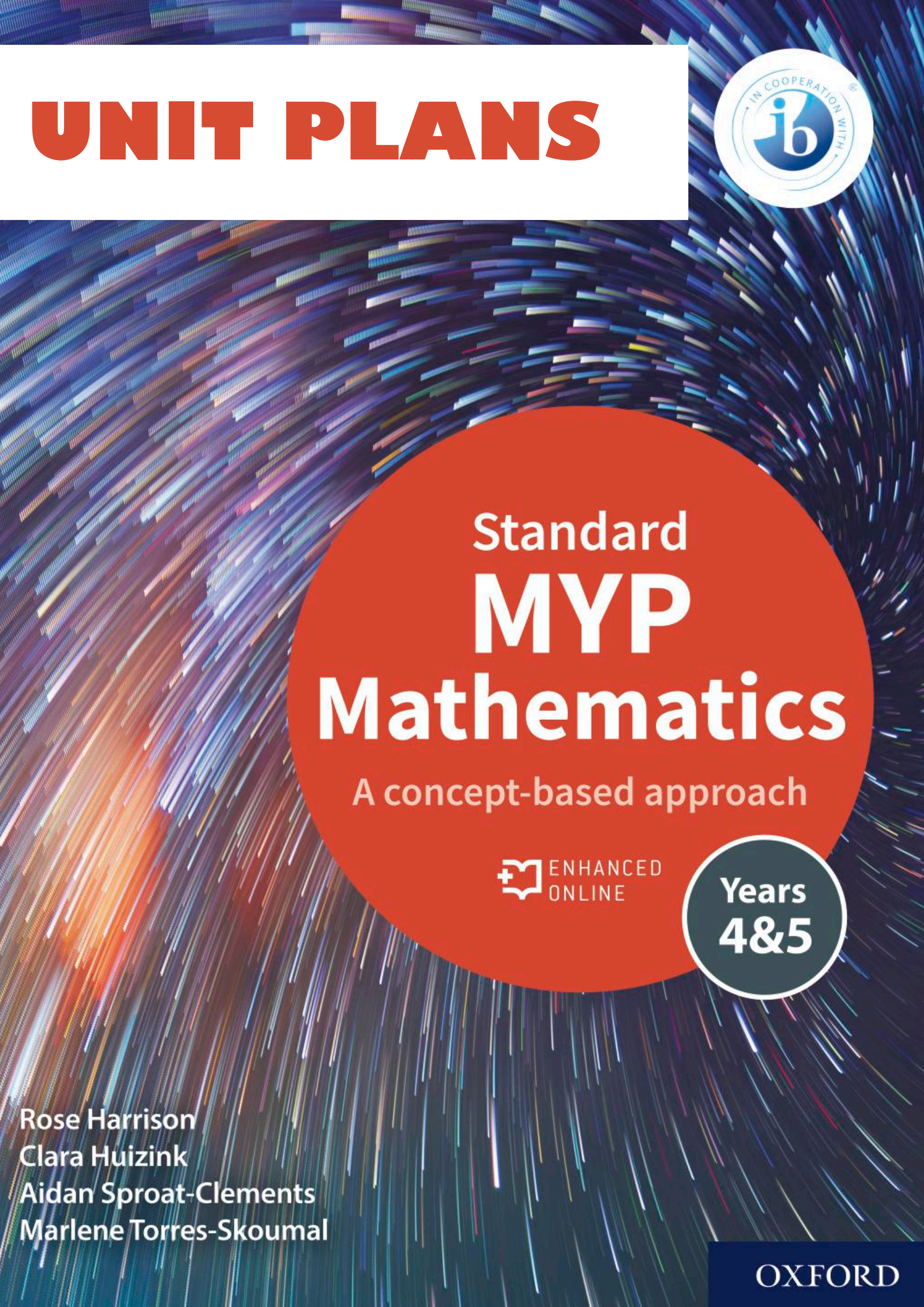
UNIT PLANS



Standard

MYP Mathematics

A concept-based approach

ENHANCED ONLINE

Years 4&5

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UNIT 1: Being specific

Branch	Numerical and abstract reasoning
Key concept	Form
Related concepts	Simplification, representation, quantity, approximation
Global context	Globalization and sustainability
Specific exploration	Exploring different ways of measuring human-made systems
Statement of Inquiry	Representing numbers in different forms to simplify them can help understand human-made systems
Approximated number of structured teaching hours	30 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will explore the concepts of form, simplification, representation, approximation and quantity by looking at different forms of numerical expressions. Students will begin the unit with understanding problem-solving techniques and appreciating the effects of simplification, before exploring different number systems and how they can be represented in different forms. This leads onto exploring the laws of exponents and how different quantities can be represented through scientific notation. Understanding units of measurement is then studied to ensure the students have a solid base to further develop the statement of inquiry. The unit ends with irrational numbers and absolute value, therefore linking to real-life examples and thus making a transferable, synthesized statement of inquiry. In addition, students will look at describing patterns as general rules to find links between the related concepts and application to real life situations.

