Rayner Stephens

HIGH SCHOOL

Curriculum

Intent

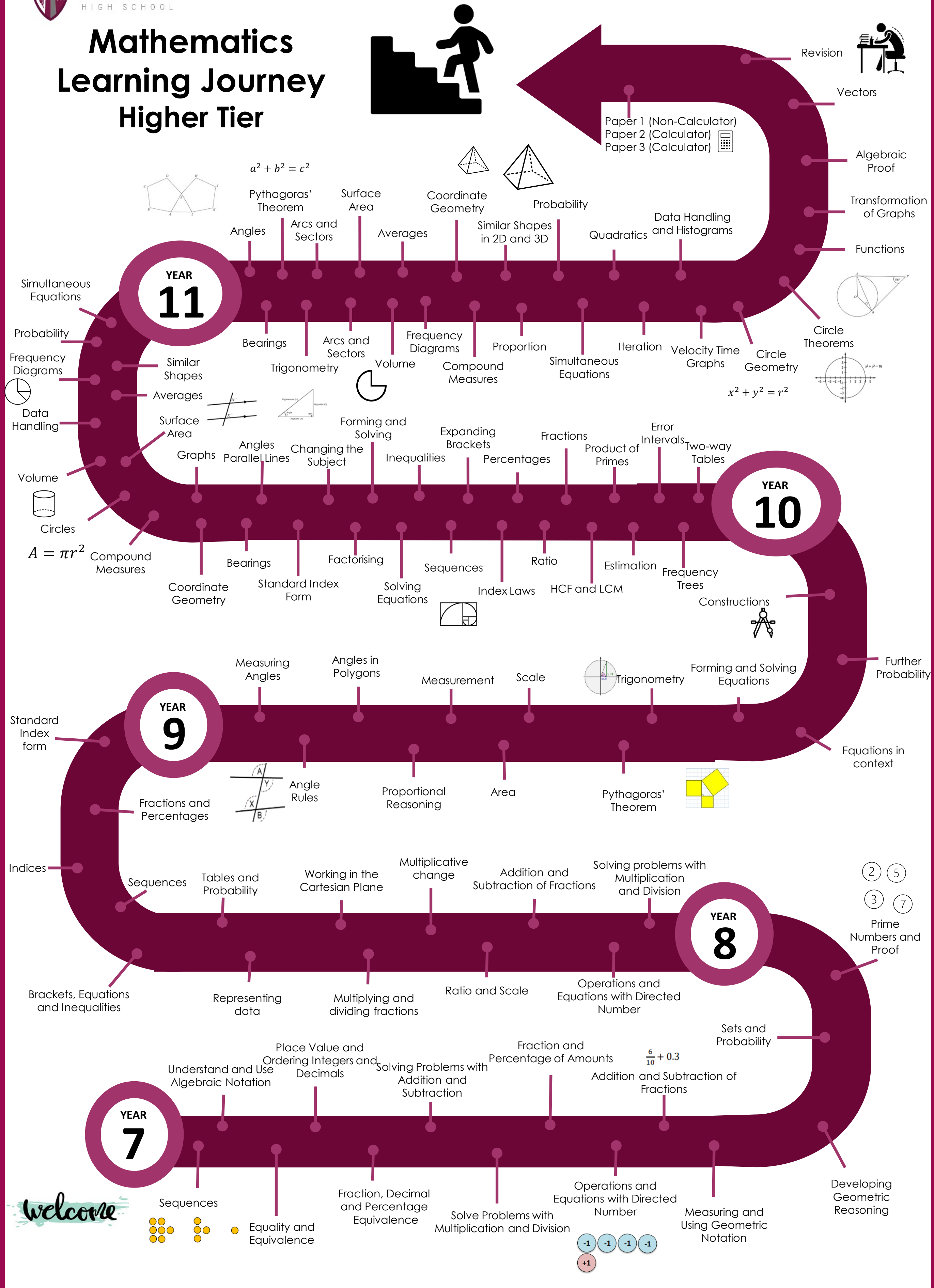
for

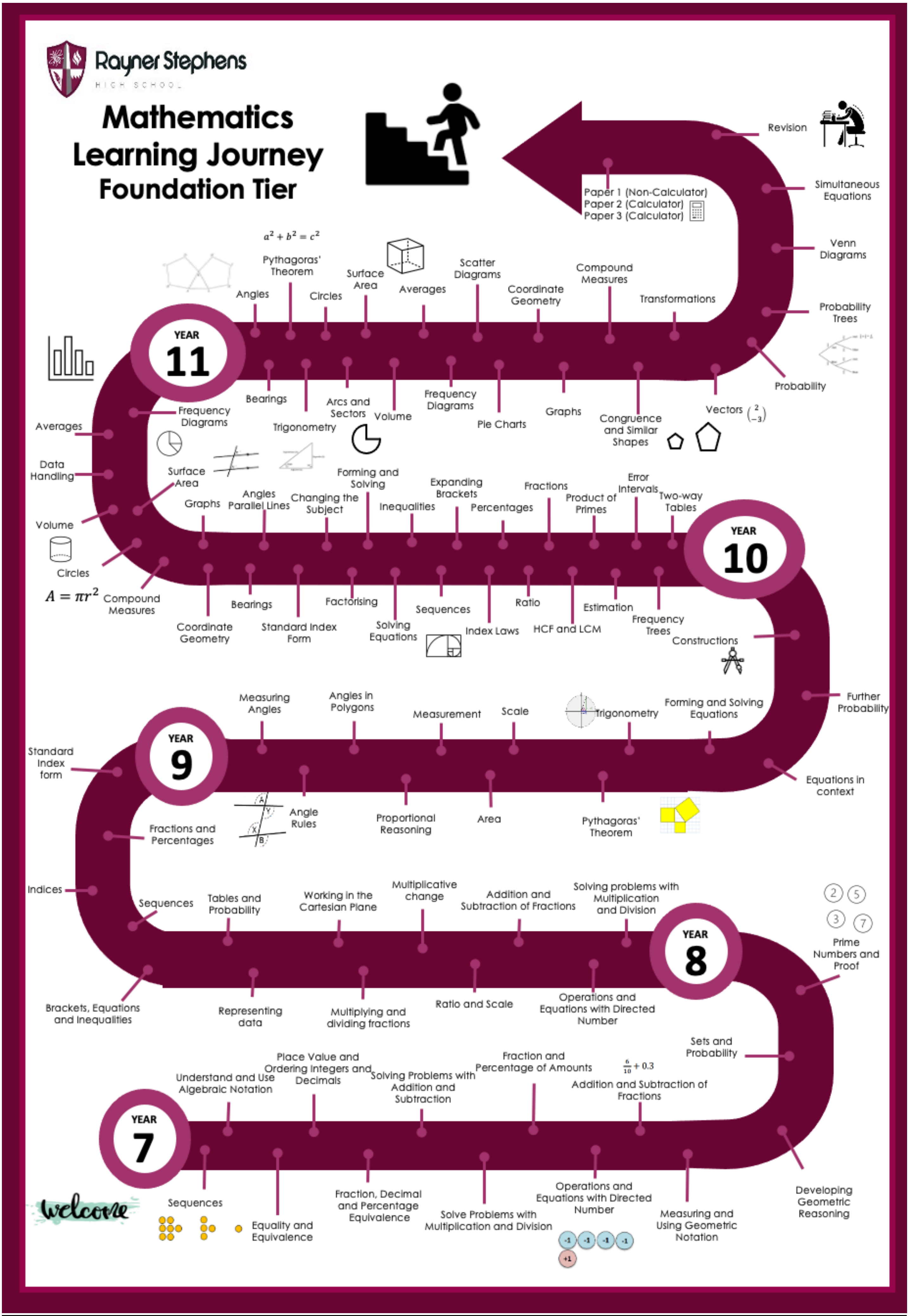
Maths

At Rayner Stephens High School, we believe that everyone can do maths. The intent of the mathematics curriculum is to provide students with a high-quality and ambitious curriculum which will allow all students to achieve their mathematical potential and prepare them well for everyday life and future employment. Through mathematics lessons, we promote mathematical thinking which will encourage students to develop conceptual understanding, to establish links between the different disciplines within maths and to provide the opportunity to apply this understanding to solve increasingly complex problems. In KS3, students are introduced to topics in mathematics using a concrete, pictorial, abstract approach to allow students to develop their fluency, reasoning and problem-solving skills. Topics are interleaved to allow students to improve their previous learning and allow them to develop application and skill links between the different areas of mathematics. In KS3, students are exploring topics in order to create the building blocks to prepare them for their GCSE studies in Years 10 and 11. Covering the disciplines of number, algebra, geometry, ratio, proportion, data handling and probability, students are given the opportunity to retrieve, affirm and extend their understanding as they progress on their mathematics journey through KS3 and KS4. Students will be encouraged to become fluent in the fundamentals, to be able to reason mathematically, by problem solving and be able to develop an argument or justification using mathematical language.

Rayner Stephens
HIGH SCHOOL

Mathematics Learning Journey Higher Tier




Rayner Stephens
HIGH SCHOOL
Mathematics
Learning Journey
Foundation Tier
YEAR
7
Welcome
Sequences
Understand and Use Algebraic Notation
