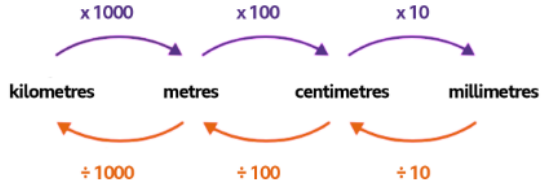
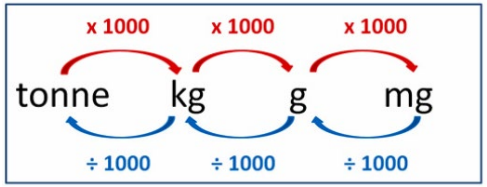
The Sutton Academy

Knowledge Rich Curriculum Plan

Year 9 Core – Measures, 2D Shapes and Angles

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
To learn how to convert metric units for measures.	• Students will know how to make simple conversions between units of length including mm, cm, m, km. • Students will know how to make simple conversions between units of mass including mg, g, kg, tonnes. • Students will know how to make simple conversions between units of volume including ml, cl, l. • Students will know how to make multi-step conversions between different units of length, mass and volume. E.g. mm to m etc. • Students will know how to make conversions between squared units. E.g. cm^2 *to* m^2 **Opportunity for challenge:** • Students will know how to make conversions between cubed units. E.g. cm^3 *to* m^3	**Convert –** change a value from one form to another **Metric** –A system of measurement that uses the meter, litre, and gram as base units of length, volume and mass **Capacity –** the maximum amount that something can contain. **Volume** – the amount of space inside a 3D object **Mass** – the weight of an object	• Students need to know how to multiply and divide by powers of 10.	 **Going from larger to smaller units (purple arrows):** • Kilometres to metres: multiply by 1000 (because 1 kilometre = 1000 metres) • Metres to centimetres: multiply by 100 (because 1 metre = 100 centimetres) • Centimetres to millimetres: multiply by 10 (because 1 centimetre = 10 millimetres) **Going from smaller to larger units (orange arrows):** • Millimetres to centimetres: divide by 10 • Centimetres to metres: divide by 100  • Metres to kilometres: divide by 1000 This diagram shows how to convert between different units of mass in the metric system: tonne, kilogram (kg), gram (g), and milligram (mg). **Converting from larger to smaller units (red arrows, multiply):** • Tonne to kilogram: multiply by 1,000 (1 tonne = 1,000 kilograms) • Kilogram to gram: multiply by 1,000 (1 kilogram = 1,000 grams) • Gram to milligram: multiply by 1,000 (1 gram = 1,000 milligrams) **Converting from smaller to larger units (blue arrows, divide):** • Milligram to gram: divide by 1,000 • Gram to kilogram: divide by 1,000 • Kilogram to tonne: divide by 1,000	

