**NZQA**

**Approved**

Achievement standard: 91029 Version 3

Standard title: Apply linear algebra in solving problems

Level: 1

Credits: 3

Resource title: Concrete quotes

Resource reference: Mathematics and Statistics VP-1.4 v2

Vocational pathway: Construction and Infrastructure

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| Date version published | February 2015 Version 2  To support internal assessment from 2015 |
| Quality assurance status | These materials have been quality assured by NZQA.  NZQA Approved number A-A-02-2015-91029-02-7265 |
| Authenticity of evidence | Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material.  Using this assessment resource without modification may mean that learners’ work is not authentic. Assessors/ educators may need to change figures, measurements or data sources or set a different context or topic to be investigated or a different text to read or perform. |

Vocational Pathway Assessment Resource

Achievement standard: 91029

Standard title: Apply linear algebra in solving problems

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Learner instructions

# Introduction

This assessment activity requires you to apply linear algebra in solving problems in relation to quotes for ready-mixed concrete.

You are going to be assessed on how you apply linear algebra, using extended abstract thinking, when investigating charge rates from different firms that supply ready-mixed concrete. You are required to communicate your solutions clearly and accurately.

The following instructions provide you with a way to structure your work so you can demonstrate what you have learnt and achieve success in this standard.

Assessor/educator note: It is expected that the assessor/educator will read the learner instructions and modify them if necessary to suit their learners.

# Task

Cory needs some concrete for home handyman projects he is planning. As part of costing the projects he has obtained quotes from three different firms that supply ready-mixed concrete delivered to the site.

Resources A and B show the quotes from each firm and the volume of concrete Cory has calculated he will need for each of his projects.

Represent the quotes from the three firms using the same representation (e.g. three equations or three graphs).

Recommend which firm Cory should use to supply the concrete for two of the projects.

Recommend volumes for which it would be cheapest for Cory to use Valley Concrete.

How could Central Construction change their quote to be the cheapest firm for any volume of ready-mixed concrete? Describe at least two different ways they could realistically change their quote to achieve this goal. Include specific examples of the rates they could use.

# Resources

## Resource A: Quotes for ready-mixed concrete delivered to site

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| --- | --- | --- |
| **Central Construction**  C = 160 m + 230  Where C is the cost in dollars and m is the volume of concrete in cubic metres. | **Valley Concrete**  Fixed charge: $90  Per cubic metre: $240 | **Woruk Pre-Mix**  $550 for any volume of concrete up to 2 m3.  $120 per cubic metre for amounts over 2 m3 with a maximum of 4 m3. |

## Resource B: Projects Cory is planning

|  |  |
| --- | --- |
| **Project** | **Volume of concrete (m3)** |
| Carport | 2.6 |
| Sleepout | 2.2 |
| Patio | 1.4 |

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Assessor/Educator guidelines

# Introduction

The following guidelines are supplied to enable assessors/educators to carry out valid and consistent assessment using this internal assessment resource.

As with all assessment resources, education providers will need to follow their own quality control processes. Assessors/educators must manage authenticity for any assessment from a public source, because learners may have access to the assessment schedule or exemplar material. Using this assessment resource without modification may mean that learners' work is not authentic. The assessor/educator may need to change figures, measurements or data sources or set a different context or topic. Assessors/educators need to consider the local context in which learning is taking place and its relevance for learners.

Assessors/educators need to be very familiar with the outcome being assessed by the achievement standard. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing learners against it.

# Context/setting

This activity requires learners to apply linear algebra, using extended abstract thinking, to investigate quotes from different firms for delivering ready-mixed concrete.

# Conditions

Learners will work independently on the activity.

# Resource requirements

Learners are expected to have access to appropriate technology.

# Additional information

Assessors/educators need to ensure that learners are familiar with any context specific vocabulary used in this resource.

# Assessment schedule: Mathematics and Statistics 91029 – Concrete quotes

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| --- | --- | --- |
| Evidence/Judgements for Achievement | Evidence/Judgements for Achievement with Merit | Evidence/Judgements for Achievement with Excellence |
| The learner applies linear algebra in solving problems by:   * selecting and using a range of methods * demonstrating knowledge of algebraic concepts and terms * communicating solutions which would usually require only one or two steps   The learner needs to select and correctly use at least three different linear algebra methods in solving problems  For example:  The learner could:   * + form a linear model for Valley Concrete   + use a formula to calculate the cost for a specified project   + use simultaneous equations to determine when Central Construction and Valley Concrete cost the same   + graph linear models for the firms.   *The examples above are indicative of the evidence that is required.* | The learner applies linear algebra, using relational thinking, in solving problems by involving one or more of:   * selecting and carrying out a logical sequence of steps * connecting different concepts and representations * demonstrating understanding of concepts * forming and using a model   and also relating findings to the context, or communicating thinking using appropriate mathematical statements  For example:  The learner has recommended a firm for two of the projects and quantities for which Valley Concrete are cheaper. The learner has also started to investigate different charges for Central Construction for them to have the cheapest quote for any volume of ready-mixed concrete.  *The examples above are indicative of the evidence that is required.* | The learner applies linear algebra, using extended abstract thinking, in solving problems by involving one or more of:   * demonstrating understanding of abstract concepts * developing a chain of logical reasoning, or proof * forming a generalisation   and also using correct mathematical statements, or communicating mathematical insight  For example:  The learner has recommended a firm for two of the projects, and recommended quantities for which Valley Concrete is cheaper. The learner has fully described the new charge rates for Central Construction and justified that they are the cheapest quote for any volume of ready-mixed concrete.  *The examples above are indicative of the evidence that is required.* |

Final grades will be decided using professional judgement based on an examination of the evidence provided against the criteria in the Achievement Standard. Judgements should be holistic, rather than based on a checklist approach.