FERNY GROVE
State High School

Mathematics Department
Year 10 Mainstream Unit Two Plan

Unit: Linear Algebra and Relationships	**Duration:** 10 Weeks

Unit Outline

Australian Curriculum Year Level Description:

- **understanding** includes **applying the four operations to algebraic fractions**, **finding unknowns in formulas after substitution, making the connection between equations of relations and their graphs,** comparing simple and compound interest in financial contexts and determining probabilities of two- and three-step experiments
- **fluency** includes factorising and expanding algebraic expressions, **using a range of strategies to solve equations** and using calculations to investigate the shape of data sets
- **problem-solving** includes calculating the surface area and volume of a diverse range of prisms to solve practical problems, finding unknown lengths and angles using applications of trigonometry, **using algebraic and graphical techniques to find solutions to simultaneous equations and inequalities** and investigating independence of events
- **reasoning** includes formulating geometric proofs involving congruence and similarity, interpreting and evaluating media statements and interpreting and comparing data sets.

This unit:

Through the sub-strands Patterns and algebra and Linear and non-linear relationships, students have opportunities to develop understanding of:

- linear equations - exploring connections between algebraic and graphical representations, making generalisations in relation to parallel and perpendicular lines and solving problems
- simultaneous equations - identifying the solution to two intersecting linear equations, applying graphical, elimination and substitution methods and solving word problems
- inequalities - recognising the difference between linear equations and linear inequalities, graphing linear inequalities and solving simple problems.
- algebraic expressions - simplifying and solving algebraic fractions and expressions and linear equations
- represent and solve problems involving simple linear equations and linear inequations
- developing a model to describe the relationship between variables in a problem situation

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.

Descriptors

CONTENT DESCRIPTORS

Number and Algebra:

Patterns and Algebra

- Substitute values into formulas to determine an unknown (ACMNA234)
- Solving simple linear equations including those arising from formulas (ACMNA235)
- Apply the four operations to simple algebraic fractions with numerical denominators (ACMNA232)

Linear and Non-Linear Relationships:

- Solve problems involving linear equations, including those derived from formulas (ACMNA235)
- Solve linear inequalities and graph their solutions on a number line (ACMNA236)
- Solve linear simultaneous equations, using algebraic and graphical techniques, including using digital technology (ACMNA237)
- Solve problems involving parallel and perpendicular lines (ACMNA238)

STANDARDS ELABORATIONS

			A	B	C	D	E
			The folio of student work has the following characteristics:				
Understanding and skills dimensions	Understanding & Fluency	Conceptual understanding	Connection and description of mathematical concepts and relationships in a range of situations, including some that are complex unfamiliar	Connection and description of mathematical concepts and relationships in complex familiar or simple unfamiliar situations	Recognition and identification of mathematical concepts and relationships in simple familiar situations	Some identification of simple mathematical concepts	Statements about obvious mathematical concepts
		Procedural fluency	Recall and use of facts, definitions, technologies and procedures to find solutions in a range of situations including some that are complex unfamiliar	Recall and use of facts, definitions, technologies and procedures to find solutions in complex familiar or simple unfamiliar situations	Recall and use of facts, definitions, technologies and procedures to find solutions in simple familiar situations	Some recall and use of facts, definitions, technologies and simple procedures	Partial recall of facts, definitions or simple procedures
		Mathematical language and symbols	Effective and clear use of appropriate mathematical terminology, diagrams, conventions and symbols	Consistent use of appropriate mathematical terminology, diagrams, conventions and symbols	Satisfactory use of appropriate mathematical terminology, diagrams, conventions and symbols	Use of aspects of mathematical terminology, diagrams and symbols	Use of everyday language

			A	B	C	D	E
			The folio of student work has the following characteristics:				
Understanding and skills dimensions	Problem solving & Reasoning	Problem-solving approaches	Systematic application of relevant problem-solving approaches to investigate a range of situations, including some that are complex unfamiliar	Application of relevant problem-solving approaches to investigate complex familiar or simple unfamiliar situations	Application of problem-solving approaches to investigate simple familiar situations	Some selection and application of problem-solving approaches in simple familiar situations.	Partial selection of problem-solving approaches
		Mathematical modelling	Development of mathematical models and representations in a range of situations, including some that are complex unfamiliar	Development of mathematical models and representations in complex familiar or simple unfamiliar situations	Development of mathematical models and representations in simple familiar situations	Statements about simple mathematical models and representations	Isolated statements about given mathematical models and representations
		Reasoning and justification	Clear explanation of mathematical thinking and reasoning, including logical justification of choices made, evaluation of strategies used, proofs formulated and conclusions reached	Explanation of mathematical thinking and reasoning, including reasons for choices made, strategies used, proofs formulated and conclusions reached	Description of mathematical thinking and reasoning, including discussion of choices made, strategies used, proofs formulated and conclusions reached	Statements about choices made, strategies used and conclusions reached	Isolated statements about given strategies or conclusions