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				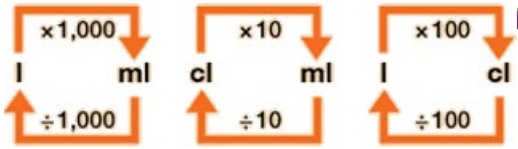 This diagram explains how to convert between three metric units of volume: litres (l), centilitres (cl), and millilitres (ml). **Converting from larger to smaller units (arrows going down/right, orange):** • From litres to millilitres: multiply by 1,000 (1 litre = 1,000 millilitres) • From centilitres to millilitres: multiply by 10 (1 centilitre = 10 millilitres) • From litres to centilitres: multiply by 100 (1 litre = 100 centilitres) **Converting from smaller to larger units (arrows going up/left, orange):** • From millilitres to litres: divide by 1,000 • From millilitres to centilitres: divide by 10 From centilitres to litres: divide by 100	
To learn how to measure, draw and estimate angles.	• Students will know how to accurately estimate angles based on their knowledge of the types of angles. • Students will know how to use a protractor to measure an angle. • Students will know how to draw an angle. • Students will know how to measure reflex angles. • Students will know how to draw reflex angles.	**Estimate –** roughly calculate or judge the value, number, quantity, or extent of. **Acute angle –** An angle that is less than 90° **Obtuse angle –** An angle that is more than 90° but less than 180° **Reflex angle –** An angle that is more than 180° but less than 360° **Right angle –** An angle that is exactly 90°	• Students need to know how to identify different types of angles.	<u>Step to Success – Measuring angles</u> **Step 1:** Place the centre of the protractor on the corner of the angle – take care and be accurate with this! Step 2: Match up the line on the protractor with the base line of the angle. **Step 2:** Read off the size of the angle you on the protractor – remember to start at 0 to ensure you use the correct set of numbers on the protractor. **Step 3:** Check your answer looks right: • If you are measuring an acute angle you should have an answer less than 90°. • If you are measuring an obtuse angle you should have an answer more than 90° but less than 180°. • If you are measuring a reflex angle you should have an answer more than 180°. <u>Step to Success – Drawing angles</u> **Step 1:** Draw a base line if one is not provided for you. **Step 2:** Place the centre of the protractor on the end of the line. If you want your angle to be on the left go to the left end of the line and if you want your angle to be on the right then go to the right end of the line. **Step 3:** Start from 0 on your line and follow it round until you get to the required measurement and make a mark. **Step 4:** Connect the mark with the end of the line that you measured from.	Do this as consolidation for bearings

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				Step 5: Check your answer looks right: • If you are drawing an angle less than 90° then your answer should look like an acute angle. • If you are drawing an angle more than 90° but less than 180° your answer should look like an obtuse angle. If you are drawing an angle more than 180° your answer should look like a reflex angle.	
To learn how to find missing angles.	• Students will know that vertically opposite angles are equal. • Students will know how to use angle facts to find missing angles on straight lines. • Students will know how to use angle facts to find missing angles at a point. • Students will know that angles in an equilateral triangle are equal - 60°. • Students will know how to use angle facts to find the missing angles in triangles. • Students will know how to use angle facts to find missing angles in special triangles. • Students will know how to use angle facts to find the missing angles in quadrilaterals. • Students will know how to solve multi-step problems involving angles in triangles, quadrilaterals and other basic angle rules (straight lines, around a point etc.) **Encourage students to write reasons for every missing angle that they find.**	Isosceles Triangle – a triangle with two equal sides and two equal angles Equilateral Triangle – a triangle with three equal sides and three equal, 60° angles Scalene Triangle – a triangle with no equal sides or angles Quadrilateral – a four-sided polygon, having four edges and four corners	• Students need to know how to add and subtract using the column method.	**Steps to Success – Angles on a straight line** **Step 1:** Add up the angles that you know. **Step 2:** Subtract the angles known from 180°. **Step 3:** Write, 'Angles on a line add up to 180°' as your reason. You may also need to write any other reasons that you have used to find that angle. **Steps to Success – Angles at a point** **Step 1**: Add up the angles that you know. **Step 2**: Subtract the angles you know from 360°. **Step 3**: Write: 'angles at a point add up to 360°', as your reason. You may also need to write any other reasons that you have used to find that angle. **Steps to Success – Angles in a triangle** **Step 1:** Add up the angles you know. **Step 2:** Subtract the known angles from 180°. **Step 3:** Write: 'Angles in a triangle add upto 180°' as your reason. You also need to write any other reasons that you have used to find that angle. **Steps to Success – Angles in special triangles** **Step 1:** Identify the type of triangle and think about what makes this triangle different or special compared to normal ones. **Step 2:** You may be able to identify an angle without any calculation – place this on the diagram. If this is not the case then go to step 3. **Step 3:** Add up the angles you know. **Step 4:** Subtract the known angles from 180°. You be required to split this in half for some isosceles angles. If this is not the case then go straight to step 5. **Step 5:** Write: 'Angles in a triangle add upto 180°' as well as one of the reasons below. • Two angles in an isosceles triangle are equal. • The three angles in an equilateral triangle are equal and 60°. **Steps to Success – Angles in a quadrilateral** **Step 1:** Add up the angles you know. **Step 2:** Subtract the known angles from 360°.	

