KNOWLEDGE ORGANISER: Year 9 Higher – ALGEBRA 1

Expanding

To **expand double** brackets, each term in one bracket needs to be multiplied by each term in the other bracket.

Examples:

1) Expand and simplify $(x + 3)(x + 4)$

$= x^2 + 4x + 3x + 12$

$= x^2 + 7x + 12$

An expression is **quadratic** if the highest power of x is 2.

2) Expand and simplify $(2x + 1)(3x - 3)$

$= 6x^2 - 6x + 3x - 3$

$= 6x^2 - 3x - 3$

3) Expand and simplify $(4x - 2)^2 = (4x - 2)(4x - 2)$

$= 16x^2 - 8x - 8x + 4$

$= 16x^2 - 16x + 4$

1) $(x - 4)^2$ o) $(1 - 3t)(4t + 5)$ p) $(x + 5)^2$

2) $(x - 2)^2$ q) $(2y + 3)^2$ r) $(3t - 1)^2$

3) $(x + 10)^2$ s) $(x + 3)(x - 3)$ t) $(x + 7)(x - 7)$

4) $(x + 2)^2$ u) $(2x + 1)(2x - 1)$ v) $(3p - 2)(3p + 2)$

Difference of Two Squares

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

Examples:

$9x^2 - 16$
$= (3x)^2 - 4^2$
$= (3x + 4)(3x - 4)$

$4x^2 - 81y^2$
$= (2x)^2 - (9y)^2$
$= (2x + 9y)(2x - 9y)$

perfect squares

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

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

$(x + 5)^2 = (x + 5)(x + 5) = x^2 + 10x + 25$

$(x - 8)^2 = (x - 8)(x - 8) = x^2 - 16x + 64$

Expand with more than 2 terms in a bracket:

$(x + 3)(2x^2 + 10x + 1)$

$x(2x^2 + 10x + 1) + 3(2x^2 + 10x + 1)$

Trial and Improvement means pick a number that you think is the answer to the problem. After substituting your value into the equation you then try a new value depending on the answer that you found. This process is repeated until you think you have an accurate enough answer You must show all your results. E.g.

Solve $x^2 + 3x = 11$ to 1 decimal place

x	$x^2 + 3x$	Decision?
2	10	Too small
3	18	Too big
2.5	13.75	Too big
2.1	10.71	Too small
2.2	11.44	Too big
2.15	11.0725	Too big

Based on the table, what must the correct answer be?

To **solve** an equation you find the value of the unknown by isolating it on one side by performing inverse operations. Remember that solutions can be integers, decimals, fractions and negative numbers.

Eg 1.)

Solve $3(4m + 1) = 15$

Expand bracket $12m + 3 = 15$

Subtract 3 $-3 \quad -3$

$12m = 12$

Divide by 12 $\div 12 \quad \div 12$

$m = 1$

Eg 2.)

Solve $5e - 1 = 3e + 6$

Subtract 3e $-3e \quad -3e$

$2e - 1 = 6$

Add 1 $+1 \quad +1$

$2e = 7$

Divide by 2 $\div 2 \quad \div 2$

$e = 3.5$

Objective - To solve equations involving negative coefficients.

$7 - x = 13$

$7 - x = 13$
$+x \quad +x$
$7 = x + 13$
$-13 \quad -13$
$-6 = x$

OR

$7 - x = 13$
$-7 \quad -7$
$-x = 6$
$(-1)(-x) = 6(-1)$
$x = -6$

KNOWLEDGE ORGANISER: Year 9 Higher – GRAPHS 1

Gradient

Gradient or **m** is a measure of the steepness of a line. The higher the value of m, the steeper the line.

Intercept

The **intercept** or **c** is the y-value where the line crosses the y-axis.

$$y = mx + c$$

gradient y-intersect

Parallel and Perpendicular

Two lines are **parallel** if they have the same gradient.

Example:

Give the equation of a line which is parallel to y = 5x + 1.

The answer to this is any line with equation y = 5x + a, where a is any number apart from +1, for example y = 5x + 4, y = 5x – 2, y= 5x + 100

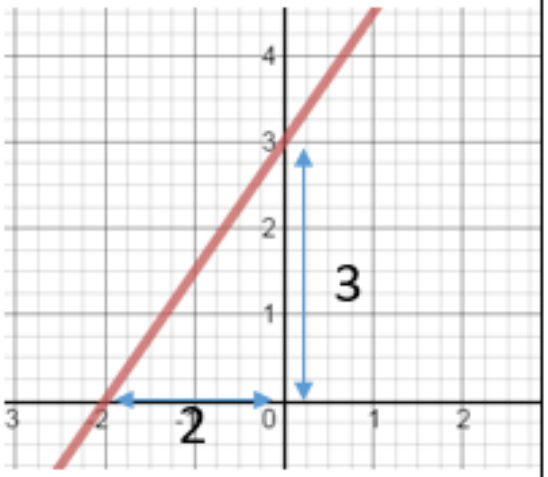
Two lines are **perpendicular** if their gradients have a product of -1.

