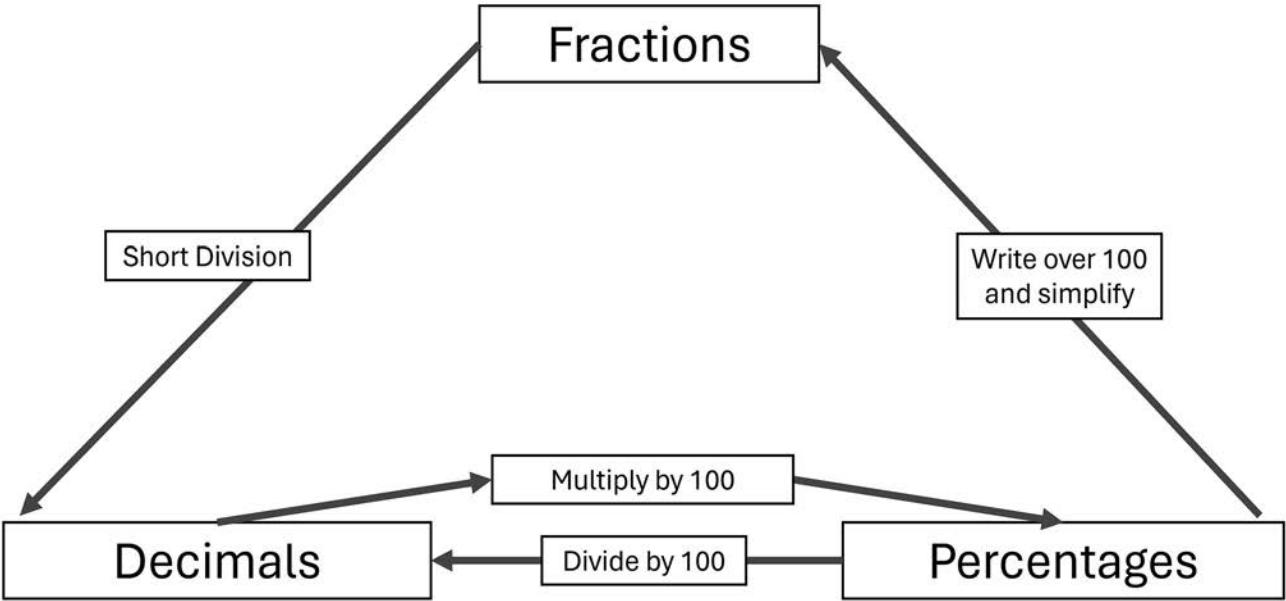
Percentage



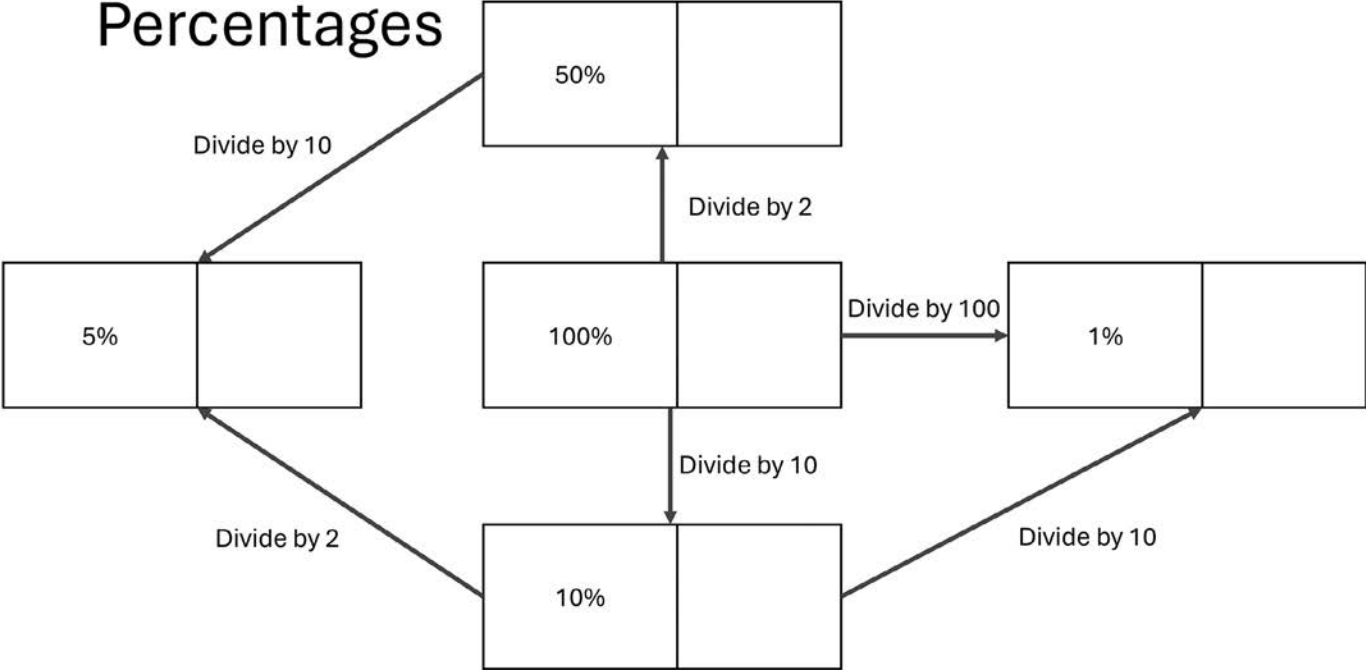
Fractions Decimals and Percentages

Need to know	Fraction	Decimal
	$\frac{1}{2}$	0.5
	$\frac{1}{4}$	0.25
	$\frac{1}{5}$	0.2
	$\frac{1}{10}$	0.1
	$\frac{1}{3}$	0. $\dot{3}$

Fractions, Decimals and Percentages



Percentages



Percentages on a Calculator

$$\frac{\text{Percentage}}{100} \times \text{Amount}$$

$$\text{Percentage multiplier} \times \text{amount}$$

Percentage Change

$$\text{New Amount} = \text{Percentage Multiplier} \times \text{Original Amount}$$

Repeated Percentage Change

$$\text{Final Amount} = \text{Percentage Multiplier} \times \text{Original Amount}^{\text{Time}}$$

Reverse a percentage change

Rearrange the original calculation

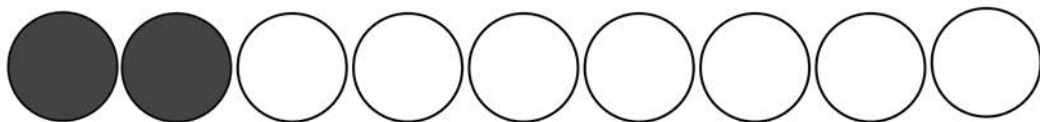
$$\text{New Amount} = \text{Percentage Multiplier} \times \text{Original Amount}$$

To

$$\text{Original Amount} = \frac{\text{New Amount}}{\text{Percentage Multiplier}}$$

Ratio

2:7



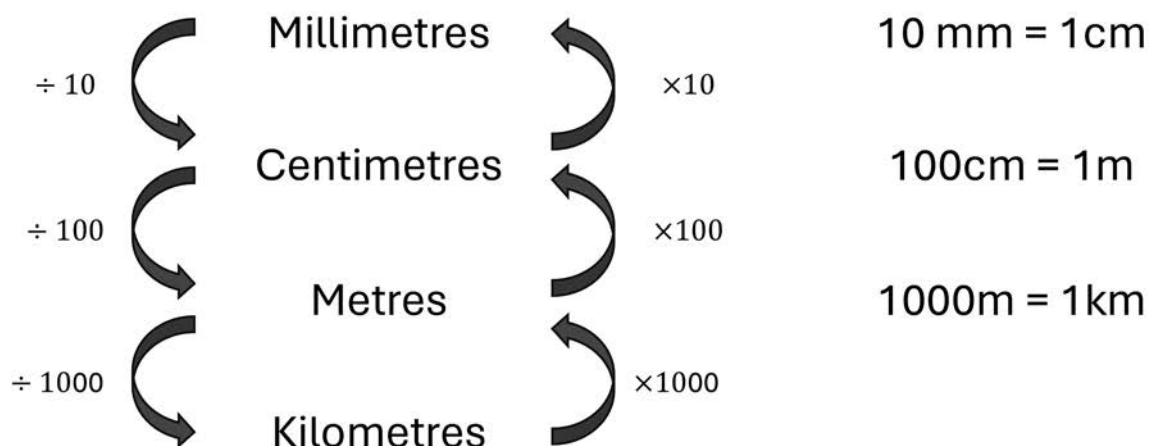
Best Buy

Pay the least amount for the same quantity

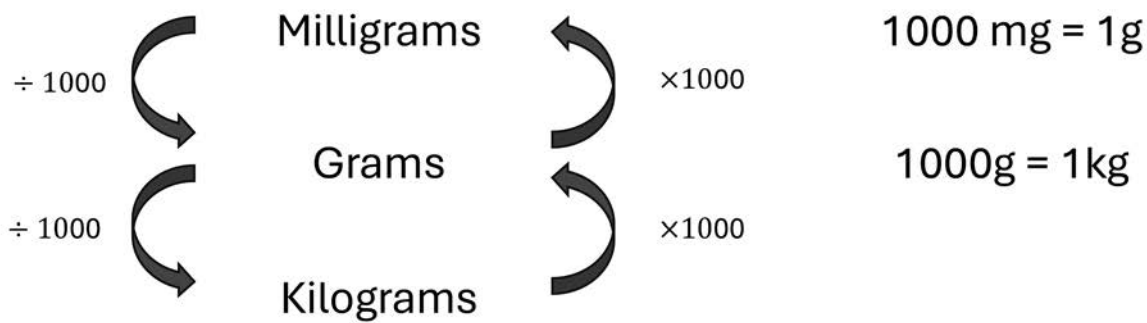
Choice A Has a Cost of A Has a Quantity of A	Choice B Has a Cost of B Has a Quantity of b
Cost for 1 of A Cost of A $\div$ Quantity of A	Cost for 1 of B Cost of B $\div$ Quantity of B