Equality and Equivalence
Place Value and Ordering Integers and Decimals
Fraction, Decimal and Percentage Equivalence
Solving Problems with Addition and Subtraction
Solve Problems with Multiplication and Division
Fraction and Percentage of Amounts
Operations and Equations with Directed Number
Addition and Subtraction of Fractions
$\frac{6}{10} + 0.3$
Measuring and Using Geometric Notation
Developing Geometric Reasoning
Sets and Probability
Prime Numbers and Proof
YEAR
8
Solving problems with Multiplication and Division
Operations and Equations with Directed Number
Addition and Subtraction of Fractions
Ratio and Scale
Multiplicative change
Multiplying and dividing fractions
Working in the Cartesian Plane
Representing data
Tables and Probability
Sequences
Brackets, Equations and Inequalities
Indices
Fractions and Percentages
Standard Index form
YEAR
9
Angle Rules
Measuring Angles
Angles in Polygons
Proportional Reasoning
Measurement
Area
Scale
Pythagoras' Theorem
Trigonometry
Forming and Solving Equations
Equations in context
Further Probability
Constructions
YEAR
10
Frequency Trees
Estimation
HCF and LCM
Ratio
Index Laws
Sequences
Solving Equations
Factorising
Standard Index Form
Bearings
Coordinate Geometry
Compound Measures
$A = \pi r^2$
Circles
Volume
Data Handling
Averages
Two-way Tables
Error Intervals
Product of Primes
Fractions
Percentages
Expanding Brackets
Inequalities
Forming and Solving
Changing the Subject
Angles Parallel Lines
Graphs
Surface Area
Frequency Diagrams
YEAR
11
Bearings
Trigonometry
Arcs and Sectors
Volume
Frequency Diagrams
Pie Charts
Graphs
Congruence and Similar Shapes
Vectors $\binom{2}{-3}$
Probability
Angles
$a^2 + b^2 = c^2$
Pythagoras' Theorem
Circles
Surface Area
Averages
Scatter Diagrams
Coordinate Geometry
Compound Measures
Transformations
Probability Trees
Venn Diagrams
Simultaneous Equations
Revision
Paper 1 (Non-Calculator)
Paper 2 (Calculator)
Paper 3 (Calculator)

