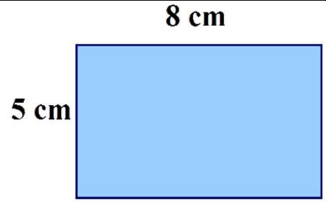
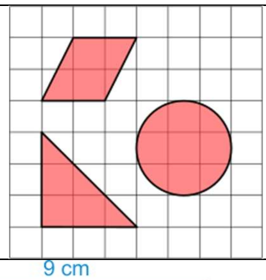
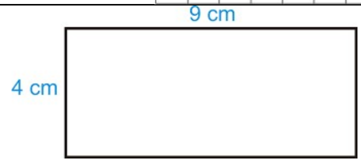
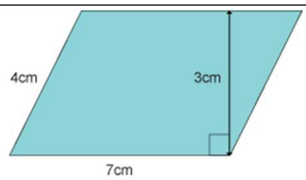
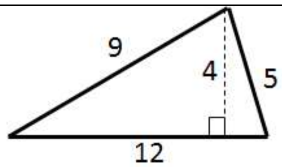
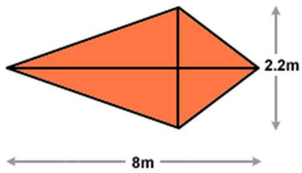
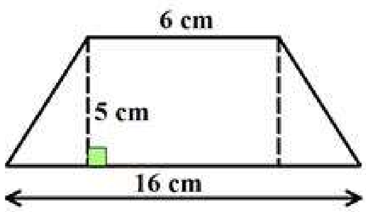
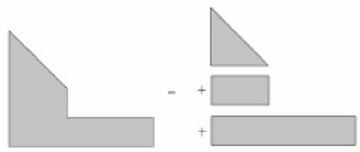
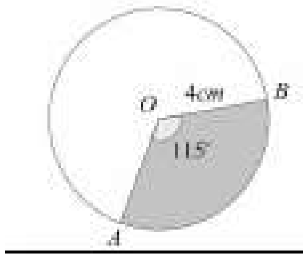
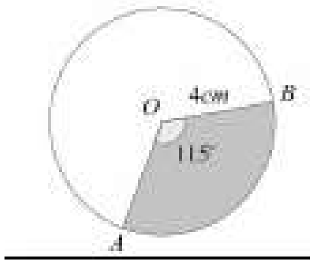
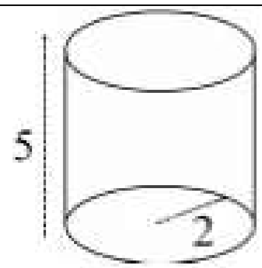
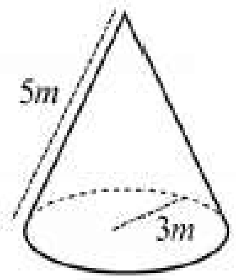
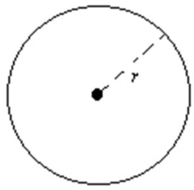
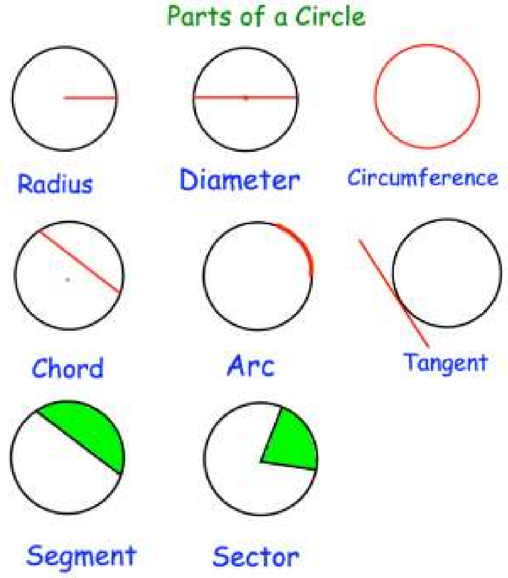
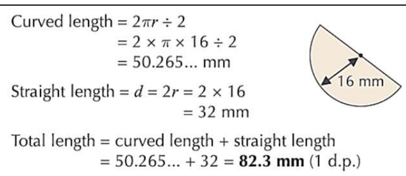
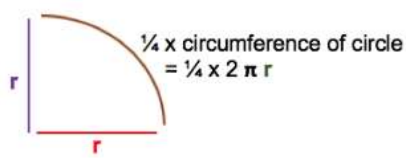
Knowledge Organiser Y11 Foundation Maths: Area and perimeter

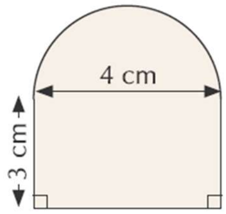
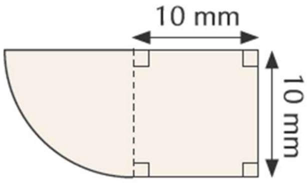
Key Vocabulary	Definition/Tips	Example
1. Perimeter	The **total distance** around the **outside** of a shape. Units include: mm, cm, m etc.	 $P = 8 + 5 + 8 + 5 = 26cm$
2. Area	The amount of **space inside** a shape. Units include: mm^2, cm^2, m^2	
3. Area of a Rectangle	**Length x Width**	 $A = 36cm^2$
4. Area of a Parallelogram	**Base x Perpendicular Height** Not the slant height.	 $A = 21cm^2$
5. Area of a Triangle	**Base x Height ÷ 2**	 $A = 24cm^2$
6. Area of a Kite	Split in to **two triangles** and use the method above.	 $A = 8.8m^2$
7. Area of a Trapezium	$\frac{(a+b)}{2} \times h$ "Half the sum of the parallel side, times the height between them. That is how you calculate the area of a trapezium"	 $A = 55cm^2$
8. Compound Shape	A shape made up of a **combination of other known shapes** put together.	

