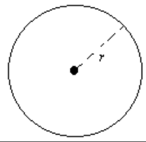
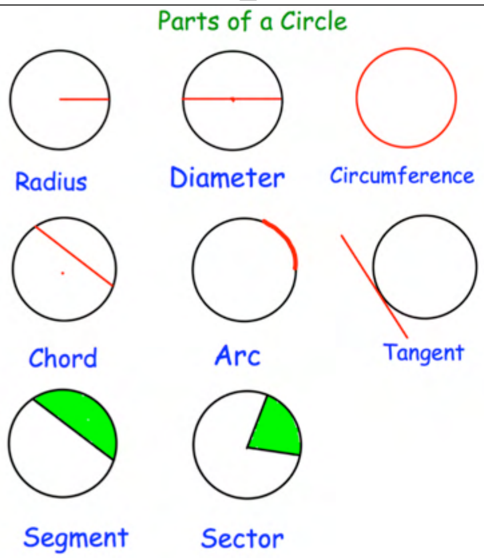
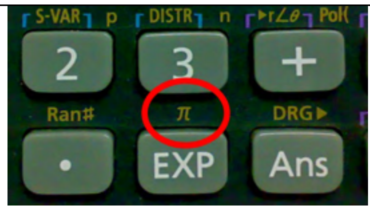
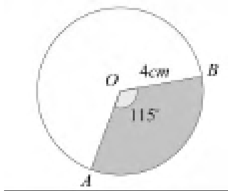
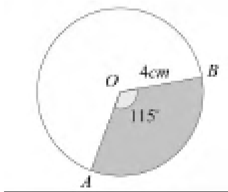
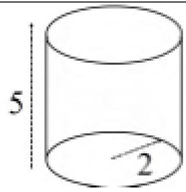
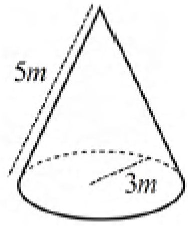
Circumference and Area

<table>
<tr><th>Topic/Skill</th><th>Definition/Tips</th><th>Example</th></tr>
<tr><td>1. Circle</td><td>A circle is the locus of all points equidistant from a central point.</td><td></td></tr>
<tr><td>2. Parts of a Circle</td><td>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</td><td>
</td></tr>
<tr><td>3. Area of a Circle</td><td>$\boldsymbol{A = \pi r^2}$ which means 'pi x radius squared'.</td><td>If the radius was 5cm, then:
$A = \pi \times 5^2 = 78.5cm^2$</td></tr>
<tr><td>4. Circumference of a Circle</td><td>$\boldsymbol{C = \pi d}$ which means 'pi x diameter'</td><td>If the radius was 5cm, then:
$C = \pi \times 10 = 31.4cm$</td></tr>
<tr><td>5. π ('pi')</td><td>Pi is the circumference of a circle divided by the diameter.

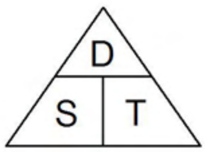
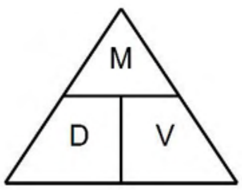
$$\boldsymbol{\pi \approx 3.14}$$</td><td>
</td></tr>
<tr><td>6. Arc Length of a Sector</td><td>The arc length is part of the circumference.

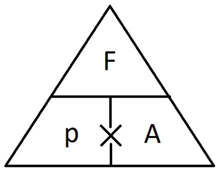
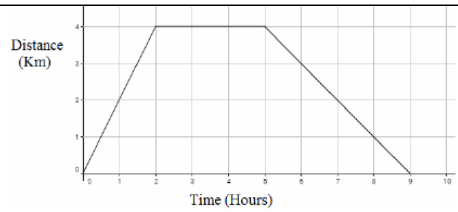
Take the angle given as a fraction over 360° and multiply by the circumference.</td><td>Arc Length $= \frac{115}{360} \times \pi \times 8 = 8.03cm$

</td></tr>
<tr><td>7. Area of a Sector</td><td>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.</td><td>Area $= \frac{115}{360} \times \pi \times 4^2 = 16.1cm^2$

</td></tr>
</table>

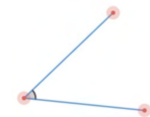
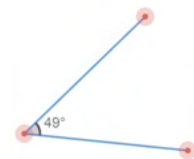
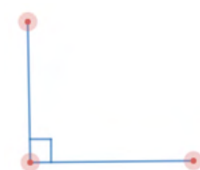
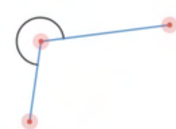
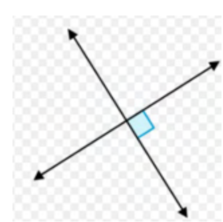
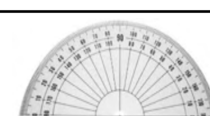
8. Surface Area of a Cylinder	**Curved Surface Area =** $\boldsymbol{\pi dh}$ or $\boldsymbol{2\pi rh}$ **Total SA =** $\boldsymbol{2\pi r^2 + \pi dh}$ or $\boldsymbol{2\pi r^2 + 2\pi rh}$	 $Total\ SA = 2\pi(2)^2 + \pi(4)(5) = 28\pi$
9. Surface Area of a Cone	**Curved Surface Area =** $\boldsymbol{\pi rl}$ where $l = slant\ height$ **Total SA =** $\boldsymbol{\pi rl + \pi r^2}$ You may need to use Pythagoras' Theorem to find the slant height	 $Total\ SA = \pi(3)(5) + \pi(3)^2 = 24\pi$
10. 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. $SA = 4\pi(3)^2 = 36\pi cm^2$

Compound area

Topic/Skill	Definition/Tips	Example
1. Metric System	A system of measures based on: - the metre for length - the kilogram for mass - the second for time **Length: mm, cm, m, km** **Mass: mg, g, kg** **Volume: ml, cl, l**	$1 kilometres = 1000\ metres$ $1\ metre = 100\ centimetres$ $1\ centimetre = 10\ millimetres$ $1\ kilogram = 1000\ grams$
2. Imperial System	A system of weights and measures originally developed in England, usually based on human quantities **Length: inch, foot, yard, miles** **Mass: lb, ounce, stone** **Volume: pint, gallon**	$1lb = 16\ ounces$ $1\ foot = 12\ inches$ $1\ gallon = 8\ pints$
3. Metric and Imperial Units	Use the **unitary method** to convert between metric and imperial units.	$5\ miles \approx 8\ kilometres$ $1\ gallon \approx 4.5\ litres$ $2.2\ pounds \approx 1\ kilogram$ $1\ inch = 2.5\ centimetres$
4. Speed, Distance, Time	**Speed = Distance ÷ Time** **Distance = Speed x Time** **Time = Distance ÷ Speed**  Remember the correct units.	Speed = 4mph Time = 2 hours Find the Distance. $D = S \times T = 4 \times 2 = 8\ miles$
5. Density, Mass, Volume	**Density = Mass ÷ Volume** **Mass = Density x Volume** **Volume = Mass ÷ Density**  Remember the correct units.	Density = $8kg/m^3$ Mass = 2000g Find the Volume. $V = M \div D = 2 \div 8 = 0.25m^3$
6. Pressure, Force, Area	**Pressure = Force ÷ Area** **Force = Pressure x Area** **Area = Force ÷ Pressure**	Pressure = 10 Pascals Area = $6cm^2$

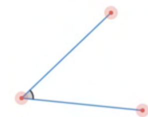
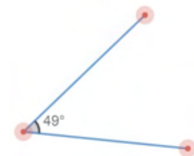
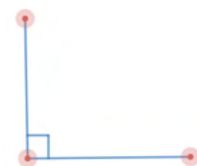
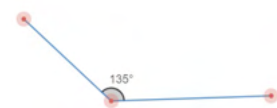
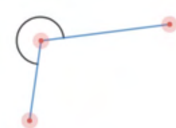
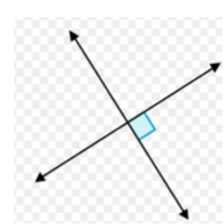
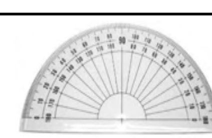
	 Remember the correct units.	Find the Force $F = P \times A = 10 \times 6 = 60\ N$
7. Distance-Time Graphs	You can find the **speed** from the **gradient** of the line (Distance ÷ Time) The steeper the line, the quicker the speed. A **horizontal** line means the object is not moving (**stationary**).	