Year 9 - Mathematics						
Curriculum intent	Through mathematics lessons we promote mathematical thinking to allow all students to achieve their mathematical potential and engage in the study of mathematics. Using a mastery style approach to develop learners' fluency, reasoning and problem solving through a concrete, pictorial and abstract approach, building upon their learning from Year 7 and 8. As students progress through their learning topics from previous learning with be interleaved into future learning so students develop application and skill links between different areas of mathematics, whilst preparing students for their GCSE studies. Whilst retrieving learning taught in Years 7 and 8 and building upon the skills acquired, in Year 9 students begin with learning about angles adding to what they discovered through rotations and adding an understanding of how to find the size of angles through measurement and geometric facts. Moving on to studying proportional reasoning by building upon learning about ratio to solve more complex problems leading to more abstract approaches. Continuing with geometry, students consolidate area and perimeter including compound shapes and trapezia and understand how to solve problems with a variety of different shape types. Linking to proportionality, students will study how to understand and complete calculations with map scales and conversion of different units of measurements. Moving into the spring term, students will continue to will focus on geometry, in particular trigonometry and Pythagoras' Theorem, increasing their knowledge and understanding of where these concepts come from through representations before applying them in preparation for GCSE Mathematics in years 10 and 11. Completing the term, students will begin to consolidate and further their algebraic notation, reasoning and problem skills using algebra and applying this to geometric and contextual problems studied earlier in the year and securing their use of formal algebraic notation. In the summer term, students will revisit probability and extend this to conditional probability and use of algebraic fractions in their calculations. To complete the year, students will further their geometric competency with constructions where they will apply their knowledge of shape properties to construct a variety of shapes, bearings, plans and elevations.					
Term	**Autumn 1**	**Autumn 2**	**Spring 1**	**Spring 2**	**Summer 1**	**Summer 2**
Knowledge	Angles	Proportional Reasoning Area, Scale and Measurement	Area, Scale and Measurement (cont.) Pythagoras' and Trigonometry	Pythagoras' and Trigonometry (cont.) Forming and Solving Equations	Further Probability	Constructions
Skills	➢ Draw and measure angles accurately,	➢ Use scale factors for length, extending to	➢ Apply area and perimeter principles to increasingly	➢ Explore, understand and apply	➢ Complete probability diagrams for independent	➢ Understanding how to use mathematical equipment to

	using a protractor. ➢ Understand the notation in which angles and shapes are written. ➢ Understand and apply angle rules to differing geometric problems, including parallel lines, interior and exterior angles in polygons.	area and volume, and find lengths on similar shapes. ➢ Formalise proportion understanding to abstract examples using the constant of proportionality ➢ Show and build confidence in using different measuring devices and in different units for length, mass and capacity.	complex and compound shapes. ➢ Interpret scales on a variety of devices and determine true lengths using map scales. ➢ Explore, understand and apply Pythagorean theorem.	trigonometric ratios. ➢ Being able to understand and apply appropriate methods for finding a length of a side or size of an angle. ➢ Reinforce basic algebra skills. ➢ Reinforce solving equations in applied contexts. ➢ Understand how to simulate different context using algebra ➢ Link shape properties and understanding to algebraic methods.	and dependent probabilities of events ➢ Calculate probabilities for independent and dependent events. ➢ Solve probability problems involving algebraic notation, including algebraic fractions.	make accurate drawings. ➢ Explore the different ways in which triangles and some quadrilaterals can be constructed. ➢ . ➢ Use and apply bearings to geometric problems. ➢ Describe and draw shapes accurately using elevations.
Assessments	End of topic assessment: Angles	End of unit assessment: Proportional Reasoning	End of unit assessment: Area, Scale and Measurement.	End of Unit assessments: Pythagoras' and Trigonometry	End of unit assessment: Further Probability	End of unit assessment: Constructions.

				Forming and Solving Equations		
Enrichment	• Practise reading from a protractor with Angles Aliens Attack game: https://mathsframe.co.uk/en/resources/resource/470/Angle-Alien-Attack • What is important about angles in order for shapes to tessellate? Have a go at tessellating shapes and even try some similar to the famous Mathematician Escher! https://stemactivitiesforkids.com/2019/10/08/create-a-simple-tessellation/	• Using an image of your choice, can you increase or reduce it by a scale factor? You might want to draw it or use a computer. How can you ensure it stays in proportion? • Mixing Lemonade: Can you work out which is stronger? https://nrich.maths.org/6870	• Measure things around your home! What can you use to measure them – be creative. How does changing the mode or unit of measurement affect answers? • Create a plan of a garden or room. Can you use a scale to create a scale drawing of it?	• In a newspaper, how many statistics can you find? Consider why they have been used. • Delve deeper into what the Pythagoreans investigated with this article: https://nrich.maths.org/2721	• Watch the video clips to understand how we use probability to assess risk and how medications can reduce the risk. What factors influence **Professor Spiegelhalter's decision?** https://nrich.maths.org/12165 • **Play a game – analyse the probabilities of you winning or losing. What affects your chances? What are the probabilities of these things happening?**	• You've got to work out the direction to get to your friends who are in the park. Try estimating your bearing from objects/friends. See if your friends agree!

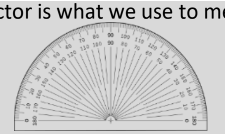
Year 9 Mathematics Autumn Term Knowledge Organiser – Angles

Key Vocabulary

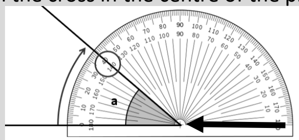
1	Protractor	An instrument for measuring angles.
2	Transversal	A line that intersects (passes through) a set of lines.
3	Vertically Opposite	Angles that are opposite each other when two lines cross. They are always equal.
4	Equal	Being the same in quantity, size, degree or value.
5	Degrees	A unit of measurement of angles.
6	Angle	The space (usually measured in degrees) between two in intersecting lines (lines that cross) or surfaces.
7	Alternate	Two angles, formed when a line crosses two other lines that line on opposite sides of the transversal line. Alternate angles are equal:
8	Corresponding	The angles which occupy the same position at each intersection where a straight line crosses two others. Corresponding angles are equal.
9	Co-interior	Co-interior angles lie between two lines on the same side of the transversal.
10	Parallel	A set of two or more lines that remain an equal distance apart.
11	Supplementary	Two angles are supplementary when they add up to 180°
12	Polygon	A shape with more than one side, for example: square, octagon.