Example:

Give the equation of a line that is perpendicular to y = ½x + 3.

The answer to this would be any line with a gradient of -2 as -2 x ½ = -1, for example y = -2x – 2, y = -2x + 22

Gradient from a graph



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

$$m = \frac{3}{2}$$

Gradient from two points

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

Example:

Find the gradient of the line segment between (2, -3) and (6, 9).

$$m = \frac{9 - -3}{6 - 2} = \frac{12}{4} = 3$$

So the gradient of this line segment is 3.

Example: Write the equation of the line through (2,5) and (4,13).

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The 1st step is to find the slope of the line.

$$m = \frac{13 - 5}{4 - 2} = \frac{8}{2} = 4$$

Then plug the slope in for m in the equation y = mx + b.

$$y = 4x + b$$

In the first step, we found out that the slope is 4.

$$y = 4x + b$$

The next step is to use one of the points to solve for b. We'll use the point (2,5). Plug in 2 for x and plug in 5 for y. Then solve the equation for b.

$$5 = 4(2) + b$$

$$5 = 8 + b$$

$$b = -3$$

Subtract 8 from both sides to solve for b.

The goal is to write the equation in slope-intercept form:

$$y = mx + b$$

In the first step, we found out that the slope is 4.

$$y = 4x + b$$

In the second step, we found out that the y-intercept is -3.

$$y = 4x - 3$$

POWER PACK: YEAR 9 HIGHER – KNOWLEDGE TEST 1

Key facts, formulae and definitions from your Knowledge Organisers to learn for the Knowledge Test. Knowing these will not only mean you pass the test, but make you a more confident mathematician.

Unit 1: Algebra 1

Key Language

expression: a combination of numbers or letters e.g. $5h$, $3a + 9b^2$
(An expression does not include an = symbol)

quadratic expression: an expression with positive powers where the highest power is 2 e.g. $x^2 + 6x + 9$

term: one part of an expression, separated by + or –
e.g. in the expression $5a – 2b + 7$ the terms are $5a$, $-2b$, 7

expand: or **multiply out**: remove the brackets from an expression

perfect square: a bracket which is squared e.g. $(k + 5)^2$

difference of two squares: an expression with one 'square' term subtracted from another e.g. $4x^2 – 49$, $a^2 – b^2$
This type of expression can be written as a double bracket where each is identical except for the sign e.g. $(x + 4)(x – 4)$

equation: a statement in algebra, including the = symbol, which is only true for certain values of the unknown letter
e.g. $5x + 3 = 23$ is only true when $x = 4$

solve: find the value (or values) of the unknown letter which make an equation true.
e.g. for $p^2 = 25$ the **solutions** are $p = 5$ and $p = -5$

trial and improvement: a method for systematically finding approximate solutions to equations that can't be solved easily

Revision

Make sure you know these conversions for simple fractions, decimals and percentages

Fraction	Decimal	Percentage
$\frac{1}{2}$	0.5	50%
$\frac{1}{4}$	0.25	25%
$\frac{1}{3}$	0.333333..... $0.\dot{3}$	$33.\dot{3}$ %
$\frac{3}{4}$	0.75	75%
$\frac{1}{5}$	0.2	20%

Unit 2: Graphs 1

Key Language

gradient: a number representing the 'steepness' of a graph

y-intercept: (or **y-axis intercept**) the point where a graph meets or crosses the y-axis

x-intercept: (or **x-axis intercept**) the point where a graph meets or crosses the x-axis

point of intersection: point on a graph where two lines/curves meet

parallel: going in the same direction

perpendicular: meeting at right-angles

The line equation y = mx + c

The equation of a straight line can be written as $y = mx + c$ where m is the gradient and c is the y-axis intercept.
e.g. $y = –4x + 3$ has gradient -4 and meets the y-axis at (0, 3)

Parallel & Perpendicular lines, and their gradients

Two lines are **parallel** if they have the same gradient
e.g. $y = 5x + 3$ and $y = 5x - 7$

Two lines are **perpendicular** if their gradients multiply to -1
e.g. $y = 5x + 3$ and $y = -\frac{1}{5}x - 7$ since $5 \times -\frac{1}{5} = -1$

Formulae for the gradient of a line through 2 points

The gradient (m) of the line through (x_1, y_1) and (x_2, y_2) is:

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

Gradient from a graph

The gradient of a graph can be found by drawing a triangle and using

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

YEAR 9 HIGHER – KNOWLEDGE TEST 1 – SAMPLE QUESTIONS

Ten of these questions will be chosen, with very little change, to make up the Knowledge Test.
If you can confidently answer all of these, you will pass easily. Use your Power Pack to research and learn anything that you don't know yet.