Choose the least cost for 1

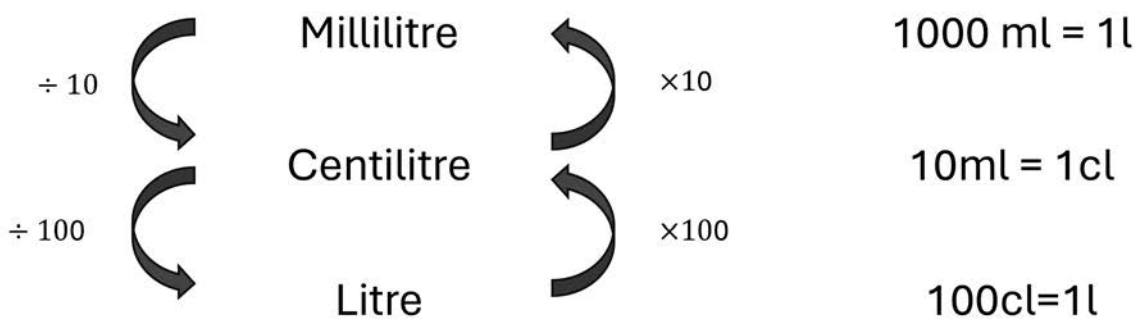
Converting Metric Units of Length



Converting Metric Units of Mass



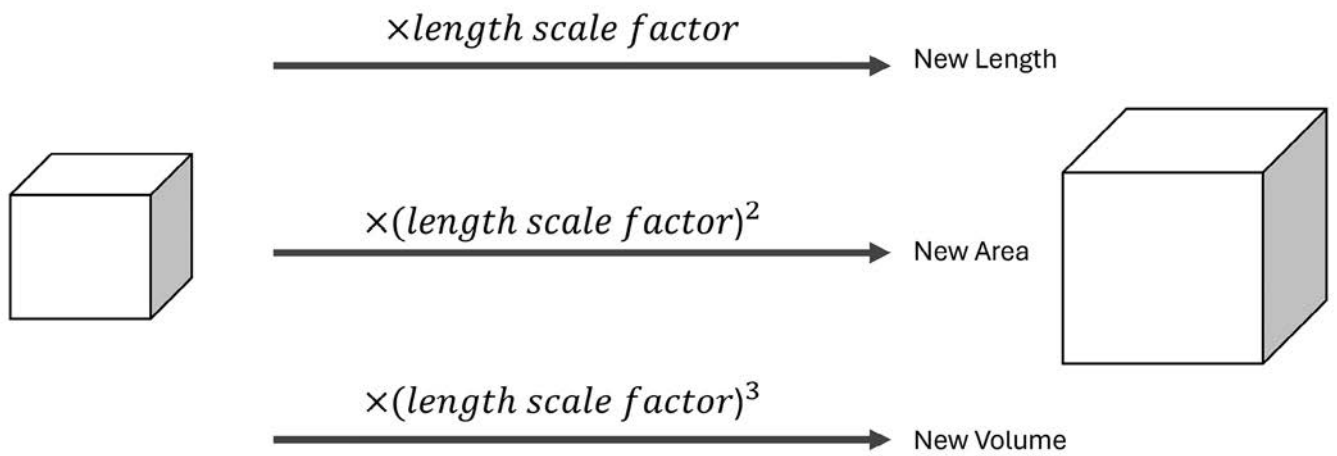
Converting Metric Units of Mass



$$1 \text{ Litre} = 1000 \text{ cm}^3$$

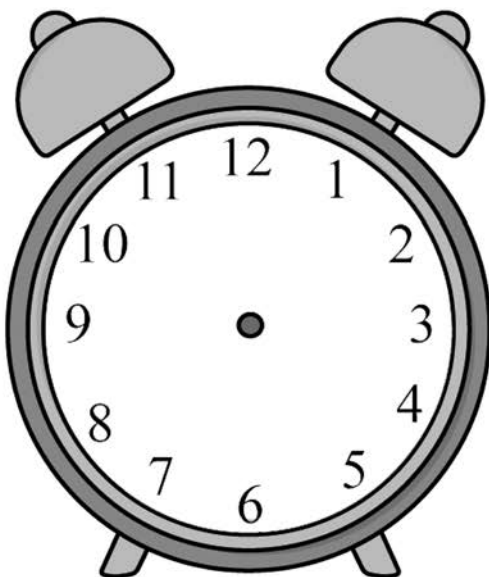
$$1 \text{ Millilitre} = 1 \text{ cm}^3$$

Area and Volume Conversions



Similar Solids

Time



1 Year = 365 days (except leap years)
= 56 weeks

1 Week = 7 days
1 Day = 24 hours
1 Hour = 60 minutes
1 minute = 60 seconds

$\frac{1}{2}$ hour = 30 minutes 0.5 hour = 30 minutes
 $\frac{1}{4}$ hour = 15 minutes 0.25 hours = 15 minutes

Compound Units

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

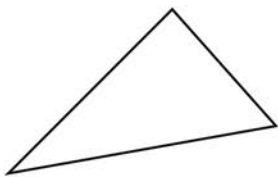
$$Density = \frac{Mass}{Volume}$$

Don't add this column

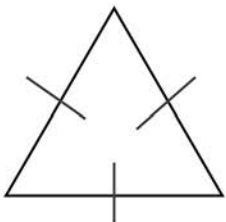
Combining
Liquids
(or speeds)

	Density =	Mass	X	Volume
A				
B				
Mixture of A and B				

Triangles



Scalene: No sides the same, no angles the same

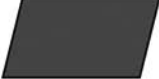


Equilateral: All sides are equal. All interior angles are equal



Isosceles: Two sides are equal. Base angles are equal

Quadrilaterals

 Square	Two pairs of parallel sides. All sides are equal. Four 90° angles. Diagonals are equal and bisect each other.	 Trapezium	One pair of parallel sides
 Rectangle	Two pairs of parallel sides. Opposite sides are equal. Four 90° angles. Diagonals bisect each other.	 Kite	Two pairs of equal sides. A pair of equal angles
 Rhombus	Two pairs of parallel sides. All sides are equal. No right angles. Diagonally opposite angles are equal.	 Arrowhead	Two pairs of equal sides. One reflex interior angle.
 Parallelogram	Two pairs of parallel sides. Opposite sides are equal. No right angles. Diagonally opposite angles are equal	 Irregular	No equal sides. No equal angles.

Other Polygons

Polygon – a straight sided shape with any number of sides.

Regular – all sides equal, all angles equal.

Pentagon: 5 sides

Hexagon: 6 sides (a regular hexagon is made up of 6 equilateral triangles)

Heptagon: 7 sides

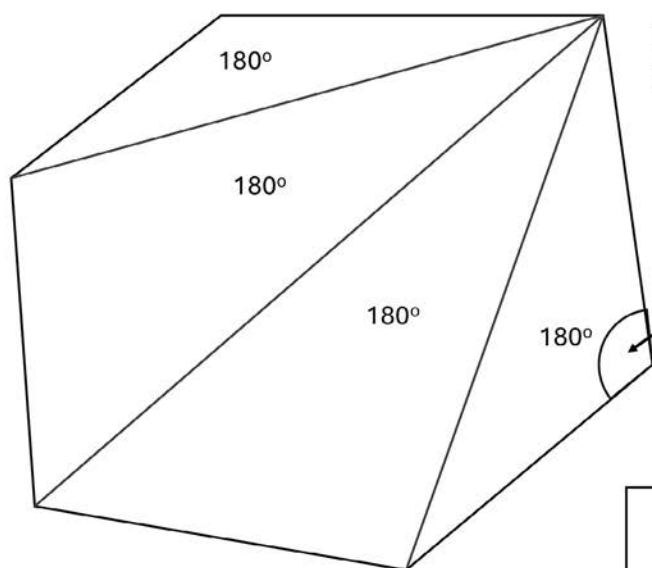
Octagon: 8 sides

Nonagon: 9 sides

Decagon: 10 sides

Dodecagon: 12 sides

Interior Angles of Polygons



Draw straight lines from one point to all other points

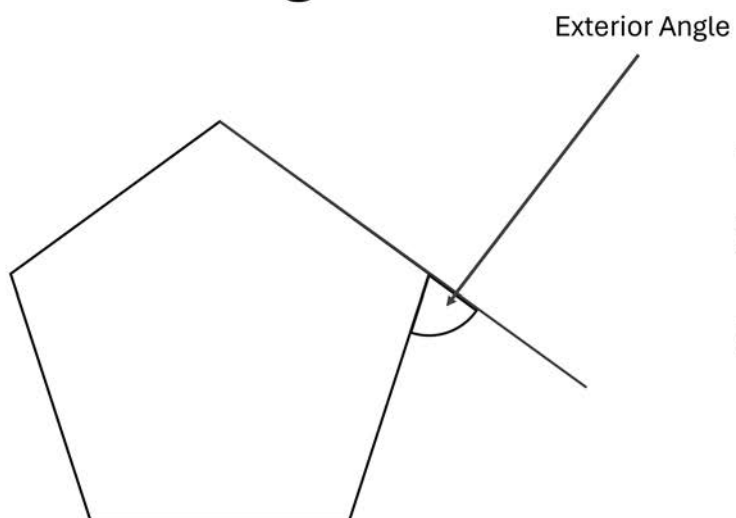
Number of triangles = Number of sides - 2

Interior Angle

180°

*Total of Interior Angles = $(n - 2) \times 180$
where n is the number of sides*

Exterior Angles

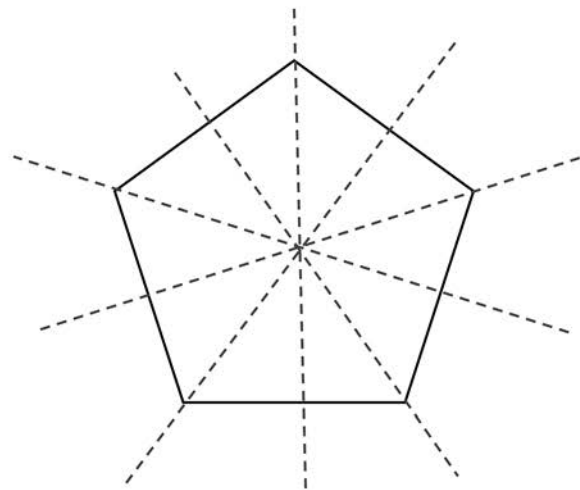
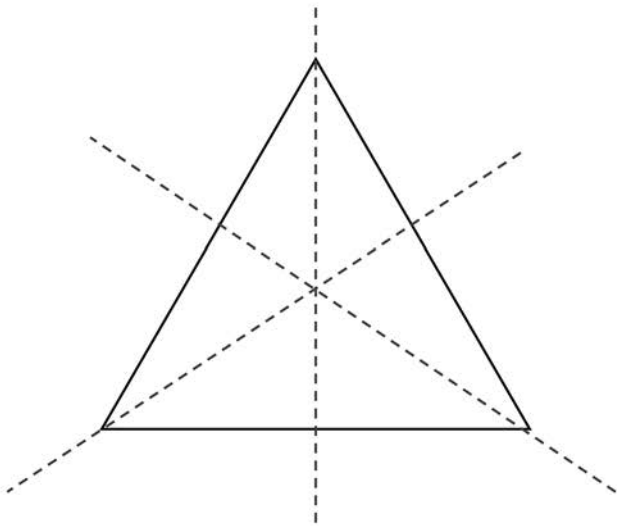


*For **any** polygon*

Total of Exterior Angles = 360°

Interior + Exterior = 180°

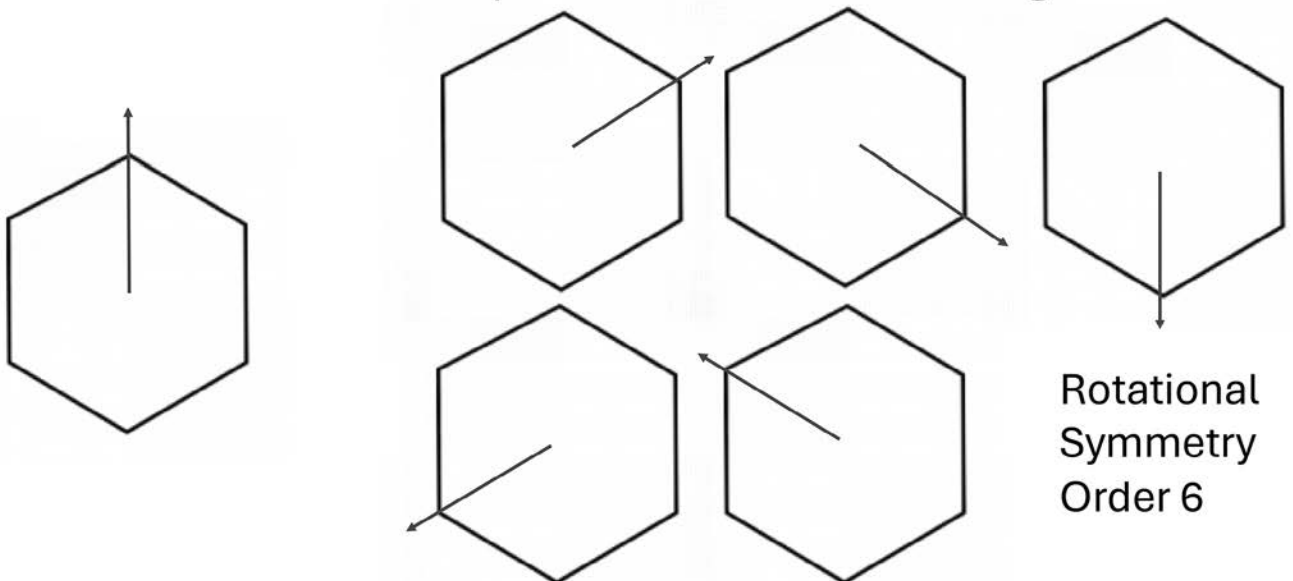
Symmetry



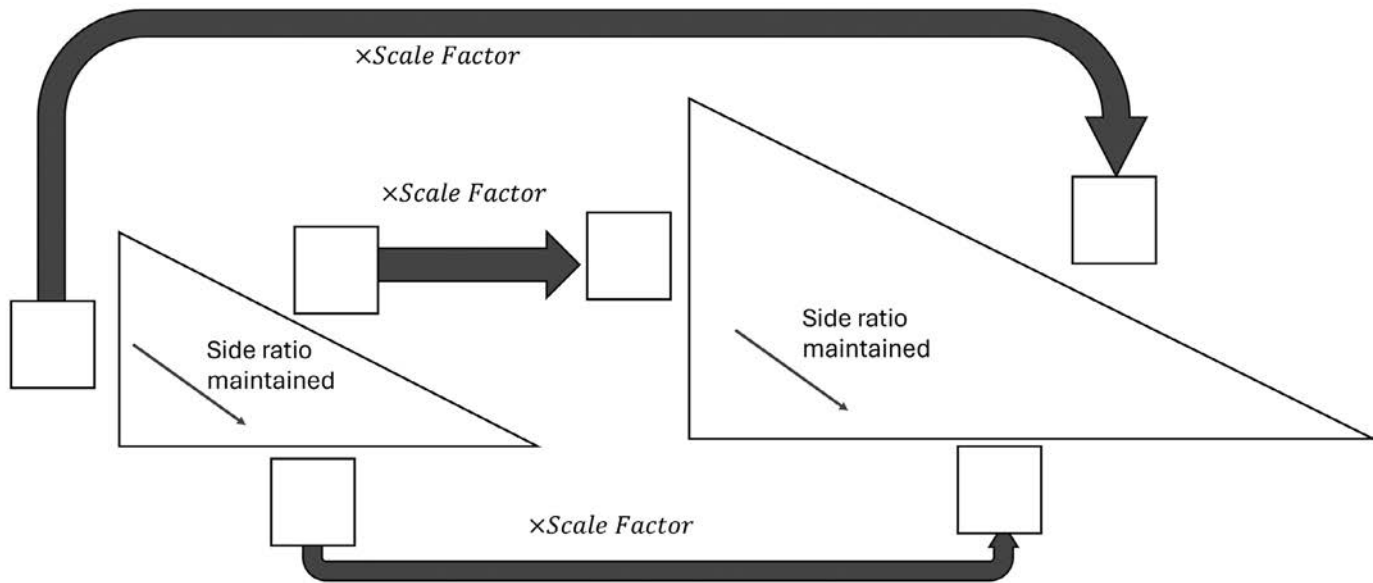
Line of Symmetry
Cuts a shape into two equal halves

Rotational Symmetry

Order: Number of times a shape fits back onto itself during a 360° turn.