13 Measuring and drawing angles

A protractor is what we use to measure an angle.



When measuring an angle, you must line the protractor on one of the intersecting lines and the apex of the angle must be on the cross in the centre of the protractor.

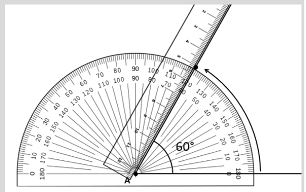


Apex of angle

14 Drawing angles

To draw an angle, you will need a ruler, pencil and protractor.

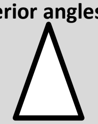
You will first need to draw a line, then match it up with the line at the base of the protractor.



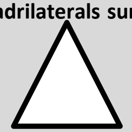
You will then need to use the ruler to line up the apex of the angle with the number of degrees for your angle and mark it on the edge of the protractor. Remove the protractor and connect the marking to the end of your line that was on the middle +/x of the protractor.

15 Shape properties:

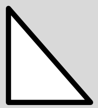
Interior angles in triangles sum 180°.
Interior angles in all quadrilaterals sum 360°



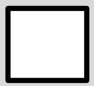
Isosceles triangle
3 sides
2 equal sides
Base angles are equal.



Equilateral triangle
3 sides
All sides and angles are equal.

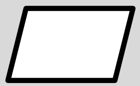


Right-angled triangle
3 sides
One angle of 90°.



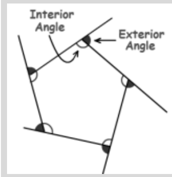
Square
4 sides and angles all of equal size.
2 pairs of parallel lines.

Rectangle
All angles are equal.
Sides in parallel are equal.



Parallelogram
Opposite angles are equal.
Sides in parallel are equal.

16 Interior and exterior angles in polygons



To find the sum of the **interior** angles in any polygon:

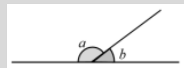
(number of sides – 2) x 180

The sum of the **exterior** angles in any polygon is **360°**

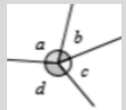
Interior + Exterior angle = 180°

17 Basic angle facts

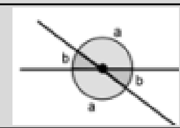
Angles on straight line equal 180°
a + b = 180°



Angles around a point equal 360°
a+b+c+d = 360°

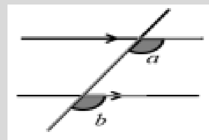


Vertically opposite angles are equal

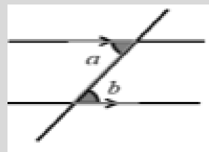


18 Angles in parallel lines

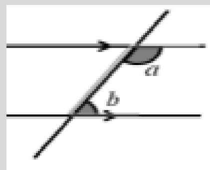
Corresponding angles are equal.



Alternate angles are equal.



Co-interior angles sum 180°
(Sometimes called **supplementary** angles).



Year 9 Maths Autumn Term Knowledge Organiser – Proportional Reasoning

Key Vocabulary

1	Proportion	A mathematical comparison between two numbers whereby the numbers are increasing or decreasing at the same rate.
2	Unitary	To find the value of one.
3	Scale Factor	A measure of similar shapes, which look the same but have different scales of measurement.
4	Exchange Rate	The number of units of a foreign currency that are bought with a unit of home currency.
5	Best Value	The method of finding out which item gives the most for the money spent.
6	Recipe	An instruction or method that gives measurements of ingredients in the correct proportion for the product to be made
7	Similar	Shapes that are the same in number of sides and size of angles but have been enlarged by a scale factor.
8	Congruent	The same shape and size, but has been rotated, reflected/flipped or turned.
9	Constant	A fixed value, often referred to k in a proportion equation.
10	Directly	To increase or decrease in the same ratio (rate).
11	Inversely	Whereby one value increases and the other linked value decreases by the same rate.

12 Ratio Tables

Multiplication

x10

1	10
15	150

x10

There are 12 eggs in a carton
How many eggs are there in 8 cartons?

x4 x 2

Cartons	1	4	8
Eggs	12	48	96

Halving:

Halving Strategy

Teams	8	4	2	1
Baseballs	120	60	30	15

Addition and Subtraction:

$10 + 2 = 12$

Baskets	1	10	2	12	8
Cherries	15	150	30	180	120

$150 + 30 = 180$

13 Unitary method

If 3 m of ribbon costs £4.80, how much would 7 m cost?

Length	3 m	1 m	7 m
Cost	£4.80	£1.60	£11.20

7 m of ribbon will cost **£11.20**

Find how much 1 unit costs

13 Best Value

When comparing two quantities to find the best value, both quantities must be calculated to their unit value to compare their price

1.2kg for £3.89  700g for £2.14

÷ 1200 ÷ 1200 ÷ 700 ÷ 700

1g = 0.324p 1g = 0.305p

This is less money per gram, so it is the best value

14 Currency conversions

These ideas can be used to convert currencies or units of measure.

Example: If £1 is worth 9 French francs, convert…

i) £14 to Ff ii) 49.50Ff to £

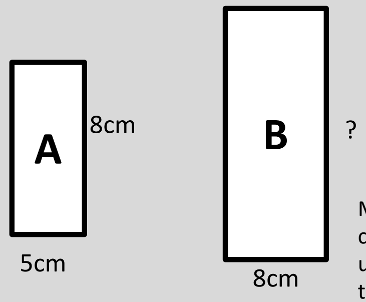
x 9

£1	9Ff
£14	126Ff

÷ 9

£1	9Ff
£5.50	49.50Ff

15 Similar shapes



A and B are mathematically similar

Step 1:
Find the scale factor.

8 ÷ 5 = 1.6

Scale factor

Multiply the length corresponding to the unknown length by the scale factor

8 x 1.6 = 12.8 cm = ?