Knowledge Organiser Y11 Foundation Maths: Arcs, sectors, and surface area

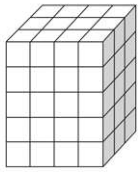
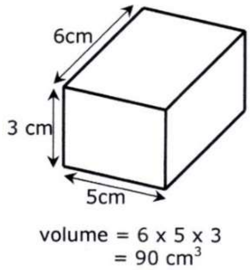
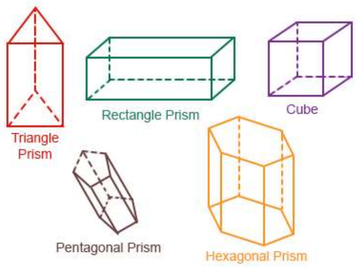
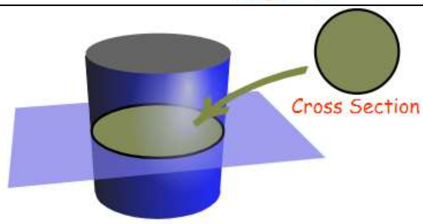
Key Vocabulary	Definition/Tips	Example
1. Arc Length of a Sector	The arc length is part of the circumference. Take the **angle** given **as a fraction over 360°** and **multiply** by the **circumference**.	Arc Length = $\frac{115}{360} \times \pi \times 8 = 8.03cm$ 
2. Area of a Sector	The area of a sector is part of the total area. Take the **angle** given **as a fraction over 360°** and **multiply** by the **area**.	Area = $\frac{115}{360} \times \pi \times 4^2 = 16.1cm^2$ 
3. Surface Area of a Cylinder	**Curved Surface Area =** $\boldsymbol{\pi dh}$ or $\boldsymbol{2\pi rh}$ **Total SA =** $\boldsymbol{2\pi r^2 + \pi dh}$ or **Total SA =** $\boldsymbol{2\pi r^2 + 2\pi rh}$	 $Total\ SA = 2\pi(2)^2 + \pi(4)(5) = 28\pi$
4. Surface Area of a Cone	**Curved Surface Area =** $\boldsymbol{\pi rl}$ where $l = slant\ height$ **Total SA =** $\boldsymbol{\pi rl + \pi r^2}$ You may need to use Pythagoras' Theorem to find the slant height	 $Total\ SA = \pi(3)(5) + \pi(3)^2 = 24\pi$
5. Surface Area of a Sphere	$\boldsymbol{SA = 4\pi r^2}$ Look out for hemispheres – halve the SA of a sphere and add on a circle (πr^2)	Find the surface area of a sphere with radius 3cm. $SA = 4\pi(3)^2 = 36\pi cm^2$

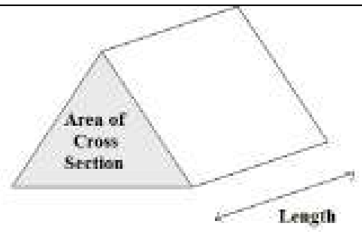
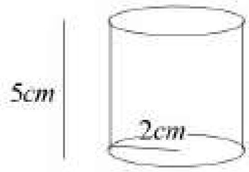
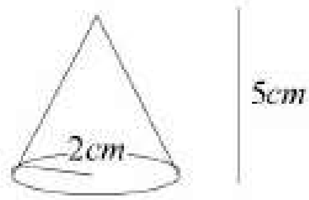
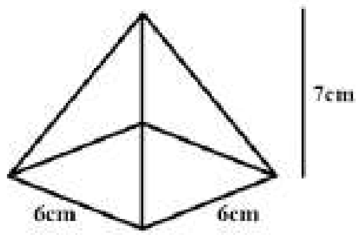
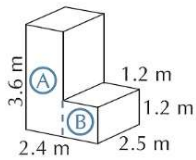
Knowledge Organiser Y11 Foundation Maths: Area and perimeter of circles