Similar Triangles



Congruency

Same size, same shape.

Corresponding sides are the same.

Corresponding angles are the same.

To prove

SSS: Prove each side is the same in both triangles

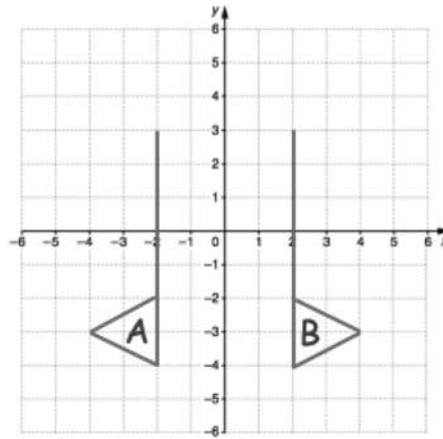
ASA: Prove angle, side and angle are the same in both triangles

SAS: Prove two sides and an enclosed angle are the same in both triangles

RHS: Prove a right angle, prove hypotenuse and one other sides are the same in both triangles.

Transformations: Reflection

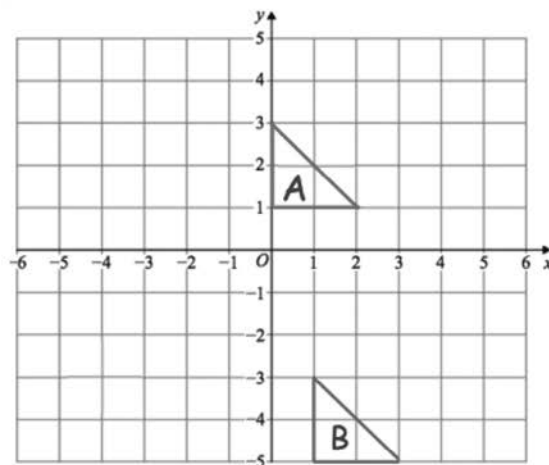
Reflection plus line of reflection.



Reflection in y - axis

Transformations: Translation

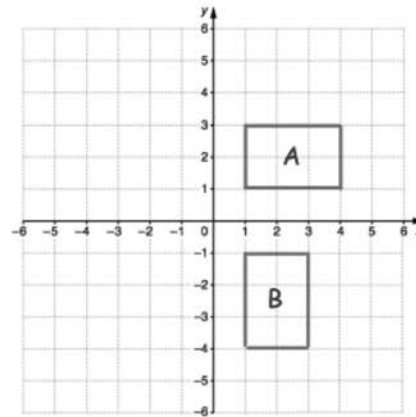
Translation plus vector



Translation $\begin{pmatrix} 1 \\ -6 \end{pmatrix}$

Transformations: Rotation

Rotation plus angle, direction and centre of rotation

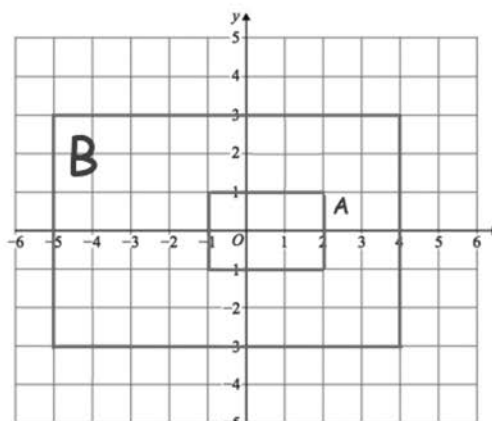


*Rotation
90° Clockwise
about (0,0)*

Transformations: Enlargement

Enlargement plus scale factor and centre of enlargement.

(scale factor can be positive, negative and a fraction)

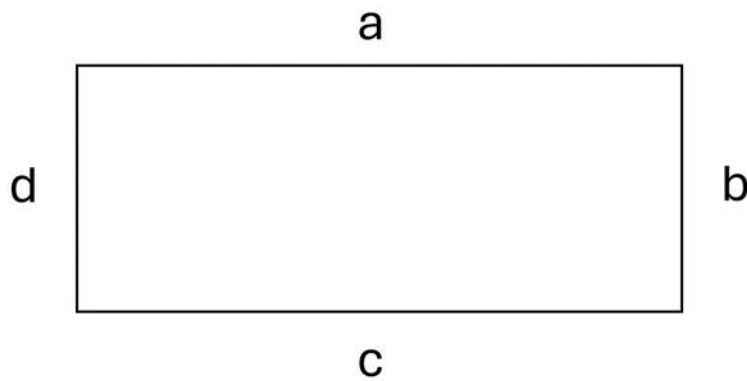


*Enlargement
Scale Factor 2
Centre (0,0)*

Perimeter

The distance around a shape.

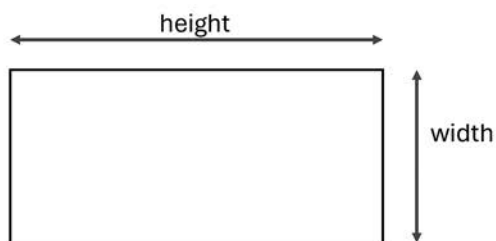
Add up all the sides



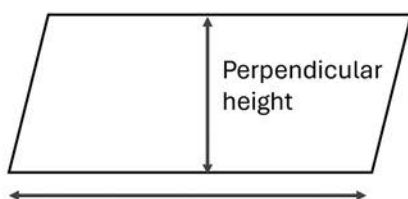
$$\text{Perimeter} = a + b + c + d$$

Area

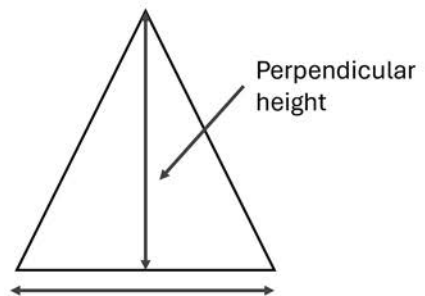
The space inside a shape



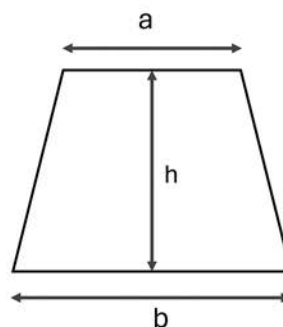
$$\text{Area} = \text{length} \times \text{width}$$



$$\text{Area} = \text{width} \times \text{perpendicular height}$$

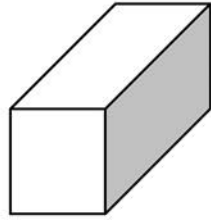


$$\text{Area} = \frac{1}{2} \times \text{base} \times \text{perpendicular height}$$



$$\text{Area} = \frac{(a + b)h}{2}$$

Volume



$$\text{Volume of a Cuboid} = \text{length} \times \text{width} \times \text{height}$$

A prism is a 3D shape with a constant cross section.

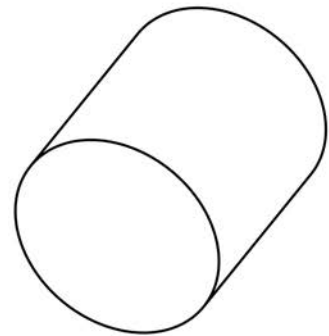
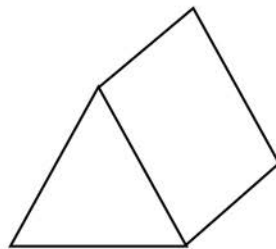
Prisms include

Cuboid

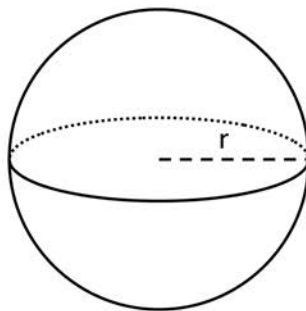
Cylinder

Triangular Prism

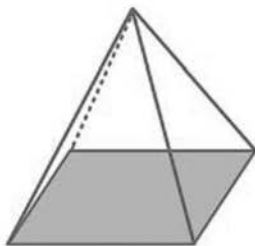
$$\text{Volume of a Prism} = \text{Cross Sectional Area} \times \text{Length}$$



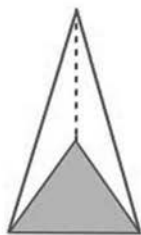
Volume



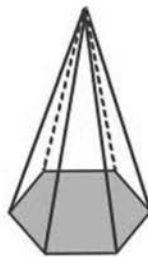
$$\text{Volume of a sphere} = \frac{4}{3} \pi r^3$$