Year 9 Key Stage 3 Spring Term Knowledge Organiser: Area, Scale and Measurement

Key Vocabulary

1	Measure	The act of measuring with an appropriate piece of equipment for the object/thing to be measured.
2	Accuracy	How close a measurement is to the actual value.
3	Length	The measurement from one end to the other.
4	Distance	The measurement of the space between two things.
5	Capacity	The amount that a container can hold.
6	Mass	The among of matter an object contains. The more matter an object has, the more that it will weigh.
7	Area	The amount of space a 2D shape covers.
8	Perimeter	The distance around the outside of a 2D shape. Perimeter is found by adding together the length of all the shape's sides.
9	Time	The measureable period during which an action or process continues (duration).
10	Compound Measures	A type of measure that involves two or more different units. For example: density if measured in kg/m3 or speed is measured in m/s.
11	Scale	The ratio of the distance on the map to the distance on the ground. It shows what 1cm on the map represents in the real world.
12	Bearing	The angle of direction in relation to north. Measured in degrees (in three figures) from north in a clockwise direction.

13 Units of measurements

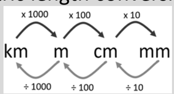
Measurement of distance /length include the units:
- Metres
- Centimetres
- Kilometres
- Millimetres
- Yards
- Feet
- Inches
- Miles

Measurement of capacity include the units:
- Litres
- Millilitres
- Centilitres

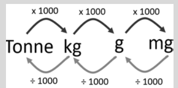
Measurements of mass include the units:
- Tonnes
- Grams
- Kilograms

Converting between units, we use can use proportional reasoning.
For example:

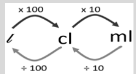
Metric length conversions:



Metric mass conversions:



Metric capacity conversions:

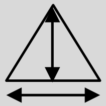


14 Area

Formula for the area of common 2D shapes.

Squares and Rectangles: area = length x width

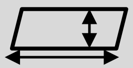
Triangles:



$$area = \frac{base \times perpendicular\ height}{2}$$

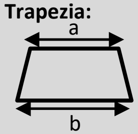
(perpendicular – at a right angle)

Parallelograms:

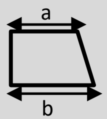


area = base x perpendicular height

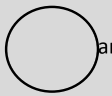
Trapezia:



area = $\frac{1}{2} \times (a + b) \times h$



Circles:



area = πr^2

For **compound shapes**, the shape will need to be broken down in the shapes that make the shape. All of the areas of the component shapes will need to be added together to find the area of the compound shape.

15 Time

Measurements of time include:
seconds, minutes, hours, days, weeks, fortnights, months, and years.

Time throughout the day is often given using an analogue or digital clock.

We often tell the time using either the 12-hour or the 24-hour clock.

12-hour clock	24-hour clock
1:25 pm	13:25
9:10 am	09:10

We can use time measurements in many everyday calculations, from knowing how long bus journey will take to calculating speed.

16 Compound Measure Calculations

Speed = $\frac{distance}{time}$

Density = $\frac{mass}{volume}$

Pressure = $\frac{force}{area}$

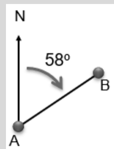
17 Map Scales

Scale drawings allow us to draw large objects on a smaller scale while keeping them accurate – for example maps.

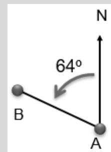
All scale drawings must have a scale on them. They are usually expressed as ratios.
Example: 1cm : 100cm This means that for every one cm on the map, the length will be 100 cm in real life.

18 Bearings

A bearing is an angle, measured clockwise from north. It must be given as three figures.



Bearing = 058°



Bearing = 360° - 64° = 296°

Bearings should be measured and drawn using a protractor. When drawing bearings, you may also be expected to use a scale to show distance from another object/place.

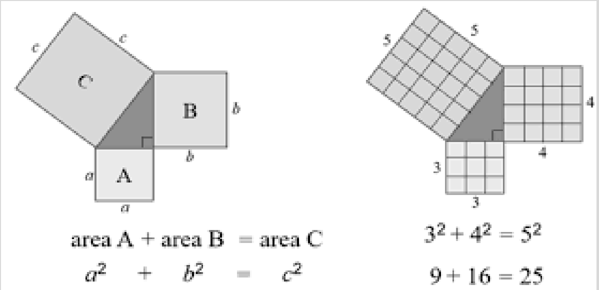
Year 9 Key Stage 3 Spring Term Knowledge Organiser - Pythagoras' Theorem and Trigonometry

Key Vocabulary:

1	Pythagoras' Theorem	In a right-angled triangle the square of the hypotenuse (long side) is equal to the sum of the square of the other two sides.
2	Trigonometry	The relationships between side lengths and angles of triangles, especially right-angled triangles.
3	Hypotenuse	The side opposite the right angle in a right-angled triangle. It is also the longest side of the right-angled triangle.
4	Square	To multiply a number by itself.
5	Square Root	The value when multiplied by itself gives a square number. E.g. the square root of 16 is 4 because 4 x 4 = 16, often seen as $\sqrt{16}$ = 4. The inverse of a square number.
6	Theta ϴ	A letter from the Greek alphabet. It is used in Maths to represent an angle.
7	Opposite	The side opposite the angle of interest in a right-angled triangle.
8	Adjacent	The side in a right-angled triangle that is between the angle ϴ and the right angle.
9	Tangent	In a right-angled triangle: the length of the side opposite the angle divided by the length of the adjacent side. Tan(ϴ) = opposite ÷ adjacent
10	Sine	In a right-angled triangle: the length of the side opposite the angle divided by the length of the hypotenuse. Sin ϴ = opposite ÷ hypotenuse
11	Cosine	In a right-angled triangle: the cosine is the length of the adjacent divided by the length of the hypotenuse. Cos ϴ = adjacent ÷ hypotenuse

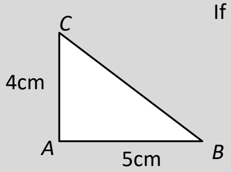
Pythagoras

11 Pythagoras's Theorem



12 Pythagoras' Theorem - finding unknown sides

Find *BC*. Answer to 1 decimal place.