RELEVANT PRIOR CURRICULUM

For this unit, students require prior knowledge of / experience with:

- substitution into expressions and equations
- the four quadrants of the Cartesian plane
- linear functions and equations
- graphical representations of linear and non-linear relationships
- perpendicular and parallel lines.

CURRICULUM WORKING TOWARDS

The teaching and learning in this unit works towards the following:

General Mathematics:

- Linear equations and their graphs (Unit 1)

Essential Mathematics:

- Bivariate Graphs – Cartesian plane, line of best fit (Unit 3)

Intended Curriculum

GENERAL CAPABILITIES AND CROSS CURRICULUM PRIORITIES

Literacy Indicators:

Text knowledge:

- Communicate to evaluate and synthesise concepts and points of view in extended learning area texts
- View, read, navigate and select texts to suit learning purposes, content and context

Comprehension:

- Use interaction and communication skills to contribute to formal and informal debates and discussions by using organising structures and language features to extend or refute diverse opinions

Word knowledge:

- Use specialised learning area vocabulary to discriminate between shades of meaning or enhance persuasive language
- Select and use learning area vocabulary to express abstract concepts and refine choices to discriminate between shades of meaning.
- Confirm spellings and word choice. Deduce word meanings using knowledge of words and reliable sources across learning areas.

Monitoring Maps:

https://www.australiancurriculum.edu.au/media/1077/general-capabilities-numeracy-learning-continuum.pdf

Numeracy Indicators:

Calculating and Estimating:

- Identify preferred mental and written strategies, select and use definitions, rules, representations and estimates, with or without technologies in calculations involving complex data and contexts. Explain the method/s
- Interpret, clarify, and analyse the mathematical features and conditions of a situation. Use a range of strategies such as using models, rules or formulas to solve problems. Explain possible solutions
- Check the reasonableness of solutions and review assumptions and methods of working

Recognising and using patterns and relationships:

- Make predictions and solve algebraic problems involving:
  - factorising using common algebraic factors
  - algebraic fractions with a common denominator
  - substituting values into formulas
- Solve, with or without technologies, problems involving:
  - linear equations including simple algebraic fractions and those derived from formulas
  - linear inequalities
  - linear simultaneous solutions
- Use graphs and equations to analyse and illustrate relations involving:
  - parallel and perpendicular lines

Monitoring Maps:

https://www.australiancurriculum.edu.au/media/1077/general-capabilities-numeracy-learning-continuum.pdf

Other General Capabilities:

- ☒ **Literacy**
- ☒ **Numeracy**
- ☒ **Information and Communication Technology (ICT) Capability**
- ☒ **Critical & Creative Thinking**
- ☐ **Ethical Understandings**
- ☐ **Personal & Social Capability**
- ☐ **Intercultural Understanding**

Cross Curricula Priorities:

- ☐ **Aboriginal and Torres Strait Islander histories and cultures**
- ☐ **Asia and Australia's engagement with Asia**
- ☐ **Sustainability**

ASOT Design Questions

	Design Areas	Design Questions
Feedback	1. Providing and Communicating Clear Learning Goals	How will I communicate clear learning goals that help students understand the progression of knowledge they are expected to master and where they are along that progression?
	2. Using Assessments	How will I design and administer assessments that help students understand how their test scores and grades are related to their status on the progression of knowledge they are expected to master?
Content	3. Conducting Direct Instruction Lessons	When content is new, how will I design and deliver direct instruction lessons that help students understand which parts are important and how the parts fit together?
	4. Conducting Practicing and Deepening Lessons	After presenting content, how will I design and deliver lessons that help students deepen their understanding and develop fluency in skills and processes?
	5. Conducting Knowledge Application Lessons	After presenting content, how will I design and deliver lessons that help students generate and defend claims through knowledge application?
	6. Using Strategies That Appear in All Types of Lessons	Throughout all types of lessons, what strategies will I use to help students continually integrate new knowledge with old knowledge and revise their understanding accordingly?
Content	7. Using Engagement Strategies	What engagement strategies will I use to help students pay attention, be energized, be intrigued, and be inspired?
	8. Implementing Rules and Procedures	What strategies will I use to help students understand and follow rules and procedures?
	9. Building Relationships	What strategies will I use to help students feel welcome, accepted, and valued?
	10. Communicating High Expectations	What strategies will I use to help typically reluctant students feel valued and comfortable interacting with me and their peers?