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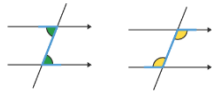
				Step 3: Write: 'Angles in a quadrilateral add upto 360°' as your reason. You also need to write any other reasons that you have used to find that angle.	
To learn how to calculate interior and exterior angles in polygons.	• Students will know how to use angles in a triangle add up to 180° to find the angle sums of any polygon. • Students will know how to find the sum of interiors angles of any polygon. • Students will know how to find one interior angle of a regular polygon. • Students will know how to find one exterior angle. • Students will know that interior and exterior angles add up to 180° as they sit on a straight line. **Opportunity for challenge:** • Students will know how to solve basic problems with interior and exterior angles.	**Interior** – Inside **Polygon** – a closed shape with straight sides **Regular Polygon** – A polygon where all sides are the same length and all angles are equal **Irregular Polygon** – A polygon where all sides are the same length and all angles are not equal **Exterior** – Outside **Exterior angle** – is the angle between a side of a polygon and an extended adjacent side.	• Students need to know that angles in a triangle add up to 180°. • Students need to recognise and identify different types of polygons.	<u>Steps to Success – Interior angles of a regular polygon</u> **Step 1:** Check that you shape is regular. Does it have equal sides and equal angles? **Step 2:** Calculate the sum of the interior angles by using the formula: $Sum\ of\ the\ interior\ angles = (n-2) \times 180$ Where, n, is the number of sides. **Step 3:** Divide this sum by how many equal angles the polygon has. <u>Steps to Success – Missing angle of an irregular polygon</u> **Step 1:** Check that you shape is irregular. Not all the sides or angle are equal. **Step 2:** Calculate the sum of the interior angles by using the formula: $Sum\ of\ the\ interior\ angles = (n-2) \times 180$ Where, n, is the number of sides. **Step 3:** Add up all the known angles. **Step 4:** Subtract the sum of the known angles from the sum of the interior angles to find the missing angle. <u>Steps to Success – Exterior angles of a regular polygon</u> **Step 1:** Check that you shape is regular. Does it have equal sides and equal angles? **Step 2:** The sum of exterior angles in any polygon is 360°. Divide 360° by the number of exterior angles to find the value of one exterior angle.	
To learn how to solve problems involving angles in polygons.	• Students will know how to solve problems involving interior and exterior angles.		• Students need to know how to find interior and exterior angles of regular polygons.		
To learn how to find missing angles in parallel lines.	• Students will know that alternate angles are equal. • Students will know how to identify alternate angles. • Students will know that corresponding angles are equal. • Students will know how to identify corresponding angles. **Encourage students to write reasons for every missing angle that they find.** *Tracing paper may be helpful for this lesson	**Parallel –** parallel lines are two lines that are side by side and have the same distance continuously between them **Isosceles Triangle –** a triangle with two equal sides and two equal angles **Corresponding –** matching **Co-interior Angles –** angles that lie between two lines and on the same side of a transversal **Transversal –** a line that crosses at least two other lines	• Students need to know how to find missing angles on a straight line, at a point and vertically opposite.	<u>Alternate angles</u> **Alternate angles** are two angles, formed when a line crosses two other lines, that lie on opposite sides of the **transversal** line and on opposite relative sides of the other lines. If the two lines crossed are parallel, the alternate angles are equal. **Alternate angles** are equal.  <u>Corresponding angles</u>	