Unit Inquiry questions

Factual

- What is an approximation?

Students will study different units of measurements and start to understand the need for approximations.

- How can you simplify?

Students will look at the differences between rational and irrational numbers and investigate techniques into simplifying radicals; they will learn the rules associated with radicals and how to simplify for different mathematical operations.

- What is a human-made system?

By examining the number systems and the systems put in place for problem-solving and systems of measurement, the students should have a better understanding of human-made systems.

Conceptual

- How does simplifying lead to better results?

Students will keep returning to simplification as they move through this unit. Through problem solving and looking at irrational numbers, they will begin to link together familiar situations and apply this to the unfamiliar situations of irrational numbers.

Debatable

- Can approximations ever be exact?

By looking at units and measurements and human-made systems, the students should get an idea of when and how to approximate efficiently and effectively. Students will incorporate their knowledge of simplification and approximation with respect to number systems to determine the advantages of simplifying, specifically with a focus on impacting others and the human-made systems.

Content based Inquiry questions

Factual

- What are Pólya's steps in solving a problem?
- What is a set?
- What kinds of sets are there?
- How are numbers classified?
- What are the laws of exponents?
- What does a negative exponent mean?
- What does exponent 0 mean?
- What are the different systems of measurement?
- What is the difference between a rational number and an irrational number?
- What is a radical (surd)?
- How do you approximate a radical?
- What is an absolute value?

Conceptual

- Which problem-solving strategies are most useful in solving real-life problems?
- What are the different forms of representing numbers?
- What are the properties of number sets?
- How do you round to a certain degree of accuracy?

- How do different forms represent quantities?
- How do different forms simplify calculations?
- How do we convert measures of area and volume into different units?
- Are some units more approximate than others?
- How are the rules of radicals related to the rules for combining terms in algebra?
- How is simplifying radicals similar to simplifying rationals?
- How are the properties of absolute value similar to other properties in mathematics?
- How can error be measured when estimating or approximating?

Debatable

- How can you represent and simplify given information in order to solve real-life problems?
- How are numbers used?
- What does it mean to be exact?
- Are some numbers more beautiful than others?
- How big is huge?
- How small is tiny?
- Do we really understand very large or very small quantities that we are able to represent and use in calculations?
- Should we adopt a single global system of measurement?
- How do human-made systems influence communities?
- Can irrational numbers be combined to form rational numbers?
- How can error best be measured?
- Can you ever know the exact value of a measurement?

Objectives with reference to textbook

Objective	Specific relevant strands	Reference
D	iv	Page 55 1.4 Practice 3
B	ii	Page 78 1.5 Exploration 8
B	ii	Page 84 1.6 Exploration 2

Possible summative assessment task

Grasping Quantities

The summative task, ‘Grasping Quantities’, provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

1.1

- Applying Pólya's problem-solving steps to solve any type of problem
- Selecting and applying appropriate mathematical strategies to solve problems
- Checking if a solution makes sense in the context of the problem

1.2

- Classifying the different kinds of real numbers
- Representing the different kinds of real numbers
- Knowing basic properties of real numbers and their operations

1.3

- Review the laws of exponents
- Understanding the meaning of zero and negative exponents
- Perform calculations using scientific notation
- Deciding when to use standard form or scientific notation for calculations

1.4

- Converting between metric units, including metric units of area and volume
- Converting between metric and imperial units
- Using units correctly in problem solving
- Solving problems involving compound measures
- Deciding if the answer to a problem is reasonable

1.5

- Simplifying irrational numerical expressions
- Approximating radicals
- Applying rules of radicals to simplify them
- Performing operations on radicals to simplify expressions that contain radicals

1.6

- Knowing different definitions for the absolute value of a number
- Understanding the properties of the absolute value of a number

Mathematics skills framework with concepts

Topic	Concept
Problem solving	simplification
Number systems notation	representation
Irrational numbers	simplification
Surds, roots and radicals, including simplifying	simplification
Standard form (scientific notation)	quantity
Laws of exponents, including integer and negative exponents	quantity
Absolute values	approximation
Metric conversions	approximation

ATL Skills

There are five skill indicators from three skill clusters identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Organization skills	Use appropriate strategies for organizing complex information	1.1 Problem solving
Communication skills	Organize and depict information logically	1.2 The number system
Communication skills	Use and interpret a range of discipline-specific terms and symbols	1.3 Laws and exponents and scientific notation
Communication skills	Use intercultural understanding to interpret communication	1.4 Units and measurement
Critical-thinking skills	Draw reasonable conclusions and generalizations	1.5 Surds, roots and radicals 1.6 Absolute value

UNIT 2: Decisions, decisions

Branch	Thinking with models, numerical and abstract reasoning, spatial reasoning
Key concept	Logic
Related concepts	Generalization, validity, models
Global context	Scientific and technical innovation
Specific exploration	Exploring the natural world by developing realistic models
Statement of Inquiry	Using logic to make and validate generalizations enhances the development of models
Approximated number of structured teaching hours	20 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will delve through many branches of mathematics with the purpose of developing their understanding of logic as a process of validating generalizations.
They will start by looking at patterns in numbers and exploring how and when to generalize. The next section will look at how to validate these generalizations through spatial geometry, mainly through linear relationships and their graphs. From this, the students will launch into the field of modelling again with a focus on linear situations such as solving simple linear equations and systems of linear equations.

