

**Term 2: Unit 2 [Measurement & Geometry]**

**Year 10 Australian Curriculum Achievement Standard:**

By the end of Year 10, students recognise the connection between simple and compound interest. They solve problems involving linear equations and inequalities. They make the connections between algebraic and graphical representations of relations. **Students solve surface area and volume problems relating to composite solids.** They recognise the relationships between parallel and perpendicular lines. **Students apply deductive reasoning to proofs and numerical exercises involving plane shapes.** They compare data sets by referring to the shapes of the various data displays. They describe bivariate data where the independent variable is time. Students describe statistical relationships between two continuous variables. They evaluate statistical reports.

Students expand binomial expressions and factorise monic quadratic expressions. **They find unknown values after substitution into formulas.** They perform the four operations with simple algebraic fractions. Students solve simple quadratic equations and pairs of simultaneous equations. **They use triangle and angle properties to prove congruence and similarity.** **Students use trigonometry to calculate unknown angles in right-angled triangles.** Students list outcomes for multi-step chance experiments and assign probabilities for these experiments. They calculate quartiles and inter-quartile ranges.

**Unit Overview:**

In this unit students will develop essential skills within the areas of geometry and measurement. Students will focus on being able to calculate unknown values after substitution into a formula for both surface area and volume. In addition to this, students will be able to apply trigonometry to calculate sides and angles within right-angled triangles. Students will also have a focus on recognising angle relationships between parallel and perpendicular lines, as well as using triangle and angle properties to prove congruence and similarity.