Drawing, Measuring and Estimating Angles

1	Angle	Where two line segments meet the measure of rotation from one segment to the other.	
2	Acute Angle	An angle between 0° and 90°.	
3	Right Angle	An angle which is exactly 90°. We use a small square to represent a right angle.	
4	Obtuse Angle	An angle between 90° and 180°.	
5	Reflex Angle	An angle which is greater than 180°.	
6	Degree	The unit that we measure angles in. We use this symbol °.	265°
7	Perpendicular	Line segments which meet at right angles	
8	Estimate	A mathematical guess. I use my knowledge about angles to estimate the size of an angle.	
9	Protractor	The piece of equipment we use to measure angles.	

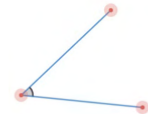
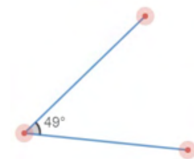
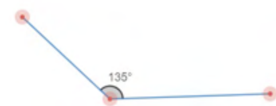
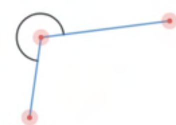
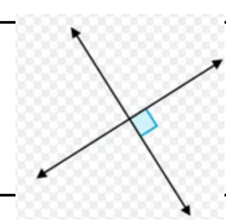
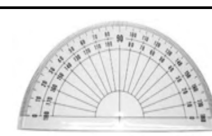
Pathway 3

Unit 2 – Drawing, Measuring and Estimating Angles

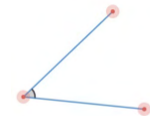
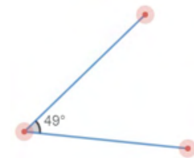
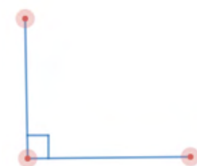
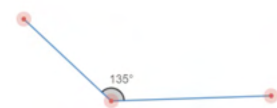
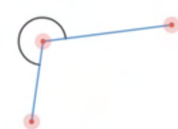
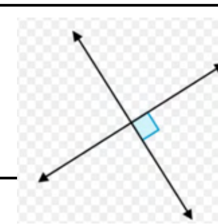
1		Where two line segments meet the measure of rotation from one segment to the other.	
2		An angle between 0° and 90°.	
3		An angle which is exactly 90°. We use a small square to represent a right angle.	
4		An angle between 90° and 180°.	
5		An angle which is greater than 180°.	
6		The unit that we measure angles in. We use this symbol °.	265°
7		Line segments which meet at right angles	
8		A mathematical guess. I use my knowledge about angles to estimate the size of an angle.	
9		The piece of equipment we use to measure angles.	

Pathway 3

Unit 2 – Drawing, Measuring and Estimating Angles

1	Angle		
2	Acute Angle		
3	Right Angle		
4	Obtuse Angle		
5	Reflex Angle		
6	Degree		265°
7	Perpendicular		
8	Estimate		
9	Protractor		

Unit 2 – Drawing, Measuring and Estimating Angles

1			
2			
3			
4			
5			
6			265°
7			
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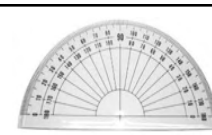
9			

Formulae, Sequences and Rules

1	Expression	A mathematical statement written using symbols, numbers or letters.	6 + 9 $5x + 8$ $5y^2$
2	Equation	A statement showing that two expressions are equal.	6 + 9 = 15 $2y - 17 = 15$
3	Formula	An equation linking sets of physical variables. The plural is formulae.	s = $\frac{d}{t}$
4	Variable	A letter representing an unknown number.	$5 + 8$ = 38 x is the variable
5	Substitute	Putting a number where a variable is shown.	Example if a = 10, calculate 4a + 2
6	Sequence	An ordered set of numbers, shapes or other mathematical objects arranged according to a rule.	Examples: 3, 7, 11, 15, 19 1, 4, 9, 16, 25
7	Arithmetic Sequence / Linear Sequence	A sequence in which terms are generated by adding or subtracting a constant amount each time.	Examples: 1, 3, 5, 7, 9, 11 8, 12, 16, 20, 24

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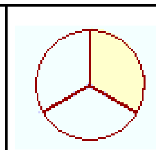
Fractions

1	Fraction	The result of dividing one integer by a second integer (which must not be zero). It relates parts to a whole.	 $\frac{1}{3}$ means one out of three
2	Vinculum	The fraction line.	$\frac{3}{4}$
3	Numerator and Denominator	The numerator is the top number in a fraction. The denominator is the bottom number in a fraction.	$\frac{3}{4}$ ← *Numerator* ← *Denominator*
4	Equivalent	Things with the same value as another.	0.5 = $\frac{1}{2}$
5	Fraction of amount	Take a number and divide it by the denominator	$\frac{3}{4}$ of 20 20÷4 = 5 5 x 3 = 15
6	Fraction into a decimal	To turn a fraction into a decimal you divide the **numerator** by the **denominator**	$\frac{3}{4}$ ← *Numerator* ← *Denominator* 3 ÷ 4 = 0.75
7			

Introduction to Algebra

1	Expression	A mathematical statement written using symbols, numbers or letters.	6 + 9 $5x + 8$ $5y^2$
2	Equation	A statement showing that two expressions are equal.	6 + 9 = 15 $2y - 17 = 15$
3	Coefficient	A number used to multiply a variable. It can be a letter.	$6x$ The coefficient is 6.
4	$x + 1$	A number plus 1.	
5	$x - 1$	A number subtract 1.	
6	$1 - x$	Subtract a number from 1.	
7	$5x$	Multiplying a number by 5.	
8	$\frac{x}{4}$	A number divided by 4.	
9	$\frac{4}{x}$	4 divided by a number.	
10	x^2	A number squared.	$x \times x$
11	x^3	A number cubed.	$x \times x \times x$
12	xy	A number multiplied by another number.	$x \times y$
13	Simplify Expressions	To write the expression in the simplest way possible.	Simplify $5x \times 7$ = $35x$
14	Collect Like Terms	The way that you simplify expressions which are added or subtracted. You can only add or subtract terms which have the same letter and power.	Simplify $2x \boxed{+ 3y} + 4x \boxed{- 5y}$ $= 6x - 2y$
15	$5(x + 3)$	Five lots of $x + 3$.	
16	Expand Brackets	Multiply out the brackets.	$5(x + 3) = 5x + 15$
17	$x + x =$	$2x$	
18	$7x + 8x =$	$15x$	
19	$7x - 4x =$	$3x$	

Introduction to Algebra

1		A mathematical statement written using symbols, numbers or letters,	6 + 9 $5x + 8$ $5y^2$
2		A statement showing that two expressions are equal.	6 + 9 = 15 $2y - 17 = 15$
3		The number in front of the letter.	$6x$ The coefficient is 6.
4	$x + 1$		
5	$x - 1$		
6	$1 - x$		
7	$5x$		
8	$\frac{x}{4}$		
9	$\frac{4}{x}$		
10	x^2		$x \times x$
11	x^3		$x \times x \times x$
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8	$\frac{x}{4}$		
9	$\frac{4}{x}$		
10	x^2		$x \times x$
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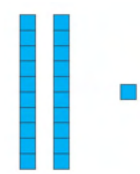
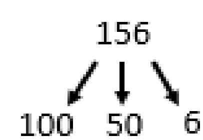
16	Expand brackets	Multiply out the brackets.	$5(x + 3) = 5x + 15$
17	$x + x =$	$2x$	
18	$7x + 8x =$	$15x$	
19	$7x - 4x =$	$3x$	

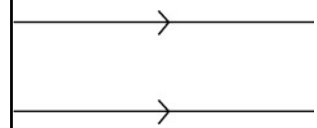
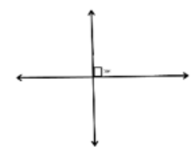
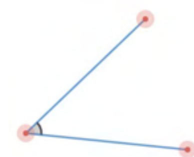
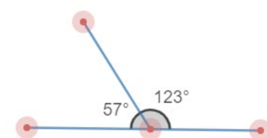
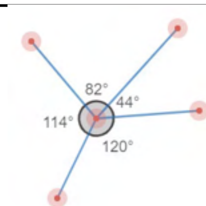
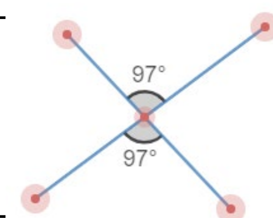
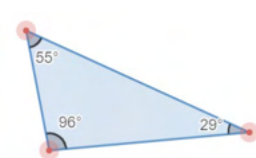
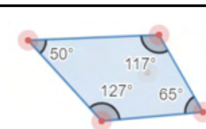
Large and Negative Numbers