1. Which of these is an *expression*?
   (a) 5x + 7 (b) 2x + 9 = 17 (c) V = IR
2. Which of these is an *equation*?
   (a) 2p + 3q (b) 5p + 3 = 10 (c) x + 2x = 3x
3. Which of these is an *perfect square*?
   (a) $(x + 3)^2$ (b) $x^2 + 25$ (c) $x^2 – 49$
4. Which is a *difference of two squares*?
   (a) $(x + 3)^2$ (b) $x^2 + 25$ (c) $x^2 – 49$
5. What do we call the method for systematically finding approximate solutions to equations that can't be solved easily?
6. When expanded, (2x + 5)(2x – 5) would give a special type of expression. What type?
7. What special name do we give to expressions like $(x + 5)^2$ or (x + 5)(x + 5) ?
8. What word do we use for a number that describes the 'steepness' of a graph?
9. What do we call the point on a graph where two lines or curves meet or cross?
10. What word is used to describe two lines which meet at right-angles?
11. What type of graph has an equation of the form y = mx + c ?
12. What is the *gradient* of the line y = 5x + 2?
13. What is the *gradient* of the line y = -7x + 3?
14. Write the co-ordinates of the point where the line y = 4x + 7 meets the y-axis.
15. Write down the equation of the line which has gradient 4 and meets the y-axis at (0,-2)
16. This formula for working out the gradient from a graph is *incorrect*:
    m = (change in x) + (change in y)
    Write down a correct formula.
17. Write down the formula we use to find the gradient of the line joining the points (x_1, y_1) and (x_2, y_2).
18. The gradients of two perpendicular lines always multiply to give *what value* ?
19. Which of these expressions is *quadratic*?
    $p^2 + 8$ 4x + 3y (x + 3)$(x^2 + 4)$
20. Which two of these lines are *parallel* ?
    (a) y = 5x + 2 (b) y = 7x + 2 (c) y = 5x – 2
21. Which two lines are *perpendicular* ?
    (a) $y = \frac{2}{3}x + 5$ (b) $y = \frac{2}{3}x + 7$
    (c) $y = \frac{3}{2}x + 2$ (d) $y = -\frac{2}{3}x + 7$
22. What is $\frac{3}{4}$ as a percentage?
23. What is the decimal equivalent of 25% ?
24. What simplified fraction is equivalent to the decimal $0.\dot{3}$?
25. What is $\frac{1}{5}$ as a decimal?

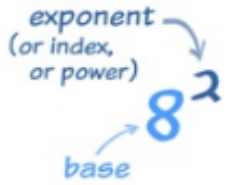
NOTE: Questions like Q22-25 could use any of the conversions in the table in the Power Pack.

ANSWERS

1. (a) 5x + 7
2. (b) 5p + 3 = 10
3. (a) $(x + 3)^2$
4. (c) $x^2 – 49$
5. trial and improvement
6. a difference of two squares
7. a perfect square
8. gradient
9. point of intersection
10. perpendicular
11. a (straight) line
12. 5
13. – 7
14. (0, 7)
15. y = 4x – 2
16. $m = \frac{\text{change in y}}{\text{change in x}}$
17. $m = \frac{y_2 - y_1}{x_2 - x_1}$
18. – 1
19. $p^2 + 8$
20. (a) and (c)
21. (c) and (d)
22. 75%
23. 0.25
24. $\frac{3}{4}$
25. 0.2

KNOWLEDGE ORGANISER: Year 9 Higher – POWERS & ROOTS

Index (plural: **indices**) means 'power'.
E.g. For 8^2
8 is the **base** number and 2 is the **index**.
For positive integer powers, the **index** represents how many times the base has been multiplied by itself.
E.g. $3^7 = 3x3x3x3x3x3x3$



$$4^{-2} = \frac{4^{-2}}{1} = \frac{1}{4^2} = \frac{1}{16}$$

POWER drops by 1

3^3	3^2	3^1	3^0	3^{-1}	3^{-2}
27	9	3	1	$\frac{1}{3}$	$\frac{1}{3^2} = \frac{1}{9}$

