





# Pete's Paving

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<b>Assessment description</b>	<b>Category</b>
Students use algebraic equations and graphs to simplify paving quotes, and to apply and evaluate the methods used.	Written
	<b>Technique</b>
	Modelling and problem solving
<b>Context for assessment</b>	<b>Alignment</b>
<p>Some jobs regularly use the same basic, routine designs, e.g. calculations for the amount and cost of materials required for paving. As only the quantities change, and not the proportions of materials, it is possible to develop tools that quickly find the quantities needed for jobs of different sizes.</p> <p>This assessment incorporates algebraic skills as well as skills involving cost scales. It provides either the context for developing the algebraic skills related to describing and using patterns, or assesses what students have learnt in a unit that developed these skills.</p>	<p><i>Australian Curriculum v5.1</i>, Year 8 Mathematics Australian Curriculum content and achievement standard Australian Curriculum, Assessment and Reporting Authority (ACARA)  <a href="http://www.australiancurriculum.edu.au">www.australiancurriculum.edu.au</a>                      Year 8 Mathematics standard elaborations  <a href="http://www.qsa.qld.edu.au/yr8-maths-resources.html">www.qsa.qld.edu.au/yr8-maths-resources.html</a></p>
	<b>Connections</b>
	<p>This assessment can be used with the QSA Australian Curriculum resources titled <i>Year 8 plan — Australian Curriculum: Mathematics</i> (Term 3: Algebraic processes and Term 4: Linear relations), available at:  <a href="http://www.qsa.qld.edu.au/yr8-maths-resources.html">www.qsa.qld.edu.au/yr8-maths-resources.html</a></p>
	<b>Definitions</b>
	<p>See the Australian Curriculum glossary for technical terms used in this assessment  <a href="http://www.qsa.qld.edu.au/yr8-maths-resources.html">www.qsa.qld.edu.au/yr8-maths-resources.html</a></p>
<b>In this assessment</b>	<b>Assessment materials</b>
Teacher guidelines Student booklet Task-specific standards — continua Task-specific standards — matrix Model response	Pens, pencils, ruler, calculator.

# Teacher guidelines

## Identify curriculum

Content descriptions to be taught
<b>Number and Algebra</b>
<b>Number and place value</b> <ul style="list-style-type: none"><li>Carry out the four operations with rational numbers and integers, using efficient mental and written strategies and appropriate digital technologies (<a href="#">ACMNA183</a>)</li></ul>
<b>Patterns and algebra</b> <ul style="list-style-type: none"><li>Extend and apply the distributive law to the expansion of algebraic expressions (<a href="#">ACMNA190</a>)</li><li>Simplify algebraic expressions involving the four operations (<a href="#">ACMNA192</a>)</li></ul>
<b>Linear and non-linear relationships</b> <ul style="list-style-type: none"><li>Plot linear relationships on the Cartesian plane with and without the use of digital technologies (<a href="#">ACMNA193</a>)</li><li>Solve linear equations using algebraic and graphical techniques. Verify solutions by substitution (<a href="#">ACMNA194</a>)</li></ul>
<b>General capabilities (GCs) and cross-curriculum priorities (CCPs)</b> <p>This assessment may provide opportunities to engage with the following GCs and CCPs. Refer also to the Resources tab on the Mathematics curriculum hub: <a href="http://www.qsa.qld.edu.au/yr8-maths-resources.html">www.qsa.qld.edu.au/yr8-maths-resources.html</a></p>
 <b>Literacy</b>
 <b>Numeracy</b>
 <b>ICT capability</b>
 <b>Critical and creative thinking</b>

### Achievement standard

This assessment provides opportunities for students to demonstrate the following highlighted aspects.

By the end of Year 8, students solve everyday problems involving rates, ratios and percentages. They recognise index laws and apply them to whole numbers. They describe rational and irrational numbers. Students solve problems involving profit and loss. They make connections between expanding and factorising algebraic expressions. Students solve problems relating to the volume of prisms. They make sense of time duration in real applications. They identify conditions for the congruence of triangles and deduce the properties of quadrilaterals. Students model authentic situations with two-way tables and Venn diagrams. They choose appropriate language to describe events and experiments. They explain issues related to the collection of data and the effect of outliers on means and medians in that data.