<table>
<tr><td>1</td><td>Integer</td><td>A whole number.
It can be negative or positive.</td><td>-7, 4, 0, 2, 19, 897</td></tr>
<tr><td>2</td><td>Decimal</td><td>A number with a decimal point in it.
It can be positive or negative.</td><td>4.5
-4.5</td></tr>
<tr><td>3</td><td>Place Value</td><td>The value of a digit that relates to its position or place in a number.</td><td>5300
The value of the 3 is 300.</td></tr>
<tr><td>4</td><td>Digits</td><td>The symbols we use to write a number.</td><td>456 has 3 digits.</td></tr>
<tr><td>5</td><td>Place Value Columns</td><td>The names of the columns tell us the value of the digits.</td><td><table><tr><td>Thousands</td><td>Hundreds</td><td>Tens</td><td>Units</td><td>.</td><td>Tenths</td></tr><tr><td></td><td></td><td></td><td></td><td></td><td></td></tr></table></td></tr>
<tr><td>6</td><td>Picturing Numbers</td><td>Twenty one is equal to 2 tens and 1 one.</td><td></td></tr>
<tr><td>7</td><td>Ordering</td><td>Putting a list of numbers in order.
Ascending is from smallest to greatest.
Descending is from greatest to smallest.</td><td>Ascending order:
7, 13, 45, 78, 124

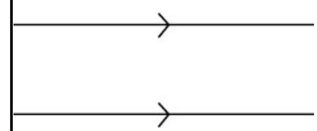
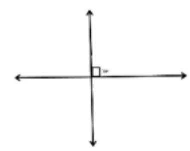
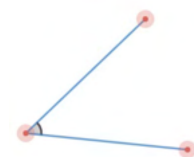
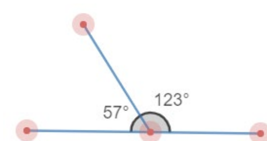
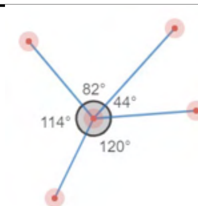
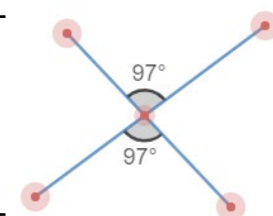
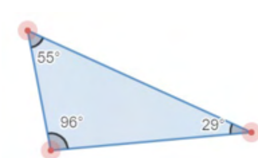
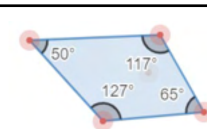
Descending order:
567, 67, 42, 16, 3</td></tr>
<tr><td>9</td><td>Partitioning</td><td>Splitting a number up.</td><td></td></tr>
<tr><td>10</td><td>Reading Large Numbers</td><td>Start at the decimal point and work your way up the place value chart to find the value of each digit up to 1,000.</td><td>1,256
One thousand, two hundred and fifty six.</td></tr>
<tr><td>11</td><td>Comparing Numbers</td><td>= Equal to
< Less than
> Greater than
$\geq$ Greater than or equal to
$\leq$ Less than or equal to</td><td>3 < 6
3 is less than 6.

6 > 3
6 is greater than 3.</td></tr>
<tr><td>12</td><td>Positive Numbers</td><td>Numbers that are greater than zero.</td><td>5 is positive 5.</td></tr>
<tr><td>13</td><td>Negative Numbers</td><td>Numbers that are less than zero.</td><td>- 5 is negative 5.</td></tr>
</table>

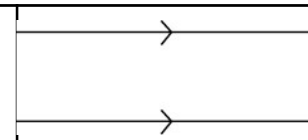
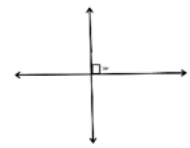
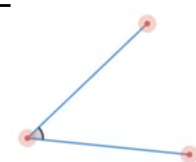
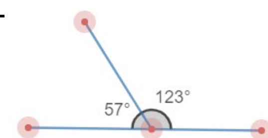
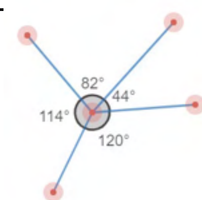
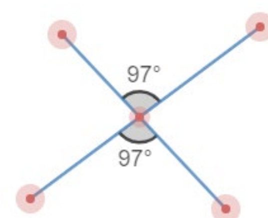
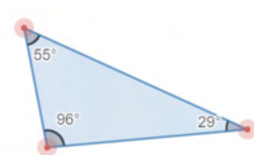
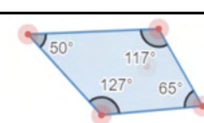
Lines and Angles

1	Parallel Lines	Lines that never meet because they are always the same distance from each other.	
2	Perpendicular Lines	Lines that meet at right angles to each other.	
3	Angle	Where two line segments meet the measure of rotation from one segment to the other.	
4	Straight Line	Angles on a straight line sum to 180º.	
5	Around a Point	Angles around a point sum to 360º.	
6	Vertically Opposite	Vertically opposite angles are equal.	
7	Triangles	Interior angles of a triangle sum to 180º.	
8	Quadrilaterals	Interior angles of a quadrilateral sum to 360º.	

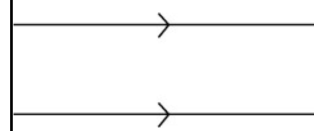
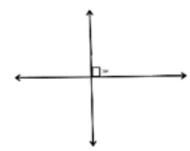
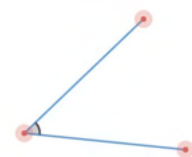
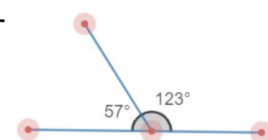
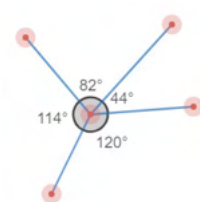
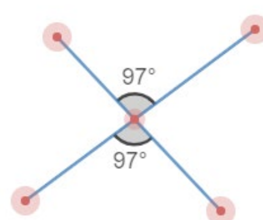
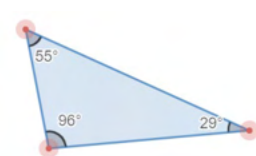
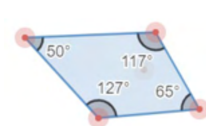
Lines and Angles

1		Lines that never meet because they are always the same distance from each other.	
2		Lines that meet at right angles to each other.	
3		Where two line segments meet the measure of rotation from one segment to the other.	
4		Angles on a straight line sum to 180º.	
5		Angles around a point sum to 360º.	
6		Vertically opposite angles are equal.	
7		Interior angles of a triangle sum to 180º.	
8		Interior angles of a quadrilateral sum to 360º.	

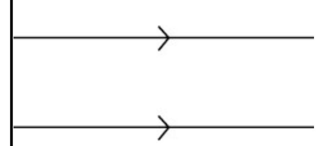
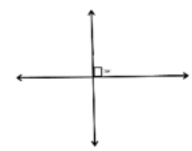
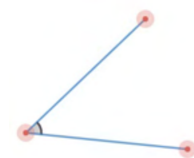
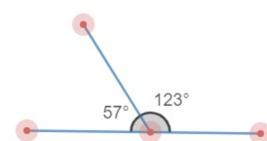
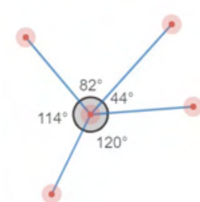
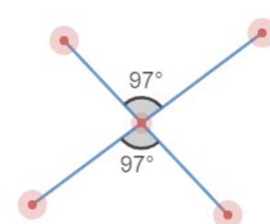
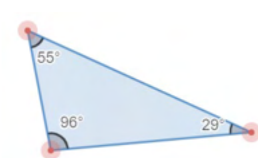
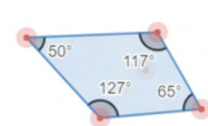
Lines and Angles

1	Parallel Lines		
2	Perpendicular Lines		
3	Angle		
4	Straight Line		
5	Around a Point		
6	Vertically Opposite		
7	Triangles		
8	Quadrilaterals		

Lines and Angles

1		Lines that never meet because they are always the same distance from each other.	
2		Lines that meet at right angles to each other.	
3		Where two line segments meet the measure of rotation from one segment to the other.	
4	Straight Line		
5	Around a Point		
6	Vertically Opposite		
7		Interior angles of a triangle sum to 180º.	
8		Interior angles of a quadrilateral sum to 360º.	