VOCABULARY

(ESSENTIAL VOCABULARY STUDENTS MUST DEVELOP WITHIN THIS UNIT. IDENTIFY WHAT LEVEL OF VOCABULARY INSTRUCTION IS REQUIRED – 1: SIMPLE INSTRUCTION, 2: VOCABULARY MAPS, 3: FRAYER MODEL)

LEVEL 1	LEVEL 2	LEVEL 3	Levels of Vocab Instruction
• Substitute • Equations • Solve • Value • X and Y Axis • X and Y intercept • Plot	• Linear Graph • Gradient • Algebraically • Determine	• Parallel • Simultaneous Equation • Solution • Substitution method	**Level 1 – Simple concepts** • Mix 'n 'Match • Flash Cards • Quizlet etc • Word wall **Level 2 – Complex concepts** • Vocabulary Maps **Level 3 – Highly abstract concepts** • Frayer Model

ASSESSMENT ITEMS

SUMMATIVE	FORMATIVE		Due Date
Exam (70 minutes) x 2 Short answer questions including described proficiencies using the content descriptions.	Homework completion Revision lessons Revision at the beginning of the lesson Diagnostic exam		Draft: Final:
	TOOLS – these are what you might use:	**TECHNIQUES** – this is how you might use the tools:	
	RUNNING RECORDS **CRITERIA FOR SUCCESS** **RESEARCH PROJECTS** **ANNOTATED WORK SAMPLES** **WRITTEN TESTS** **MULTIPLE CHOICE TESTS** **EXTENDED RESPONSE** **GROUPS DISCUSSION** **ORAL PRESENTATION** **WRITTEN TASKS** **PORTFOLIO**	**TEACHER OBSERVATION** **PEER FEEDBACK** **STUDENT SELF-ASSESSMENT** **FOCUSED ANALYSIS** **STUDENT/TEACHER CONSULTATION**	

ASSESSMENT AUDIT – KNOWLEDGE (CONTENT) AND UNDERSTANDING:

- Substitute values into formulas to determine an unknown
- Solving simple equations arising from formulas
- Solve problems involving linear equations, including those derived from formulas
- Representing word problems with simple linear equations and solving them to answer questions
- Solve linear inequalities
- Solve linear simultaneous equations, using algebraic and graphical techniques,
- Associating the solution of simultaneous equations with the coordinates of the intersection of their corresponding graphs
- Identify linear equations as either parallel or perpendicular

SKILLS (CCES) BEING ASSESSED:

UNIT TWO – Linear Algebra and Relationships Proficiency Scale

TERM 2 WEEKS 4 - 10

	LEARNING GOAL: By the end of the unit students should know	SUCCESS CRITERIA: Students will be able to	MY PROGRESS			
			Not yet	Working on it	I Got It	I Can Teach It (Pro)
Linear Relationships	Linear graphs	… Identify key features of linear and non-linear equations	❑	❑	❑	❑
		… Apply gradient – intercept method to graph linear equations	❑	❑	❑	❑
		… Construct a linear graph using a table of values	❑	❑	❑	❑
		… Apply x- and y-intercepts method graph linear equations	❑	❑	❑	❑
	Linear Equations	… Determine the equation of a line from a graph	❑	❑	❑	❑
		… Determine the equation of a line from gradient and one point	❑	❑	❑	❑
		… Determine the equation of a line from two points	❑	❑	❑	❑
		… Construct equations from given information	❑	❑	❑	❑
		… Interpret and solve contextualised linear functions	❑	❑	❑	❑
	Parallel lines	… Investigate parallel lines (m1 = m2)	❑	❑	❑	❑
		… Determine equations to parallel lines	❑	❑	❑	❑
		… Investigate perpendicular lines (m1 x m2 = -1)	❑	❑	❑	❑
		… Determine equations to perpendicular lines	❑	❑	❑	❑