**Assessment Overview**

**Plus - Measurement & Geometry**

**General - Measurement & Geometry**

<p><b>Item [2] – PSMT</b>  <b>Scheduled</b> – Weeks 4,5 &amp; 6  <b>Length</b> – 3 Weeks</p> <p><b>Key Skill/s:</b></p> <ul style="list-style-type: none"> <li>• <b>Substitute</b> values into formulas to determine an unknown</li> </ul> <p><b>Conditions:</b>                  Assessment is one in-class exam.</p>	<p><b>Item [3] - EXAM</b>  <b>Scheduled</b> – Week 11 <i>Exam Block</i>  <b>Length</b> – 90 Min</p> <p><b>Key Skill/s:</b></p> <ul style="list-style-type: none"> <li>• Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids</li> <li>• Formulate proofs involving congruent triangles and angle properties</li> <li>• Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes</li> <li>• Solve right-angled triangle problems including those involving direction and angles of elevation and depression</li> <li>• Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids</li> <li>• Prove and apply angle and chord properties of circles</li> <li>• Establish the sine, cosine and area rules for any triangle and solve related problems</li> <li>• Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies</li> <li>• Solve simple trigonometric equations</li> <li>• Pythagoras' theorem and trigonometry to solving three-dimensional problems in right-angled triangles</li> </ul> <p><b>Conditions:</b>                  Assessment is one in-class exam.                  Students will work <b>INDIVIDUALLY</b> following test protocols.  <b>Refer to KSHS Test protocol</b></p>	<p><b>Item [2] – PSMT</b>  <b>Scheduled</b> – Weeks 4,5 &amp; 6  <b>Length</b> – 3 Weeks</p> <p><b>Key Skill/s:</b></p> <ul style="list-style-type: none"> <li>• <b>Substitute</b> values into formulas to determine an unknown</li> </ul>	<p><b>Item [3] - EXAM</b>  <b>Scheduled</b> - Week 11 <i>Exam Block</i>  <b>Length</b> – 60 Min</p> <p><b>Key Skill/s:</b></p> <ul style="list-style-type: none"> <li>• Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids</li> <li>• Formulate proofs involving congruent triangles and angle properties</li> <li>• Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes</li> <li>• Solve right-angled triangle problems including those involving direction and angles of elevation and depression</li> </ul> <p><b>Conditions:</b>                  Assessment is one in-class exam.                  Students will work <b>INDIVIDUALLY</b> following test protocols. <b>Refer to KSHS Test protocol</b></p>
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Guaranteed Vocabulary:	Design Question Four Strategy	Design Question Five Strategy		21 <sup>st</sup> Century Skill:
<p><b>Technical Vocabulary:</b> Surface area, volume, trigonometric equations, periodic,</p> <p><b>Procedural Vocabulary:</b> Substitution, Solve, Find, , Evaluate, Calculate, Define</p> <p><b>Conventions &amp; Symbols:</b> square and cubed units (cm<sup>2</sup>, cm<sup>3</sup>)</p>	<p>Students will primarily be <b>practising</b> exercises with routinely set homework and <b>feedback</b> structure.</p> <p>Students will <b>practice</b> a variety of questions and contexts through textbook examples</p> <p>Students will be encouraged to write their own questions and these can be swapped with other students to increase <b>engagement/collaboration</b></p>	<p>Students will <b>investigate</b> real world scenarios through the calculation of surface area and volume in real-world contexts.</p>	<p>Using the reading as a mathematician to interpret and model word problems and develop strategies to <b>solve</b> them.</p>	<p><b>Critical thinking:</b> analytical thinking, problem-solving, decision-making, reasoning, reflecting &amp; evaluating, intellectual flexibility</p> <p><b>Creative thinking,</b> curiosity &amp; imagination, identifying alternatives, seeing or making new links</p> <p><b>Communication:</b> effective oral and written communication, using language, symbols and texts</p> <p><b>Collaboration and teamwork:</b> participating &amp; contributing</p> <p><b>Personal and social skills:</b> management (self, career, time, planning and organising), character (resilience, mindfulness, open- and fair-mindedness, self-awareness)</p>
Guaranteed Skills/Language Features:	Reading Comprehension Skill & Strategy	Cognitive Verbs		ICT to Enhance learning:
<p>Substitution into formulas for surface area, volume, Pythagoras' theorem and trigonometric ratios.</p> <p>Calculate unknown sides and angles in right angled triangles.</p> <p>Solve surface area and volume problems in standard 3D shapes and composite shapes.</p> <p>Recognise relationships between angles in parallel and perpendicular lines.</p> <p>Use of triangle and angle properties to prove similarity and congruence.</p> <p>Apply Pythagorean theorem to real life contexts.</p> <p>Identify errors and check solutions.</p> <p><i>Solve trigonometric equations using periodicity.</i></p> <p><i>Apply volume and surface area to real life situations.</i></p>	<p><b>Reading as a Mathematician</b></p> <p><b>Students will complete the following steps when starting a problem:</b></p> <ol style="list-style-type: none"> <li>1. Scan the whole problem.</li> <li>2. Identify the task. It could be a:</li> <li>3. Reread the problem. What is important to help you solve the problem?</li> <li>4. Translate - (create a mathematical model)</li> <li>5. Solve the problem.</li> </ol>	<p><b>Item 2 – PSMT Retrieval &amp; Comprehension</b></p> <ul style="list-style-type: none"> <li>• Explain - make an idea or situation plain or clear by describing it in more detail or revealing relevant facts; give an account; provide additional information</li> </ul> <p><b>Knowledge Utilisation</b></p> <ul style="list-style-type: none"> <li>• Comment - express an opinion, observation or reaction in speech or writing; give a judgment based on a given statement or result of a calculation</li> <li>• Conduct - direct in action or course; manage; organise; carry out</li> <li>• Hypothesise - formulate a supposition to account for known facts or observed occurrences; conjecture, theorise, speculate; especially on uncertain or tentative grounds</li> <li>• Investigate - carry out an examination or formal inquiry in order to establish or obtain facts and reach new conclusions; search, inquire into, interpret and draw conclusions about data and information</li> <li>• Justify - give reasons or evidence to support an answer, response or conclusion; show or prove how an argument, statement or conclusion is right or reasonable</li> </ul>	<p><b>Item 3 – EXAM Retrieval &amp; Comprehension</b></p> <ul style="list-style-type: none"> <li>• Symbolise - represent or identify by a symbol or symbols</li> <li>• Calculate - determine or find (e.g. a number, answer) by using mathematical processes; obtain a numerical answer showing the relevant stages in the working; ascertain/determine from given facts, figures or information</li> </ul> <p><b>Analytical Processes</b></p> <ul style="list-style-type: none"> <li>• Identify (Errors/Problems) – distinguish; locate, recognise and name; establish or indicate who or what someone or something is; provide an answer from a number of possibilities; recognise and state a distinguishing factor or feature</li> <li>• Interpret - use knowledge and understanding to recognise trends and draw conclusions from given information; make clear or explicit; elucidate or understand in a particular way; give one's own interpretation of; identify or draw meaning from, or give meaning to, information presented in various forms, such as words, symbols, pictures or graphs</li> </ul>	<p>Use of Scientific calculators</p>