Lines and Angles

1	Parallel Lines		
2	Perpendicular Lines		
3	Angle		
4		Angles on a straight line sum to 180º.	
5		Angles around a point sum to 360º.	
6		Vertically opposite angles are equal.	
7	Triangles		
8	Quadrilaterals		

Multiplication and Division

1	Product	The result of multiplying two numbers together.	The product of 2 and 3 is 6 because 2 x 3 = 6.
2	Sum	The result of adding two numbers together.	The sum of 2 and 3 is 5 because 2 + 3 = 5.
3	Commutative	The order of numbers involved in an operation does not matter and does not affect the answer. Addition and multiplication are commutative. Subtraction and division are **not** commutative.	3 + 2 = 2 + 3 4 x 5 = 5 x 4 3 – 2 ≠ 2 - 3 10 ÷ 2 ≠ 2 ÷ 10
4	Long Multiplication	When we multiply two large numbers together we can use the long multiplication method.	7232 16 X 43392 4 + + + 72320 115712
5	Dividend	The number that is being divided.	dividend ÷ divisor = quotient 30 ÷ 6 = 5
6	Divisor	The number by which another is divided.	
7	Quotient	The result of a division.	
8	Short Division	A written method of dividing.	186 ÷ 6 = 0 3 1 6 | 1 ¹8 6 no groups of 6 can be made 3 x 6 = 18 1 x 6 = 6
9	Grid Method	This method is used for multiplication. It involves partitioning numbers into hundreds, tens and units before they are multiplied.	35 x 7 × | 30 | 5 7 | 210 | 35 210 + 35 = 245
10	Column Method	This method of multiplication, addition and subtraction is the method where numbers are 'carried' or 'borrowed'.	The column method for multiplication the carried numbers can go above or below. 2 3 7 x 4 9 4 8 1 2

Pathway 4

Unit 2 – Multiplication and Division

1		The result of multiplying two numbers together.	The product of 2 and 3 is 6 because 2 x 3 = 6.
2		The result of adding two numbers together.	The sum of 2 and 3 is 5 because 2 + 3 = 5.
3	Commutative		4 x 7 = 7 x 4 4 + 7 = 7 + 4
4	Long Multiplication	When we multiply two large numbers together we can use the long multiplication method.	7232 16 X 43392 4 1 1 1 72320 115712
5		The number that is being divided.	30 ÷ 6 = 5 dividend ÷ divisor = quotient
6	Divisor		
7		The result of a division	
8	Short division	A written method of dividing.	186 ÷ 6 = 0 3 1 6 | 1 ¹8 6 no groups of 6 can be made 3 x 6 = 18 1 x 6 = 6

Pathway 4

Unit 2 – Multiplication and Division

1	Product		The product of 2 and 3 is 6 because 2 x 3 = 6.
2	Sum		The sum of 2 and 3 is 5 because 2 + 3 = 5.
3	Commutative		4 x 7 = 7 x 4 4 + 7 = 7 + 4
4	Long Multiplication		7232 16 X 43392 4 1 1 1 72320 115712
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Pathway 4

Unit 2 – Multiplication and Division

1		The result of multiplying two numbers together.	The product of 2 and 3 is 6 because 2 x 3 = 6.
2		The result of adding two numbers together.	The sum of 2 and 3 is 5 because 2 + 3 = 5.
3		Addition and multiplication are commutative because the order that we do them doesn't matter.	4 x 7 = 7 x 4 4 + 7 = 7 + 4
4		When we multiply two large numbers together we can use the long multiplication method.	7232 16 X 43392 4 1 1 1 72320 115712
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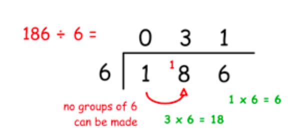
8		A written method of dividing.	

Pathway 4

Unit 2 – Multiplication and Division

1			
2			
3			
4			
5			
6			
7			
8			

Percentages

1	Percentage	A percentage is a fraction expressed as the number of parts per hundred. It is recorded using the notation %	89% 105% 0.67%
2	Vinculum	The fraction line.	$\frac{3}{4}$
3	Write an amount as a percentage of another	Write as a fraction and multiply by 100.	$\frac{14}{17} \times 100 = 82.4\%$ (1dp)
4	Find 10% of an amount	Divide by 10.	$56 \div 10 = 5.6$
5	Find 1% of an amount	Divide by 100.	$56 \div 100 = 0.56$
6	Find 5% of an amount	Divide by 10 (to find 10%) and then divide by 2.	$(56 \div 10) \div 2 = 2.8$
7	Find 20% of an amount	Divide by 10 (to find 10%) and then multiply by 2.	$(56 \div 10) \times 2 = 11.2$
8	Percentage Multiplier	The decimal equivalent to the percentage.	Find 57% of 893 893 x 0.57 = 509.01
9	Percentage Increase/Decrease	<u>Non-Calculator</u> 1) Find the percentage of the amount 2) Add/Subtract to or from the original amount <u>Calculator</u> 1) Find the percentage multiplier	<u>Increase 500 by 20% (N-Calc)</u> 10% of 500 = 50 so 20% of 500 = 100 500 + 100 = 600 <u>Decrease 800 by 17% (Calc):</u> 100%-17%=83% 83% ÷ 100 = 0.83
10	Percentage Change	The amount of change written as a percentage of the original amount.	$\frac{\text{new value} - \text{original value}}{\text{orginal value}} \times 100$
11	0.5	$\frac{1}{2}$	50%
12	0.25	$\frac{1}{4}$	25%
13	0.75	$\frac{3}{4}$	75%
14	0.2	$\frac{1}{5}$	20%
15	0.125	$\frac{1}{8}$	12.5%
16	0.7	$\frac{7}{10}$	70%
17	$0.\dot{3}$	$\frac{1}{3}$	33.3%$_{(1dp)}$

Pathway 6

Unit 4 – Percentages

1		A ____________________ is a fraction expressed as the number of parts per hundred. It is recorded using the notation %	89% 105% 0.67%
2		The fraction line.	$\frac{3}{4}$
3		Write as a fraction and multiply by 100.	$\frac{14}{17} \times 100 = 82.4\%$ (1dp)
4		Divide by 10.	$56 \div 10 = 5.6$
5		Divide by 100.	$56 \div 100 = 0.56$
6		Divide by 10 (to find 10%) and then divide by 2.	$(56 \div 10) \div 2 = 2.8$
7		Divide by 10 (to find 10%) and then multiply by 2.	$(56 \div 10) \times 2 = 11.2$
8		The decimal equivalent to the percentage.	Find 57% of 893 893 x 0.57 = 509.01
9		<u>Non-Calculator</u> 1) Find the percentage of the amount 2) Add/Subtract to or from the original amount <u>Calculator</u> 1) Find the percentage multiplier	<u>Increase 500 by 20% (N-Calc)</u> 10% of 500 = 50 so 20% of 500 = 100 500 + 100 = 600 <u>Decrease 800 by 17% (Calc):</u> 100%-17%=83% 83% ÷ 100 = 0.83
10		The amount of change written as a percentage of the original amount.	$\frac{\text{new value} - \text{original value}}{\text{orginal value}} \times 100$
11		$\frac{1}{2}$	50%
12		$\frac{1}{4}$	25%
13		$\frac{3}{4}$	75%
14		$\frac{1}{5}$	20%
15		$\frac{1}{8}$	12.5%
16		$\frac{7}{10}$	70%
17		$\frac{1}{3}$	33.3%(1dp)

Pathway 6

Unit 4 – Percentages

1	Percentage		89% 105% 0.67%
2	Vinculum		$\frac{3}{4}$
3	Write an amount as a percentage of another		$\frac{14}{17} \times 100 = 82.4\%$ (1dp)
4	Find 10% of an amount		$56 \div 10 = 5.6$
5	Find 1% of an amount		$56 \div 100 = 0.56$
6	Find 5% of an amount		$(56 \div 10) \div 2 = 2.8$
7	Find 20% of an amount		$(56 \div 10) \times 2 = 11.2$
8	Percentage Multiplier		Find 57% of 893 893 x 0.57 = 509.01
9	Percentage Increase/Decrease		<u>Increase 500 by 20% (N-Calc)</u> 10% of 500 = 50 so 20% of 500 = 100 500 + 100 = 600 <u>Decrease 800 by 17% (Calc):</u> 100%-17%=83% 83% ÷ 100 = 0.83
10	Percentage Change		$\frac{\text{new value} - \text{original value}}{\text{orginal value}} \times 100$
11	0.5		50%
12	0.25		25%
13	0.75		75%
14	0.2		20%
15	0.125		12.5%
16	0.7		70%
17	$0.\dot{3}$		$33.3\%_{(1dp)}$