If finding long side Square and ADD

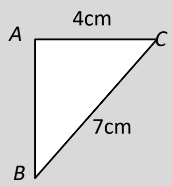
$5^2 + 4^2$ = 25 + 16 = 41

Square root

√41 = 6.4cm

13 Pythagoras' Theorem - finding unknown sides

Find *AB*. Answer to 1 decimal place.



If finding short side Square and SUBTRACT

49 – 16 = 33

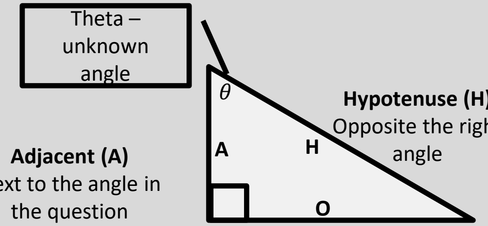
Square root

√33 = 5.7cm

Trigonometry

14 Trigonometry – labelling a triangle

In a trigonometric calculation, it usually involves an angle. Before we can start to calculate, we must label the triangle.



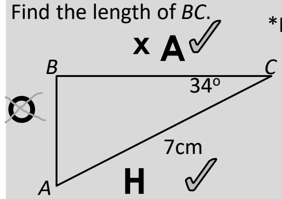
Hypotenuse (H)
Opposite the right angle

Adjacent (A)
Next to the angle in the question

Opposite (O)
Opposite the angle in the question

15 Trigonometry – finding a missing side

Find the length of *BC*.



*Label sides

SOH CAH TOA

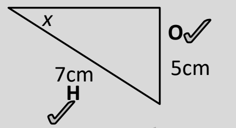
Cosθ = $\frac{A}{H}$

Cos34 = $\frac{x}{7}$ ×7 ×7

7 × cos34 = 5.8cm

16 Trigonometry – finding a unknown angle

Find angle x



*Label sides

Sinθ = $\frac{O}{H}$

Sinx = $\frac{5}{7}$

SOH CAH TOA

*2nd function for angles

x =sin^{-1}(5 ÷ 7)

x =45.6°

Year 9 KS3 Spring Term Knowledge Organiser – Forming and Solving Equations

Key Vocabulary

1	Expression	A collection of one or more terms that can be made up of variables, constants, operators or grouping symbols.
2	Equation	A mathematical statement where each side of the equal sign are equal to the other.
3	Inverse	The opposite of another operation. For example: + is the inverse of -
4	Solve	To find the value of a variable that makes the equation true.
5	Form	When given a mathematical situation which can be described using algebraic expressions.
6	Variable	A symbol (usually a letter) for a value that isn't known yet.
7	Coefficient	A numerical constant quantity that is placed before a variable and shows multiplying of the variable in an algebraic expression or equation.
8	Expand	To multiply each term in the bracket by the expression outside of the bracket e.g.: 4(m+7) ≡ 4m+28 Or when there are two or more brackets together, to expand, each term in each bracket is multiplied by the other. E.g.: $(x+2)(x+3) = x^2 + 5x + 6$ It is the inverse of factorising.
9	Substitute	To replace a variable(s) in an algebraic expression with a value.
10	Evaluate	To find the value of an expression when the variable is replaced by a given number.

Solving one-step equations

Finding the value of an unknown, by identifying operations performed and doing the inverse operation:

$$\begin{array}{ccc} & x + 6 = 8 & \\ +6 & & -6 \\ & x = \mathbf{2} & \end{array}$$

Solving two-step Equations

Finding the value of an unknown, by identifying operations performed and doing the inverse operation:

$$\begin{array}{ccc} & 2x + 1 = 9 & \\ +1 & & -1 \\ & 2x = \mathbf{8} & \\ \times 2 & & \div 2 \\ & x = \mathbf{4} & \end{array}$$

Solving Equations involving fractions.

Finding the value of an unknown. To eliminate a denominator, multiply every term by the denominator:

$$\begin{array}{ccc} & \frac{x+3}{2} = 4 & \\ \div 2 & & \times 2 \\ & x + 3 = \mathbf{8} & \\ +3 & & -3 \\ & x = \mathbf{5} & \end{array}$$

Solving Equations with unknowns on both sides

Add/subtract the smallest algebraic term from both sides, so that the variable is only on one side.

$$\begin{array}{ccc} & 3a - 4 = 7a + 8 & \\ -3a & & -3a \\ & -4 = 4a + 8 & \\ -8 & & -8 \\ & -12 = 4a & \\ \div 4 & & \div 4 \\ & -3 = a & \end{array}$$

Forming Equations

Many of the situations where an equation is formed uses other areas of maths such as area, perimeter, money, angle facts etc.

Create an expression first using the information in the question and your mathematical knowledge.
Once you have your equation, you then solve the equation using the balance method.

Example:

James thinks of a number.
Kate's number is 14 less than James' number.
The sum of their numbers is 212.
What is Kate's number?

Let James' number be n, this means Kate number $n - 14$.

$$n + n - 14 = 212$$
$$2n - 14 = 212$$

Then solve to find the value of n.

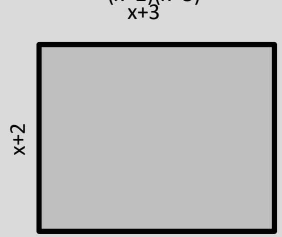
$n = 113$, so Kate's number is 99.

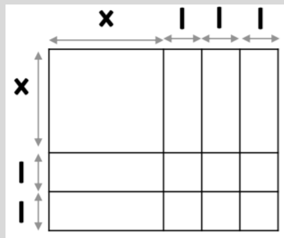
Area: expanding double brackets.

When calculating area, we multiply the height x width.
When multiplying dimensions using algebra, we put each expression into brackets.