**YEAR 10 - UNIT 2: Measurement & Geometry**

Content Descriptors	Elaborations	Kirwan High Learning Goals
<b>Measurement &amp; Geometry</b>		
<ul style="list-style-type: none"> <li>Solve problems involving surface area and volume for a range of prisms, cylinders and composite solids (ACMMG242)</li> </ul>	<ul style="list-style-type: none"> <li>investigating and determining the volumes and surface areas of composite solids by considering the individual solids from which they are constructed</li> </ul>	<i>I Can...</i> <ul style="list-style-type: none"> <li>I can define surface area and volume.</li> <li>I can substitute into formulas for surface area in order to solve for an unknown.</li> <li>I can calculate the surface area and volume of composite solids.</li> <li>I can substitute into formulas for volume in order to solve for an unknown.</li> </ul>
<ul style="list-style-type: none"> <li>Formulate proofs involving congruent triangles and angle properties (ACMMG243)</li> </ul>	<ul style="list-style-type: none"> <li>applying an understanding of relationships to deduce properties of geometric figures (for example the base angles of an isosceles triangle are equal)</li> </ul>	<ul style="list-style-type: none"> <li>I can state the rules for congruency and similarity.</li> <li>I can use proofs and logical reasoning to show that triangles are similar or congruent.</li> </ul>
<ul style="list-style-type: none"> <li>Apply logical reasoning, including the use of congruence and similarity, to proofs and numerical exercises involving plane shapes (ACMMG244)</li> </ul>	<ul style="list-style-type: none"> <li>distinguishing between a practical demonstration and a proof (for example demonstrating triangles are congruent by placing them on top of each other, as compared to using congruence tests to establish that triangles are congruent)</li> <li>performing a sequence of steps to determine an unknown angle giving a justification in moving from one step to the next.</li> <li>communicating a proof using a sequence of logically connected statements</li> </ul>	<ul style="list-style-type: none"> <li>I can use proofs to demonstrate that triangles are congruent or similar.</li> <li>I can communicate a proof through logical sequencing.</li> </ul>
<ul style="list-style-type: none"> <li>Solve right-angled triangle problems including those involving direction and angles of elevation and depression (ACMMG245)</li> </ul>	<ul style="list-style-type: none"> <li>applying Pythagoras' Theorem and trigonometry to problems in surveying and design</li> </ul>	<ul style="list-style-type: none"> <li>I can use trigonometric ratios and Pythagoras' theorem to solve for unknown angles and sides in right-angled triangles.</li> <li>I can apply Pythagoras' theorem and trigonometric ratios to problems in a real-life context.</li> </ul>

**10 A - The following descriptors will only be completed by 10 Plus**

<b>Measurement and Geometry</b>		
<ul style="list-style-type: none"> <li>Solve problems involving surface area and volume of right pyramids, right cones, spheres and related composite solids (ACMMG271)</li> </ul>	<ul style="list-style-type: none"> <li>using formulas to solve problems</li> <li>using authentic situations to apply knowledge and understanding of surface area and volume</li> </ul>	<ul style="list-style-type: none"> <li>I can substitute into formulas to find the surface area of right pyramids, right cones and spheres.</li> <li>I can substitute into formulas to find the volume of right pyramids, right cones and spheres.</li> <li>I can calculate the surface area and volume of composite solids.</li> </ul>
<ul style="list-style-type: none"> <li>Prove and apply angle and chord properties of circles (ACMMG272)</li> </ul>	<ul style="list-style-type: none"> <li>performing a sequence of steps to determine an unknown angle or length in a diagram involving a circle, or circles, giving a justification in moving from one step to the next</li> <li>communicating a proof using a logical sequence of statement</li> <li>proving results involving chords of circles</li> </ul>	<ul style="list-style-type: none"> <li>I can use logical reasoning to determine and prove an unknown angle or length within a diagram involving circles.</li> </ul>
<ul style="list-style-type: none"> <li>Establish the sine, cosine and area rules for any triangle and solve related problems (ACMMG273)</li> </ul>	<ul style="list-style-type: none"> <li>applying knowledge of sine, cosine and area rules to authentic problems such as those involving surveying and design</li> </ul>	<ul style="list-style-type: none"> <li>I can state the sine and cosine rules.</li> <li>I can substitute into sine and cosine rules in order to solve for the unknown side or angle.</li> <li>Apply sine and cosine rules to real life contexts.</li> </ul>
<ul style="list-style-type: none"> <li>Use the unit circle to define trigonometric functions, and graph them with and without the use of digital technologies (ACMMG274)</li> </ul>	<ul style="list-style-type: none"> <li>establishing the symmetrical properties of trigonometric functions</li> <li>investigating angles of any magnitude</li> <li>understanding that trigonometric functions are periodic and that this can be used to describe motion</li> </ul>	<ul style="list-style-type: none"> <li>I can solve basic trigonometric equations over the domain <math>0^\circ \leq \theta \leq 360^\circ</math></li> <li>I can use periodicity to solve trigonometric equations.</li> </ul>
<ul style="list-style-type: none"> <li>Solve simple trigonometric equations (ACMMG275)</li> </ul>	<ul style="list-style-type: none"> <li>using periodicity and symmetry to solve equations</li> </ul>	
<ul style="list-style-type: none"> <li>Pythagoras' theorem and trigonometry to solving three-dimensional problems in right-angled triangles (ACMMG276)</li> </ul>	<ul style="list-style-type: none"> <li>investigating the applications of Pythagoras' theorem in authentic problems</li> </ul>	<ul style="list-style-type: none"> <li>I can state Pythagoras' theorem.</li> <li>I can apply Pythagoras' theorem within authentic problems.</li> </ul>