Key Vocabulary	Definition/Tips	Example
1. Circle	A circle is the locus of all points equidistant from a central point.	
2. Parts of a Circle	**Radius** – the **distance** from the **centre** of a circle to the **edge** **Diameter** – the total **distance** across the **width** of a circle **through the centre**. **Circumference** – the **total distance** around the **outside** of a circle **Chord** – a **straight line** whose **end points lie on a circle** **Tangent** – a **straight line** which **touches** a circle at exactly **one point** **Arc** – a **part of the circumference** of a circle **Sector** – the **region** of a circle enclosed by **two radii** and their intercepted **arc** **Segment** – the **region** bounded by a **chord** and the **arc** created by the chord	
3. Circumference of a Circle	$C = \pi d$ which means 'pi x diameter'	If the radius was 5cm, then: $C = \pi \times 10 = 31.4cm$
4. Perimeter of a Semi-Circle	**Perimeter** of a semi-circle is the curved length (half the circumference of the circle) plus the straight length (diameter)	
5. Perimeter of a quarter-Circle	**Perimeter** of a quarter-circle is the curved length (quarter of the circumference) plus the straight length (2 radii)	
6. Area of a Circle	$A = \pi r^2$ which means 'pi x radius squared'.	If the radius was 5cm, then: $A = \pi \times 5^2 = 78.5cm^2$
7. Area of a Semi-Circle	$\frac{A=\pi r^2}{2}$ which means 'pi x radius squared all divided by 2'.	If the radius was 5cm, then: $A = \frac{\pi \times 5^2}{2} = 39.3\ cm^2$
8. Area of a quarter-Circle	$\frac{A=\pi r^2}{4}$ which means 'pi x radius squared all divided by 4'.	If the radius was 5cm, then: $A = \frac{\pi \times 5^2}{4} = 19.6\ cm^2$
9.Finding the Diameter from the Circumference of a Circle	$d = \frac{C}{\pi}$ which means 'circumference divided by pi'	If the circumference was 5cm, then: $d = \frac{5}{\pi} = 1.59$ cm

10.Finding the Radius from the Area of a Circle	$r = \sqrt{\frac{A}{\pi}}$ which means 'the square root of (area divided by pi)'	If the circumference was 5cm, then: $d = \frac{5}{\pi} = 1.59$ cm
11. π ('pi')	Pi is the circumference of a circle divided by the diameter. $\boldsymbol{\pi \approx 3.14}$	
12. Perimeter of Compound Shapes	Find the lengths of the outside parts of the individual shapes that form the compound shape and add the lengths together.	
13. Area of Compound Shapes	Find the area for each individual shape that creates the compound shape and add the areas together.	

Knowledge Organiser Y11 Foundation Maths: Volume including cylinders

Key vocabulary	Definition/Tips	Example
1. Volume	Volume is a measure of the amount of space inside a solid shape. Units: mm^3, cm^3, m^3 etc.	
2. Volume of a Cube/Cuboid	$\boldsymbol{V = Length \times Width \times Height}$ $\boldsymbol{V = L \times W \times H}$ You can also use the Volume of a Prism formula for a cube/cuboid.	
3. Prism	A prism is a 3D shape whose **cross section is the same** throughout.	
4. Cross Section	The **cross section** is the **shape** that **continues** all the way **through the prism**.	

5. Volume of a Prism	$V = Area\ of\ Cross\ Section \times Length$ $V = A \times L$	
6. Volume of a Cylinder	$V = \pi r^2 h$	 $V = \pi(4)(5)$ $= 62.8cm^3$
7. Volume of a Cone	$V = \frac{1}{3}\pi r^2 h$	 $V = \frac{1}{3}\pi(4)(5)$ $= 20.9cm^3$
8. Volume of a Pyramid	$Volume = \frac{1}{3}Bh$ where B = area of the base	 $V = \frac{1}{3} \times 6 \times 6 \times 7 = 84cm^3$
9. Volume of a Sphere	$V = \frac{4}{3}\pi r^3$ Look out for hemispheres – just halve the volume of a sphere.	Find the volume of a sphere with diameter 10cm. $V = \frac{4}{3}\pi(5)^3 = \frac{500\pi}{3}cm^3$
10. Volume of a Compound Shape	A compound shape made up of a **combination of other known shapes** put together.	Area of rectangle A = 1.2 × 3.6 = 4.32 m² Area of rectangle B = 1.2 × 1.2 = 1.44 m² Area of cross-section = 4.32 + 1.44 = 5.76 m² Volume = area of cross-section × length = 5.76 × 2.5 = **14.4 m³** 

Knowledge Organiser Y11 Foundation Maths: Fractions and reciprocals

Key Vocabulary	Definition/Tips	Example
1. Fraction	A mathematical expression representing the **division** of one integer by another. Fractions are written as **two numbers separated by a horizontal line**.	$\frac{2}{7}$ is a 'proper' fraction. $\frac{9}{4}$ is an 'improper' or 'top-heavy' fraction.
2. Numerator	The **top** number of a fraction.	In the fraction $\frac{3}{5}$, 3 is the numerator.
3. Denominator	The **bottom** number of a fraction.	In the fraction $\frac{3}{5}$, 5 is the denominator.
4. Unit Fraction	A fraction where the **numerator is one** and the denominator is a positive integer.	$\frac{1}{2}, \frac{1}{3}, \frac{1}{4}$ $etc.$ are examples of unit fractions.
5. Reciprocal	The reciprocal of a number is **1 divided by the number**. The reciprocal of x is $\frac{1}{x}$ **When we multiply a number by its reciprocal, we get 1**. This is called the 'multiplicative inverse'.	The reciprocal of 5 is $\frac{1}{5}$ The reciprocal of $\frac{2}{3}$ is $\frac{3}{2}$, because $\frac{2}{3} \times \frac{3}{2} = 1$
6. Mixed Number	A number formed of both an **integer part** and a **fraction part**.	$3\frac{2}{5}$ is an example of a mixed number.
7. Simplifying Fractions	**Divide the numerator and denominator by the highest common factor**.	$\frac{20}{45} = \frac{4}{9}$
8. Equivalent Fractions	Fractions which represent the **same value**.	$\frac{2}{5} = \frac{4}{10} = \frac{20}{50} = \frac{60}{150}$ $etc.$
9. 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: $\frac{1}{2}, \frac{2}{3}, \frac{3}{4}, \frac{5}{6}$
10. Fraction of an Amount	**Divide** by the **bottom**, **times** by the **top**	Find $\frac{2}{5}$ of £60 $60 \div 5 = 12$ $12 \times 2 = 24$