Unit Inquiry questions

Factual

- Which logical skills enable you to model real-life situations effectively?

Students will be able to answer this question by the end of the unit when they have successfully understood the significance of forming a mathematical model and applied it to real life situations

Conceptual

- How do you validate generalizations?

During this unit, students will begin to understand the purpose of making generalizations in a variety of situations and then, through the concept of validation, be able to apply this.

Debatable

- To what extent does developing models enable you to understand real life problems?

By looking at different models in different real-life situations, students should be able to discuss the benefits and limitations of developing models, realizing that mathematics needs to be taught in relevant, realistic contexts, rather than by attempting to impart a fixed body of knowledge.

Content based Inquiry questions

Factual

- What is a conjecture?
- What is a generalization?
- How do you find the distance between two points?
- How do you find the midpoint between two points?
- What is an equivalence transformation?
- How can you solve linear equations using equivalence transformations?

Conceptual

- How can generalizations be used to solve specific problems?
- How can the steepness of a line be quantified?
- What is the relationship between the gradients of parallel/perpendicular lines?
- How can you validate the distance and/or midpoint formula?
- Are all solution methods for systems of equations equivalent?
- How do the graphs of systems of equations relate to the types of solutions they may have?

Debatable

- What are the risks of making generalizations?
- Are the different forms of a straight line equivalent?
- Are all forms of the equation of a straight line suitable to solve a particular real-life problem?
- Can good decisions be calculated by using a mathematical model?

Objectives with reference to textbook

Objective	Strand	Page
B	i	Page 98 2.1 Practice 2
C	iv	Page 115 2.2 Activity
A	iii	Page 136 Review in context

Possible summative assessment task

Austrian Ascents

The summative task, 'Austrian Ascents', provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

2.1

- Identifying patterns in number problems
- Solving complicated problems by looking at a more general case
- Making generalizations from a given pattern

2.2

- Finding the distance between two points
- Finding the midpoint between two points
- Finding the gradient of a straight line
- Finding the gradients of parallel/ perpendicular lines
- Finding the equation of a straight line

2.3

- Solving linear equations and systems of linear equations algebraically and graphically
- Using equivalence transformations to solve linear equations and systems of equations
- Creating a mathematical model to solve real-life problems
- Determining if a model solution is equivalent to the real-life solution
- Evaluating and interpreting solutions in light of the real-life problems

Mathematics skills framework with concepts

Topic	Concept
Coordinate geometry, including distance, midpoint and gradient formulae	validity
Pythagoras' theorem	models
Converse of Pythagoras' theorem	models
Linear functions	models
$y = mx + c$	validity
Gradient of parallel lines	models
Parallel and perpendicular lines	models
Systems of equations/simultaneous equations	models

ATL Skills

There are three skill indicators from two skill clusters identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Critical-thinking skills	Draw reasonable conclusions and generalizations	2.1 Making generalizations
Critical-thinking skills	Gather and organize relevant information to formulate an argument	2.2 Coordinate geometry
Transfer skills	Apply skills and knowledge in unfamiliar situations	2.3 Modelling: Linear equations and systems and linear equations

UNIT 3: Back to the beginning

Branch	Numerical and abstract reasoning and Thinking with models
Key concept	Relationships
Related concepts	Representation, patterns, equivalence
Global context	Scientific and technical innovation
Specific exploration	Exploring systems and methods to create models
Statement of Inquiry	Discovering relationships in patterns and studying equivalence between representations can lead to better models
Approximated number of structured teaching hours	25 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, the students explore the concepts of relationships, patterns and equivalence. They will begin by understanding functions and function notation from the branch 'Thinking with Models' and then move into the concept of patterns by looking at equivalent forms of quadratic expressions. Then the concept of representation will be explored by analysing quadratics in a given space. The real-life applications of quadratic models will deepen understanding as the students solve quadratic equations both algebraically and graphically. They then look at equivalent transformations to move between different forms of representation. The emphasis is on how different models can be used to create authentic solutions of real-life problems.

Unit Inquiry questions

Factual

- What determines equivalence?

Students will explore this concept by looking at equivalence relationships within quadratic equations and how to solve them. They will also look at equivalent forms represented in different ways.

- What kind of patterns exist?

Students will be looking at patterns in quadratic expressions and recognising how these patterns lead to methods of factorizing them.