Mathematics Department
Year 10 Unit Two Lesson Overview

This Ferny Grove State High School Unit is based on

Unit 2 Linear Algebra and Relationships	**Duration: 10 Weeks**

Week 1 – 22nd April		
EASTER MONDAY PUBLIC HOLIDAY	**Title: Review of Algebra** Learning Intentions **KNOWLEDGE** – students will learn about: • Algebraic conventions • Algebraic expressions **SKILL** – students will learn to: • Evaluate expressions after substituting given values • Apply the correct algebraic conventions when writing expressions **Text References:** Maths Quest: Exercise 2A **Additional Resources:** • WS – Substitution • WS - Algebraic Representation • WS – Substitution & Algebraic Representation **Supporting learning resources:**	**Title: Operating on algebraic fractions** Learning Intentions **KNOWLEDGE** – students will learn about: • simple algebraic fractions with numerical denominators **SKILL** – students will learn to: • Simplify algebraic fractions involving addition and subtraction **Text References:** Pearson: Exercise 3.7 **Additional Resources:** • WS – Adding & Subtracting Algebraic Fractions **Supporting learning resources:**

Week 2 – 29th April		
Title: Operating on algebraic fractions Learning Intentions **KNOWLEDGE** – students will learn about: • algebraic fractions **SKILL** – students will learn to: • Simplify algebraic fractions involving multiplication and division **Text References:** Pearson: Exercise 3.7 **Additional Resources:** • WS – Multiplying & Dividing Algebraic Fractions **Supporting learning resources:**	**Title: Linear Algebra** Learning Intentions **KNOWLEDGE** – students will learn about: • Balancing equations **SKILL** – students will learn to: • Solve linear equations by balancing *Stress the importance of 'undoing' the equation in the correct way (reverse the Order of Operations)* *Focus for this lesson should be on **simple one and two step equations.** With a lead in to equations including multiple brackets, fractions and unknowns on both sides.* **Text References:** Pearson: Exercise 1.1 **Additional Resources:** • WS – Solving Linear Equations **Supporting learning resources:**	**Title: Linear Algebra** Learning Intentions **KNOWLEDGE** – students will learn about: • Solving linear equations **SKILL** – students will learn to: • Solve linear equations by balancing *Focus for this lesson should be equations including multiple brackets, fractions and unknowns on both sides.* **Text References:** Pearson: Exercise 1.1 **Additional Resources:** • WS – Solving Linear Equations **Supporting learning resources:**

<table>
<tr><th colspan="3">Week 3 – 6th May</th></tr>
<tr>
<td>LABOUR DAY
PUBLIC HOLIDAY</td>
<td>Title: Linear Inequalities
Learning Intentions

KNOWLEDGE – students will learn about:
• Inequalities

SKILL – students will learn to:
• Identify inequalities
• Solve simple inequalities
• Recognise how multiplying and dividing by negative numbers affect the inequality

Text References: Pearson: Exercise 1.5

Additional Resources:
• WS – Linear Inequalities

Supporting learning resources:</td>
<td>Title: Problem solving using algebra
Learning Intentions

KNOWLEDGE – students will learn about:
• Applications of algebra to solve problems

SKILL – students will learn to:
• Solve number problems involving algebra
• Solve contextualised problems involving algebra

Text References:
Maths Quest: Ex 2 Review Problem Solving (p53)

Additional Resources:
• WS – Number problems Ex16F
• WS – Algebraic Problem Solving

Supporting learning resources:</td>
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<tr><th colspan="3">Week 4 – 13th May</th></tr>
<tr>
<td>Title: Exploring linear relations
Learning Intentions

KNOWLEDGE – students will learn about:
• Linear relationships

SKILL – students will learn to:
• Identify key features of linear and non-linear equations
• Apply gradient – intercept method to graph linear equations
• Construct a linear graph using a table of values

Text References: Pearson: Exercise 1.2 & 1.3

Additional Resources:
• WS – Gradient-Intercept Method
• WS – Table of Values and Graph

Supporting learning resources:</td>
<td>Title: Exploring linear relations
Learning Intentions

KNOWLEDGE – students will learn about:
• Linear relationships

SKILL – students will learn to:
• Identify key features of linear and non-linear equations
• Apply x- and y-intercepts method graph linear equations

Text References: Pearson: Exercise 1.3

Additional Resources:
• WS – X and Y Intercept Method
Supporting learning resources:</td>
<td>Title: Exploring linear relations
Learning Intentions

KNOWLEDGE – students will learn about:
• Linear relationships

SKILL – students will learn to:
• Recall and consolidate their knowledge and skills for graphing linear equations using a variety of methods

Text References: Pearson: Exercise 1.3

Additional Resources:
Supporting learning resources:</td>
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<table>
<tr><th colspan="3">Week 5 – 20th May</th></tr>
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<td>Title: Determining linear equations
Learning Intentions