Students use efficient mental and written strategies to carry out the four operations with integers. They simplify a variety of algebraic expressions. They solve linear equations and graph linear relationships on the Cartesian plane. Students convert between units of measurement for area and volume. They perform calculations to determine perimeter and area of parallelograms, rhombuses and kites. They name the features of circles and calculate the areas and circumferences of circles. Students determine complementary events and calculate the sum of probabilities.

Source: ACARA, The Australian Curriculum v4.1, [www.australiancurriculum.edu.au](http://www.australiancurriculum.edu.au)

## Sequence learning

### Suggested learning experiences

This assessment relates to the learning experiences outlined in the QSA's Year 8 Mathematics plan, terms 3 and 4 – Algebraic processes and Linear relations.

- Year 8 plan — Mathematics exemplar
- [www.qsa.qld.edu.au/yr8-maths-resources.html](http://www.qsa.qld.edu.au/yr8-maths-resources.html)

### Adjustments for needs of learners

To make adjustments, teachers refer to learning area content aligned to the student's chronological age, personalise learning by emphasising alternate levels of content, general capabilities or cross-curriculum priorities in relation to the chronological age learning area content. The emphasis placed on each area is informed by the student's current level of learning and their strengths, goals and interests. Advice on the process of curriculum adjustment for all students and in particular for those with disability, gifted and talented or for whom English is an additional language or dialect are addressed in *Australian Curriculum — Student Diversity* materials.

For information to support students with diverse learning needs, see:

- Queensland Studies Authority materials for supporting students with diverse learning needs [www.qsa.qld.edu.au/10188.html](http://www.qsa.qld.edu.au/10188.html)
- Australian Curriculum Student Diversity [www.australiancurriculum.edu.au/StudentDiversity/Overview](http://www.australiancurriculum.edu.au/StudentDiversity/Overview)
- The *Melbourne Declaration on Educational Goals for Young Australians* [www.mceecdya.edu.au/mceecdya/melbourne\\_declaration,25979.html](http://www.mceecdya.edu.au/mceecdya/melbourne_declaration,25979.html)
- The *Disability Standards for Education* [www.ag.gov.au](http://www.ag.gov.au).

### Resources

#### Online

Sample investigation that includes many of the learning experiences described in this package. Queensland Studies Authority 2005. *Patterns and pavers*, Mathematics (2004) support materials, [www.qsa.qld.edu.au/1184.html](http://www.qsa.qld.edu.au/1184.html) (search for "Patterns and pavers" on this webpage).

## Develop assessment

### Preparing for the assessment

Learning experiences in preparation for the assessment could include:

- Identify the relevant information, the calculations, laws (commutative, associative, distributive, inverse) and the order of operations to be used to solve an algebraic expression.
- Use letters and symbols to represent numbers in relationships and algebraic expressions.
- Expand algebraic expressions by applying the distributive law, and use the four operations to collect like terms and manipulate algebraic expressions.
- Find an unknown value by substituting into, then simplifying, linear equations or algebraic expressions involving the four operations.
- Read and construct tables of values from word problems, algebraic expressions and linear equations.
- Use a Cartesian plane to plot tables of values or ordered pairs, or find values for a point.
- Interpret and analyse graphs for features such as cost.
- Find and represent patterns in a variety of situations, e.g. looking at tiled areas and counting the number of tiles per  $m^2$ , then working out the pattern.
- Use blocks and tiles to model a paved area, including edging.
- Use simple scales and keys to scales, e.g. 1 cm : 1 m.
- Estimate and check the reasonableness of answers.
- Practise critically reviewing and articulating thinking and working for a particular purpose (e.g. evaluating strategies used in different situations or by different people), making connections to possible usefulness in other contexts.
- Develop skills in providing a justification (including a mathematical reason) to a decision.

### Implementing

#### Teacher role

- Read questions aloud to the class to ensure literacy demands do not prevent students from providing evidence of their understanding and skills in mathematics.
- Explain that the purpose of a material reckoner is to save time by not having to start from the beginning each time you need to work out the amount of materials necessary for a paving job.
- Clarify with students that in Section 1 they are writing descriptions for how to calculate the number of pavers or the length of timber edging from the length, not how to calculate the next quantity from the previous one.
- Encourage students to highlight key words in the instructions such as number of pavers, length of timber edging, Design 1, Design 2, and to use colour coding on the diagram to show the work to be done on Mrs Kent's property (noting where edging is required).
- The lengths of the paths to Mrs Kent's house may not be exact multiples of the paver size. When preparing the quote, students must realise that they need to purchase whole pavers, and must factor this into their calculations.