÷ 3

Laws of Indices

Rule	Example
$a^m \times a^n = a^{m+n}$	$2^5 \times 2^3 = 2^8$
$a^m \div a^n = a^{m-n}$	$5^7 \div 5^3 = 5^4$
$(a^m)^n = a^{m \times n}$	$(10^3)^7 = 10^{21}$
$a^1 = a$	$17^1 = 17$
$a^0 = 1$	$34^0 = 1$
$\left(\frac{a}{b}\right)^m = \frac{a^m}{b^m}$	$\left(\frac{5}{6}\right)^2 = \frac{25}{36}$
$a^{-m} = \frac{1}{a^m}$	$9^{-2} = \frac{1}{81}$

Example 1

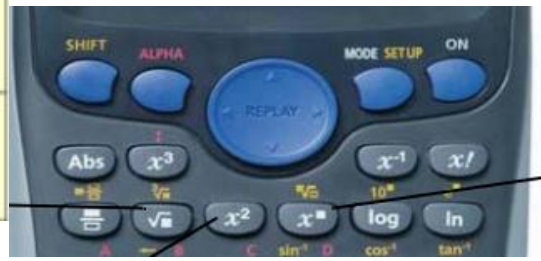
$$6^{-4} = \frac{6^{-4}}{1} = \frac{1}{6^4} = \frac{1}{1296}$$

In this example, we simply flipped the fraction around which allowed us to make the exponent positive so that we can easily find the answer.

Example 2

$$2^{-7} = \frac{2^{-7}}{1} = \frac{1}{2^7} = \frac{1}{128}$$

In example 2, we also simply used the reciprocal and then solved the expression with the positive exponent.

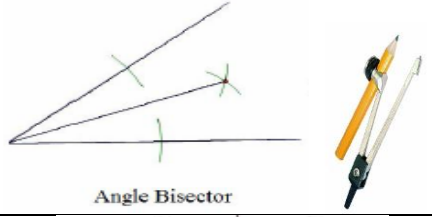
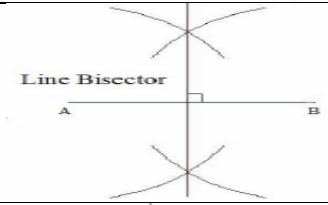
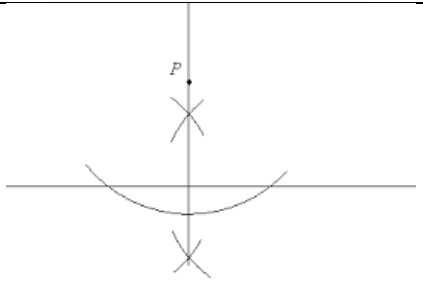


$x^{\square}$ power key

Evaluate

1) $5^2 \times 5^3$
2) 4^{-2}
3) 500^0
4) $9^2 \times 3^{-2}$
5) $3^6 \div 3^4$
6) $2^{-2} \times 2^6$
7) $(2^3)^2$
8) $(3.79)^0$
9) 5^{-3}
10) $3^3 \div 3^{-1}$
11) $(3 \times 2^2)^2$
12) $\left(3^{\frac{1}{2}}\right)^2$

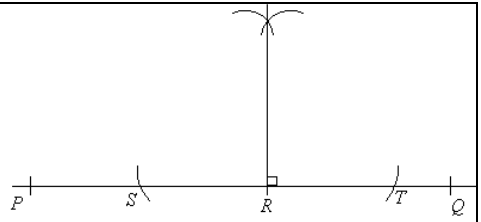
KNOWLEDGE ORGANISER: Year 9 Higher – LOCI & CONSTRUCTION

Topic/Skill - Definition/Tips	Example
1. Angle Bisector: Cuts the angle in half. 1. Place the sharp end of a pair of compasses on the vertex. 2. Draw an arc, marking a point on each line. 3. Without changing the compass put the compass on each point and mark a centre point where two arcs cross over. 4. Use a ruler to draw a line through the vertex and centre point.	
2. Perpendicular Bisector: Cuts a line in half and at right angles. 1. Put the sharp point of a pair of compasses on A. 2. Open the compass over half way on the line. 3. Draw an arc above and below the line. 4. Without changing the compass, repeat from point B. 5. Draw a straight line through the two intersecting arcs.	
3. Perpendicular from an External Point The **perpendicular distance** from a point to a line is the **shortest distance** to that line. 1. Put the sharp point of a pair of compasses on the point. 2. Draw an arc that crosses the line twice. 3. Place the sharp point of the compass on one of these points, open over half way and draw an arc above and below the line. 4. Repeat from the other point on the line. 5. Draw a straight line through the two intersecting arcs.	