KNOWLEDGE – students will learn about:
• Linear equations

SKILL – students will learn to:
• Determine the equation of a line from a graph

Text References: Pearson: Exercise 1.2

Additional Resources:
Supporting learning resources:</td>
<td>Title: Determining linear equations
Learning Intentions

KNOWLEDGE – students will learn about:
• Linear equations

SKILL – students will learn to:
• Determine the equation of a line from:

I. Gradient and one point
II. Two points

Text References: Pearson: Exercise 1.2

Additional Resources:
Supporting learning resources:</td>
<td>Title: Contextualised linear problems
Learning Intentions

KNOWLEDGE – students will learn about:
• Applications of linear functions

SKILL – students will learn to:
• Construct equations from given information
• Interpret and solve contextualised linear functions

Text References:

Additional Resources:
• Worksheet
Supporting learning resources:</td>
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<tr><th colspan="3">Week 6 – 27th May</th></tr>
<tr>
<td>DIAGNOSTIC EXAM</td>
<td>Title: Parallel lines
Learning Intentions

KNOWLEDGE – students will learn about:
• Parallel lines

SKILL – students will learn to:
• Investigate parallel lines (m1 = m2)
• Determine equations to parallel lines

Text References: Pearson: Exercise 1.4

Additional Resources:
Supporting learning resources:</td>
<td>Title: Perpendicular lines
Learning Intentions

KNOWLEDGE – students will learn about:
• Perpendicular lines

SKILL – students will learn to:
• Investigate perpendicular lines (m1 x m2 = -1)
• Determine equations to perpendicular lines

Text References: Pearson: Exercise 1.4

Additional Resources:
Supporting learning resources:</td>
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<table>
<tr><th colspan="3">Week 7 – 3rd June</th></tr>
<tr>
<td>Title: Simultaneous equations
Learning Intentions

KNOWLEDGE – students will learn about:
• Solving simultaneous equations graphically

SKILL – students will learn to:
• Recognise and identify the intersection point for two simultaneous equations
• Solve simultaneous equations graphically

Text References: Pearson: Exercise 1.6

Additional Resources:
Supporting learning resources:</td>
<td>Title: Simultaneous equations
Learning Intentions

KNOWLEDGE – students will learn about:
• Solving simultaneous equations using the substitution method

SKILL – students will learn to:
• Solve simultaneous equations using the substitution method
• Identify the strengths and limitations of graphical

Text References: Pearson: Exercise 1.6

Additional Resources:
• WS – Solving Simultaneous Equations using Substitution

Supporting learning resources:</td>
<td>Title: Simultaneous equations
Learning Intentions

KNOWLEDGE – students will learn about:
• Solving simultaneous equations using the elimination method

SKILL – students will learn to:
• Solve simultaneous equations using the elimination method

Text References: Pearson: Exercise 1.6

Additional Resources:
• WS – Solving Simultaneous Equations using Elimination

Supporting learning resources:</td>
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<tr><th colspan="3">Week 8 – 10th June</th></tr>
<tr>
<td>Title: Contextualised simultaneous equations
Learning Intentions

KNOWLEDGE – students will learn about:
• Applications of simultaneous equations

SKILL – students will learn to:
• Solve simultaneous equations in real-life contexts using an appropriate method.

Text References: Pearson: Exercise 1.6

Additional Resources:
• WS – Solving Simultaneous Equation Problems

Supporting learning resources:</td>
<td>Title: REVISION LESSON
Learning Intentions

KNOWLEDGE – students will learn about:
•
SKILL – students will learn to:
• Recall, consolidate and extend learning

Text References:
Additional Resources:
Supporting learning resources:</td>
<td>Title: REVISION LESSON
Learning Intentions

KNOWLEDGE – students will learn about:
•
SKILL – students will learn to:
• Recall, consolidate and extend learning

Text References:
Additional Resources:
Supporting learning resources:</td>
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Week 9 – 17th June		
Exam Week **Session 1 Monday 17th June** **Session 2 Wednesday 19th June**		
Week 10 – 24th June		
Title: TBA Learning Intentions **KNOWLEDGE** – students will learn about: • **SKILL** – students will learn to: • **Text References:** **Additional Resources:** **Supporting learning resources:**	**Title: TBA** Learning Intentions **KNOWLEDGE** – students will learn about: • **SKILL** – students will learn to: • **Text References:** **Additional Resources:** **Supporting learning resources:**	**Title: TBA** Learning Intentions **KNOWLEDGE** – students will learn about: • **SKILL** – students will learn to: • **Text References:** **Additional Resources:** **Supporting learning resources:**