## Make judgments

When making judgments about the evidence in student responses to this assessment, teachers are advised to use the task-specific standards provided. The development of these task-specific standards has been informed by the Queensland Year 8 standard elaborations. See [www.qsa.qld.edu.au/yr8-maths-resources.html](http://www.qsa.qld.edu.au/yr8-maths-resources.html)

## The Queensland standard elaborations for Mathematics

The Queensland Year 8 standard elaborations for Mathematics is a resource to assist teachers to make consistent and comparable evidence-based A to E (or equivalent) judgments. It should be used in conjunction with the Australian Curriculum achievement standard and content descriptions for the relevant year level.

The Queensland Mathematics standard elaborations provide a basis for judging *how well* students have demonstrated what they know, understand and can do using the Australian Curriculum achievement standard.

The Australian Curriculum achievement standards dimensions of Understanding and Skills are used to organise the Queensland Mathematics standard elaborations. Understanding and Skills in Mathematics are organised as Understanding, Fluency, Problem solving and Reasoning.

The valued features of Mathematics are drawn from the achievement standard and the content descriptions for Understanding and Skills are organised as:

- Mathematical understandings
- Recall and use of facts, definitions, technologies and procedures
- Use of mathematical language, conventions and symbols
- Use of problem-solving strategies
- Modelling and representation
- Results and conclusions of investigations and inquiries
- Communication of mathematical thinking, choices and strategies.

### Task-specific standards

Task-specific standards give teachers:

- a tool for directly matching the evidence of learning in the student response to the standards
- a focal point for discussing student responses
- a tool to help provide feedback to students.

Task-specific standards are not a checklist; rather they are a guide that:

- highlights the valued features that are being targeted in the assessment and the qualities that will inform the overall judgment
- specifies particular *targeted aspects* of the curriculum content and achievement standard
- aligns the valued feature, task-specific descriptor and assessment
- allows teachers to make consistent and comparable on-balance judgments about student work by matching the qualities of student responses with the descriptors
- clarifies the curriculum expectations for learning at each of the five grades (A–E or the early years equivalent)
- shows the connections between what students are expected to know and do, and how their responses will be judged and the qualities that will inform the overall judgment
- supports evidence-based discussions to help students gain a better understanding of how they can critique their own responses and achievements, and identify the qualities needed to improve
- encourages and provides the basis for conversations among teachers, students and parents/carers about the quality of student work and curriculum expectations and related standards.

## Task-specific valued features

Task-specific valued features are the discrete aspects of the valued features of Mathematics targeted in a particular assessment and incorporated into the task-specific standards for that assessment. They are selected from the Queensland Mathematics standard elaborations valued features drawn from the Australian Curriculum achievement standard and content descriptions.

### Task-specific valued features for this assessment

The following table identifies the valued features for this assessment and makes explicit the understandings and skills that students will have the opportunity to demonstrate. This ensures that the alignment between what is taught, what is assessed and what is reported is clear.

Task-specific valued features for this assessment			
The following identifies the valued features for this assessment and makes explicit the understandings and skills that students will have the opportunity to demonstrate. This ensures that the alignment between what is taught, what is assessed and what is reported is clear.			
Australian Curriculum achievement standard dimensions	Australian Curriculum Proficiency strands	Queensland standard elaborations valued features	Task-specific valued features
Understanding and Skills	Understanding & Fluency	Connection and description of mathematical understandings.	<ul style="list-style-type: none"> <li>Developing equations to represent numbers of pavers and lengths of timber.</li> </ul>
		Recall and use of facts, definitions, technologies and procedures.	<ul style="list-style-type: none"> <li>Expanding and simplifying algebraic expressions to develop a linear equation.</li> <li>Plotting a linear relationship and reading from the graph.</li> </ul>
		Use of mathematical language, conventions and symbols.	<ul style="list-style-type: none"> <li>Using mathematical language, symbols and conventions when writing and using equations, plotting graphs and writing explanations.</li> </ul>
	Problem solving & Reasoning	Application of problem-solving strategies.	<ul style="list-style-type: none"> <li>Applying strategies to justify costs and prepare a paving quote.</li> </ul>
		Discussion of mathematical thinking, choices and strategies.	<ul style="list-style-type: none"> <li>Justifying and evaluating the choice of a preferred costing method.</li> <li>Describing modifications to the method in a particular application.</li> </ul>

The task-specific standards for this assessment are provided in two models using the same task-specific valued features:

- a matrix
- a continua.