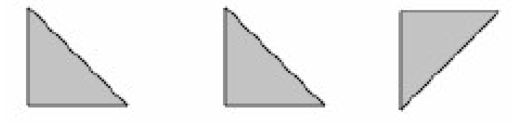
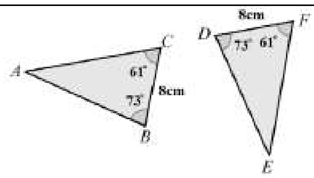
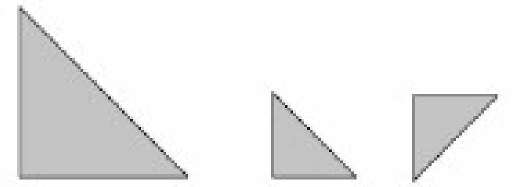
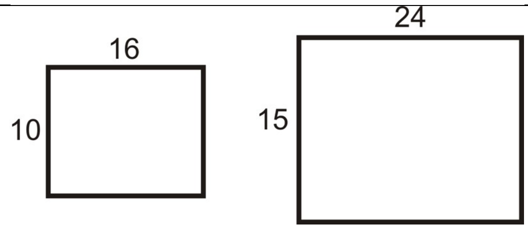
11. Adding or Subtracting Fractions	Find the **LCM of the denominators** to find a common denominator. Use equivalent fractions to change each fraction to the **common denominator**. Then just **add or subtract the numerators** and keep the **denominator the same**.	$\frac{2}{3}+\frac{4}{5}$ Multiples of 3: 3, 6, 9, 12, **15**.. Multiples of 5: 5, 10, **15**.. LCM of 3 and 5 = 15 $\frac{2}{3}=\frac{10}{15}$ $\frac{4}{5}=\frac{12}{15}$ $\frac{10}{15}+\frac{12}{15}=\frac{22}{15}=1\frac{7}{15}$
12. Multiplying Fractions	**Multiply** the **numerators** together and **multiply** the **denominators** together.	$\frac{3}{8}\times\frac{2}{9}=\frac{6}{72}=\frac{1}{12}$
13. Dividing Fractions	**'Keep it, Flip it, Change it – KFC'** Keep the first fraction the same. Flip the second fraction upside down. Change the divide to a multiply. Multiply by the reciprocal of the second fraction.	$\frac{3}{4}\div\frac{5}{6}=\frac{3}{4}\times\frac{6}{5}=\frac{18}{20}=\frac{9}{10}$

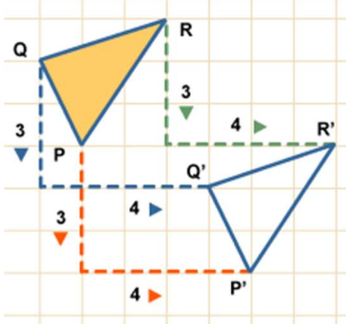
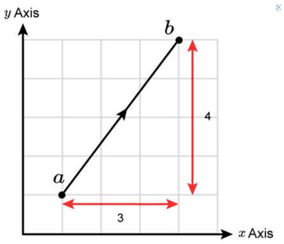
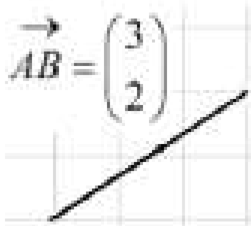
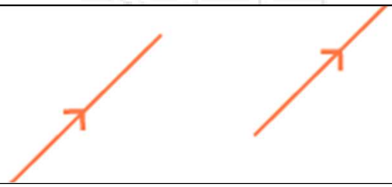
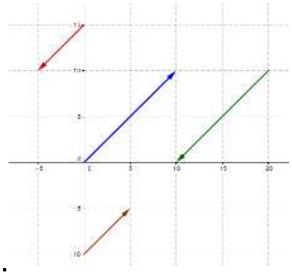
Knowledge Organiser Y11 Foundation Maths: Indices and standard form