Conceptual

- How can relationships be represented effectively?

The concept of representation appears twice in this unit. The students will look at how different functions and mappings can be represented and then the concept will be deepened by looking at how quadratic functions can be represented both algebraically and graphically.

- How does equivalence affect representations?

Students should be able to merge their knowledge of equivalence of different representations of quadratic functions to answer this question.

Debatable

- To what extent does understanding patterns allow you to understand the natural world?

There are many opportunities throughout the unit to explore real-life situations and the importance of patterns and relationships in the natural world.

Content based Inquiry questions

Factual

- What are different ways to represent relationships?
- What is a function?
- What does ‘expanding brackets’ mean?
- What does ‘factorize a quadratic expression’ mean?
- What shape represents the graph of a quadratic function?
- How do the parameters of a quadratic function affect the shape of its graph?
- What is the null factor law?
- How do you solve a quadratic equation in factorized form?

Conceptual

- What are the similarities and differences between relations and functions?
- How are the different ways of determining if a relation is a function related to one another?
- How do the patterns in expanding brackets help you factorize quadratic expressions?
- How can patterns help you write quadratic expressions in a form that is easier to factorize?
- How can you represent a quadratic function in three different ways?
- What are the advantages and disadvantages of the different forms of a quadratic function?
- How can you use equivalence transformations to solve quadratic equations?
- How are the three methods for solving quadratic equations equivalent?

Debatable

- What do relations that are not functions look like?
- Can inequality be justified?
- Can everything be written in a different form?
- What makes one quadratic form better than another?
- How do you determine a ‘best method’ among equivalent methods?

- Do systems, models and methods solve problems or create them?

Objectives with reference to textbook

Objective	Strand	Page
B	iii	Page 171 3.2 Exploration 5
D	v	Page 197 203 3.3 Activity
D	ii	Page 215 3.4 Activity Page 217 223 3.4 Review in context

Possible summative assessment task

Australian Asteroids

The summative task, 'Australian Asteroids', provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

3.1

- Understanding the difference between a relation and a function
- Understanding mapping diagrams
- Knowing how to find ordered pairs in a relation
- Understanding domain and range
- Manipulating functions using the correct notation

3.2

- Factorizing quadratic expressions, where the coefficient of x^2 is 1, including the difference of two squares
- Factorizing quadratic expressions where the coefficient of x^2 is not 1

3.3

- Finding the axis of symmetry and vertex of a quadratic function
- Expressing a quadratic function in three different forms: standard, factorized and vertex

- Finding a quadratic function given three distinct points on its graph

3.4

- Finding a function to model a real-life parabola
- Understanding how many unique points define an object in a given dimension of space
- Solving quadratic equations algebraically and graphically
- Solving real-life problems by creating and using quadratic models

Mathematics skills framework with concepts

Topic	Concept
Mappings	representation
Function notation	representation
Domain and range	representation
Quadratic functions	representation
Factorizing quadratic expressions	patterns
Solving quadratic equations	equivalence

ATL Skills

There are four skill indicators from three skill clusters identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Communication skills	Organize and depict information logically	3.1 Relations and functions
Critical-thinking skills	Draw reasonable conclusions and generalizations	3.2 Quadratic expressions
Creative-thinking skills	Apply existing knowledge to generate new ideas or processes	3.3 Representing quadratic functions
Critical-thinking skills	Propose and evaluate a variety of solutions	3.4 Solving quadratic equations

UNIT 4: Mathematically speaking

Branch	Reasoning with data
Key concept	Logic
Related concepts	Representation, validity
Global context	Identities and relationships
Specific exploration	Exploring personal and physical health and good lifestyle choices
Statement of Inquiry	Understanding health and validating life-style choices results from using logical representations and systems
Approximated number of structured teaching hours	20 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will use their knowledge of representing different sample spaces to develop axiomatic probability systems. They will begin by understanding the purpose and necessity for representing number systems as sets and justify the validity of having specific notation and conditions for the systems of numbers and set operations, moving into probability and how they can apply it to real-life situations. After introducing probability systems, they should be able to determine outcomes based on their knowledge and consequently make good choices when faced with lifestyle decisions. The subsequent study of combined events will consolidate this learning.

Unit Inquiry questions

Factual

- How can representing language with symbols facilitate set operations?

Students will look at different occasions where mathematical notation is used as a precise and unique indicator for a given situation. In this unit, they will learn some specific mathematical symbols for set operations.

Conceptual

- How do axioms enhance the understanding of logic?

By analysing the representation of sets and probability in a variety of ways and seeing how this develops into laws of probability, the students will encounter the richness of a probability axiomatic system.

Debatable

- What factors validate our life-style decisions?

Once the system has been established and the laws understood, students can begin to apply this to real-life situations and, based on their decisions, begin to make healthy lifestyle choices.