Australian Curriculum Year 8 Mathematics	Pete's Paving	Teacher guidelines
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## **Matrix and Continua**

Task-specific standards can be prepared as a matrix or continua. Both the continua and the matrix:

- use the Queensland standard elaborations to develop task-specific descriptors to convey expected qualities in student work — A to E or equivalent
- highlight the same valued features from the Queensland standard elaborations that are being targeted in the assessment and the qualities that will inform the overall judgment
- incorporate the same task-specific valued features, i.e. make explicit the particular understanding / skills students have the opportunity to demonstrate for each selected valued feature
- provide a tool for directly matching the evidence of learning in the student response to the standards to make an on-balance judgment about student achievement
- assist teachers to make consistent and comparable evidence-based A to E or equivalent judgments.

### **Continua**

The continua model of task-specific standards uses the dimensions of the Australian Curriculum achievement standard to organise task-specific valued features and standards as a number of reference points represented progressively along an A to E continuum. The task-specific valued features at each point are described holistically. The task-specific descriptors of the standard use the relevant degrees of quality described in the Queensland standard elaborations.

Teachers determine a position along each continuum that best matches the evidence in the students' responses to make an on-balance judgment about student achievement on the task.

The continua model is a tool for making an overall on-balance judgment about the assessment and for providing feedback on task-specific valued features.

### **Matrix**

The matrix model of task-specific standards uses the structure of the Queensland standard elaborations to organise the task-specific valued features and standards A to E. The task-specific descriptors of the standard described in the matrix model use the same degrees of quality described in the Queensland standard elaborations.

Teachers make a judgment about the task-specific descriptor in the A to E (or equivalent) cell of the matrix that best matches the evidence in the students' responses in order to make an on-balance judgment about how well the pattern of evidence meets the standard.

The matrix is a tool for making both overall on-balance judgments and analytic judgments about the assessment. Achievement in each valued feature of the Queensland standard elaboration targeted in the assessment can be recorded and feedback can be provided on the task-specific valued features.

## Use feedback

<b>Feedback to students</b>	<p>This assessment provides opportunities to provide feedback to students on how well they:</p> <ul style="list-style-type: none"><li>• select a sequence of steps to find a solution</li><li>• use algebraic skills</li><li>• generate and use equations, tables of values, and line graphs:<ul style="list-style-type: none"><li>– selecting the correct axes and scale for the independent and dependent variables when using graph paper</li><li>– manipulating graphs in spreadsheet software to best display the data</li><li>– inputting work into spreadsheets or reckoners</li><li>– interpolating data</li><li>– consolidating concepts of area and perimeter and their applications when identifying, describing and applying relationships</li></ul></li><li>• check for reasonableness:<ul style="list-style-type: none"><li>– verifying the reasonableness of the solution by checking that the answer fits the question, e.g. by applying existing strategies, using a variety of techniques, estimation, working backwards</li></ul></li><li>• discuss results:<ul style="list-style-type: none"><li>– making links between results of the mathematical model and the original question.</li></ul></li></ul>
<b>Resources</b>	<p>For guidance on providing feedback, see the professional development packages titled:</p> <ul style="list-style-type: none"><li>• <i>About feedback</i> <a href="http://www.qsa.qld.edu.au/downloads/p_10/as_feedback_about.doc">www.qsa.qld.edu.au/downloads/p_10/as_feedback_about.doc</a></li><li>• <i>Seeking and providing feedback</i> <a href="http://www.qsa.qld.edu.au/downloads/p_10/as_feedback_provide.doc">www.qsa.qld.edu.au/downloads/p_10/as_feedback_provide.doc</a></li></ul>