<b>Possible Habit of Mind:</b>				
<b>Exploring Meaning of the HOM</b> By the end of this unit students will be able to:	<b>Expanding Capacity for using the HOM</b> By the end of this unit students will be able to:	<b>Increasing Alertness for the HOM</b> By the end of this unit students will be able to:	<b>Extending Values of the HOM</b> By the end of this unit students will be able to:	<b>Building Commitment towards the HOM</b> By the end of this unit students will be able to:
<b>General Capabilities:</b> This unit provides opportunities for students to engage in following capabilities:				
<b>Literacy</b> <input checked="" type="checkbox"/> <b>Comprehending texts through listening, reading and viewing</b> <input type="checkbox"/> Composing texts through speaking, writing and creating <input type="checkbox"/> Text knowledge <input type="checkbox"/> Grammar knowledge <input checked="" type="checkbox"/> <b>Word knowledge</b> <input type="checkbox"/> Visual knowledge <b>Numeracy</b> <input checked="" type="checkbox"/> Estimating and calculating with whole numbers <input checked="" type="checkbox"/> <b>Recognising and using patterns and relationships</b> <input checked="" type="checkbox"/> <b>Using fractions, decimals, percentages, ratios and rates</b> <input type="checkbox"/> Using spatial reasoning <input type="checkbox"/> Interpreting statistical information <input type="checkbox"/> Using measurement	<b>ICT</b> <input type="checkbox"/> Applying social and ethical protocols and practices when using ICT <input type="checkbox"/> Investigating with ICT <input type="checkbox"/> Creating with ICT <input type="checkbox"/> Communicating with ICT <input type="checkbox"/> Managing and operating ICT <b>Critical and creative thinking</b> <input checked="" type="checkbox"/> <b>Inquiring - identifying, exploring and organising information and ideas</b> <input type="checkbox"/> Generating ideas, possibilities and actions <input type="checkbox"/> Reflecting on thinking and processes <input checked="" type="checkbox"/> <b>Analysing, synthesising and evaluating reasoning and procedures</b>	<b>Personal and social capability</b> <input type="checkbox"/> Self-awareness <input checked="" type="checkbox"/> <b>Self-management</b> <input type="checkbox"/> Social awareness <input type="checkbox"/> Social management <b>Ethical understanding</b> <input checked="" type="checkbox"/> <b>Understanding ethical concepts and issues</b> <input checked="" type="checkbox"/> <b>Reasoning in decision making and actions</b> <input checked="" type="checkbox"/> <b>Exploring values, rights and responsibilities</b> <b>Intercultural understanding</b> <input type="checkbox"/> Recognising culture and developing respect <input type="checkbox"/> Interacting and empathising with others <input type="checkbox"/> Reflecting on intercultural experiences and taking responsibility		
<b>Cross Curriculum Priorities:</b>				
<input type="checkbox"/> Aboriginal and Torres Strait Islander histories and cultures	<input type="checkbox"/> Asia and Australia's engagement with Asia	<input type="checkbox"/> Sustainability		
<b>Differentiation [for small groups or individuals]:</b>				
The learning experiences within this unit can be differentiated by increasing: <ul style="list-style-type: none"> <li>• The frequency of exposure for some students</li> <li>• The intensity of teaching by adjusting the group size</li> <li>• The duration needed to complete tasks and assessment</li> </ul> Teachers are encouraged to use hands on, visual approaches or real life where necessary. This provides clear links to the outside world and provides concrete examples for students. Increasing the complexity of problems will also allow an opportunity for higher order thinking and for students to solve problems with multiple steps.				