4. Perpendicular from a Point on a Line

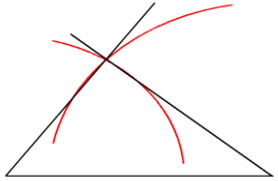
Given line PQ and point R on the line:

1. Put the sharp point of a pair of compasses on point R.
2. Draw two arcs either side of the point of equal width (giving points S and T)
3. Place the compass on point S, open over halfway and draw an arc above the line.
4. Repeat from the other arc on the line (point T).
5. Draw a straight line from the intersecting arcs to the original point on the line.



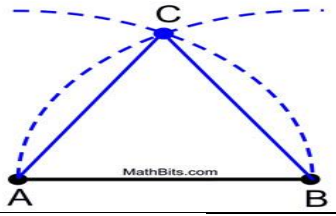
5. Constructing Triangles (Side, Side, Side)

1. Draw the base of the triangle using a ruler.
2. Open a pair of compasses to the width of one side of the triangle.
3. Place the point on one end of the line and draw an arc.
4. Repeat for the other side of the triangle at the other end of the line.
5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect



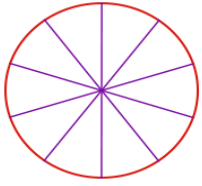
6. Constructing an Equilateral Triangle (also makes a 60° angle

1. Draw the base of the triangle using a ruler.
2. Open the pair of compasses to the exact length of the side of the triangle.
3. Place the sharp point on one end of the line and draw an arc.
4. Repeat this from the other end of the line.
5. Using a ruler, draw lines connecting the ends of the base of the triangle to the point where the arcs intersect.



7. Equidistant

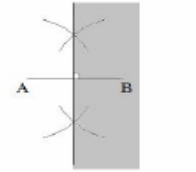
A point is equidistant from a set of objects if the **distances between that point and each of the objects is the same**.



8. Loci and Regions

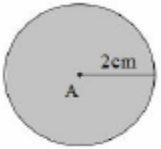
A **locus** is a **path of points that follow a rule**.

For the locus of points **closer to B than A**, create a **perpendicular bisector** between A and B and shade the side closer to B.

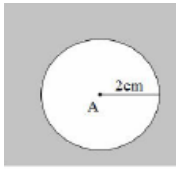


Points Closer to B than A

For the locus of points **equidistant from A**, use a compass to draw a **circle**, centre A.

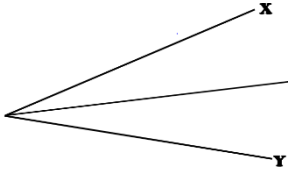


Points less than 2cm from A



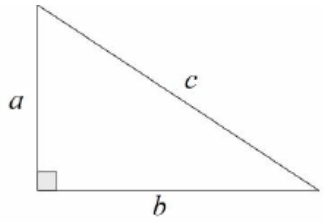
Points more than 2cm from A

For the locus of points **equidistant to line X and line Y**, create an **angle bisector**.



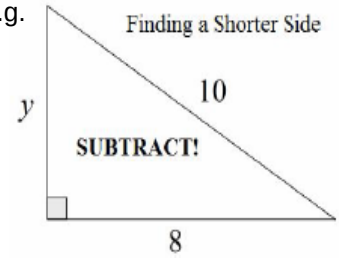
KNOWLEDGE ORGANISER: Year 9 Higher – GEOMETRY 1

Pythagoras' Theorem



For any **right angled triangle**, $a^2 + b^2 = c^2$
c is the **hypotenuse** (longest side)

e.g.



$a = y,\ b = 8,\ c = 10$

$a^2 = c^2 - b^2$

$y^2 = 100 - 64$

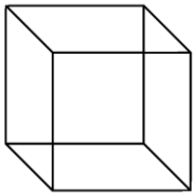
$y^2 = 36$

$y = 6$

Properties of Solids

Faces = flat surfaces
Edges = line between two faces
Vertices = corners

e.g. A cube has
6 faces
12 edges
8 vertices

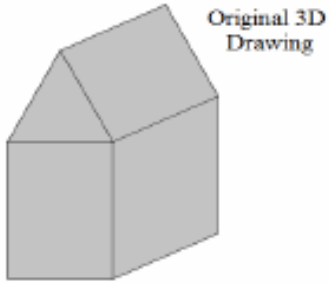


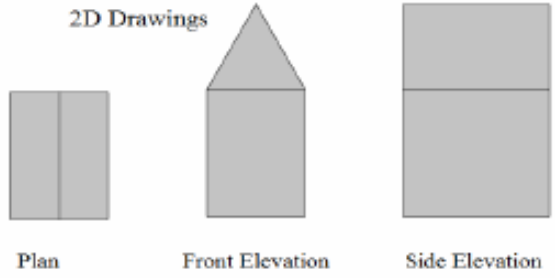
A sphere has 1 surface,
no faces, no edges & no vertices

Plans & Elevations

2D drawings of views of a 3D solid.