# Pete's Paving

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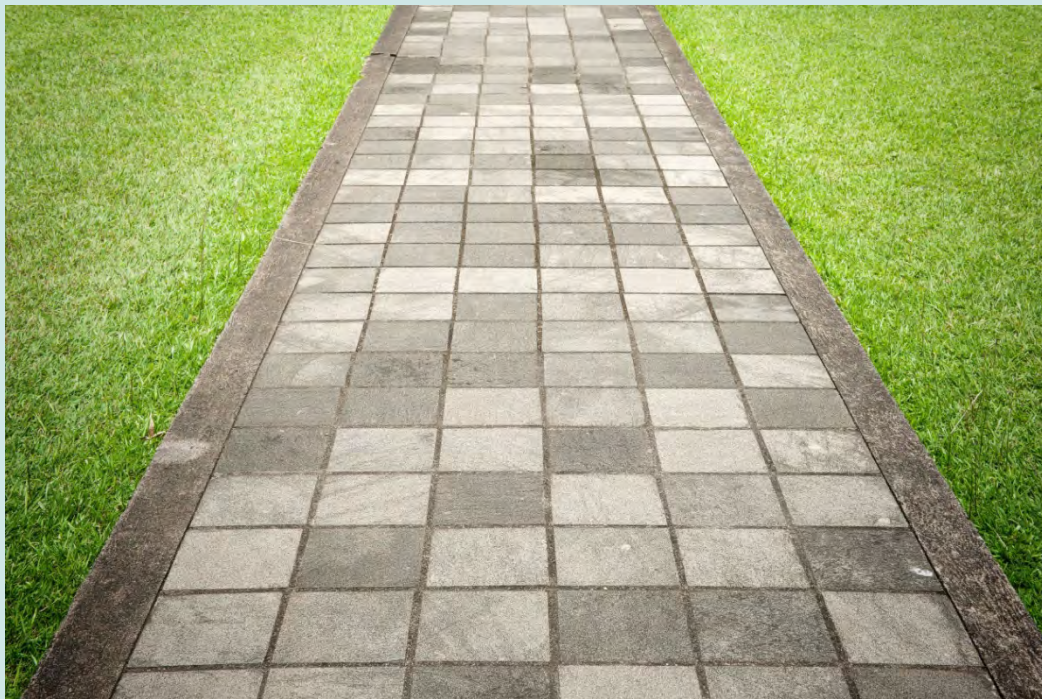


Image: Stock Photo - The walk way surface of concrete blocks, 123RF stock image 9144637, [www.123rf.com/photo\\_9144637\\_the-walk-way-surface-of-concrete-blocks.html](http://www.123rf.com/photo_9144637_the-walk-way-surface-of-concrete-blocks.html)

**To use algebraic equations and graphs to simplify paving quotes, and to apply and evaluate the methods used.**

**You will:**

- develop methods to calculate materials and costs quickly and accurately
- compare methods
- prepare a quote for providing an area of paving.

# Setting the scene

The owners of Pete’s Paving have decided to update their manual.

They have decided to develop some **reckoners** to quickly and accurately calculate the amount of materials and costs for different jobs, such as building a path or outdoor area.

These reckoners will be used when preparing quotes for customers.

## Section 1. Material reckoners

A **material reckoner** is used to calculate quickly and accurately the number of pavers or the length of timber edging needed for different-sized jobs, without drawing a diagram.

1. Complete Reckoners A and B for Design 1 — Straight path.

<b>Design 1 — Straight path</b>	<ul style="list-style-type: none"> <li>• 1 m wide, using 500 mm x 500 mm pavers</li> <li>• pavers held together by timber edging</li> </ul>

Reckoner A	Number of pavers for Design 1 — Straight path					
Length of path in metres (l)	1	2	3	4	5	20
Number of pavers (n)	4					
To find the number of pavers from the length of the path without drawing a diagram, you can:						
Equation:						

Reckoner B	Length of timber edging for Design 1 — Straight path					
Length of path in metres (l)	1	2	3	4	5	20
Length of timber edging in metres (e)	4	6				
To find the length of timber edging from the length of the path without drawing a diagram, you can:						
Equation:						

2. Complete Reckoners C and D for Design 2 — Square area.

<b>Design 2 — Square area</b>	<ul style="list-style-type: none"> <li>square area using 500 mm x 500 mm pavers</li> <li>pavers held together by timber edging</li> </ul>