Key Vocabulary	Definition/Tips	Example
1. Square Number	The number you get when you **multiply a number by itself**.	**1, 4, 9, 16, 25, 36, 49, 64, 81, 100, 121, 144, 169, 196, 225…** $9^2 = 9 \times 9 = 81$
2. Square Root	The **number you multiply by itself** to get another number. The reverse process of squaring a number.	$\sqrt{36}=6$ because $6\times 6=36$
3. Solutions to $x^2 =$ ….	**Equations** involving **squares** have **two solutions**, one **positive** and one **negative**.	Solve $x^2 = 25$ $x = 5\ or\ x = -5$ This can also be written as $x = \pm 5$
4. Cube Number	The number you get when you **multiply a number by itself and itself again**.	1, 8, 27, 64, 125… $2^3 = 2\times 2\times 2=8$
5. Cube Root	The **number you multiply by itself and itself again** to get another number. The reverse process of cubing a number.	$\sqrt[3]{125}=5$ because $5\times 5\times 5=125$

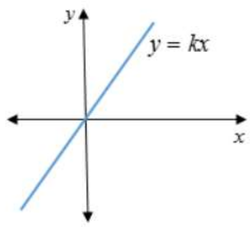
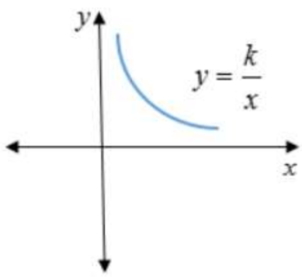
6. Powers of…	The powers of a number are that **number raised to various powers**.	The powers of 3 are: $3^1 = 3$ $3^2 = 9$ $3^3 = 27$ $3^4 = 81$ etc.
7. Multiplication Index Law	When **multiplying** with the same base (number or letter), **add the powers**. $\boldsymbol{a^m \times a^n = a^{m+n}}$	$7^5 \times 7^3 = 7^8$ $a^{12} \times a = a^{13}$ $4x^5 \times 2x^8 = 8x^{13}$
8. Division Index Law	When **dividing** with the same base (number or letter), **subtract the powers**. $\boldsymbol{a^m \div a^n = a^{m-n}}$	$15^7 \div 15^4 = 15^3$ $x^9 \div x^2 = x^7$ $20a^{11} \div 5a^3 = 4a^8$
9. Brackets Index Laws	When raising a power to another power, multiply the powers together. $\boldsymbol{(a^m)^n = a^{mn}}$	$(y^2)^5 = y^{10}$ $(6^3)^4 = 6^{12}$ $(5x^6)^3 = 125x^{18}$
10. Notable Powers	$\boldsymbol{p = p^1}$ $\boldsymbol{p^0 = 1}$	$99999^0 = 1$
11. Negative Powers	A negative power performs the reciprocal. $\boldsymbol{a^{-m} = \frac{1}{a^m}}$	$3^{-2} = \frac{1}{3^2} = \frac{1}{9}$
12. Fractional Powers	The denominator of a fractional power acts as a 'root'. The numerator of a fractional power acts as a normal power. $a^{\frac{m}{n}} = \left(\sqrt[n]{a}\right)^m$	$27^{\frac{2}{3}} = \left(\sqrt[3]{27}\right)^2 = 3^2 = 9$ $\left(\frac{25}{16}\right)^{\frac{3}{2}} = \left(\frac{\sqrt{25}}{\sqrt{16}}\right)^3 = \left(\frac{5}{4}\right)^3 = \frac{125}{64}$
13. Standard Form	$\boldsymbol{A \times 10^b}$ $where\ \boldsymbol{1 \leq A < 10}, \quad \boldsymbol{b = integer}$	8400 = 8.4 x 10^3 0.00036 = 3.6 x 10^{-4}
14. Multiplying or Dividing with Standard Form	Multiply: **Multiply the numbers** and **add the powers**. Divide: **Divide the numbers** and **subtract the powers**.	$(1.2 \times 10^3) \times (4 \times 10^6) = 8.8 \times 10^9$ $(4.5 \times 10^5) \div (3 \times 10^2) = 1.5 \times 10^3$
15. Adding or Subtracting with Standard Form	**Convert** into **ordinary** numbers, **calculate,** and then **convert back** into standard form	$2.7 \times 10^4 + 4.6 \times 10^3$ $= 27000 + 4600 = 31600$ $= 3.16 \times 10^4$

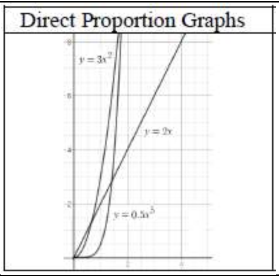
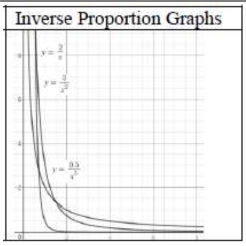
Knowledge Organiser Y11 Foundation Maths: Congruence and Similarity

Key Vocabulary	Definition/Tips	Example
1. Congruent Shapes	Shapes are congruent if they are **identical** - same **shape** and **same size**. Shapes can be rotated or reflected but still be congruent.	
2. Congruent Triangles	4 ways of proving that two triangles are congruent: 1. **SSS** (**S**ide, **S**ide, **S**ide) 2. **RHS** (**R**ight angle, **H**ypotenuse, **S**ide) 3. **SAS** (**S**ide, **A**ngle, **S**ide) 4. **ASA** (**A**ngle, **S**ide, **A**ngle) or **AAS** **ASS** (**A**ngle, **S**ide, **S**ide) does not prove congruency.	 $BC = DF$ $\angle ABC = \angle EDF$ $\angle ACB = \angle EFD$ $\therefore$ The two triangles are congruent by AAS.
3. Similar Shapes	Shapes are similar if they are the **same shape but different sizes**. The matching sides must have the same proportions.	
4. Scale Factor	The **ratio of corresponding sides** of two similar shapes. To find a scale factor, **divide a length** on one shape **by the corresponding length** on a similar shape.	 Scale Factor = $15 \div 10 = 1.5$