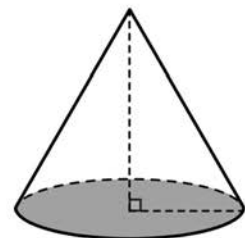
SQUARE PYRAMID



TRIANGULAR PYRAMID



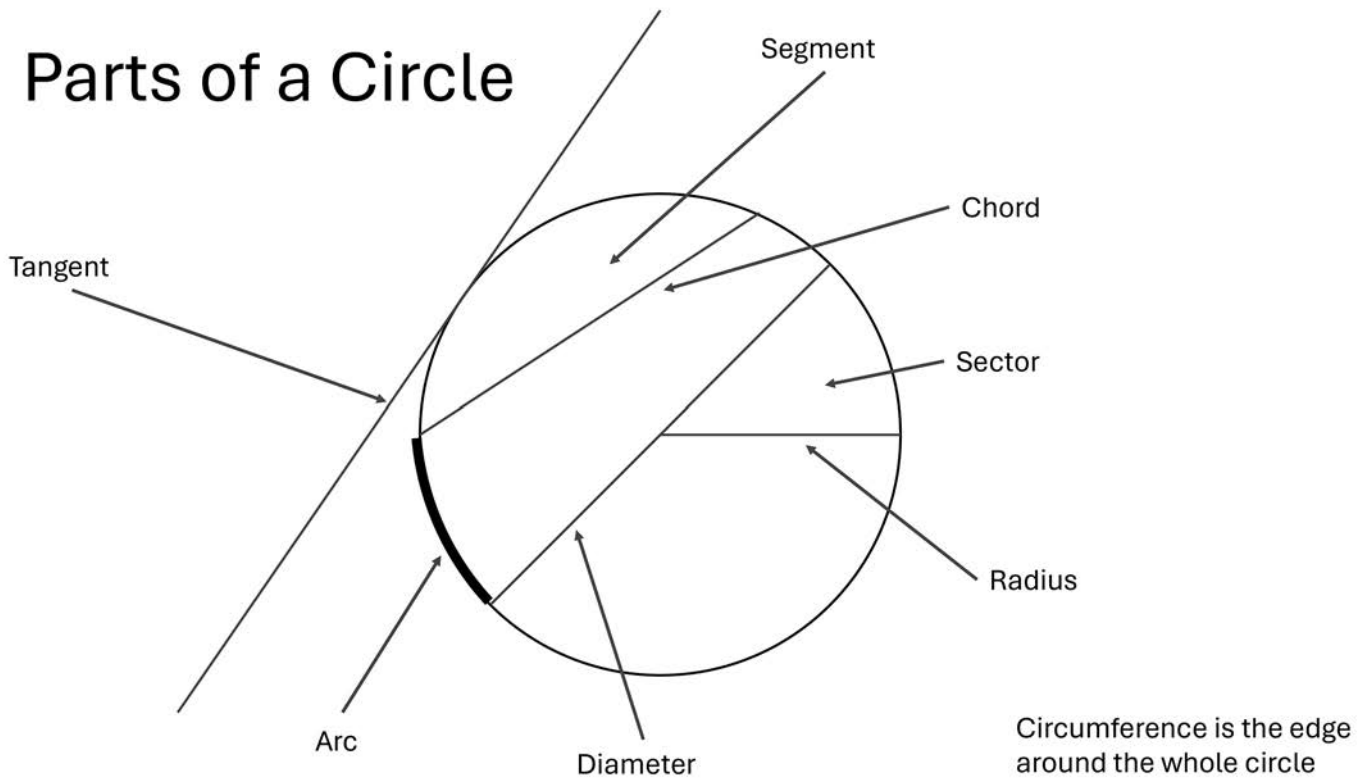
HEXAGONAL PYRAMID



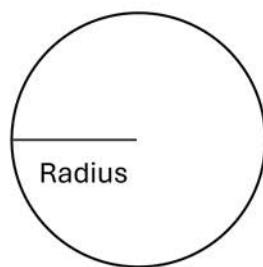
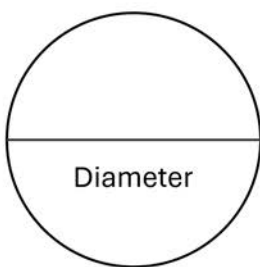
Cone
(A circle-based pyramid)

$$\text{Volume of a Cone} = \frac{1}{3} \times \text{height} \times \text{area of base}$$

Parts of a Circle



Measures of a Circle



A Circle of radius r and diameter d

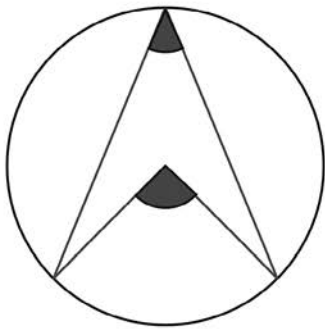
$$Diameter = 2 \times Radius$$

$$Length\ of\ the\ Circumference = 2\pi r$$

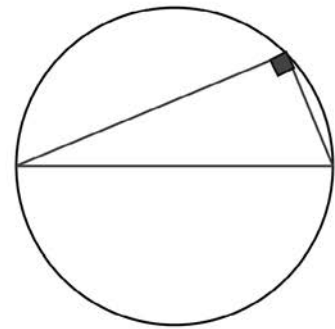
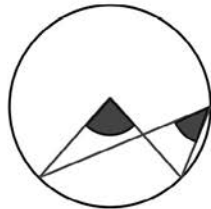
$$Length\ of\ the\ Circumference = \pi d$$