Content based Inquiry questions

Factual

- What are set operations?
- How do you represent sets and their operations?
- What are the axioms of probability?
- What are the different ways of representing a sample space?
- How do you calculate the probability of an event?

Conceptual

- Can diagrams and drawings be used to validate mathematical laws?
- How do you calculate the probability of combined events?
- What are the advantages and disadvantages of the different probability representations?

Debatable

- How does a Venn diagram help to interpret a real-life situation?
- How useful are sets and Venn diagrams in solving real-life problems?
- Does randomness affect the decisions we make?

Objectives with reference to textbook

Objective	Strand	Page
C	iii	Page 238 4.2 Practice 1

Possible summative assessment task

Counting Calories

The summative task, ‘Counting Calories’, provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

4.1

- Finding the intersection and union of sets
- Drawing Venn diagrams to represent real-life situations
- Interpreting Venn diagrams to solve real-life problems
- Applying the language of sets to different areas of mathematics
- Using the language of sets to model real-life problems
- Understanding and using formal probability axioms and notation

4.2

- Representing sample spaces in tables, lists and diagrams
- Drawing tree diagrams, Venn diagrams and two-way tables
- Calculating probabilities from Venn diagrams and two-way tables
- Using tree diagrams to calculate probabilities with and without replacement
- Understanding informal ideas of randomness

Mathematics skills framework

Topic	Concept
Sets, including notation and operations up to three sets	validity
Probability with Venn diagrams, tree diagrams and sample spaces	representation
Mutually exclusive events	representation
Combined events	representation

ATL Skills

There are two skill indicators from one skill cluster identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Communication skills	Organize and depict information logically	4.1 Set operations and Venn diagrams
Communication skills	Understand and use mathematical notation	4.2 Probability of single and combined events

UNIT 5: Spacious interiors

Branch	Spatial reasoning
Key concept	Form
Related concepts	Representation, space
Global context	Personal and cultural expression
Specific exploration	Exploring the ways in which we reflect on, extend and enjoy our creativity
Statement of Inquiry	Representing transformed objects and studying their form helps us enjoy their creativity in space
Approximated number of structured teaching hours	20 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will begin by looking at different ways of representing shapes, looking specifically at the different forms and relationships between surface area and volume. They will expand their knowledge of simple shapes and move onto cones, pyramids and spheres. Looking at the space that these shapes occupy, moves them into looking at how these shapes can be transformed by translations, rotations and enlargements

Unit Inquiry questions

Factual

- What is space?

By exploring both surface area and volume, students will be able to examine the space a shape occupies.

Conceptual

- How can you create different representations of space?

Students will become more familiar with the differences between 2D and 3D shapes by looking at more complex shapes and their formulae; they will be able to see the importance of the different representations.

Debatable

- To what extent does expressing shapes in different forms allow creativity?

Students will have many opportunities to look at the relationships between shapes and where they are seen in the real world. They can explore the cultural aspects of different shapes and reflect on the creative importance which these shapes hold.

Content based Inquiry questions

Factual

- What is the difference between area and surface area?
- What are some properties of prisms, cylinders, pyramids and cones?
- How can geometric shapes be transformed?
- How are isometric transformations defined?
- How are tessellations created?

Conceptual

- How are the surface areas of pyramids, cones and spheres related?
- Can isometric transformations replace each other?
- How are geometric transformations similar to functions?

Debatable

- Is there a best method for finding volume?
- Does the order of transformations matter?

Objectives with reference to textbook

Objective	Strand	Page
D	ii	Page 276 5.1 Review in context

Possible summative assessment task

Semaphore Beauty

The summative task, ‘Semaphore Beauty’, provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

5.1

- Finding the surface area of any 3D shape (including pyramids, cones and spheres)
- Finding the volume of any 3D shape (including pyramids, cones and spheres)

5.2

- Transforming 2D shapes on a plane by translation, rotation, reflection and enlargement
- Regular and semi-regular tessellations
- Performing combined transformations on shapes
- Replacing transformations by other transformations

Mathematics skills framework with concepts

Topic	Concept
Volume of regular polyhedra	representation
Similarity and congruence	space
Movement on a plane – isometric transformations, enlargements and tessellations	space
Rotation around a given point	space

ATL Skills

There are two skill indicators from one skill cluster identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Creative-thinking skills	Apply existing knowledge to generate new ideas, products or processes	5.1 Surface area and volume
Creative-thinking skills	Use visual diagrams to generate new ideas	5.2 Geometric transformations

UNIT 6: A whole range of things

Branch	Reasoning with data
Key concept	Relationships
Related concepts	Representation, quantity, generalization
Global context	Globalization and sustainability
Specific exploration	Analysing trends and the impact of decision-making on the environment
Statement of Inquiry	How quantities are represented can help to establish underlying relationships and trends in a population
Approximated number of structured teaching hours	20 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, the students will continue their understanding of representation and quantity. They will use statistical analysis to identify the trends in populations by applying these to real-life situations, they will see how this can impact decision-making with respect to the environment. The unit begins by looking at categorizing and analysing data and why it is important to define the data type before moving on to how data can be represented. This leads into the purpose and techniques for analysing grouped data and the necessity to understand the different quantities represented as statistics to make real-life comparisons. The unit ends by looking at more representations of data and how to visualize the different characteristics of a data set.