Unit 4 – Percentages

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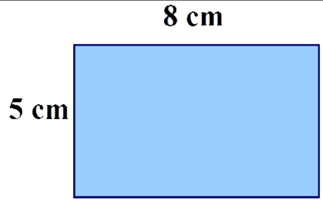
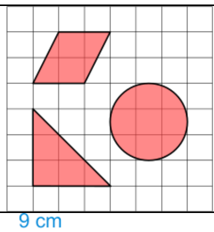
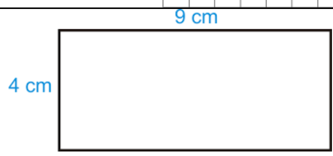
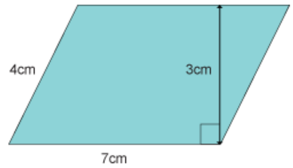
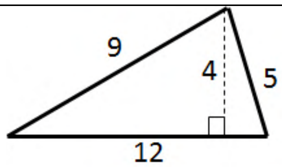
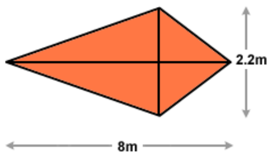
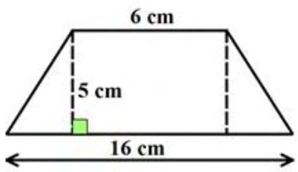
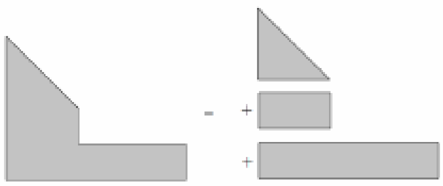
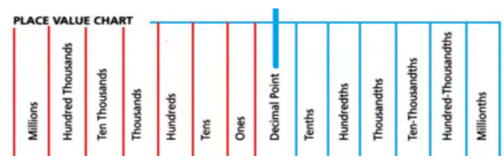
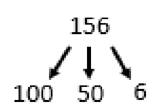
Topic: Perimeter and Area

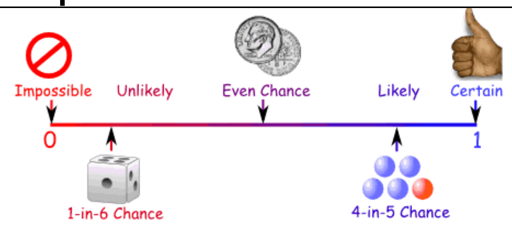
Topic/Skill	Definition/Tips	Example
1. Perimeter	The **total distance** around the **outside** of a shape. Units include: mm, cm, m etc.	 $P = 8 + 5 + 8 + 5 = 26cm$
2. Area	The amount of **space inside** a shape. Units include: mm^2, cm^2, m^2	
3. Area of a Rectangle	**Length x Width**	 $A = 36cm^2$
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.	

Place Value

1	Integer	A whole number. It can be negative or positive.	-7, 4, 0, 2, 19, 897
2	Decimal	A number with a decimal point in it. It can be positive or negative.	4.5 -4.5
3	Place Value	The value of a digit that relates to its position or place in a number.	5300 The value of the 3 is 300
4	Digits	The symbols we use to write a number.	456 has 3 digits
5	Place Value Columns	The names of the columns tell us the value of the digits.	
6	Ordering	Putting a list of numbers in order. Ascending is from smallest to greatest. Descending is from greatest to smallest.	Ascending order: 7, 13, 45, 78, 124 Descending order: 567, 67, 42, 16, 3
7	Partitioning	Splitting a number up.	
9	Reading Large Numbers	Start at the decimal point and work your way left along the place value chart to find the value of each digit up to 1,000.	1,256 One thousand, two hundred and fifty six.
10	Comparing Numbers	We use these symbols = Equal to < Less than > Greater than ≥ Greater than or equal to ≤ Less than or equal to	3 < 6 3 is less than 6 6 > 3 6 is greater than 3
11	Positive numbers	Numbers that are greater than zero.	5 is positive 5.
12	Negative Numbers	Numbers that are less than zero.	- 5 is negative 5.
13	Rounding	To change a number to a similar number which is either easier to read or easier to calculate with. If the digit to the right of the rounding digit is less than 5, round down.	74 rounded to the nearest ten is 70, because 74 is closer to 70 than 80.

GCSE Mathematics – Unit 13: Probability

Name:.......................................

Topic/Skill	**Definition/Tips**	**Example**	**Your Turn**
Probability	The likelihood/chance of something happening. Is expressed as a fraction, decimal, percentage between 0 (impossible) and 1 (certain).		The chance of flipping a coin and getting heads is: The chance of flipping a coin and it flying into space is:
Sample	A sample is a small selection of items from a population. A sample is biased if individuals or groups from the population are not represented in the sample.	A sample could be selecting 10 students from a year group at school.	I want to know about the favourite subjects of **all pupils in our school.** I conduct a survey asking girls in Year 11. What is wrong with my sample?
Sample Size	The larger a sample size, the closer those probabilities will be to the true probability.	A sample size of 100 gives a more reliable result than a sample size of 10.	Why don't survey's just ask everyone in the population?
Theoretical Probability	$\frac{Number\ of\ Favourable\ Outcomes}{Total\ Number\ of\ Possible\ Outcomes}$	Probability of rolling a 4 on a **fair** 6-sided die = $\frac{1}{6}$	The probability of rolling an even number on a fair 6-sided dice is:
Relative Frequency	$\frac{Number\ of\ Successful\ Trials}{Total\ Number\ of\ Trials}$	A coin is flipped 50 times and lands on Tails 29 times. The relative frequency of getting Tails = $\frac{29}{50}$.	A dice is rolled 100 times and lands on 3 14 times. The relative frequency of getting 3 =

Exhaustive	Outcomes are exhaustive if they cover the entire range of possible outcomes. The probabilities of an exhaustive set of outcomes adds up to 1.	When rolling a six-sided die, the outcomes 1, 2, 3, 4, 5 and 6 are exhaustive, because they cover all the possible outcomes. $\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}+\frac{1}{6}=\frac{6}{6}=1$	When flipping a coin…
Mutually Exclusive	Events are mutually exclusive if they cannot happen at the same time. The probabilities of an exhaustive set of mutually exclusive events adds up to 1.	Examples of mutually exclusive events: - Turning left and right - Heads and Tails on a coin Examples of non mutually exclusive events: - King and Hearts from a deck of cards, because you can pick the King of Hearts	Put a tick or a cross for mutally exclusive (✓) and non mutually exclusive (**X**) events: Choosing a random pupil in a **high school survey:** - Getting someone with glasses or someone without glasses - Getting someone in Year 10 or in Year 11 - Getting a boy in Year 7 or a girl in Year 7
Independent Events	The outcome of a previous event does not influence/affect the outcome of a second event.	An example of independent events could be being late to school and eating a jacket potato for lunch	Tick the correct example: - Being in Year 7 and being in KS3 - Being a boy and liking maths
Dependent Events	The outcome of a previous event does influence/affect the outcome of a second event.	An example of dependent events could be being late to school and missing the train	Tick the correct example: - Flipping a coin and getting heads, and then flipping and getting heads again - Pulling a green marble out of a bag and then pulling another green marble