Reckoner C	Number of pavers for Design 2 — Square area				
Side length in metres (s)	1	2	3	4	20
Number of pavers (n)	4				
To find the number of pavers from the side length of a square area without drawing a diagram, you can:					
Equation:					

Reckoner D	Length of timber edging for Design 2 — Square area				
Side length in metres (s)	1	2	3	4	20
Length of timber edging in metres (e)	4				
To find the length of timber edging from the side length of a square area without drawing a diagram, you can:					
Equation:					

## Section 2. Quote reckoners

A **quote rechner** is used to calculate quickly and accurately the costs for different jobs.

Pete's Paving charges the following when costing work:

Item	Description	Cost
Pavers	500 mm x 500 mm	\$12 each
Timber edging	sold per metre	\$1.70 per metre
Delivery costs	delivery of materials incurs a fixed charge	\$132
Labour	includes preparing the base and timber edging	\$10.50 per paver

- Using the equations from Question 1, formulate a single linear equation that describes how to calculate the cost ( $c$ ) of the work from the length ( $l$ ) of the straight path.
- Draw a line graph for the cost of a straight path using the linear equation from Question 3.
  - Show your working.
  - Label your graph "Reckoner E: Cost for Design 1 — Straight path".
- Rule straight lines on the graph to show how to find the cost of a path 15 metres long.
- Reading from the graph, what is the cost of a 15-metre path?
- Use a strategy to check your answer to Question 6.
  - Hint: Look at your answers to previous questions.
  - Show your working.
- The owners of Pete's Paving have decided to include just one method for calculating the cost of straight paths in the manual.
  - Which method would you recommend they use?  
(Hint: Look at your answers to questions 3 to 6 before answering.)
  - Give two reasons for recommending this method.  
In your answer, suggest ways it is better than the other methods considered.
  - Describe any disadvantages there could be to using this method.

### Section 3. Mrs Kent's quote

Mrs Kent wants the following paving work carried out on her property (shown on page 6):

- a square, paved BBQ area in the back corner
- a path from the house to the BBQ area (Path 1)
- a path from the house to Solitude St (Path 2)
- timber edging around the outside of paved areas and paths. (Note that this means there is no timber edging where a path connects to another paved area or to the house.)

A plan for the work required is included in the diagram overleaf.

9. Prepare a quote for Mrs Kent, in a format like the one below.

- Use one or more of the reckoners you developed in Sections 1 and 2.
- Show all working.

 **Pete's Paving** Quote No: 002987

Client name: Mrs Kent  
14 Somewhere Ave  
Brisbane QLD 4000

**Details of work:** .....

Pavers	
Timber edging	
Delivery	\$132.00
Labour	
<b>Total</b>	

Quote valid for 30 days

10. What modifications did you need to make when using the reckoners to calculate the materials needed for Mrs Kent's property?