Unit Inquiry questions

Factual

- What makes a good representation?

Students will learn different representations of data and understand the similarities and differences between them. At the end of this unit they should be able to understand how and when to use the following representations:

- Frequency tables
- Stem-and-leaf diagrams
- Box-and-whisker diagrams
- Cumulative frequency curves
- Histograms

Conceptual

- How does understanding quantities enable you to make decisions about trends?

Students will be able to analyse these representations and extract the measures of central tendency and dispersion. These specific quantities will enable the students to see trends in the distribution and, with practice, allow them to make decisions based on these trends.

Debatable

- To what extent does understanding trends and relationships make decision making more effective?

By analysing different distributions the students will learn to identify outliers and the reasons why these should or should not be included in the data sets. There is extension work on how the media can be used to skew our perception of the data (data torturing), and therefore change our decision-making.

Content based Inquiry questions

Factual

- What are the different types of data?
- How are the different measures of central tendency calculated?
- How can you quantify the measures of central tendency from a grouped frequency table?
- How can you represent grouped data in a cumulative frequency curve?
- What are the differences between a bar chart and a histogram?

Conceptual

- How do measures of dispersion help you describe relationships in data?
- How do different representations help you compare data sets?
- How does the type of data affect the way it can be represented and quantified?
- How do you accurately analyse a data distribution from a histogram?

Debatable

- Should we ignore amounts or numbers that aren't typical?
- How do individuals stand out in a crowd?
- How can real data ever be misleading?
- How can generalizations made from real data ever be misleading?

Objectives with reference to textbook

Objective	Strand	Page
C	iii	Page 318 6.1 practice 6
C	v	Page 345 6.2 mixed practice

D	v	Page 357 6.3 exploration 1

Possible summative assessment task

Conserving Lemurs

The summative task, 'Conserving Lemurs', provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

6.1

- Categorizing data
- Constructing stem-and-leaf diagrams
- Calculating quartiles, the range and the interquartile range
- Finding a five-point summary from a set of data
- Constructing box-and-whisker plots
- Identifying outliers
- Comparing distributions

6.2

- Finding the mean, median, mode and range from a grouped frequency table
- Representing grouped data in a cumulative frequency curve
- Finding the five-point summary from a cumulative frequency curve
- Constructing a box-and-whisker diagram from a cumulative frequency curve
- Finding percentiles on a cumulative frequency curve

6.3

- Constructing bar charts and histograms
- Interpreting frequency and relative frequency histograms
- Visualizing characteristics of a data set

Mathematics skills framework with concepts

Topic	Concept
Data manipulation and misinterpretation	representation
Graphical representations (including box plots, cumulative frequency graphs)	representation
Data processing: quartiles and percentiles	representation
Measures of dispersion: interquartile range	representation
Relative frequency	representation
Histograms for continuous fixed interval groups	generalization

ATL Skills

There are two skill indicators from two skill clusters identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Communication skills	Organize and depict information logically	6.1 Univariate statistics 6.2 Quantifying data
Critical-thinking skills	Revise understanding based on new evidence and information	6.3 Histograms

UNIT 7: How do they measure up?

Branch	Spatial reasoning
Key concept	Logic
Related concepts	Approximation, generalization, systems
Global context	Personal and cultural expression
Specific exploration	Exploring our appreciation of the aesthetic
Statement of Inquiry	Systems use logic to validate generalizations and increase our appreciation of the aesthetic
Approximated number of structured teaching hours	30 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will begin by looking at measurements and the necessary approximations in right-angled triangles using trigonometry. They will discover special triangles which have important results and this will lead them into continuing to use logic to look at circles and how to develop systems for circle theorems. By analysing the properties of triangles and circles, along with their knowledge of relationships, they will develop the skills to create generalizations, to identify where they occur in the real world, and where the nature of beauty and art can be studied.

Unit Inquiry questions

Factual

- When is a measurement an approximation?

Students will explore the concept of measurement and approximation through the study of right triangles, they will use logic as a reasoning process to seek out when measurements can be approximated.

Conceptual

- How can understanding logic help us to make generalizations?

Following on from the first unit question, the students will see how the reasoning process enables them to see the links between the triangle relationships and the circle theorems to make generalizations that hold true for all cases.

Debatable

- To what extent does understanding systems help you make more aesthetic solutions?

Students will look at circle theorems from a systematic approach and by consolidating different methods they will see which ones are the most efficient and which can be used to create beauty.

- Is it advantageous to make your own generalizations?