$$Area\ of\ a\ circle = \pi r^2$$

Circle Theorems

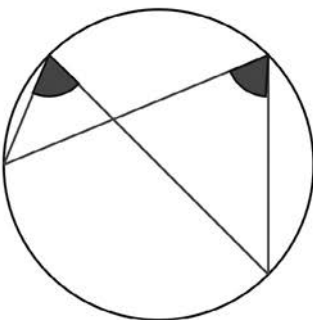


Angles at the centre
are twice the angle
at the
circumference

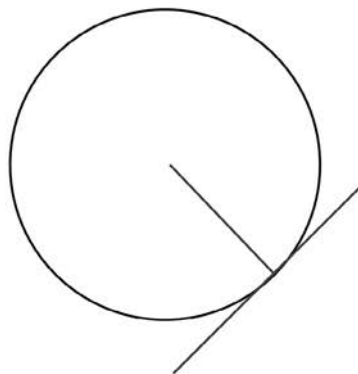


Angles on the
diameter are 90°

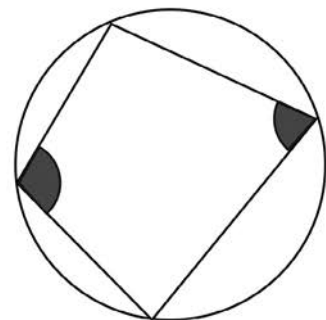
Circle Theorems



Angles on the same
segment are equal

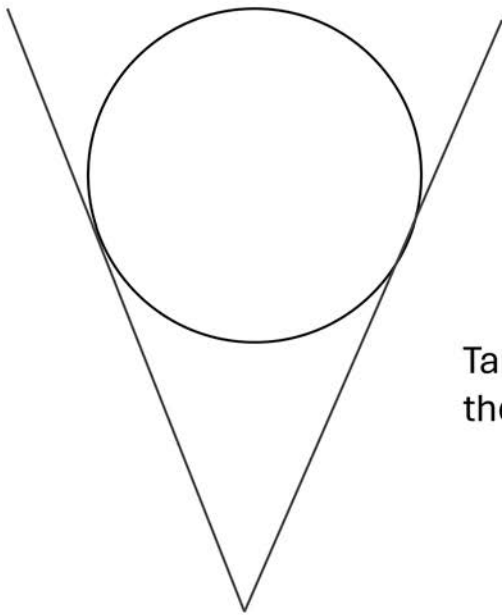


A radius and a
tangent meet at 90°

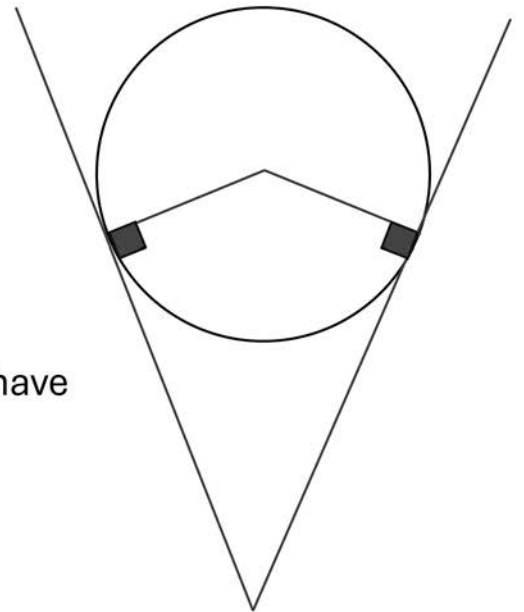


Opposite angles on a
cyclic quadrilateral add
to 180°

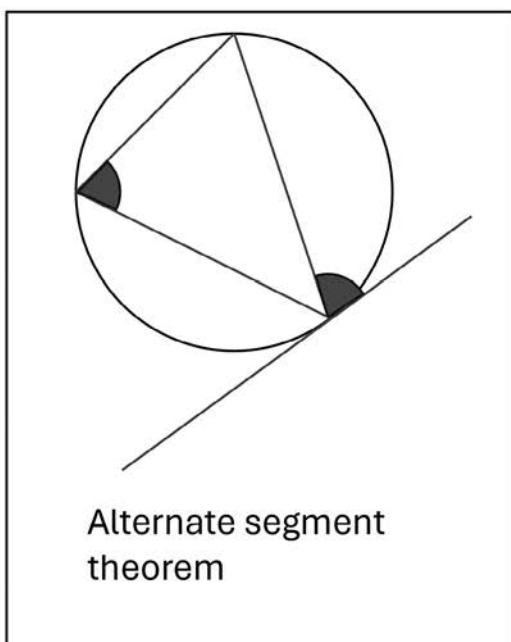
Circle Theorems



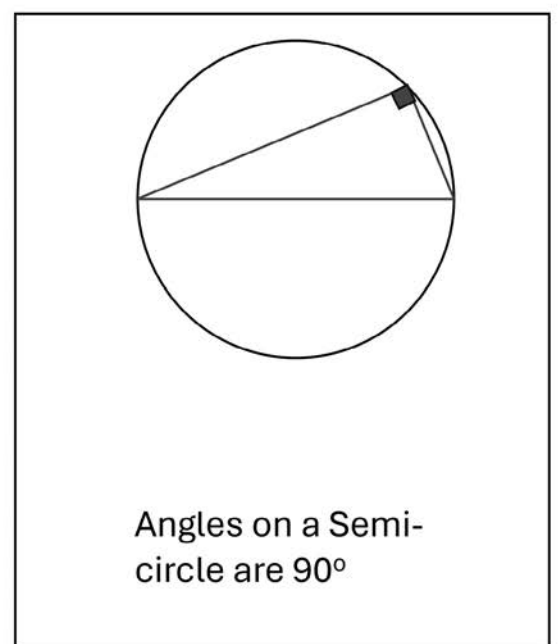
Tangents that meet have the same length



Circle Theorems

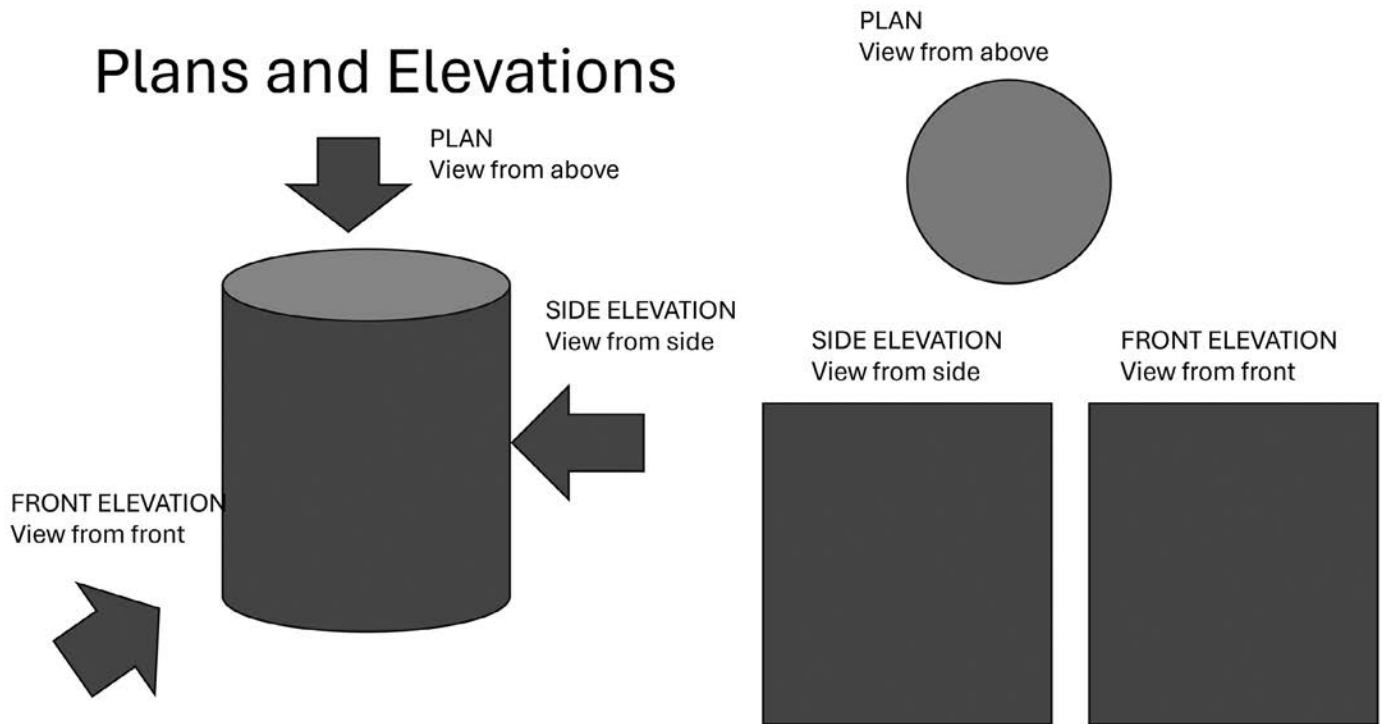


Alternate segment theorem

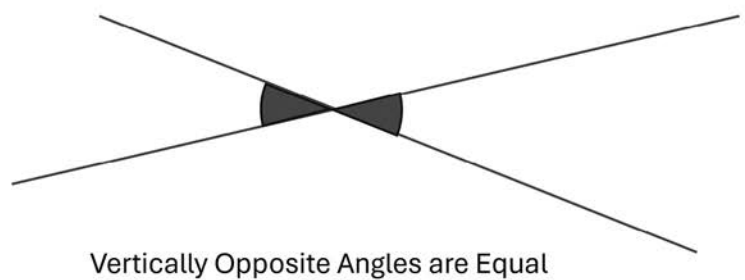
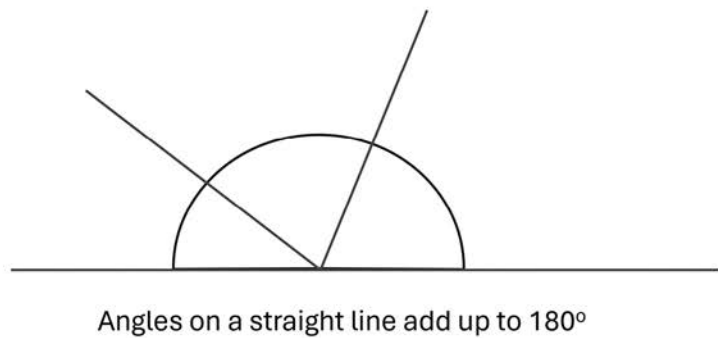
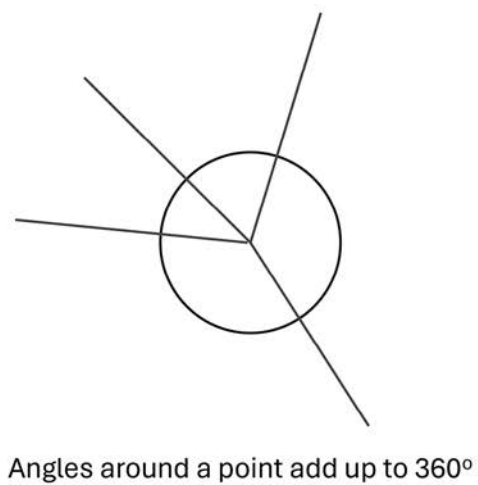


Angles on a Semi-circle are 90°

Plans and Elevations

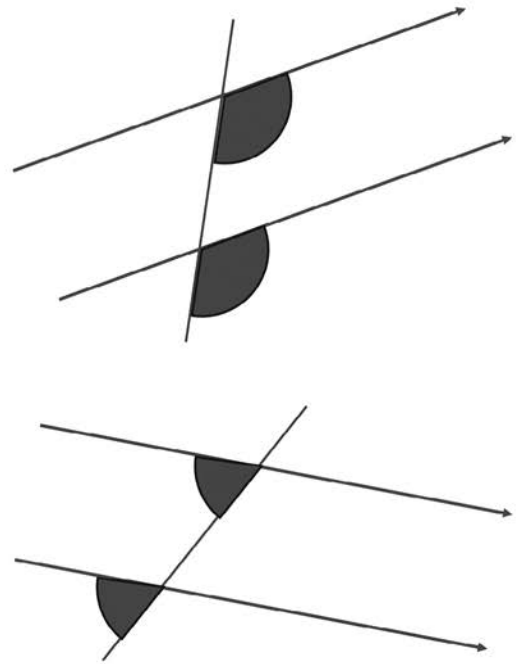
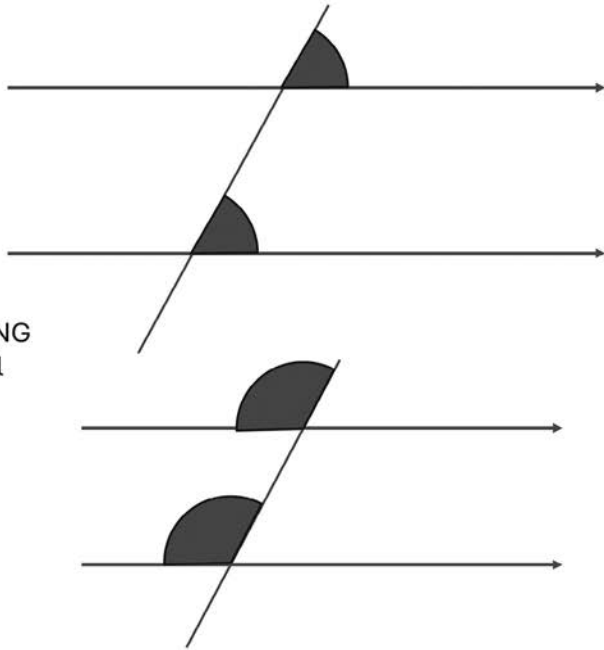


Angle Facts



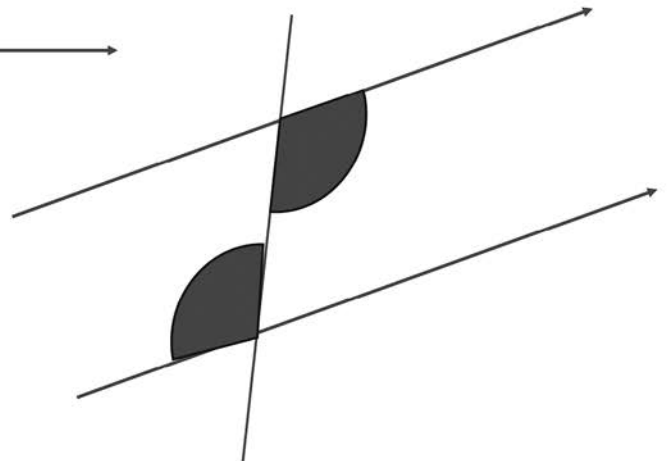
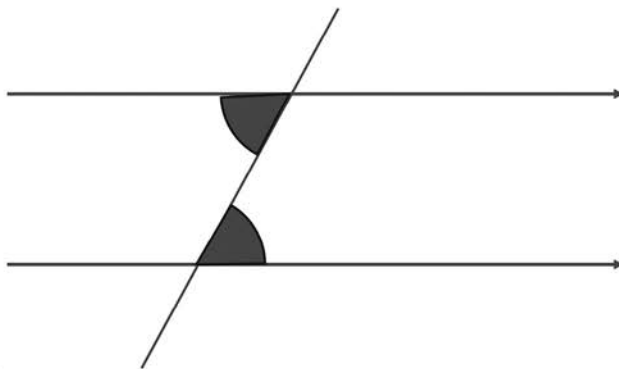
Angles on Parallel Lines

CORRESPONDING
Angles are Equal

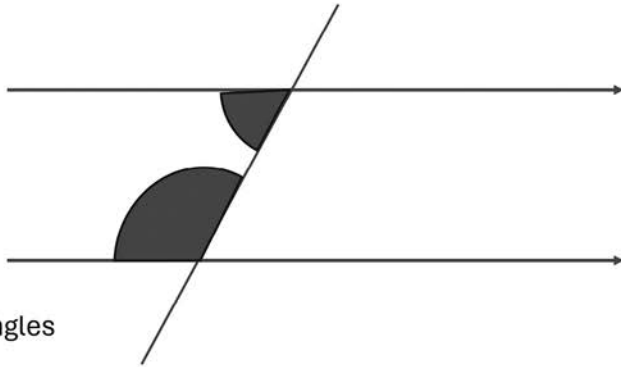


Angles on Parallel Lines

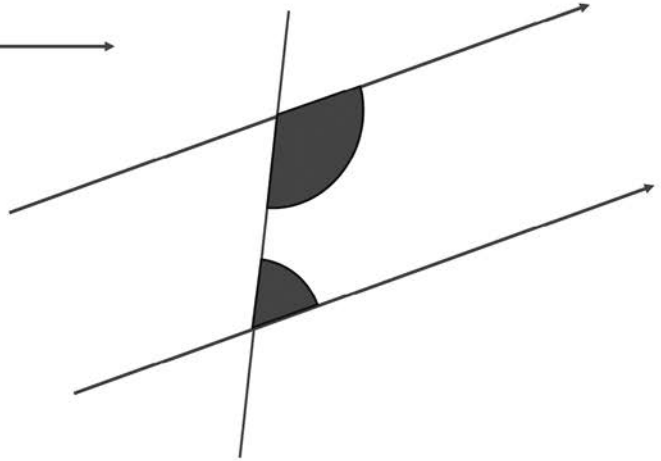
ALTERNATE
Angles are Equal



Angles on Parallel Lines

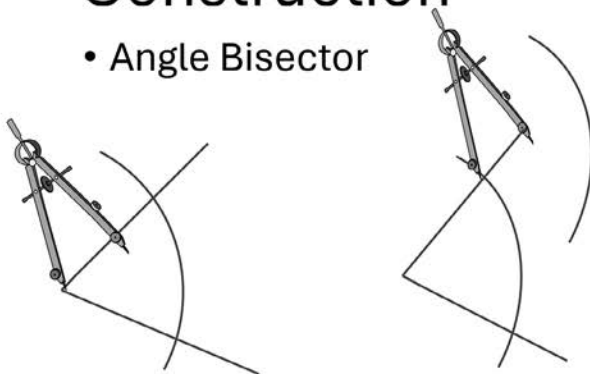


CO-INTERIOR Angles
add up to 180°



Construction

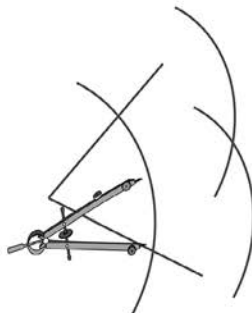
• Angle Bisector



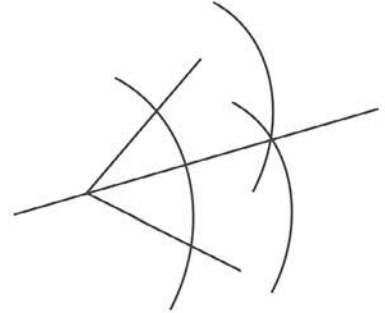
1. Put compass on point of lines
2. Draw an arc across both lines



3. Put compass on crossing point
4. Draw another arc



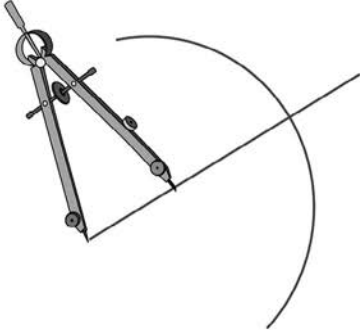
5. Put compass on second crossing point
6. Draw another arc



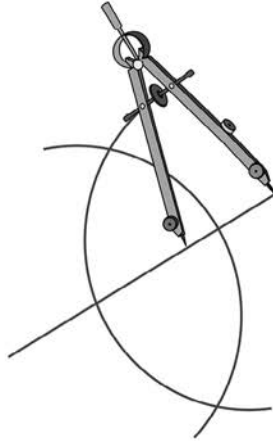
7. Draw a straight line through point of angle and the crossing point of the arcs

Construction

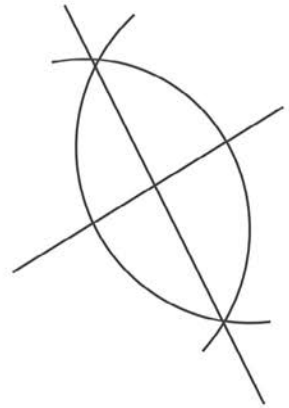
• Perpendicular Bisector



1. Place the compass on the end of the line.
2. Open compasses over half the line
3. Draw an arc

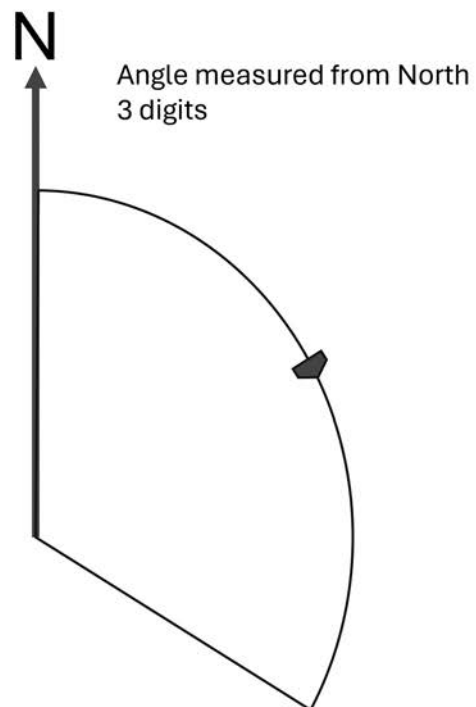
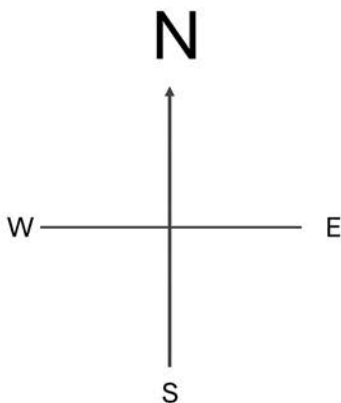