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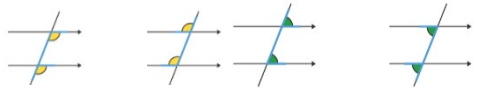
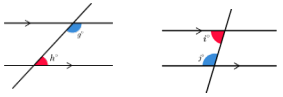
				Corresponding angles are angles that occur on the same side of the transversal line and are equal in size. They are either both obtuse or both acute. **Corresponding** means matching. **Corresponding angles** are equal.  **Co-interior angles** **Co-interior angles** are angles on the same side of the **transversal** and inside the parallel lines. The two angles that occur on the same side of the transversal always add up to 180º. **Co-interior** angles add up to 180º. 	
To learn how to find missing angles in parallel lines using a combination of rules.	• Students will know how to use a mixture of parallel line rules to find missing angles.		• Students need to know how to find missing angles on a straight line, at a point and vertically opposite. • Students need to know how to find missing angles on parallel lines.		
To learn how measure bearings.	• Students will know how to use a protractor and ruler to accurately measure bearings on a map, including measuring from A to B and B to A. • Students will know how to measure reflex bearings.	**Bearing –** angles, measured clockwise from north involving 3 digits	• Students need to know how to measure and draw angles.	**Steps to Success- Measuring bearings** **Step 1:** Draw a line connecting the two points unless this has been drawn for you. **Step 2:** Identify which point you are measuring the bearing **from.** **Step 3:** Place the protractors centre on the bottom of the line with 0 on the **North** line. **Step 4:** Measure the size of the angle, remembering to measure **clockwise.** **Step 5:** Record your bearing, ensuring it has 3 digits. If the angle is less than 100, place a zero as the first digit. **Steps to Success- Measuring reflex bearings** **Step 1:** Draw a line connecting the two points unless this has been drawn for you. **Step 2:** Identify which point you are measuring the bearing **from.** **Step 3:** Measure the smaller angle. This will be **anticlockwise** from the North. **Step 4:** Subtract this angle from 360°. **Step 5:** Record your bearing, ensuring it has 3 digits.	
To learn how to draw bearings.	• Students will know how to use a protractor to accurately draw bearings from A to B and B to A.		• Students will need to know how to measure bearings.	**Steps to Success- Drawing bearings**	

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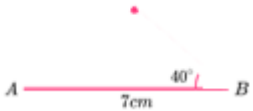
	• Students will know how to draw reflex bearings. **Opportunity for challenge:** Students will know how to draw a point at a given bearing and distance from a point.			**Step 1:** Identify which point you are drawing the bearing **from.** **Step 2:** Draw the North line at that point unless it has been drawn for you. **Step 3:** Place the protractors centre on the bottom of the line with 0 on the **North** line. **Step 4:** Measure the angle in the question, remembering that bearings are measured **clockwise**. **Step 5:** Make a marking at the position of the angle, then draw through the point to the required measurement as given in the question. **Steps to Success- Drawing reflex bearings** **Step 1:** Identify which point you are drawing the bearing **from.** **Step 2:** Draw the North line at that point unless it has been drawn for you. **Step 3:** Subtract your angle from 360° Step 4: Place the protractors centre on the bottom of the line with 0 on the **North** line. **Step 4:** Measure the smaller angle, remembering that this time we are measuring **anticlockwise**. **Step 5:** Make a marking at the position of the angle, then draw through the point to the required measurement as given in the question.	
To learn how to construct triangles.	• Students will know how to use a pair of compasses to accurately draw a circle when given the radius. • Students will know how to construct SAS triangles using a ruler and protractor. • Students will know how to construct ASA triangles using a ruler and protractor. • Students will know how to construct SSS triangles using a ruler and compass.	Construct – In maths, construct means to draw a shape, line or angle accurately using a compass and rule	• Students need to know how to draw straight lines accurately with a ruler. • Students need to know how to draw angles using a protractor.	**Steps to Success- Constructing SAS Triangles** **Step 1: Draw the base.** Use a pencil and a ruler to draw the base.  **Step 2: At one end point measure one angle.** At point B use a protractor to measure the angle 40˚, make a mark.  **Step 3: At the end point draw a line.** Use a ruler to measure 5cm from point B, while making sure that the ruler lines up with the mark you made in step 2.  **Step 4: Complete the triangle.** Use your ruler to draw a straight line from point A to the end of the 5cm line drawn in step 3.	