# Mrs Kent's property



House



Clothes line



Tree

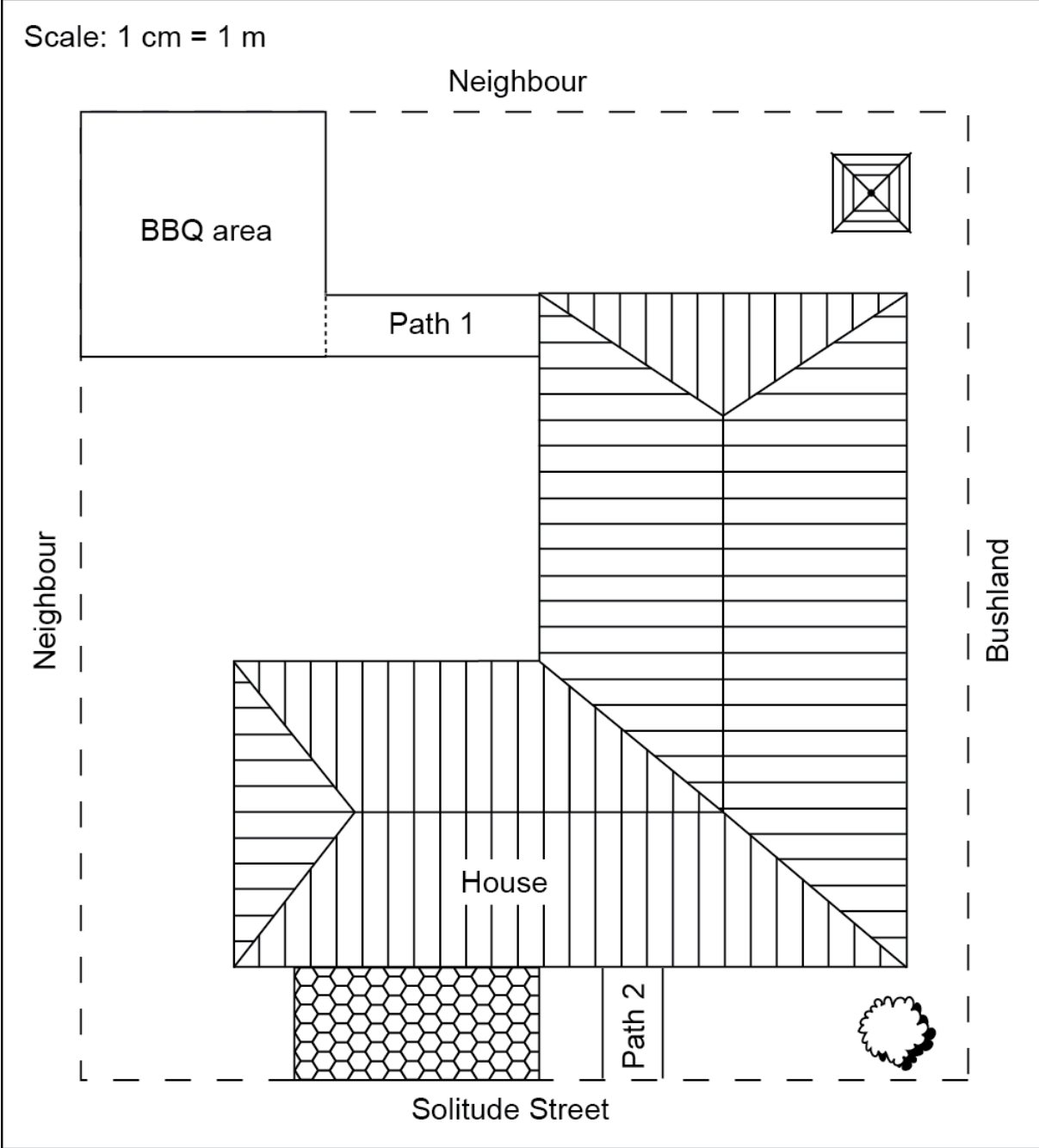


Driveway



Land boundary

Scale: 1 cm = 1 m



# Pete's Paving

Name .....

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**Purpose of assessment:** To use algebraic equations and graphs to simplify paving quotes, and to apply and evaluate the methods used.

Understanding and Skills				
Understanding & Fluency		Problem solving & Reasoning		
<p>Writing equations to connect the length of the design of the paved areas to the numbers of pavers and lengths of timber (Q1, 2). Expanding and simplifying algebraic expressions to develop a linear equation (Q3).</p> <p>Plotting a linear relationship and reading a graph (Q4, 5, 6).</p>	<p>Using mathematical language, symbols and conventions when writing and using equations, plotting graphs and writing explanations (Q1–9).</p>	<p>Applying a strategy to justify the cost of the 15 m path (Q7) and to prepare a paving quote (Q9).</p>	<p>Justifying and evaluating the choice of a preferred costing method (Q8).</p> <p>Describing modifications to the method in a particular application (Q10).</p>	
<p>Writing equations to connect the length of the design of the paved areas to the numbers of pavers and lengths of timber. Development of a linear equation to calculate the cost (c) of the work from the length (l) of the straight path. Accurate and efficient use of a linear equation to plot a line graph and find the correct cost of a 15 m path.</p> <p>Description of a method for finding the number of pavers or lengths of timber.</p> <p>Identification of the number of pavers and lengths of timber for Design 1 and Design 2. Recognition of a pattern for finding the number of pavers or lengths of timber.</p> <p>Statement about the number of pavers or lengths of timber for Design 1 or Design 2. Attempted use of procedures to plot a graph.</p>	<p>Consistent use of appropriate conventions and symbols when writing equations and plotting a graph. Consistent use of appropriate mathematical language in explanations.</p> <p>Use of conventions and symbols when writing equations and plotting a graph. Use of mathematical language in explanations.</p> <p>Use of some conventions and symbols and mathematical language.</p> <p>Use of everyday language.</p>	<p>Successful application of a strategy to mathematically justify the cost of the 15 m path and prepare an accurate paving quote.</p> <p>Some justification of the cost of the 15 m path. Application of a strategy to prepare a paving quote.</p> <p>Application of a strategy to partially prepare a paving quote.</p>	<p>Clear justification for a choice of costing method and a clear explanation of practical disadvantages. Clear explanation of modifications to the method.</p> <p>Discussion of a choice of costing method and statement of a possible disadvantage. Description of a modification to the method.</p> <p>Isolated statements about the costing method.</p>	<p>A</p> <p>B</p> <p>C</p> <p>D</p> <p>E</p>