4. Place the compass on the end of the line.
5. Open compasses over half the line
6. Draw an arc



7. Draw a straight line connecting the two crossing arcs

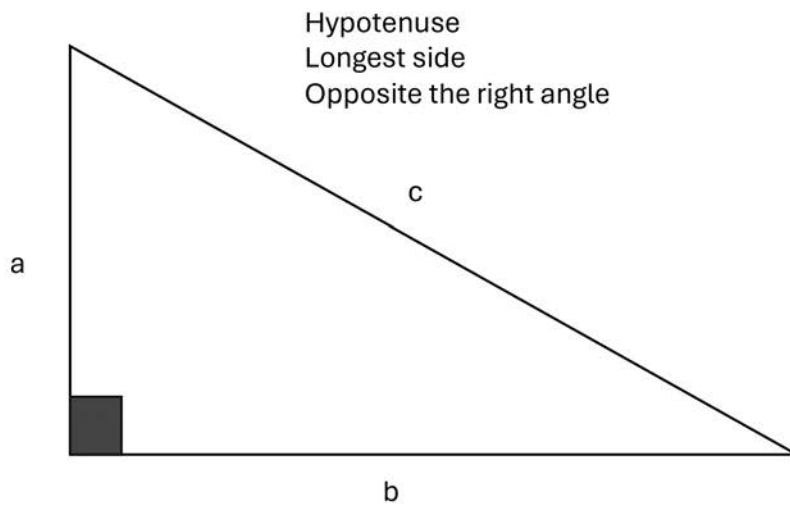
Bearings



Pythagoras Theorem

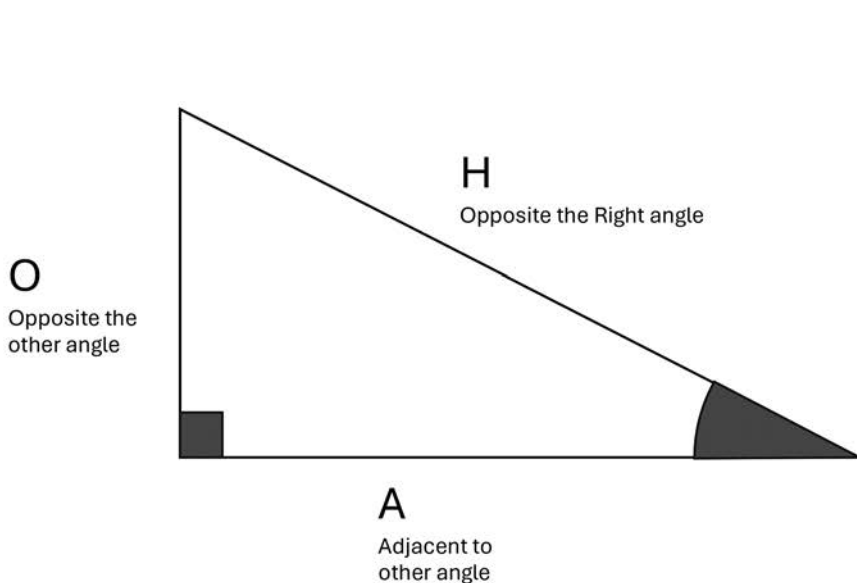
To find a missing side

$$a^2 + b^2 = c^2$$



Must be a right angled triangle

Trigonometry: Right Angled Triangle



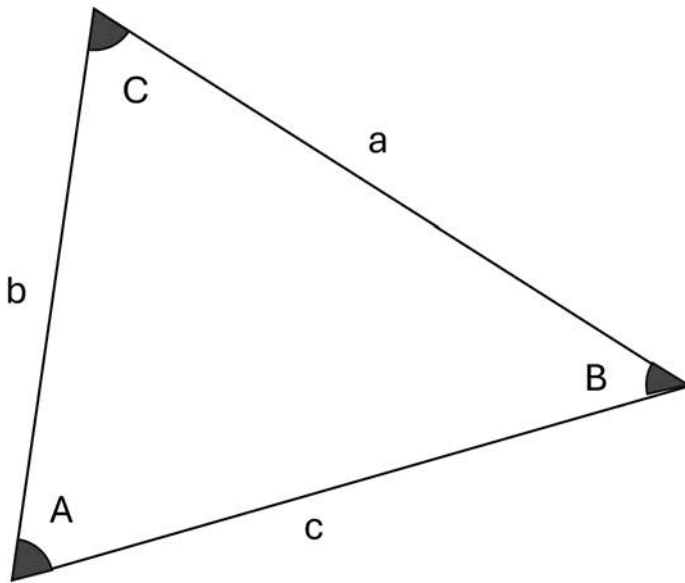
S
O
H
C
A
H
T
O
A

$$\sin(\text{angle}) = \frac{O}{H}$$

$$\cos(\text{angle}) = \frac{A}{H}$$

$$\tan(\text{angle}) = \frac{O}{A}$$

Sine Rule



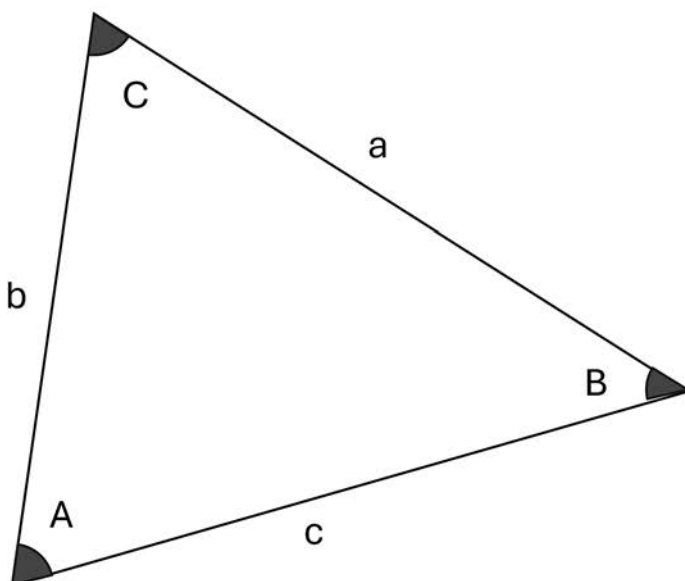
For Missing Side

$$\frac{a}{\sin A} = \frac{b}{\sin B} = \frac{c}{\sin C}$$

For Missing Angle

$$\frac{\sin A}{a} = \frac{\sin B}{b} = \frac{\sin C}{c}$$

Cosine Rule



For Missing Side

$$a^2 = b^2 + c^2 - 2bc \cos A$$

For Missing Angle

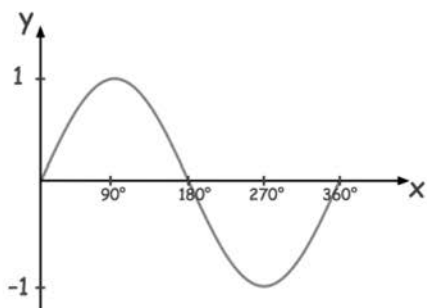
$$\cos A = \frac{b^2 + c^2 - a^2}{2bc}$$

Exact Trigonometry Values

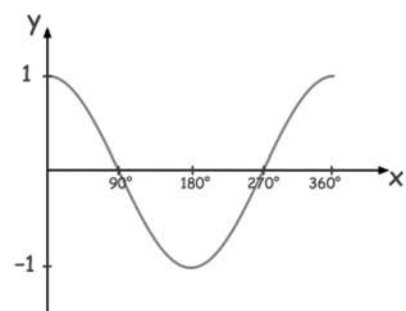
	0	30	45	60	90
Sin	0	1	2	3	4
Cos	4	3	2	1	0

2

Trigonometry Graphs

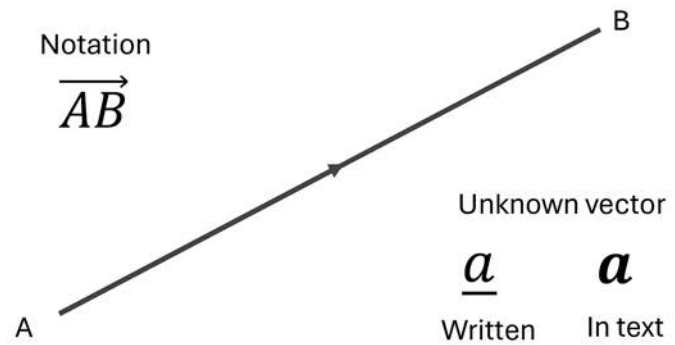
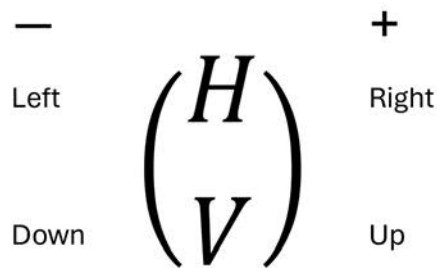


$$y = \sin(x)$$



$$y = \cos(x)$$

Vectors



If two vectors are parallel, then one is a multiple of the other

To prove two vectors are co-linear show that two vector paths are parallel and share a common point

Notation

$a + b$ a plus b

$3 + b$ 3 plus b

$a - b$ a minus b

$a - 3$ a minus 3

ab a times b

$3b$ 3 times b

$\frac{a}{b}$ a divide by b

$\frac{3}{b}$ 3 divide by b

Notation: Signs

=

Equal to

≠

Not equal to

≈

Approximately
equal to

≡

Equivalent to

<

Smaller than

>

Greater than

≤

Smaller than or equal to

≥

Greater than or equal to

Difference of Two Squares

$$(x - a)(x + a)$$



$$x^2 - a^2$$

A square number

Equations, expressions, identities, formulae and inequalities

$$2a - b^2 + 3ab$$

EXPRESSION

No equals sign or inequality sign.

$$x^2 + 3x + 2 = (x + 2)(x + 1)$$

IDENTITY

Both sides are exactly the same

$$x^2 + 3x + 2 = 0$$

EQUATION

Possible to find a value for the unknown

$$x^2 + 3x + 2 < 0$$

INEQUALITY

Similar to an equation but an inequality sign.

Can find a range of values for the unknown

$$s = ut + \frac{1}{2}at^2$$

FORMULA

Used to find the value of the subject when the other values are known

Sequences

Linear or Arithmetic

Changes by the same amount each time.