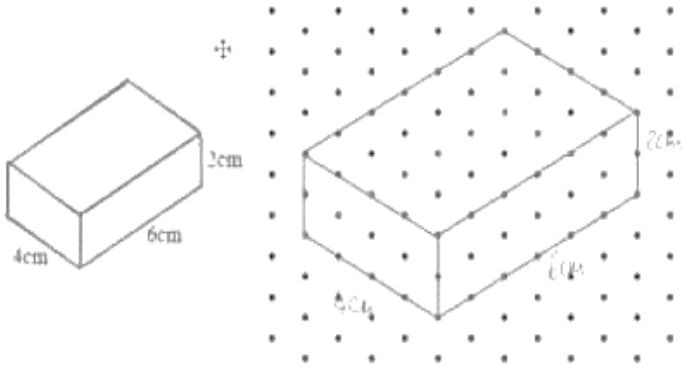
Plan View: from **above**
Side Elevation: from the **side**
Front Elevation: from the **front**





Isometric Drawing

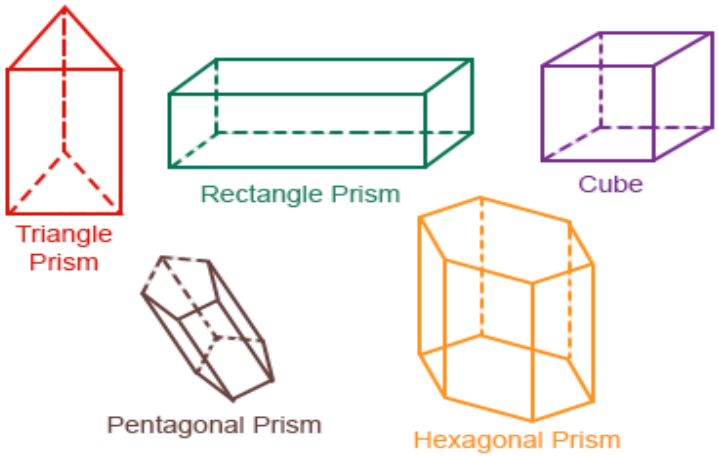
A method for visually **representing 3D objects in 2D**.



Prisms

A prism is a 3D shape whose **cross-section is the same** throughout.

The **cross section** is the shape that continues all the way through the prism.



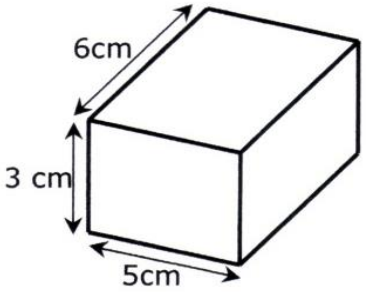
Volume of a cube/cuboid

$$V = Length \times Width \times Height$$

$$V = L \times W \times H$$

Volume is a measure of the amount of space inside a solid.

Units: mm^3, cm^3, m^3 etc.

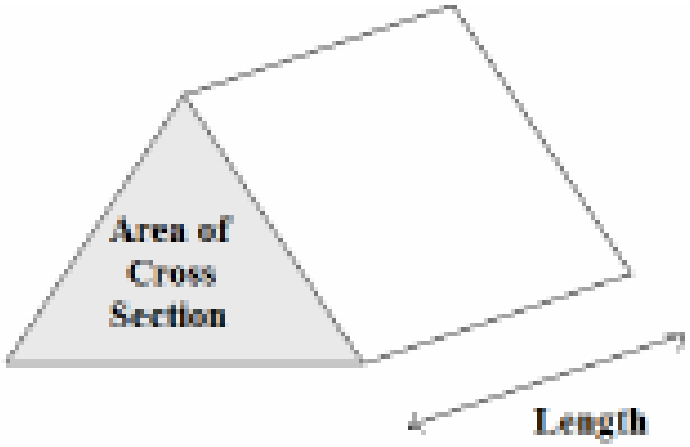


volume = 6 x 5 x 3
= 90 cm^3

Volume of a prism

$$V = Area\ of\ Cross\ Section \times Length$$

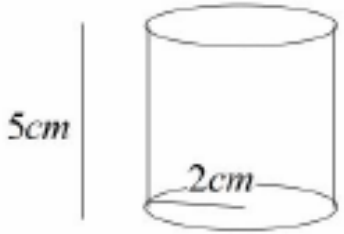
$$V = A \times L$$



Volume of a cylinder

$$V = \pi r^2 h$$

An answer can sometimes be left "in terms of π"



$V = \pi(4)(5)$

$= 62.8cm^3$

"in terms of π" V = 20 π

POWER PACK: YEAR 9 HIGHER – KNOWLEDGE TEST 2

Key facts, formulae and definitions from your Knowledge Organisers to learn for the Knowledge Test. Knowing these will not only mean you pass the test, but make you a more confident mathematician.