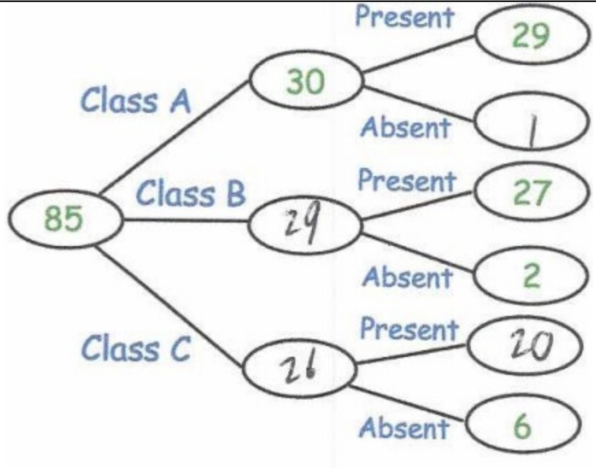
Expected Outcomes	To find the number of expected outcomes, multiply the probability by the number of trials.	The probability that a football team wins is 0.2 How many games would you expect them to win out of 40? $0.2 \times 40 = 8\ games$	I roll a fair 6-sided dice 300 times. How many times would you expect to get a 5?
Probability Notation	P(A) refers to the probability that event A will occur. P(A') refers to the probability that event A will <u>not</u> occur. P(A ∪ B) refers to the probability that event A <u>or</u> B <u>or</u> both will occur. P(A ∩ B) refers to the probability that <u>both</u> events A and B will occur.	P(Red Queen) refers to the probability of picking a Red Queen from a pack of cards. P(Blue') refers to the probability that you do not pick Blue. P(Blonde ∪ Right Handed) refers to the probability that you pick someone who is Blonde or Right Handed or both. P(Blonde ∩ Right Handed) refers to the probability that you pick someone who is both Blonde and Right Handed.	All these are for fair 6-sided dice: P(6) refers to… P(1 ∪ 6)… P(5')… P(3 ∩ 4)…
AND rule for Probability	When two events, A and B, are independent: $P(A\ and\ B) = P(A) \times P(B)$	What is the probability of rolling a 4 and flipping a Tails? $P(4\ and\ Tails) = P(4) \times P(Tails)$ $= \frac{1}{6} \times \frac{1}{2} = \frac{1}{12}$	What is the probability of rolling a 3 and flipping a Heads?

<table>
<tr>
<td>OR rule for Probability</td>
<td>When two events, A and B, are mutually exclusive:

$$P(A\ or\ B) = P(A) + P(B)$$</td>
<td>What is the probability of rolling a 2 or rolling a 5?

$$P(2\ or\ 5) = P(2) + P(5)$$ $$= \frac{1}{6} + \frac{1}{6} = \frac{2}{6} = \frac{1}{3}$$</td>
<td>What is the probability of flipping and getting a Heads or a Tails?</td>
</tr>
<tr>
<td>Frequency Tree</td>
<td>A diagram showing how information is categorised into various categories.

The numbers at the ends of branches tells us how often something happened (frequency).

You can work out the missing numbers by making sure they add up.</td>
<td>
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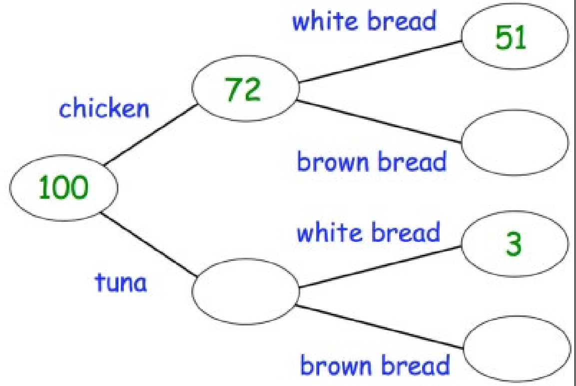
<td>
</td>
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<tr>
<td>Sample Space</td>
<td>The set of all possible outcomes of an experiment.

For example, the diagram shows all the different possible outcomes of rolling two dice and adding the scores.</td>
<td>
<table>
<tr><td>+</td><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td></tr>
<tr><td>1</td><td>2</td><td>3</td><td>4</td><td>5</td><td>6</td><td>7</td></tr>
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<tr><td>6</td><td>7</td><td>8</td><td>9</td><td>10</td><td>11</td><td>12</td></tr>
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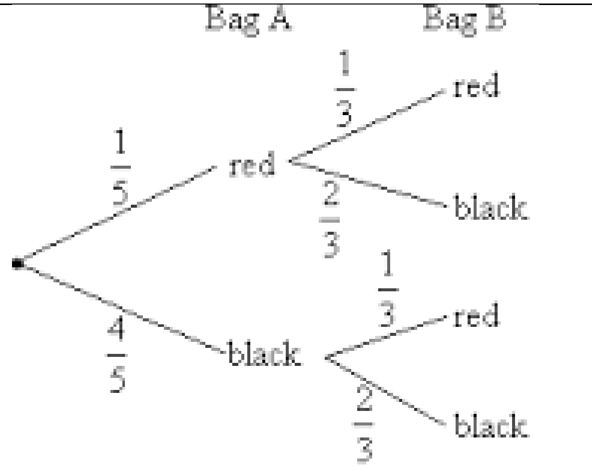
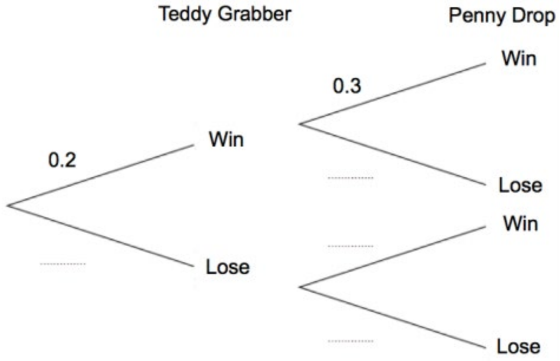
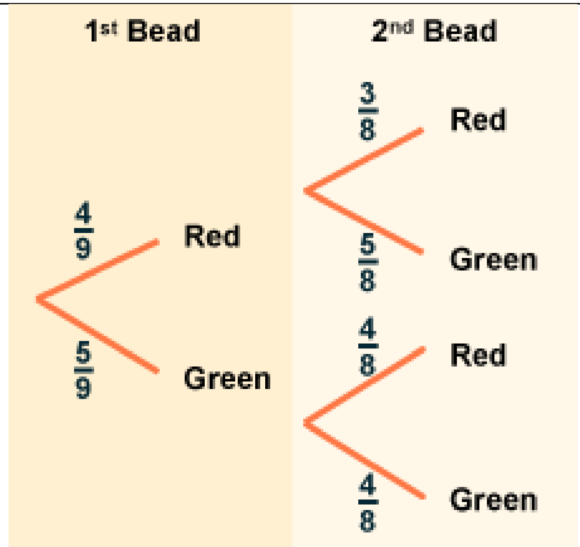
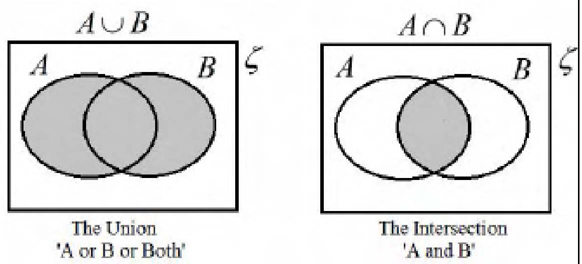
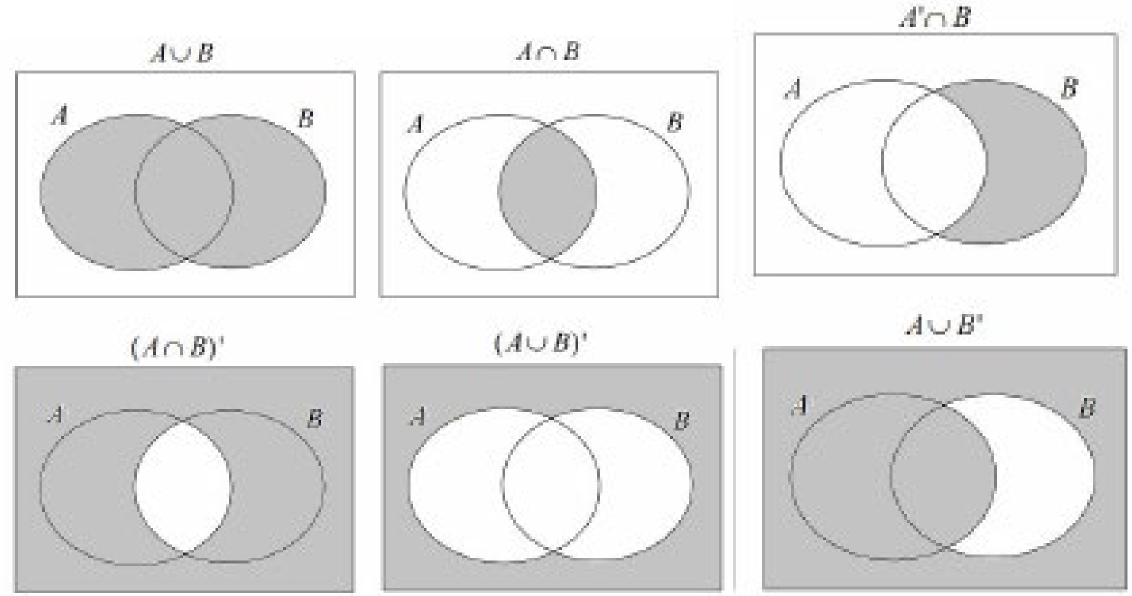
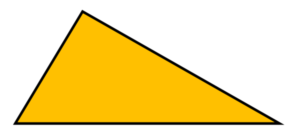
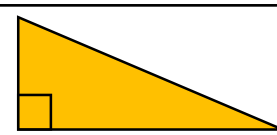
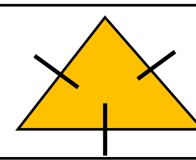
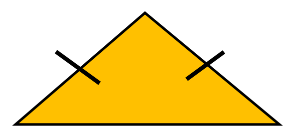
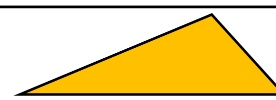
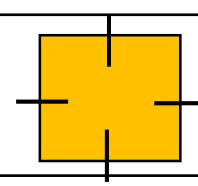
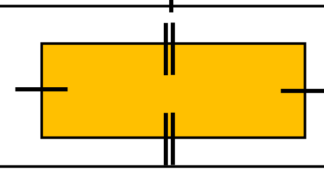
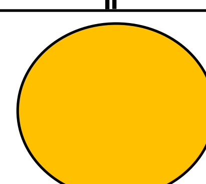
<td>
<table>
<tr><td></td><td></td><td colspan="3">Spinner 1</td></tr>
<tr><td></td><td>x</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="3">Spinner 2</td><td>1</td><td></td><td></td><td></td></tr>
<tr><td>3</td><td></td><td></td><td></td></tr>
<tr><td>5</td><td></td><td></td><td></td></tr>
</table>
</td>
</tr>
</table>