We don't need to write the x sign

(x+2)(x+3)





$x^2 + 5x + 6$

Year 9 Key Stage 3 Summer Term Knowledge Organiser: Area, Scale and Measurement

Key Vocabulary

1	Measure	The act of measuring with an appropriate piece of equipment for the object/thing to be measured.
2	Accuracy	How close a measurement is to the actual value.
3	Length	The measurement from one end to the other.
4	Distance	The measurement of the space between two things.
5	Capacity	The amount that a container can hold.
6	Mass	The among of matter an object contains. The more matter an object has, the more that it will weigh.
7	Area	The amount of space a 2D shape covers.
8	Perimeter	The distance around the outside of a 2D shape. Perimeter is found by adding together the length of all the shape's sides.
9	Time	The measureable period during which an action or process continues (duration).
10	Compound Measures	A type of measure that involves two or more different units. For example: density if measured in kg/m3 or speed is measured in m/s.
11	Scale	The ratio of the distance on the map to the distance on the ground. It shows what 1cm on the map represents in the real world.
12	Bearing	The angle of direction in relation to north. Measured in degrees (in three figures) from north in a clockwise direction.

13 Units of measurements

Measurement of distance /length include the units:

- Metres
- Centimetres
- Kilometres
- Millimetres
- Yards
- Feet
- Inches
- Miles

Measurement of capacity include the units:

- Litres
- Millilitres
- Centilitres

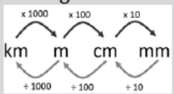
Measurements of mass include the units:

- Tonnes
- Grams
- Kilograms

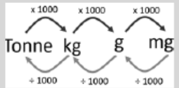
Converting between units, we use can use proportional reasoning.

For example:

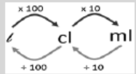
Metric length conversions:



Metric mass conversions:



Metric capacity conversions:

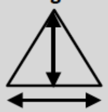


14 Area

Formula for the area of common 2D shapes.

Squares and Rectangles: area = length x width

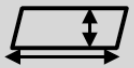
Triangles:



$$area = \frac{base \times perpendicular\ height}{2}$$

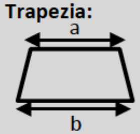
(perpendicular – at a right angle)

Parallelograms:

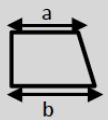


area = base x perpendicular height

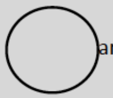
Trapezia:



area = $\frac{1}{2} \times (a + b) \times h$



Circles:



area = πr^2

For **compound shapes**, the shape will need to be broken down in the shapes that make the shape. All of the areas of the component shapes will need to be added together to find the area of the compound shape.

15 Time

Measurements of time include:
seconds, minutes, hours, days, weeks, fortnights, months, and years.

Time throughout the day is often given using an analogue or digital clock.

We often tell the time using either the 12-hour or the 24-hour clock.

12-hour clock	24-hour clock
1:25 pm	13:25
9:10 am	09:10

We can use time measurements in many everyday calculations, from knowing how long bus journey will take to calculating speed.

16 Compound Measure Calculations

Speed = $\frac{distance}{time}$

Density = $\frac{mass}{volume}$

Pressure = $\frac{force}{area}$

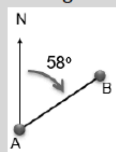
17 Map Scales

Scale drawings allow us to draw large objects on a smaller scale while keeping them accurate – for example maps.

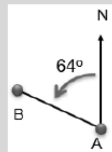
All scale drawings must have a scale on them. They are usually expressed as ratios.
Example: 1cm : 100cm This means that for every one cm on the map, the length will be 100 cm in real life.

18 Bearings

A bearing is an angle, measured clockwise from north. It must be given as three figures.



Bearing = 058°



Bearing = 360° - 64° = 296°

Bearings should be measured and drawn using a protractor. When drawing bearings, you may also be expected to use a scale to show distance from another object/place.

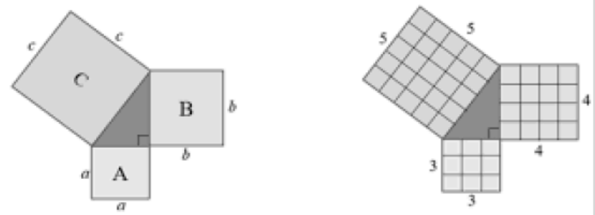
Year 9 Key Stage 3 Summer Term Knowledge Organiser - Pythagoras' Theorem and Trigonometry

Key Vocabulary:

1	Pythagoras' Theorem	In a right-angled triangle the square of the hypotenuse (long side) is equal to the sum of the square of the other two sides.
2	Trigonometry	The relationships between side lengths and angles of triangles, especially right-angled triangles.
3	Hypotenuse	The side opposite the right angle in a right-angled triangle. It is also the longest side of the right-angled triangle.
4	Square	To multiply a number by itself.
5	Square Root	The value when multiplied by itself gives a square number. E.g. the square root of 16 is 4 because 4 x 4 = 16, often seen as $\sqrt{16}$ = 4. The inverse of a square number.
6	Theta Θ	A letter from the Greek alphabet. It is used in Maths to represent an angle.
7	Opposite	The side opposite the angle of interest in a right-angled triangle.
8	Adjacent	The side in a right-angled triangle that is between the angle Θ and the right angle.
9	Tangent	In a right-angled triangle: the length of the side opposite the angle divided by the length of the adjacent side. Tan(Θ) = opposite ÷ adjacent
10	Sine	In a right-angled triangle: the length of the side opposite the angle divided by the length of the hypotenuse. Sin Θ = opposite ÷ hypotenuse
11	Cosine	In a right-angled triangle: the cosine is the length of the adjacent divided by the length of the hypotenuse. Cos Θ = adjacent ÷ hypotenuse

Pythagoras

11 Pythagoras's Theorem



area A + area B = area C

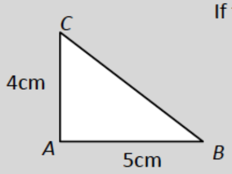
$a^2 + b^2 = c^2$

$3^2 + 4^2 = 5^2$

$9 + 16 = 25$

12 Pythagoras' Theorem - finding unknown sides

Find *BC*. Answer to 1 decimal place.