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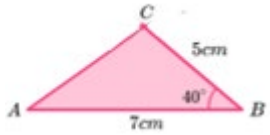
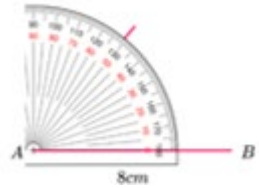
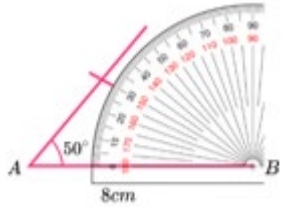
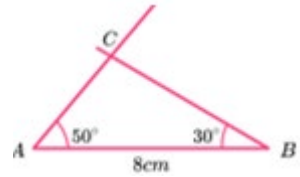
				 **Steps to Success- Constructing ASA Triangles** **Step 1: Draw the base.** Use a pencil and a ruler to draw the base.  **Step 2: At one end point measure one angle.** At point A use a protractor to measure the angle 50˚, make a mark and then draw a straight line from point A through the mark. Make this line long.  **Step 3: At the other end point measure the second angle.** At point B use a protractor to measure the angle 30˚, make a mark and then draw a straight line from point B though the mark.  **Step 4: Complete the triangle.** Make sure that the two lines intersect each other to form the triangle. **Leave all construction lines visible!**  **Steps to Success- Constructing SSS Triangles** **Step 1: Draw the base.** Use a pencil and a ruler to draw the base. It is usually easier to use the longest side. 	

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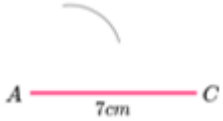
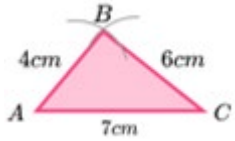
				Step 2: Set compasses for the second side and draw an arc. Open the compasses to 4cm. Place the point on point A and draw an arc. Make sure this arc is longer than you think necessary.  **Step 3: Set compasses for the third side and draw an arc.** Open the compasses to 6cm. Place the point on point C and draw an arc. This second arc should cross the first arc. If they don't cross you may have to go make and draw the arc's longer.  **Step 4: Join up the intersection of the arcs.** Complete the triangle by joining the point where the arcs intersect to point A and point C. **Leave all construction lines visible!** 	
To learn how to perpendicular bisectors and angle bisectors.	• Students will know how to construct a perpendicular bisector of a line. • Students will know how to construct an angle bisector. • Students will know that the perpendicular distance from a point to a line is the shortest distance to the line. • Students will know how to construct a perpendicular line from a point to a line.	Perpendicular – at a right angle to Bisect – cut into two equal parts Bisector – A line that splits an angle or line into two equal parts	• Students need to know how to use a compass to draw circles.	<u>Steps to Success- Constructing perpendicular bisectors</u> **Step 1: Use compasses to draw an arc.** Open the compasses to about three-quarters of the length of the line. Put the point of the compasses on one of the endpoints of the line. Draw an arc.  **Step 2: Use the compasses to draw a second arc, intersecting the first arc.** Keeping the compasses, the same, draw another arc from the other end of the line.	