Students should be able to discuss this question upon completion of the unit.

Content based Inquiry questions

Factual

- How do you find measurements of immeasurable objects?
- What are the relationships in the special triangles?
- How can you find measurements of the different parts of a circle?
- What are the circle theorems?
- What is the intersecting chords theorem?
- How can you apply the theorem?

Conceptual

- How do relationships between sides and angles in right-angled triangles help you find real-life measurements?
- How are the parts of a circle related?
- How do we validate mathematical systems?
- How can theorems within systems have different cases?

Debatable

- How does understanding the trigonometric ratios help you create and understand mathematical models?
- Is the converse of a true statement always false?
- Can aesthetics be calculated?

Objectives with reference to textbook

Objective	Strand	Page
C	i	Page 368 7.1 Exploration 1
B	ii	Page 384 7.2 Exploration 3
C	iv	Page 401 7.3 Exploration 7
D	ii	Page 415 7.4 Review in context

Possible summative assessment task

Bridging the Gap

The summative task, 'Bridging the Gap', provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

7.1

- Solving problems in right-angled triangles using trigonometric ratios
- Knowing the properties of trigonometric ratios
- Solving problems that include angles of elevation and angles of depression
- Solving problems using bearings

7.2

- Knowing the terms chord, arc, segment and sector
- Finding the length of an arc of a circle
- Finding the angle in a sector of a circle
- Finding the perimeter and area of a sector of a circle
- Finding the length of a chord

7.3

- Finding angles and lengths using circle theorems
- Proving results using circle theorems
- Examining 'If … then …' statements and testing the truth of their converses

7.4

- Using circle theorems to find lengths of chords
- Finding lengths using the intersecting chord theorem

Mathematics skills framework with concepts

Topic	Concept
Triangle properties	approximation
Bearings	approximation
Trigonometric ratios in right-angled triangles	approximation
Circle geometry	generalization, systems

ATL Skills

There are four skill indicators from two skill clusters identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Critical-thinking skills	Propose and evaluate a variety of solutions	7.1 The right triangle
Communication skills	Use and interpret a range of discipline-specific terms and symbols	7.2 Properties of circles
Critical-thinking skills	Draw reasonable conclusions and generalizations	7.3 Circle theorems 1
Critical-thinking skills	Test generalizations and conclusions	7.4 Circle theorems 2

UNIT 8: What comes next?

Branch	Numerical and abstract reasoning
Key concept	Form
Related concepts	Patterns, change
Global context	Scientific and technical innovation
Specific exploration	Exploring how humans apply their understanding of scientific principles to real-life situations
Statement of Inquiry	Representing patterns and change in a variety of forms has helped humans apply their understanding of scientific principles
Approximated number of structured teaching hours	30 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will begin by understanding what a sequence means in mathematics, how to identify patterns in number problems and how to solve complicated problems by generalizing and changing to simpler cases. Studying this in conjunction with using the appropriate terminology and notation for sequences will lead to understanding the content in real-life situations. The statement of inquiry will be consolidated as the students find and justify general rules for arithmetic and geometric sequences in different contexts involving generating products, interpreting processes and finding appropriate solutions. This leads into the second part of the unit, where the students will look at how to rearrange and change formulae and the effects of recognizing and identifying direct and inverse proportions.

Unit Inquiry questions

Factual

- Which patterns exist in real-life situations?

By examining a variety of patterns in many real-life situations the students should begin to see that there are many patterns around them at different times.

Conceptual

- How can changing the form help to visualise a pattern?

The students will look at both number sequences and linear functions and realize that by representing them in different forms leads to more efficient and effective visualization.

Debatable

- To what extent does changing the form help you understand the scientific principles in real-life situations?

Once the students have looked at the effects of patterns and generalization in real-life situations, they can apply their knowledge to discuss this debatable question.

Content based Inquiry questions

Factual

- What is a sequence?
- How can you describe the terms of a sequence?
- What is a general formula for a sequence?
- What is the subject of a formula?
- How can you change the subject of a formula?
- How do you find a constant of proportionality?
- What does a proportional relationship look like?

Conceptual

- How does the pattern of a sequence help you identify its form?
- How does the pattern of a sequence help you find its general formula?
- What does it mean to be proportional?
- How does changing one variable in a proportional relationship affect the other?

Debatable

- What are the similarities/differences in the forms of linear sequences and linear functions?
- Can situations seem proportional when they are not?
- Is simpler always better?

Objectives with reference to textbook

Objective	Strand	Page
B	ii	Page 440 8.2 Exploration 3

Possible summative assessment task

Bridging the Gap

The summative task, ‘Bridging the Gap’, provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

8.1

- Understanding and using recursive and explicit formulae for sequences
- Recognizing linear sequences
- Recognizing patterns in real-life contexts
- Solving problems involving sequences in real-life contexts
- Changing the subject of a formula

8.2

- Finding a constant of proportionality
- Setting up direct and indirect proportion equations to model a situation
- Graphing direct and indirect relationships
- Recognizing direct and inverse proportion from graphs
- Identifying direct and inverse proportion from tables of values

Mathematics skills framework with concepts

Topic	Concept
Number sequences (prediction, description)	patterns
Linear functions (sequences)	patterns
Changing the subject of an equation	patterns
Direct and inverse proportion	change

ATL Skills

There are two skill indicators from two skill clusters identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks.