If finding long side Square and ADD

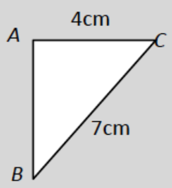
$5^2 + 4^2$ = 25 + 16 = 41

Square root

√41 = 6.4cm

13 Pythagoras' Theorem - finding unknown sides

Find *AB*. Answer to 1 decimal place.



If finding short side Square and SUBTRACT

49 – 16 = 33

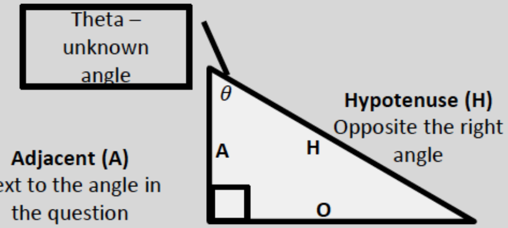
Square root

√33 = 5.7cm

Trigonometry

14 Trigonometry – labelling a triangle

In a trigonometric calculation, it usually involves an angle. Before we can start to calculate, we must label the triangle.



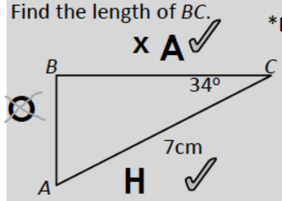
Hypotenuse (H)
Opposite the right angle

Adjacent (A)
Next to the angle in the question

Opposite (O)
Opposite the angle in the question

15 Trigonometry – finding a missing side

Find the length of *BC*.



*Label sides

S O H   C A H   T O A

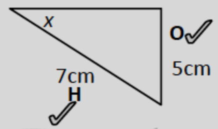
Cosθ = $\frac{A}{H}$

Cos34 = $\frac{x}{7}$ ×7 ×7

7 × cos34 = 5.8cm

16 Trigonometry – finding a unknown angle

Find angle x



*Label sides

Sinθ = $\frac{O}{H}$

Sinx = $\frac{5}{7}$

S O H   C A H   T O A

*2nd function for angles

x =$\sin^{-1}$(5 ÷ 7)

x =45.6°

Year 9 KS3 Summer Term Knowledge Organiser – Forming and Solving Equations

Key Vocabulary

1	Expression	A collection of one or more terms that can be made up of variables, constants, operators or grouping symbols.
2	Equation	A mathematical statement where each side of the equal sign are equal to the other.
3	Inverse	The opposite of another operation. For example: + is the inverse of -
4	Solve	To find the value of a variable that makes the equation true.
5	Form	When given a mathematical situation which can be described using algebraic expressions.
6	Variable	A symbol (usually a letter) for a value that isn't known yet.
7	Coefficient	A numerical constant quantity that is placed before a variable and shows multiplying of the variable in an algebraic expression or equation.
8	Expand	To multiply each term in the bracket by the expression outside of the bracket e.g.: 4(m+7) ≡ 4m+28 Or when there are two or more brackets together, to expand, each term in each bracket is multiplied by the other. E.g.: (x+2)(x+3) = x^2 +5x+ 6 It is the inverse of factorising.
9	Substitute	To replace a variable(s) in an algebraic expression with a value.
10	Evaluate	To find the value of an expression when the variable is replaced by a given number.

Solving one-step equations

Finding the value of an unknown, by identifying operations performed and doing the inverse operation:

$$\begin{array}{ccc} & x + 6 = 8 & \\ +6 & & -6 \\ & x = \mathbf{2} & \end{array}$$

Solving two-step Equations

Finding the value of an unknown, by identifying operations performed and doing the inverse operation:

$$\begin{array}{ccc} & 2x + 1 = 9 & \\ +1 & & -1 \\ & 2x = \mathbf{8} & \\ \times 2 & & \div 2 \\ & x = \mathbf{4} & \end{array}$$

Solving Equations involving fractions.

Finding the value of an unknown. To eliminate a denominator, multiply every term by the denominator:

$$\begin{array}{ccc} & \frac{x+3}{2} = 4 & \\ \div 2 & & \times 2 \\ & x + 3 = \mathbf{8} & \\ +3 & & -3 \\ & x = \mathbf{5} & \end{array}$$

Solving Equations with unknowns on both sides

Add/subtract the smallest algebraic term from both sides, so that the variable is only on one side.

$$\begin{array}{ccc} & 3a - 4 = 7a + 8 & \\ -3a & & -3a \\ & -4 = 4a + 8 & \\ -8 & & -8 \\ & -12 = 4a & \\ \div 4 & & \div 4 \\ & -3 = a & \end{array}$$

Forming Equations

Many of the situations where an equation is formed uses other areas of maths such as area, perimeter, money, angle facts etc.

Create an expression first using the information in the question and your mathematical knowledge.
Once you have your equation, you then solve the equation using the balance method.

Example:

James thinks of a number.
Kate's number is 14 less than James' number.
The sum of their numbers is 212.
What is Kate's number?

Let James' number be *n*, this means Kate number *n* – 14.

n + *n* – 14 = 212
2*n* – 14 = 212

Then solve to find the value of *n*.

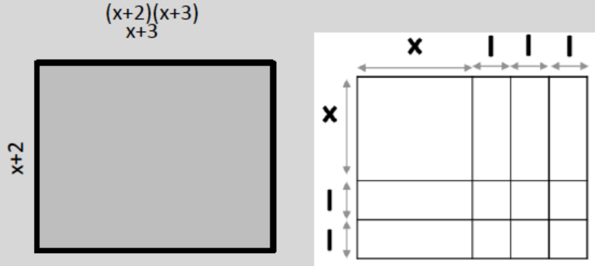
n = 113, so Kate's number is 99.

Area: expanding double brackets.

When calculating area, we multiply the height x width.
When multiplying dimensions using algebra, we put each expression into brackets.

We don't need to write the x sign

(x+2)(x+3)



x^2 +5x+ 6