# Pete's Paving

Name .....

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**Purpose of assessment:** To use algebraic equations and graphs to simplify paving quotes, and to apply and evaluate the methods used.

		A	B	C	D	E	
Understanding and Skills dimensions	Understanding & Fluency	<b>Mathematical understandings</b> Writing equations to connect the length of the design of the paved areas to the numbers of pavers and lengths of timber (Q1, 2). Expanding and simplifying algebraic expressions to develop a linear equation (Q3).	Writing equations to connect the length of the design of the paved areas to the numbers of pavers and lengths of timber. Development of a linear equation to calculate the cost (c) of the work from the length (l) of the straight path.	Identification of the number of pavers and lengths of timber for Design 1 and Design 2. Description of a method for finding the number of pavers or lengths of timber.	Identification of the number of pavers and lengths of timber for Design 1 and Design 2. Recognition of a pattern for finding the number of pavers or lengths of timber.	Identification of the number of pavers or lengths of timber for Design 1 or Design 2.	Statement about the number of pavers or lengths of timber for Design 1 or Design 2.
		<b>Recall and use of facts, definitions, technologies and procedures</b> Plotting a linear relationship and reading from a graph (Q4, 5, 6).	Accurate and efficient use of a linear equation to plot a line graph and find the correct cost of a 15 m path.	Accurate use of a linear equation to plot a line graph and read from the graph.	Use of procedures to plot a line graph and read from the graph.	Some use of procedures to plot a graph and attempt to read from the graph.	Attempted to use of procedures to plot a graph.
		<b>Use of mathematical language, conventions and symbols</b> Using mathematical language, symbols and conventions when writing and using equations, plotting graphs and writing explanations (Q1–9).	Consistent use of appropriate conventions and symbols when writing equations and plotting a graph. Consistent use of appropriate mathematical language in explanations.	Use of appropriate conventions and symbols when writing equations and plotting a graph. Appropriate use of mathematical language in explanations.	Use of conventions and symbols when writing equations and plotting a graph. Use of mathematical language in explanations.	Use of some conventions and symbols and mathematical language.	Use of everyday language.
	Problem solving & Reasoning	<b>Application of problem-solving strategies</b> Applying a strategy to justify the cost of the 15 m path (Q7) and to prepare a paving quote (Q9).	Successful application of a strategy to mathematically justify the cost of the 15 m path and prepare an accurate paving quote.	Successful application of a strategy to prepare an accurate paving quote.	Some justification of the cost of the 15 m path, Application of a strategy to prepare a paving quote.	Partial preparation of a paving quote.	Attempted preparation of a paving quote.
		<b>Discussion of mathematical thinking, choices and strategies</b> Justifying and evaluating the choice of a preferred costing method (Q8). Describing modifications to the method in a particular application (Q10).	Clear justification for a choice of costing method and a clear explanation of practical disadvantages. Clear explanation of modifications to the method.	Justification for a choice of costing method and an explanation of possible disadvantages. Explanation of modifications to the method.	Discussion of a choice of costing method and statement of a possible disadvantage. Description of a modification to the method.	Statements about the costing method and possible disadvantages.	Isolated statements about the costing method.



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## Question 4 Graphing response sheet

Reckoner E