Tree Diagrams	Tree diagrams show all the possible outcomes of an event and calculate their probabilities. All branches must add up to 1 when adding downwards. This is because the probability of something not happening is 1 minus the probability that it does happen. They are **exhaustive.** Multiply going across a tree diagram to work out the probability of both events happening. Fractions or decimals, the process is the same	 The probability of getting a Black from Bag A and a Red from Bag B is $\frac{4}{5}\times\frac{1}{3}=\frac{4}{15}$	James goes to an arcade. He has one go on the Teddy Grabber. He has one go on the Penny Drop. The probability that he wins on the Teddy Grabber is 0.2. The probability that he wins on the Penny Drop is 0.3.  Find the probability that he wins both games:
Conditional Probability	The probability of an event A happening, given that event B has already happened. With conditional probability, check if the numbers on the second branches of a tree diagram changes. **For example, if you have 4 red beads in a bag of 9 beads and pick a red bead on the first pick, then there will be 3 red beads left out of 8 beads on the second pick.**		Draw a tree diagram for a bag with 5 red marbles and 5 yellow marbles, with two counters picked:

Venn Diagrams	A Venn Diagram shows the relationship between a group of different things and how they overlap. You may be asked to shade Venn Diagrams as shown below and to the right. 		
Venn Diagram Notation	∈ means 'element of a set' (a value in the set) { } means the collection of values in the set. ξ means the 'universal set' (all the values to consider in the question) A' means 'not in set A' (called complement) A ∪ B means 'A or B or both' (called Union) A ∩ B means 'A and B (called Intersection)	Set A is the even numbers less than 10. A = {2, 4, 6, 8} Set B is the prime numbers less than 10. B = {2, 3, 5, 7} A ∪ B = {2, 3, 4, 5, 6, 7, 8} A ∩ B = {2}	Set A is the odd numbers less than 15. A = Set B is the square numbers less than 30. B = A ∪ B = A ∩ B = A' ∩ B =

<u>Properties of Shapes</u>

1	2D	Two-dimensional. Describes a plane (flat) shape with a length and width.	Examples of 2D shapes include: triangle, square, pentagon
2	3D	Three-dimensional Describes a solid shape with a length, width and depth.	Examples of 3D shapes include a: cube, sphere, prism
3	Polygon	A plane shape with three or more straight sides.	
4	Triangle	A polygon with three sides.	
5	Right-angle Triangle	A triangle with one internal right-angle.	
6	Equilateral Triangle	A triangle which has three equal length sides and internal angles which measure 60^{o}.	
7	Isosceles Triangle	A triangle which has two sides of equal length and equal sized base angles.	
8	Scalene Triangle	A triangle where the three sides are of different length.	
9	Square	A polygon with four equal length sides and four internal right angles.	
10	Rectangle	A polygon with two pairs of opposite equal length sides and four internal right angles	
11	Circle	A plane shape bounded by a continuous line which is always the same distance from the centre.	

Ratio

1	Proportion	A part to whole comparison. Any two variables are directly proportional if they are related in the same ratio by a multiplier in the form y=kx.	£20 is shared between two people in the ratio 3:5, the first person received 3/8 of the whole. This is their proportion of the whole. In currency exchange the ratio £1: €1.20 shows that pounds are directly proportional to euros. £1 = 1.2 x Euros
2	Ratio	Ratio compares the size of one part to another part.	The order is important, the ratio of a to b is written a : b
3	Unitary ratio	A part to part comparison where one part is 1. It is written as 1 : n or n : 1	
4	Fraction	Any part of a group, number or whole. The numerator tells us how many parts we have. The denominator tells us how many parts the whole has been split into.	$\frac{\text{Numerator}}{\text{Denominator}}$
5	Respectively	One after the other in the order already mentioned.	

Representing Data

1	Data	A collection of information. Usually gathered by observation, questioning or measurement.	There are two types of data: **Continuous** data can have an infinite number of possible values within a selected range. For example, height 158.5cm, 142.028cm, 180.1cm. **Discrete** data only has a limited number of possible values. For example, shoe size 5, 5½, 6, 6½, 7 etc.
2	Frequency	The number of times a particular item appears in a set of data.	In maths we have frequency tables which show the number of items in a data set.
3	Interpreting	From the Old French *interpreter* which meant “explain or translate”. It means to expound the meaning, render clear or explicit.	To interpret data using graphs means to find meaning from the graph and to understand what it is telling us.
4	Represent	From the Old French *representer* “present, show or display”. It means to symbolise, to serve as a sign.	To represent data is to make it present and show what it means. This means to turn ‘raw’ data into a graph.
5	Types of Graph	There are many types of graph. Examples include bar graph, pie chart and pictogram.	

Pathway 5

Unit 8 – Representing Data

1		A collection of information. Usually gathered by observation, questioning or measurement.	There are two types of data: **Continuous** data can have an infinite number of possible values within a selected range. For example, height 158.5cm, 142.028cm, 180.1cm. **Discrete** data only has a limited number of possible values. For example, shoe size 5, 5½, 6, 6½, 7 etc.
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5	Types of Graph		

Rounding and Arithmetic

<table>
<tr><td>1</td><td>Rounding</td><td>To change a number to a similar number which is either easier to read or easier to calculate with.

If the digit to the right of the rounding digit is less than 5, round down.</td><td>We can round to a number of decimal places or significant figures, to the nearest 10, 100 or 1000, or to the nearest integer.</td></tr>
<tr><td>2</td><td>Upper Boundary</td><td>The highest that a number could have been before it was rounded.</td><td></td></tr>
<tr><td>3</td><td>Lower Boundary</td><td>The lowest that a number could have been before it was rounded.</td><td></td></tr>
<tr><td>4</td><td>Distributive Law</td><td>The Distributive Law states that multiplying a number by a group of numbers added together is the same as doing each multiplication separately.</td><td>12 x 3 is the same as (10 x 3) + (2 x 3) or (8 x 3) + (4 x 3)</td></tr>
<tr><td>5</td><td>Commutative Law</td><td>The Commutative Law states that the answer of any sum or product is unchanged by re-ordering the calculation.
Addition and multiplication are commutative.</td><td>3 x 4 = 4 x 3
3+4 = 4+3</td></tr>
<tr><td>6</td><td>Grid Method</td><td>This method is used for multiplication. It involves partitioning numbers into hundreds, tens and units before they are multiplied.</td><td>35 x 7<table><tr><td>×</td><td>30</td><td>5</td></tr><tr><td>7</td><td>210</td><td>35</td></tr></table>210 + 35 = 245</td></tr>
<tr><td>7</td><td>Column Method</td><td>This method of multiplication, addition and subtraction is the method where numbers are 'carried' or 'borrowed'.</td><td>The column method for multiplication the carried numbers can go above or below.
237
x 4
948
1 2</td></tr>
</table>