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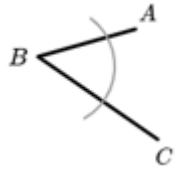
				 **Step 3: Join the two points where the arcs intersect.** Using a ruler, join up the two points where the arcs intersect each other. The new line is the perpendicular bisector of the original line segment *AB*.  **Step 4: Check.** You can check that the new line goes through the midpoint of the line segment *AB* by using a ruler to measure. The line *AB* should have been cut into two equal halves. You can also check if the lines meet at a right angle. **Steps to Success- Constructing angle bisectors** **Step 1: Use compasses to draw an arc.** Set your compasses to a length that is less than the shortest line. Putting the point of the compasses on *B*, draw one arc going through both *AB* and *BC*.  **Step 2: Use the compasses to draw two more arcs.** Put the point of the compasses on the point where the first arc crossed *AB* and draw an arc. Keep the compass on the same setting. Repeat by putting the point of the compasses on the point where the first arc crossed *BC* and draw an arc. These two arcs need to intersect.	

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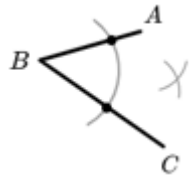
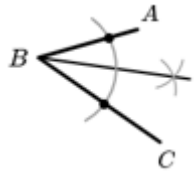
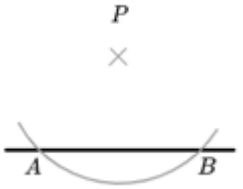
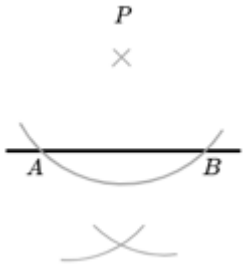
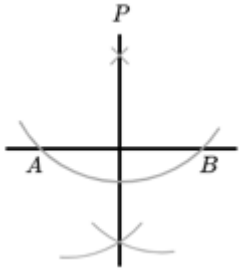
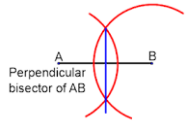
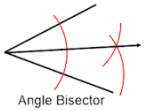
				 **Step 3: Join the vertex with the point where the arcs intersect.** Using a ruler, join up the point where the arcs intersect each other with the vertex *B*. The new straight line is the angle bisector of the original angle *ABC* and splits it into two equal parts.  **Step 4: Check.** You can check that the new straight line bisects the angle *ABC* by using a protractor. **Steps to Success- Constructing a perpendicular line to a point** **Step 1: Draw two arcs crossing the line segment.** Put the point of the compasses on the original point *P*. Draw an arc that crosses the original line in two places. These are labelled *A* and *B*.  **Step 2: Make two more arcs which intersect.** Put the point of the compasses on point *A* where an arc crosses the line and draw another arc. Keep the compasses on the same setting. Repeat with point *B*, drawing another arc to intersect the arc just drawn. 	

Lesson objective	Intended Knowledge:	Tiered Vocabulary	Prior Knowledge:	Steps to Success	Feedback
				Step 3: Join the point where the arcs intersect to the original point. Using a ruler, join up the point where the arcs intersect each other and the original point *P*. The new line is perpendicular to the original line segment. The new line will have also bisected the length *AB* – this may not be true for all questions.  **Step 4: Measure the line.** You may be asked to measure the shortest distance from the point to the line. To do this measure the line you have constructed.	
To learn how to construct loci.	• Students will know how to construct a region bounded by a circle. • Students will know how to construct a region bounded by two circles. • Students will know how to construct a given distance from a point. • Students will know how to construct a given distance from a line. • Students will know how to construct equal distances from two points. • Students will know how to construct equal distances from two-line segments. • Students will know how to construct regions defined by 'less than', 'nearer to' or 'greater than'. **Opportunity for challenge:** • Students will know how to use constructions to solve loci problems.	**Locus (Loci is the plural) –** the set of all points (usually forming a curve or surface) satisfying some condition **Equidistant –** an equal distance	• Students need to know how to draw circles using a known radius. • Students need to know how to draw line and angle bisectors.	<u>Loci – Key points:</u> • When 1 point is involved draw a circle/arc e.g. more than 4cm away from C  • When 2 points are involved draw a perpendicular bisector e.g. closer to A than B  • When 2 sides are involved draw an angle bisector e.g. closer to AB than BC  • When 1 side is involved draw a straight line e.g. more than 3cm away from AC 	
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