Cluster	Skill Indicator	Chapter reference
Critical-thinking skills	Identify trends and forecast possibilities	8.1 Sequences

Transfer skills	Combine knowledge, understanding and skills to produce products and solutions	8.2 Rearranging formulae and proportion

UNIT 9: So, what do you think?

Branch	Reasoning with data
Key concept	Relationships
Related concepts	Generalization, representation
Global context	Identities and relationships
Specific exploration	Exploring trends and characteristics amongst individuals
Statement of Inquiry	Generalizing and representing relationships can help to clarify trends among individuals
Approximated number of structured teaching hours	20 hours

Inquiry

Establishing the purpose of the unit

Unit overview

In this unit, students will begin by looking at the difference between a sample and a population and therefore discover the most efficient sampling techniques. They will also see how to make generalizations of a population from a sample. The students will explore the concepts of representation and generalization through meaningful and engaging real-life situations. It will enable them to see the links between the concepts and the mathematics in a transferable manner. The students will learn how identifying generalized trends through scatter graphs and linear regression can enable predictions.

Students will learn about making generalizations, and by studying correlation and lines of best fit they should begin to comment on trends and differentiate between interpolation and extrapolation. They should discuss various effects of generalization. They will use their creative and critical thinking skills and links to the Global context and Exploration. Throughout the unit they will examine which data can be used and which data is misleading and identify trends and patterns within the data sets.

Unit Inquiry questions

Factual

- Can relationships always be generalized?

Students will learn about different sampling techniques and how inferences can be made from populations. They can discuss various benefits and limitations of generalization and the effects it has on individuals.

Conceptual

- How can relationships be best represented?

After having looked at generalization, inferences, outliers and bias, the students should have informed ideas on what the effects of this content will have on making predictions and representing the relationships. The study of correlation versus causation is also relevant in discussing this question.

Debatable

- To what extent do generalized representations provide a true picture of trends within individuals?

Students will use their critical-thinking skills to reflect on this unit and links to the global context exploration: Exploring the identity and individuality of students by focusing on trends.

Content based Inquiry questions

Factual

- What are the different sampling methods?
- How can you describe a relationship between two sets of data?
- How do you draw and use a line of best fit?

Conceptual

- How are generalizations made from experimental data?
- How do you determine the validity of the generalizations?
- How does the way data is represented affect our ability to make predictions?

Debatable

- How do we know when to say 'when'?
- Does correlation indicate causation?
- Do I want to be like everybody else?

Objectives with reference to textbook

Objective	Strand	Page
D	i	Page 464 9.1 Exploration1
D	ii	Page 487 9.2 Review in context

Possible summative assessment task

Allowing Allowances

The summative task, 'Allowing Allowances', provides students with a meaningful opportunity to thoughtfully demonstrate their understanding of the concepts, conceptual relationship, and context described in the statement of inquiry.

The description of the summative task clearly explains what students will do to demonstrate what they know, understand and can do.

The task is open-ended and represents a challenging and yet manageable opportunity for students to communicate their learning in a variety of ways.

The summative task allows students to address each of the identified mathematics objectives.

Action: Teaching and learning through inquiry

Content based objectives

9.1

- Selecting samples and making inferences about populations
- Understanding the purpose of taking a sample
- Using different sampling techniques
- Understanding when it is appropriate to generalize from a sample to a population
- Understanding the effect of sample size on the reliability of your generalizations
- Calculating response rates

9.2

- Drawing a scatter diagram for bivariate data
- Drawing a line of best fit (regression line) by eye
- Qualitative handling of data
- Understanding and interpreting the correlation between two sets of data

Mathematics skills framework with concepts

Topic	Concept
Graphical representations (including bivariate graphs, scatter graphs)	representation
Lines of best fit	representation
Correlation, qualitative handling	representation
Sampling techniques	generalization
Response rates	generalization

ATL Skills

There are two skill indicators from one skill cluster identified in the unit plan.
These skills provide support for students in achieving the unit's objectives, and also integrate meaningfully with the statement of inquiry. The details provided in the book give descriptions of the learning activities that can be taught explicitly and practised in order to support students in developing each identified skill indicator and help students to reach higher levels of achievement on the unit's summative assessment tasks

Cluster	Skill Indicator	Chapter reference
Critical-thinking skills	Recognize unstated assumptions and bias	9.1 Sampling techniques
Critical thinking skills	Identify trends and forecast possibilities	9.2 Bivariate data