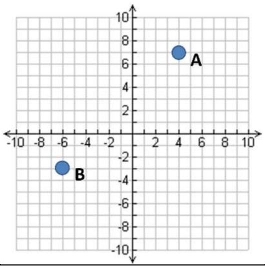
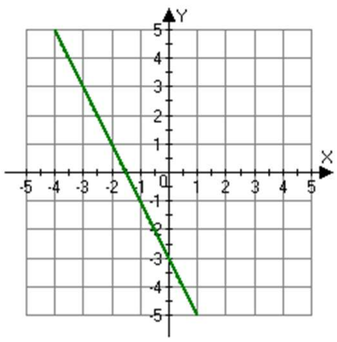
Key vocabulary	Definition/Tips	Example
1. Translation	**Translate** means to **move a shape**. The shape does not change **size** or **orientation**.	
2. Vector Notation	A vector can be written in 3 ways: **A** or $\overrightarrow{\boldsymbol{AB}}$ or $\begin{pmatrix}\mathbf{1}\\\mathbf{3}\end{pmatrix}$	
3. Column Vector	In a column vector, the **top** number moves **left (-) or right (+)** and the **bottom** number moves **up (+) or down (-)**	$\begin{pmatrix}2\\3\end{pmatrix}$ means '2 right, 3 up' $\begin{pmatrix}-1\\-5\end{pmatrix}$ means '1 left, 5 down'  $\overrightarrow{\boldsymbol{AB}}$ = $\begin{pmatrix}3\\4\end{pmatrix}$
4. Vector	A **vector** is a quantity represented by an arrow with both **direction** and **magnitude**. $\overrightarrow{AB} = -\overrightarrow{BA}$	
5. Equal Vectors	Magnitude is defined as the **length** of a vector. If two vectors have the **same magnitude and direction**, they are **equal**.	
6. Parallel Vectors	**Parallel** vectors are **multiples** of each other.	2**a**+**b** and 4**a**+2**b** are parallel as they are multiple of each other 

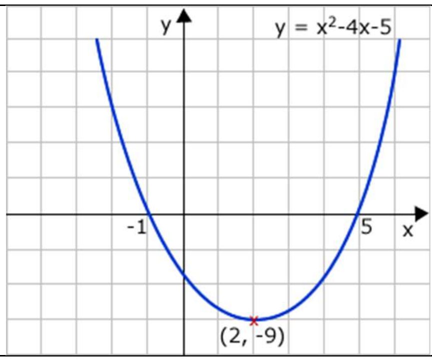
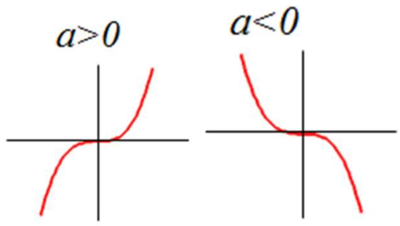
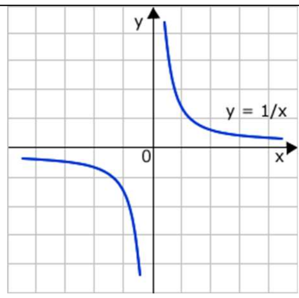
Knowledge Organiser Y11 Foundation Maths: Algebra And Proportion

Key vocabulary	Definition/Tips	Example
1. Expression	A mathematical statement written using **symbols**, **numbers,** or **letters**.	$3x + 2$ or $5y^2$
2. Equation	A statement showing that **two expressions are equal**	$2y – 17 = 15$
3. Identity	An equation that is **true for all values** of the variables An identity uses the symbol: ≡	$2x \equiv x + x$
4. Formula	Shows the **relationship** between **two or more variables**	Area of a rectangle = length x width or A= L x W
5. Changing The Subject	**Use inverse operations** on both sides of the formula (balancing method) until you find the expression for the letter.	Make x the subject of $y = \frac{2x-1}{z}$ Multiply both sides by z $yz = 2x - 1$ Add 1 to both sides $yz + 1 = 2x$ Divide by 2 on both sides $\frac{yz+1}{2} = x$ X is now the subject
6. Direct Proportion	If y is directly proportional to x, this can be written as $\boldsymbol{y} \propto \boldsymbol{x}$ An equation of the form $\boldsymbol{y} = \boldsymbol{kx}$ represents direct proportion, where k **is the constant of proportionality**.	
7. Inverse Proportion	If two quantities are inversely proportional, **as one increases**, the **other decreases** by the **same percentage**. If y is inversely proportional to x, this can be written as $\boldsymbol{y} \propto \frac{\boldsymbol{1}}{\boldsymbol{x}}$ An equation of the form $\boldsymbol{y} = \frac{\boldsymbol{k}}{\boldsymbol{x}}$ represents inverse proportion.	