Unit 3: Powers & Roots

Key Language

index: is another word for 'power' (plural: **indices**)
base: the base is the 'large' number in an expression involving a power e.g. for 5^6 the base is 5
index laws: rules for simplifying expressions involving powers
simplify: write in the simplest possible way
evaluate: work out the value of an expression or formula
reciprocal: 1 divided by the number (this inverts fractions)

e.g. the reciprocal of 5 is $1 \div 5 = \frac{1}{5}$

Index Laws

multiplication:	$5^3 \times 5^7 = 5^{10}$	same base – add the powers
division:	$5^{12} \div 5^4 = 5^8$	same base – subtract powers
power of power:	$(5^{20})^3 = 5^{60}$	multiply the powers
power 0:	$5^0 = 1$	anything to power 0 is 1

Power of -1

A power of -1 is a reciprocal

e.g. $6^{-1} = \frac{1}{6}$ $\left(\frac{1}{6}\right)^{-1} = 6$ $\left(\frac{2}{3}\right)^{-1} = \frac{3}{2}$

Revision

Make sure you know the squares of numbers up to 10^2 and cubes of numbers up to 5^3. Here's a reminder:

SQUARE NUMBERS

$1^2 = 1 \times 1 = 1$	$6^2 = 36$
$2^2 = 2 \times 2 = 4$	$7^2 = 49$
$3^2 = 3 \times 3 = 9$	$8^2 = 64$
$4^2 = 4 \times 4 = 16$	$9^2 = 81$
$5^2 = 5 \times 5 = 25$	$10^2 = 100$

CUBE NUMBERS

$1^3 = 1 \times 1 \times 1 = 1$
$2^3 = 2 \times 2 \times 2 = 8$
$3^3 = 27$
$4^3 = 64$
$5^3 = 125$

Unit 4: Loci & Construction

Key Language

construct: draw accurately, usually using a pair of compasses
bisect: cut exactly in half (by construction)
perpendicular: at right-angles to, line at right-angles to another
equidistant: equal distance (from a point)

Unit 5: Geometry 1

Key Language

solid: a 3D 'shape'
prism: a solid with the same shape (the **cross-section**) running through the middle from one end to the other
cylinder: like a prism, but with a circular cross-section
elevation: a view of a 3D solid from the front or side
plan: a view of a 3D solid from above (bird's eye view)
volume: the amount of space taken up by a 3D shape
capacity: the amount of liquid (or gas) that a 3D container can hold

Pythagoras' theorem

Pythagoras' theorem is used to calculate a missing side in a right-angled triangle. It is often written $a^2 + b^2 = c^2$

Volume Formulae

Cube/cuboid:	V = length x width x height
Prism:	V = (area of cross section) x height
Cylinder:	V = $\pi r^2 h$

Units of volume & capacity

Volume: e.g. mm^3, cm^3, m^3
Capacity: e.g. ml, cl, litres
1 litre = 1000 ml

Conversions to know

1 litre = 1000 ml
1 ml = 1 cm^3
1 litre = 1000 cm^3

YEAR 9 HIGHER – KNOWLEDGE TEST 2 – SAMPLE QUESTIONS

Ten of these questions will be chosen, with very little change, to make up the Knowledge Test.
If you can confidently answer all of these, you will pass easily. Use your Power Pack to research and learn anything that you don't know yet.

1. Evaluate 6^{-1}
2. Evaluate 213^{-1}
3. Write 5^{-1} as a fraction
4. What is the missing power? $9^{_} = \frac{1}{9}$
5. What number is the *base* here: $6^2 = 36$?
6. What is the *reciprocal* of 7 ?
7. What is the *reciprocal* of $\frac{4}{5}$?
8. Simplify $4^{10} \times 4^9$
9. Simplify $p^{12} \div p^3$
10. Simplify $(5^8)^{12}$
11. Simplify y^0
12. What would you multiply 7^3 by to get the answer 7^{15} ?
    Write your answer using a power.
13. Write down the value of 6^2
14. Write down the value of 4^3
15. Write down the value of 2^3
16. What number is cubed to give 125?

Note: Questions like Q13-16 could involve any of the squares to 100 or any of the cubes to 125, as shown in the Power Pack notes.