Pathway 2

Unit 4 – Rounding and arithmetic

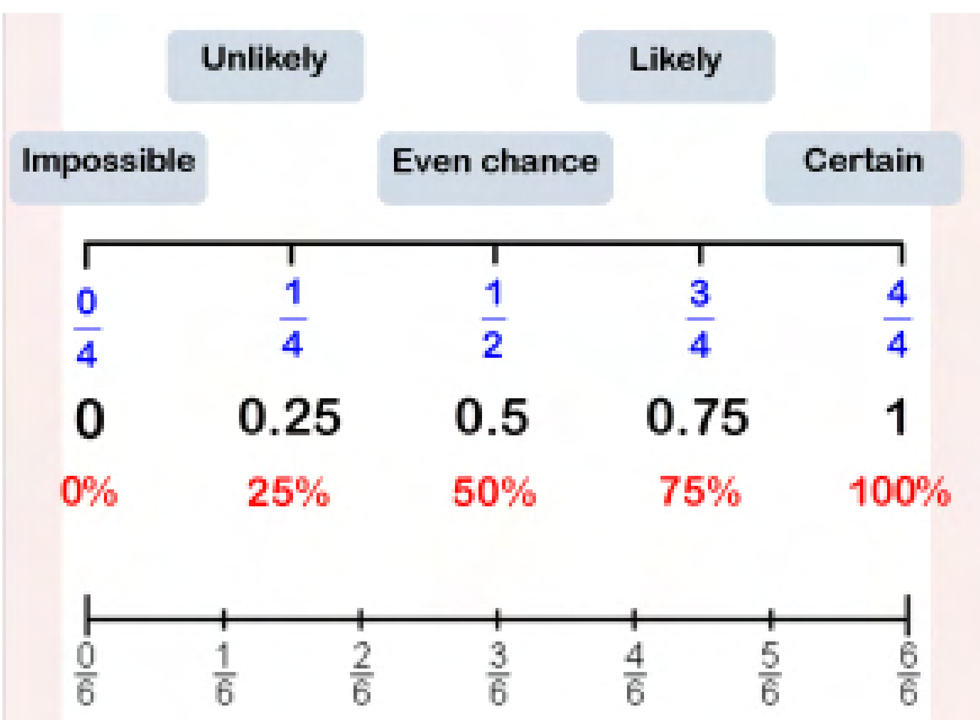
1		To change a number to a more useful value which is similar.	We can round to the nearest 10, 100, 1000
2		The highest that a number could have been before it was rounded.	
3		The lowest that a number could have been before it was rounded.	
4		The **Distributive Law** says that multiplying a number by a group of numbers <u>added</u> together is the same as doing each multiplication separately.	12 x 3 is the same as (10 x 3) + (2 x 3) or (8 x 3) + (4 x 3)
5		The **Law** that says you can swap numbers around and still get the same answer when you add. Or when you multiply.	3 x 4 = 4 x 3 3+4 = 4+3
6		This method is used for multiplication it involves partitioning numbers into hundreds, tens and units before they are multiplied.	35 x 7 $\begin{array}{ccc} \times & 30 & 5 \\ 7 & 210 & 35 \end{array}$ 210 + 35 = 245
7		**Column method** of multiplication, addition and subtraction is the **method** where numbers are 'carried' or 'borrowed'.	The column method for multiplication the carried numbers can go above or below $\begin{array}{rrrr} & 2 & 3 & 7 \\ \times & & & 4 \\ \hline & 9 & 4 & 8 \\ & {}_1 & {}_2 & \end{array}$

Unit 4 – Rounding and arithmetic

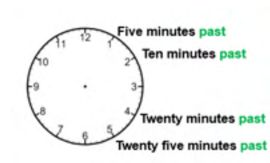
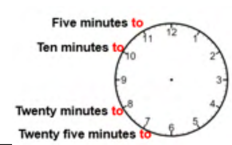
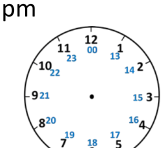
1	Rounding		We can round to the nearest 10, 100, 1000
2		The highest that a number could have been before it was rounded.	
3	Lower boundary		
4		The ________________ says that multiplying a number by a group of numbers _______ together is the same as doing each multiplication separately.	12 x 3 is the same as (10 x 3) + (2 x 3) or (8 x 3) + (4 x 3)
5		The **Law** that says you can swap numbers around and still get the same answer when you add. Or when you multiply.	3 x 4 = 4 x 3 3+4 = 4+3
6	Grid method		35 x 7 × | 30 | 5 7 | 210 | 35 210 + 35 = 245
7	Colum method		The column method for multiplication the carried numbers can go above or below $\begin{array}{r} 237 \\ \times \quad 4 \\ \hline 948 \\ {\scriptstyle 1\,2\ \ } \end{array}$

The Probability Scale

1	Probability	The likelihood of an event happening. It can be expressed in words or in numbers on a scale from 0 to 1. We write probabilities as fractions, decimals or percentages.	
2	Impossible	The probability is 0.	It is impossible to roll a 7 on a normal die.
3	Certain	The probability is 1.	It is certain that you will roll a number between 1-6 on a normal die.
4	Even Chance	The probability is 0.5 (50%/1/2) . Also called fifty-fifty chance or evens.	There is an even chance of getting tails when flipping a coin.
5	Total Probability	All the probabilities of an event, where each is mutually exclusive, sum to 1.	
6	Outcome	The result of a single trial of an experiment.	
7	Mutually Exclusive	Events are mutually exclusive if it is impossible for them to both happen at the same time.	Flipping a heads or tails on a coin is mutually exclusive. You cannot get both at the same time.



Time

1	Quarter-past	It is fifteen minutes past the hour. The minute hand is pointing to the 3.	 Quarter-past Eight Eight Fifteen 8:15
2	Quarter-to	It is 15 minutes until the next hour. The minute hand is pointing to the 9.	 Quarter-to Ten Nine Forty-five 9:45
3	Five-past, Ten-past, Twenty-past, Twenty-five-past’	It is this many minutes past the hour.	
4	Five-to, Ten-to, Twenty-to, Twenty-five-to	It is this many minutes until the next hour.	
5	Analogue Clock	A clock that usually has 12 divisions labelled 1 to 12 to represent the hours. The long hand is the minute hand. The shorter hand is the hour hand.	
6	Digital Clock	A clock that shows the time in digits.	
7	Day	A unit of time. There are 365 days in a year.	
8	Week	A unit of time. There are 52 weeks in a year.	
9	Hour	A unit of time. There are 24 hours in one day.	
10	Minute	A unit of time. There are 60 minutes in one hour.	
11	Second	A unit of time. There are 60 seconds in one minute.	
12	AM	AM indicates the morning (before 12 midday). It comes from the Latin for 'before midday'.	6AM is six o'clock in the morning.
13	PM	The afternoon and evening. It comes from the Latin for 'after midday'.	6PM is six o'clock in the evening.
14	24 Hour Clock	The time is given in the number of hours and minutes since midnight.	13: 15 means 1:15pm 

Times Tables and Formal Methods for Addition and Subtraction

1	Multiplication	The operation where a number is added to itself a number of times to form a product.	Synonyms: ‘times’, ‘multiply’, ‘repeated addition’, ‘product’, ‘lots of’ and ‘groups of’.
2	Division	The operation where a number is shared or grouped into a number of equal parts.	Synonyms: ‘divide’, ‘share equally’ and ‘divided by’.
3	Addition	The operation to combine numbers or quantities to form a total or sum. Addition is the inverse of subtraction.	Synonyms: ‘sum’, ‘add’, ‘plus’, ‘more’, ‘total’ and ‘all together’.
4	Subtraction	The operation to find the difference between two numbers of quantities. Subtraction is the inverse of addition.	Synonyms: ‘minus’, ‘take away’, ‘subtract’, ‘reduce’, ‘take from’, ‘difference’, ‘decrease’, ‘fewer’, and ‘between’.
5	Inverse Operations	The opposite operation. Inverse operations ‘undo’ each other.	Addition and Subtraction. Multiplication and Division.
6	Column Method	Lining up numbers and performing an operation using a formal algorithm.	$\begin{array}{r} 5\ 2 \\ +\ 6\ 4 \\ \hline \\ \hline \end{array}$
7	Commutative	The order of numbers involved in an operation does not matter and does not affect the answer. Addition and multiplication are commutative. Subtraction and division are **not** commutative.	$3 + 2 = 2 + 3$ $4 \times 5 = 5 \times 4$ $3 - 2 \neq 2 - 3$ $10 \div 2 \neq 2 \div 10$