8. Using proportionality formulae	**Direct**: **y = kx** or **y** ∝ **x** **Inverse**: **y =** $\frac{k}{x}$ or **y** ∝ $\frac{1}{x}$ 1. **Solve to find k** using the pair of values in the question. 2. **Rewrite the equation** using the k you have just found. 3. **Substitute the other given value** from the question into the equation to **find the missing value**.	p is directly proportional to q. When p = 12, q = 4. Find p when q = 20. 1. p = kq 12 = k x 4 So, k = 3 2. p = 3q 3. p = 3 x 20 = 60, so p = 60
9. Direct Proportion with powers	Graphs showing **direct proportion** can be written in the form $\boldsymbol{y = kx^n}$ Direct proportion graphs will always start at the origin.	
10. Inverse Proportion with powers	Graphs showing **inverse proportion** can be written in the form $\boldsymbol{y = \frac{k}{x^n}}$ Inverse proportion graphs will never start at the origin.	

Knowledge Organiser Y11 Foundation Maths: Graphs

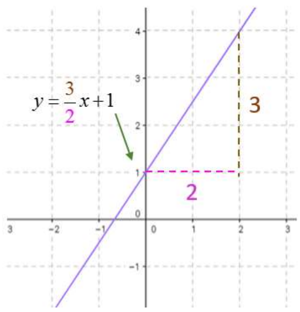
Key vocabulary	Definition/Tips	Example
1. Coordinates	Written in **pairs**. The **first** term is the **x-coordinate** (movement **across**). The **second** term is the **y-coordinate** (movement **up or down**)	 A: (4,7) B: (-6,-3)
2. Linear Graph	**Straight line** graph. The **equation** of a linear graph can contain an **x-term**, a **y-term,** and a **number**.	Example:  Other examples: $x = y$ $y = 4$ $x = -2$ $y = 2x - 7$

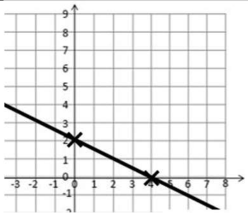
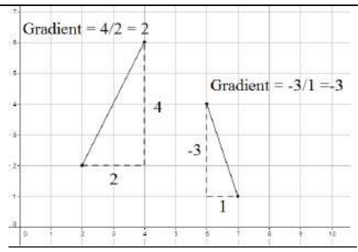
3. Quadratic Graph	A '**U-shaped**' curve called a **parabola**. The equation is of the form $y = \boldsymbol{ax^2} + \boldsymbol{bx} + \boldsymbol{c}$, where a, b and c are numbers, $\boldsymbol{a} \neq \boldsymbol{0}$. If $\boldsymbol{a} < \boldsymbol{0}$**,** the parabola is **upside down**.	
4. Cubic Graph	The equation is of the form $\boldsymbol{y} = \boldsymbol{ax^3} + \boldsymbol{k}$, where $\boldsymbol{k}$ **is a number**.	
5. Reciprocal Graph	The equation is of the form $\boldsymbol{y} = \frac{\boldsymbol{A}}{\boldsymbol{x}}$, where $\boldsymbol{A}$ **is a number** and $\boldsymbol{x} \neq \boldsymbol{0}$. The graph has **asymptotes** on the **x-axis and y-axis**.	

Knowledge Organiser Y11 Foundation Maths: Equations and Lines

Key vocabulary	Definition/Tips	Example
1. Midpoint of a Line	Method 1: **add the x coordinates and divide by 2**, **add the y coordinates and divide by 2** Method 2: Sketch the line and find the values half-way between the two x and two y values.	Find the midpoint between (2,1) and (6,9) $\frac{2+6}{2} = 4$ and $\frac{1+9}{2} = 5$ So, the midpoint is (4,5)
2. Plotting Linear Graphs	Method 1: **Table of Values** Construct a table of values to calculate coordinates. Method 2: **Gradient-Intercept Method** (use when the equation is in the form $y = mx + c$) 1. Plots the y-intercept 2. Using the gradient, plot a second point. 3. Draw a line through the two points plotted.	see below

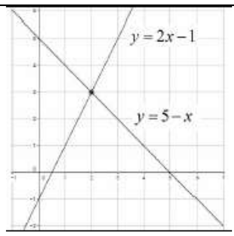
x	-3	-2	-1	0	1	2	3
y= x +3	0	1	2	3	4	5	6