17. What is the missing power?
    $h^{17} \div h^{_} = h^{15}$
18. What does the word *bisect* mean?
19. What word means 'at right-angles' ?
20. What does the word *equidistant* mean ?
21. What is a *plan* view of a solid ?
22. What do we call the shape that runs through the middle of a prism?
23. What word describes the amount of liquid (or gas) that a 3D container can hold?
24. What word describes the amount of space that a 3D solid takes up?
25. Here is a formula for Pythagoras' theorem: $a - b = c$
    This is *incorrect*. Write a correct formula.
26. Which of these is a unit of *volume*?
    A: km B: m^3 C: cm^2 D: litres
27. Which of these is a unit of *capacity*?
    A: km B: m^3 C: cm^2 D: litres
28. How many millilitres are there in 1 litre?
29. How many cm^3 is the same as 1 ml?
30. How many cm^3 is the same as 1 litre?
31. What does *perpendicular* mean?
32. Write a formula for the volume of a cube with width w, height h and length l.
33. Write a formula for the volume of a cylinder with height h and radius r.

ANSWERS

1. $\frac{1}{6}$ 2. $\frac{1}{213}$ 3. $\frac{1}{5}$
4. -1 5. 6 6. $\frac{1}{7}$
7. $\frac{5}{4}$ 8. 4^{19} 9. p^9
10. 5^{96} 11. 0 12. 7^{12}
13. 36 14. 64 15. 8
16. 5 17. 2
18. cut exactly in half
19. perpendicular
20. equal distance
21. a view from above (bird's eye view)
22. the cross-section
23. capacity
24. volume
25. $a^2 + b^2 = c^2$
26. B: m^3 27. D: litres
28. 1000 29. 1
30. 1000
31. 'at right angles to' (or 'at 90° to')
32. V = w x h x l (or V = whl, any order)
33. V = $\pi r^2 h$

KNOWLEDGE ORGANISER: Year 9 Higher – NUMBER

1. Recurring Decimal	A decimal number that has **digits that repeat forever**. The part that repeats is usually shown by placing a dot above the digit that repeats, or dots over the first and last digit of the repeating pattern.	$\frac{1}{3} = 0.333 \ldots = 0.\dot{3}$ $\frac{1}{7} = 0.142857142857 \ldots = 0.\dot{1}42857\dot{7}$ $\frac{77}{600} = 0.128333 \ldots = 0.128\dot{3}$
2. Equivalent Fractions	Fractions which represent the same value	2 5 = 4 10 = 20 50 = 60 150 *eeeeee*.
3. Comparing Fractions	To compare fractions, they each need to be rewritten so that they have a **common denominator**. **Ascending** means **smallest to biggest**. **Descending** means **biggest to smallest**.	Put in to ascending order : $\frac{3}{4}, \frac{2}{3}, \frac{5}{6}, \frac{1}{2}$. Equivalent: $\frac{9}{12}, \frac{8}{12}, \frac{10}{12}, \frac{6}{12}$ Correct order: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$
4. Fractions to Decimals	**Divide the numerator by the denominator** using the bus stop method. Sometimes when dividing there is always a remainder this results in a non-terminating or recurring decimal	$\frac{3}{8} = 3 \div 8 = 0.375$ $\frac{1}{3} = 1 \div 3 = 0.333 \ldots = 0.\dot{3}$
5. Decimals to Fractions	**Write as a fraction** over 10, 100 or 1000 and simplify.	$0.36 = \frac{36}{100} = \frac{9}{25}$
6. Percentages to Decimals	**Divide by 100**	$8\% = 8 \div 100 = 0.08$
7. Decimals to Percentages	**Multiply by 100**	$0.4 = 0.4 \times 100\% = 40\%$
8. Fractions to Percentages	Percentage is just a fraction out of 100. **Make the denominator 100 using equivalent fractions**. When the denominator doesn't go in to 100, use a calculator and **multiply the fraction by 100**.	$\frac{3}{25} = \frac{12}{100} = 12\%$ $\frac{9}{17} \times 100 = 52.9\%$
9. Percentages to Fractions	Percentage is just a fraction out of 100. **Write the percentage over 100** and simplify.	$14\% = \frac{14}{100} = \frac{7}{50}$
10. Division by a decimal (decimal divisor)	When dividing by a decimal multiply both numbers by 10 or 100 or 1000 etc to change the decimal into an integer (whole number) Then use bus shelter method for division	$35 \div 0.7 = 350 \div 7 = 50$ multiply by 10 $36 \div 0.12 = 3600 \div 12 = 30$ multiply by 100 $35.07 \div 0.7 = 350.7 \div 7 = 50.1$ Notice it is only the 0.7 (the divisor) that needs to be an integer