Geometric

Multiplied or divided by the same amount each time

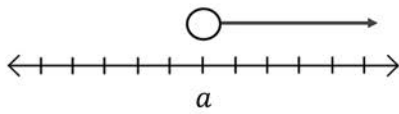
Quadratic

Second difference is the same

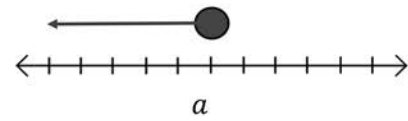
Fibonacci

The next term is the sum of the previous two terms

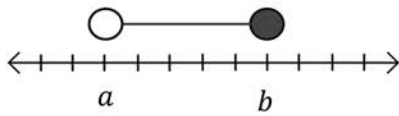
Inequality on a number line



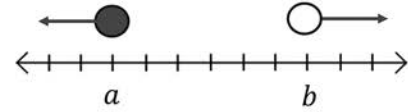
$$x > a$$



$$x \leq a$$

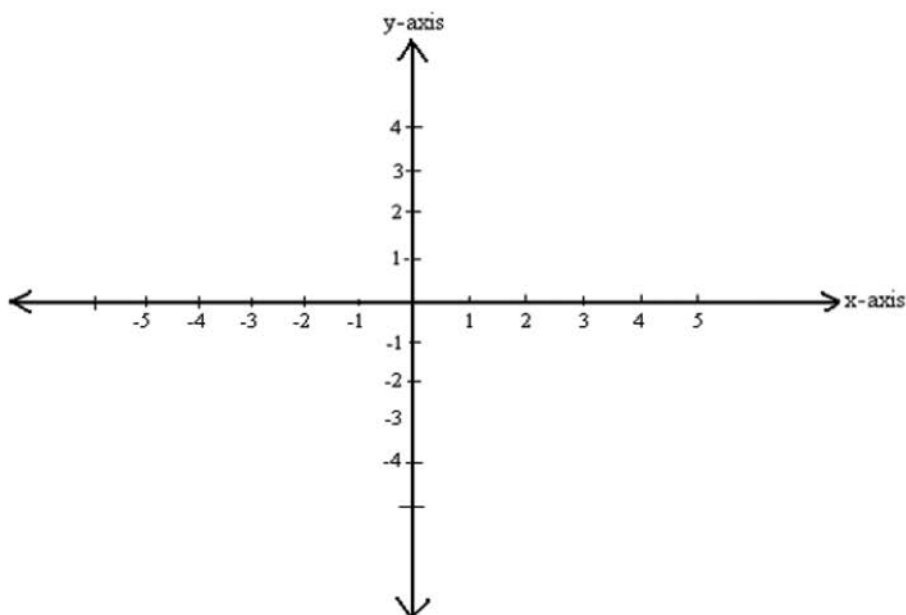


$$a < x \leq b$$



$$x \leq a \text{ or } x > b$$

Coordinates and Axes



Coordinate

(x, y)

Equation of a line

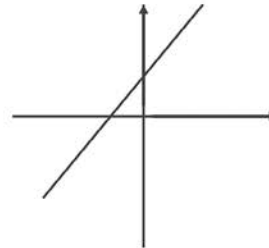
Equation of a straight line is in this form.
Rearrange to this form.

c is the y intercept.
The y value where the line
crosses the y -axis.
Coordinates $(0,c)$

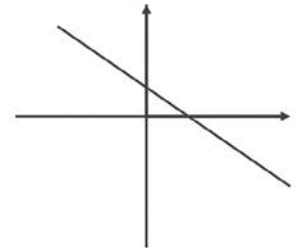
$$y = mx + c$$

m is the gradient
Gradient is the rate of change of y for
every change of 1 in x

$$m = \frac{\text{difference in } y}{\text{difference in } x}$$



Positive Gradient



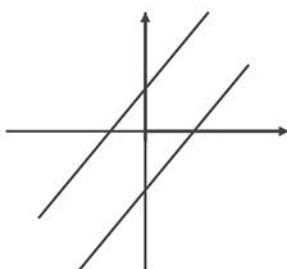
Negative Gradient

Parallel and Perpendicular Lines

$$y = mx + c$$

Parallel

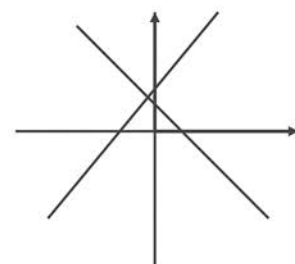
Parallel lines will have the same gradient.
They will have different y -intercepts.



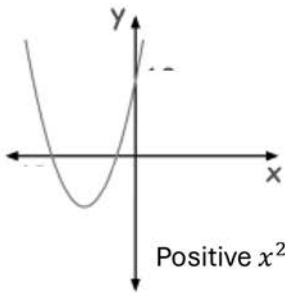
Perpendicular

Perpendicular lines are at 90° to each other.
If a line has a gradient m
Then a line perpendicular to it will have a
gradient

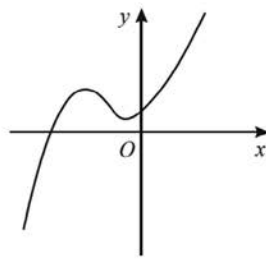
$$-\frac{1}{m}$$



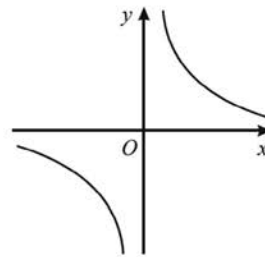
Common Graph Shapes



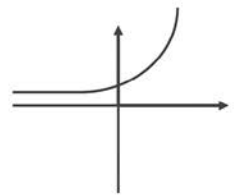
Quadratic Graph
Of form
 $y = ax^2 + bx + c$



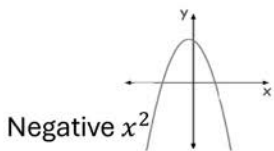
Cubic Graph
Of form
 $y = ax^3 + bx^2 + cx + d$



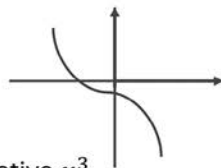
Reciprocal Graph
Of form
 $y = \frac{a}{x}$



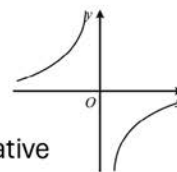
Exponential Graph
Of form
 $y = a^x$



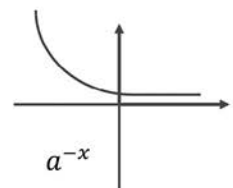
Negative x^2



Negative x^3

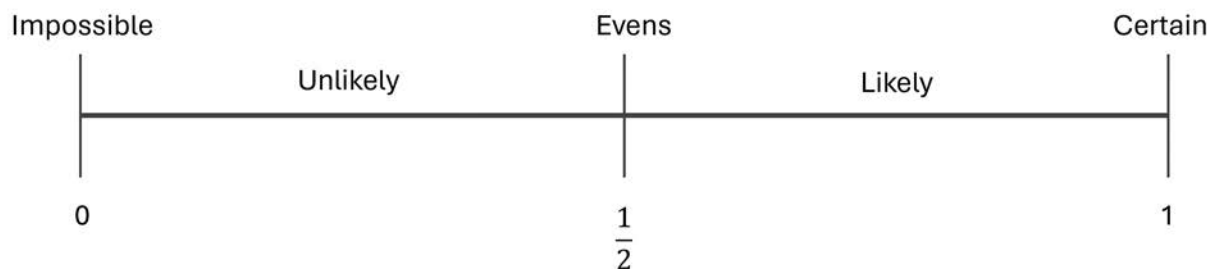


Negative



a^{-x}

Probability Scale



Probability

Mutually Exclusive

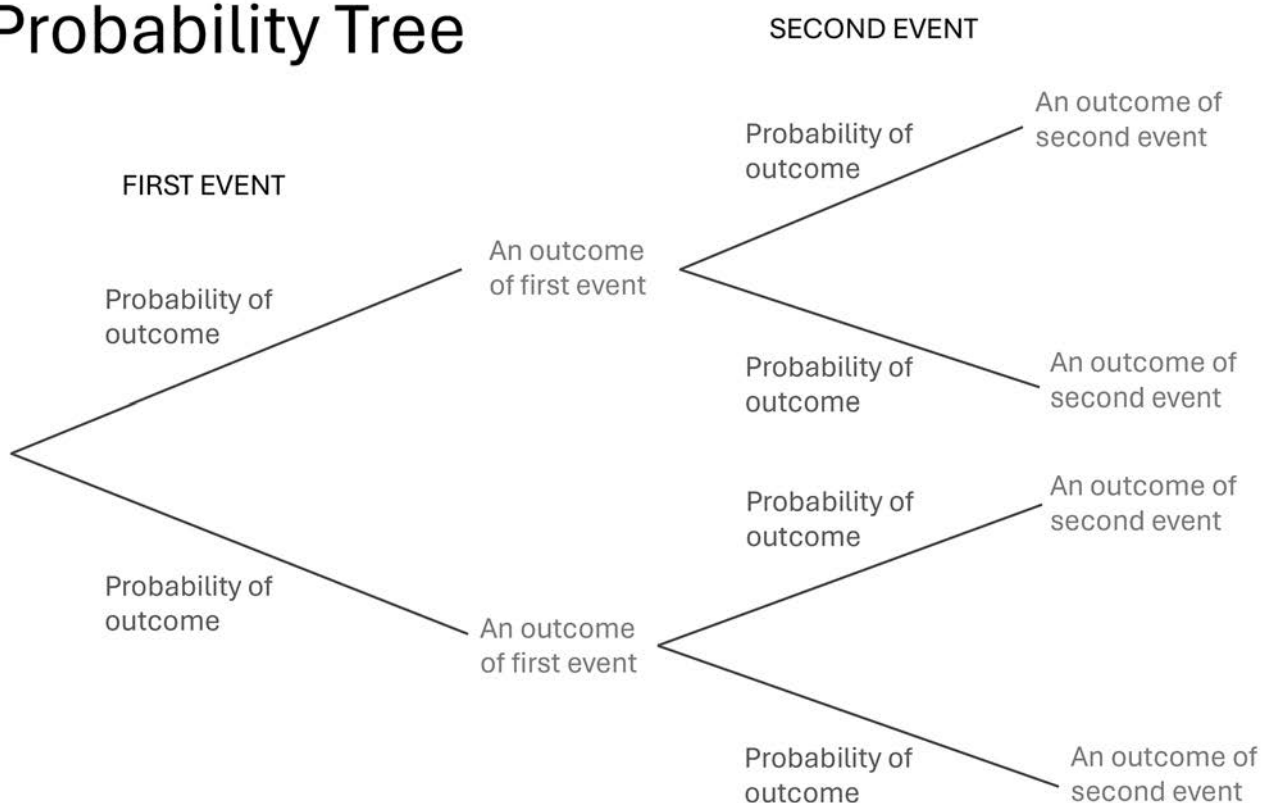
Events cannot happen together

Exclusivity

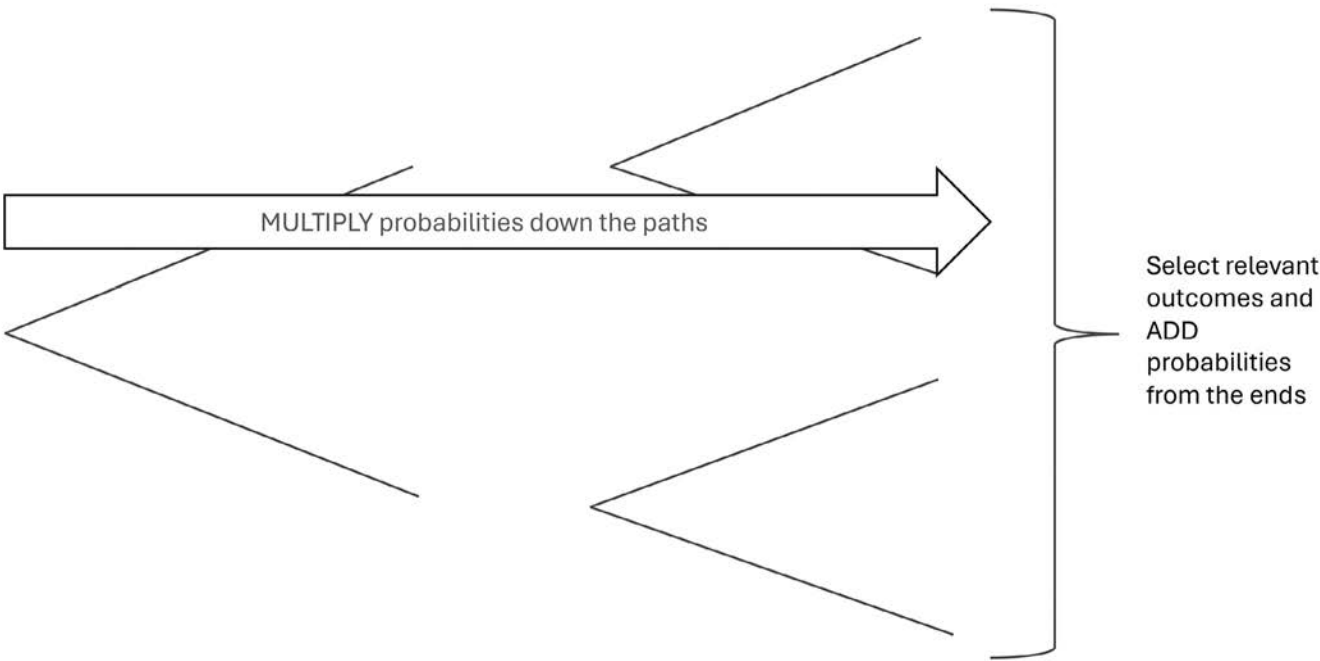
Probability of all outcomes adds to one

$$P(\text{Event not Occuring}) = 1 - P(\text{Event Occuring})$$

Probability Tree

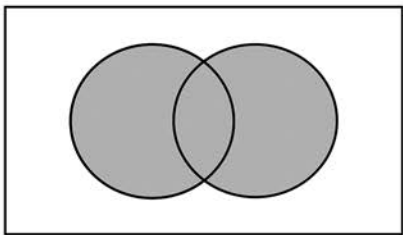
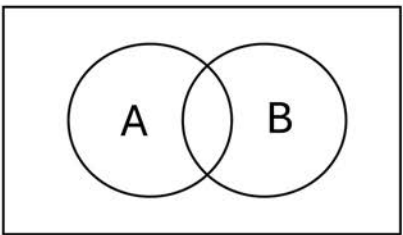