	Method 3: **Cover-Up Method** (use when the equation is in the form $ax + by = c$) 1. Cover the x term and solve the resulting equation. Plot this on the $x - axis$. 2. Cover the y term and solve the resulting equation. Plot this on the $y - axis$. 3. Draw a line through the two points plotted.	 $2x + 4y = 8$
3. Gradient	The gradient of a line is how **steep** it is. **Gradient =** $$\frac{\boldsymbol{Change\ in\ y}}{\boldsymbol{Change\ in\ x}} = \frac{\boldsymbol{Rise}}{\boldsymbol{Run}}$$ The gradient can be positive negative.	
4. Finding the Equation of a Line <u>given a point and a gradient</u>	**Substitute** in the **gradient (m)** and **point (x,y)** in to the equation $\boldsymbol{y = mx + c}$ and **solve for c**.	Find the equation of the line with gradient 4 passing through (2,7). $y = mx + c$ $7 = 4 \times 2 + c$ $c = -1$ $y = 4x - 1$
5. Finding the Equation of a Line <u>given two points</u>	Use the two points to **calculate the gradient**. Then **repeat the method above** using the gradient and either of the points.	Find the equation of the line passing through (6,11) and (2,3) $m = \frac{11 - 3}{6 - 2} = 2$ $y = mx + c$ $11 = 2 \times 6 + c$ $c = -1$ $y = 2x - 1$
6. Parallel Lines	If two lines are **parallel**, they will have the **same gradient**. The value of m will be the same for both lines.	Are the lines $y = 3x - 1$ and $2y - 6x + 10 = 0$ parallel? Answer: Rearrange the second equation into the form $y = mx + c$ $2y - 6x + 10 = 0 \rightarrow y = 3x - 5$ Since the two gradients are equal (3), the lines are parallel.

Knowledge Organiser Y11 Foundation Maths: Simultaneous Equations

Key vocabulary	Definition/Tips	Example
1. Simultaneous Equations	A set of **two or more equations**, each involving **two or more variables** (letters). The **solutions** to simultaneous equations **satisfy both**/**all** of the **equations**.	$2x + y = 7$ $3x - y = 8$ $x = 3$ $y = 1$
2. Coefficient	A **number** used to **multiply** a **variable**. It is the number that comes before/in front of a letter.	6z 6 is the coefficient z is the variable
3. Solving Simultaneous Equations (by Elimination)	1. **Balance** the **coefficients** of one of the variables. 2. **Eliminate** this variable by adding or subtracting the equations (**Same Sign Subtract, Different Sign Add**) 3. **Solve** the linear equation you get using the other variable. 4. **Substitute** the value you found back into one of the previous equations. 5. **Solve** the equation you get. 6. **Check** that the two values you get satisfy both original equations.	$5x + 2y = 9$ $10x + 3y = 16$ Multiply the first equation by 2. $10x + 4y = 18$ $10x + 3y = 16$ Same Sign Subtract (+10x on both) $y = 2$ Substitute $y = 2$ into equation. $5x + 2 \times 2 = 9$ $5x + 4 = 9$ $5x = 5$ $x = 1$ Solution: $x = 1, y = 2$
4. Solving Simultaneous Equations (by Substitution)	1. **Rearrange** one of the equations into the form $y = \ldots$ or $x = \ldots$ 2. **Substitute** the right-hand side of the rearranged equation into the other equation. 3. Expand and **solve** this equation. 4. **Substitute** the value into the $y = \ldots$ or $x = \ldots$ equation. 5. **Check** that the two values you get satisfy both original equations.	$y - 2x = 3$ $3x + 4y = 1$ Rearrange: $y - 2x = 3$ $\rightarrow y = 2x + 3$ Substitute: $3x + 4(2x + 3) = 1$ Solve: $3x + 8x + 12 = 1$ $11x = -11$ $x = -1$ Substitute: $y = 2 \times -1 + 3, y = 1$ Solution: $x = -1, y = 1$

5. Solving Simultaneous Equations **(Graphically)**	**Draw the graphs** of the two equations. The **solutions** will be **where the lines meet**. The solution can be written as a **coordinate**.	 $y = 5 - x$ and $y = 2x - 1$. They meet at the point with coordinates (2,3) so the answer is $x = 2$ and $y = 3$
6. Solving Linear and Quadratic Simultaneous Equations	Method 1: If both equations are in the same form (e.g., Both $y =$…): 1. Set the equations **equal to each other**. 2. **Rearrange** to make the equation **equal to zero**. 3. **Solve** the quadratic equation. 4. **Substitute** the values back in to one of the equations. Method 2: If the equations are not in the same form: 1. **Rearrange** the linear equation into the form $y =$.. or $x =$.. 2. **Substitute** in to the quadratic equation. 3. **Rearrange** to make the equation **equal to zero**. 4. **Solve** the quadratic equation. 5. **Substitute** the values back in to one of the equations. You should get **two pairs of solutions** (two values for x, two values for y.) Graphically, you should have **two points of intersection**.	<u>Example 1</u> Solve $y = x^2 - 2x - 5$ and $y = x - 1$ $x^2 - 2x - 5 = x - 1$ $x^2 - 3x - 4 = 0$ $(x - 4)(x + 1) = 0$ $x = 4$ and $x = -1$ $y = 4 - 1 = 3$ and $y = -1 - 1 = -2$ Answers: (4,3) and (-1,-2) <u>Example 2</u> Solve $x^2 + y^2 = 5$ and $x + y = 3$ $x = 3 - y$ $(3 - y)^2 + y^2 = 5$ $9 - 6y + y^2 + y^2 = 5$ $2y^2 - 6y + 4 = 0$ $y^2 - 3y + 2 = 0$ $(y - 1)(y - 2) = 0$ $y = 1$ and $y = 2$ $x = 3 - 1 = 2$ and $x = 3 - 2 = 1$ Answers: (2,1) and (1,2)