Probability Tree : Calculating Probability

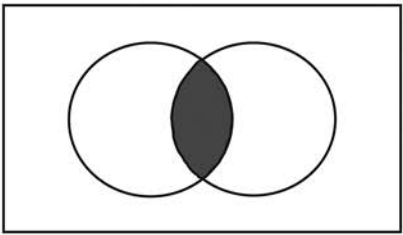


Venn Diagrams

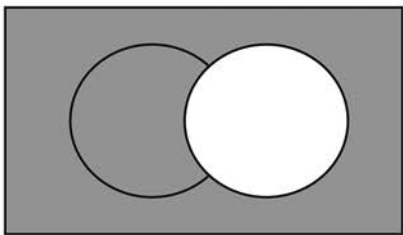
$\mathcal{U}$ Universal Set



$$A \cup B$$



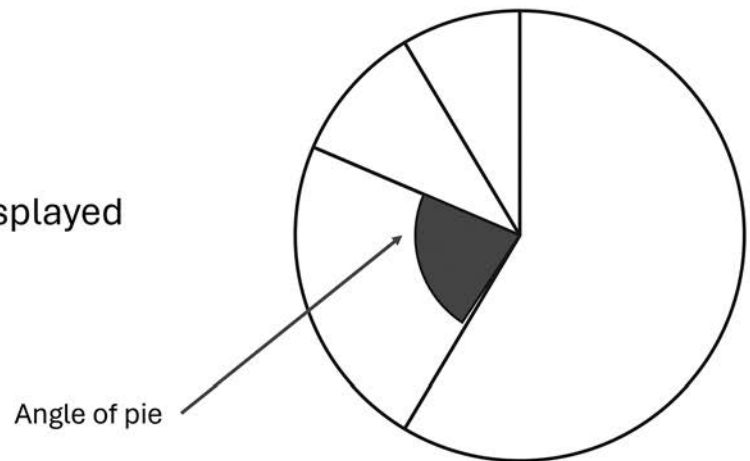
$$A \cap B$$



$$B'$$

Pie Charts

Frequency not displayed
Proportion of Total Frequency Displayed
Displayed as a sector of circle

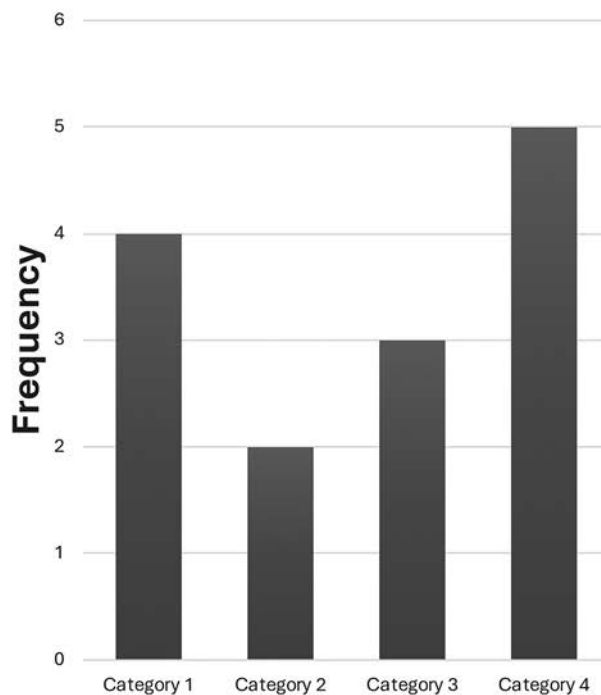


$$Proportion = \frac{Frequency}{Total\ Frequency} = \frac{angle\ of\ pie}{360}$$

Bar Chart

Frequency displayed as
Bar Height

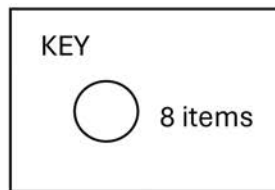
Bars of same width
Gap between bars



Pictogram

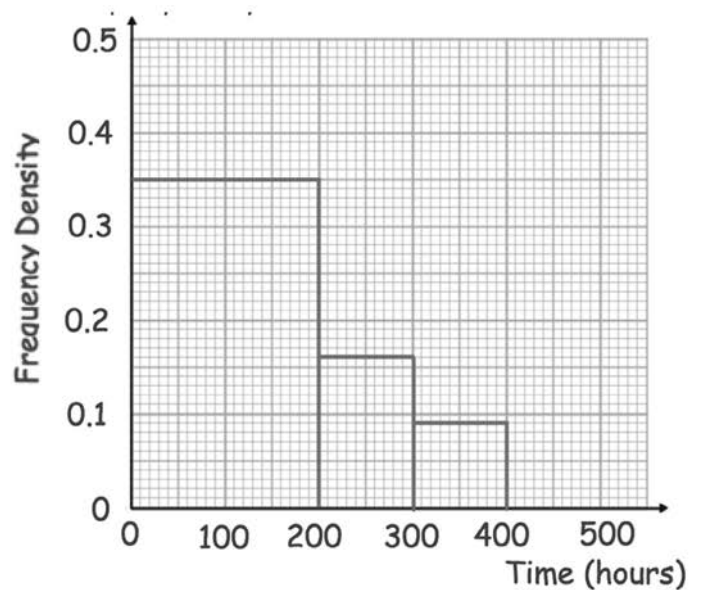
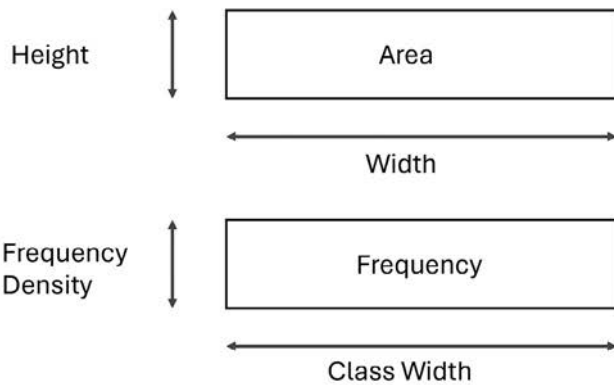
Frequency displayed by pictures or icons

Category 1	  
Category 2	 
Category 3	 

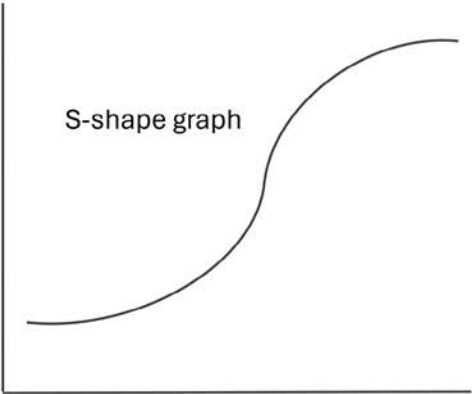


Histogram

Frequency
Displayed as Area



Cumulative Frequency



Data	Frequency	Cumulative Frequency
$0 < x \leq 10$	a	a
$10 < x \leq 20$	b	a+b
$20 < x \leq 30$	c	a+b+c

Plot on upper bound of group

Add up frequencies
as you go down table



INDEPENDENCE: DIAGNOSIS – THERAPY - TEST

NAME: CLASS:

TOPIC:

DIAGNOSIS: The thing I don't understand

THERAPY: Where am I going to learn about this?

Which of the templates will I use to transform the information?

TEST: 5 questions someone can ask me about my new understanding.



INDEPENDENCE: DIAGNOSE

NAME: CLASS:

SUBJECT:

Be clear about what you know and what you don't know before you begin.

First, use a contents page or a topic list for the subject you are going to revise.

Then, fill in the following table – the topics, and how well you know them.

Next, prioritise. Which topics will you revise first? Spend time studying the topics which will make the biggest difference to your results.

Topic	Knowledge	Priority
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	
	Know it/Sort of know it/Don't know it	

Finally, use the **diagnosis – therapy – test** worksheet to plan your independent study.



INDEPENDENCE: PRIORITISE, REDUCE, CATEGORISE, EXTEND

NAME:

CLASS:

TOPIC:

Take a section of text and do the following:

Prioritise: write out the three most important sentences. Rank 1-3 in terms of importance. Justify your decision.

Reduce: reduce the key information to 20 words.

Categorise: sort out the information into three categories. Give each category a title which sums up the information.

Extend: write down three questions you would like to ask an expert in this subject.



INDEPENDENCE: RANKING TRIANGLE

NAME:

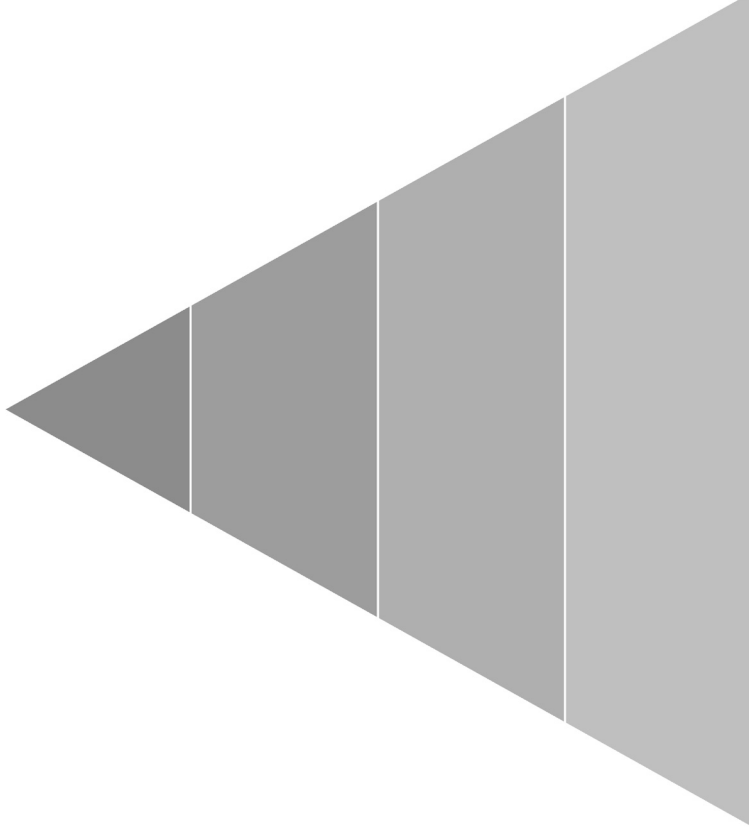
CLASS:

TOPIC:

The most important information goes at the top.

The least important information goes at the bottom.

Justify WHY. Why is it the most important? Why is it the least important?





INDEPENDENCE: QUIZZING

NAME:

CLASS:

TOPIC:

Read the text and transform it into 10 questions to ask someone.

Question	Answer
1	
2	
3	
4	
5	
6	
7	
8	
9	
10	

Question stems:

- State...
Describe...
- Explain...
Evaluate...
- Suggest...
Compare...



INDEPENDENCE: BOXING UP

NAME:

CLASS:

TOPIC:

Take a section of text. Read it and put your thoughts about the text into different boxes.

Needs a boost: 3 things I did not know:	
Almost there: 3 things I understand better now:	
I've got these: 3 things I already knew:	



INDEPENDENCE: OTHER IDEAS

Steps → flow chart Transform a sequence of steps into a flow chart or a diagram.

Flow chart → steps Transform a flow chart or a diagram into a sequence of steps.

Look, cover, write, check Cover a list of key words. Write them down. Check which ones you have got right. Repeat until you get them all right.

Link key words Take three words from a topic. Link them together in a sentence or a diagram. Repeat until all the key words have been linked.



INDEPENDENCE: Pictionary

NAME:

CLASS:

TOPIC:

Transform the material into 6 pictures – one per paragraph or one per key piece of information. The pictures should represent the information so that they can act as a reminder of what the text said. Underneath each picture, explain your thinking.

1.	2.	3.

4.	5.	6.

