



National Certificate of Educational Achievement
TAUMATA MĀTAURANGA Ā-MOTU KUA TĀEA

Internal Assessment Resource Mathematics and Statistics Level 2

This resource supports assessment against:
Achievement Standard 91269 version 2
Apply systems of equations in solving problems

Resource title: Logo Design

2 credits

This resource:

- Clarifies the requirements of the standard
- Supports good assessment practice
- Should be subjected to the school's usual assessment quality assurance process
- Should be modified to make the context relevant to students in their school environment and ensure that submitted evidence is authentic

Date version published by Ministry of Education	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-02-2015-91269-02-5597
Authenticity of evidence	Teachers must manage authenticity for any assessment from a public source, because students may have access to the assessment schedule or student exemplar material. Using this assessment resource without modification may mean that students' work is not authentic. The teacher 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.

Internal Assessment Resource

Achievement Standard Mathematics and Statistics 91269:

Apply systems of equations in solving problems

Resource reference: Mathematics and Statistics 2.14B v2

Resource title: Logo Design

Credits: 2

Teacher guidelines

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

Teachers need to be very familiar with the outcome being assessed by Achievement Standard Mathematics and Statistics 91269. The achievement criteria and the explanatory notes contain information, definitions, and requirements that are crucial when interpreting the standard and assessing students against it.

Context/setting

The context for this activity is the analysis of a logo design. This activity requires students to use systems of equations involving two variables to locate key features of the design and to consider new features for the design.

Conditions

This assessment activity may be conducted in one or more sessions. Confirm the time frame with your students.

Students work individually to complete the task.

Students may use technology such as graphic calculators or computers to complete the task.

Resource requirements

Provide students with the Level 2 formulae sheet.

Additional information

None.

Internal Assessment Resource

Achievement Standard Mathematics and Statistics 91269:

Apply systems of equations in solving problems

Resource reference: Mathematics and Statistics 2.14B v2

Resource title: Logo Design

Credits: 2

Achievement	Achievement with Merit	Achievement with Excellence
Apply systems of equations in solving problems.	Apply systems of equations using relational thinking, in solving problems.	Apply systems of equations using extended abstract thinking, in solving problems.

Student instructions

Introduction

An engineering company is developing a new logo using graphing software. This assessment activity requires you to use systems of equations to analyse the logo design and to consider new features for the design.

Teacher note: This activity can be adapted to another context or type of design, for example, a sports club logo or a packaging design. The design could be modified to be one based on a quadratic and a line.

You have one period of in-class time to independently complete this task.

Teacher note: Confirm conditions and timing of the assessment.

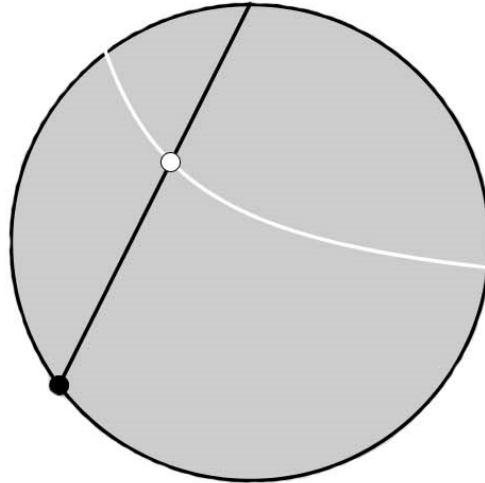
Your overall grade will be determined by the quality of your reasoning and how well you link this to the context.

Task

An engineering company is developing a new logo using graphing software. Their first design is based on a circle. Dots are placed at some of the points of intersection, as shown in the diagram.

They have asked you to analyse the logo design and to consider new features for the design.

Part of the design for the logo is shown on the next page:



Equations used for the logo design:

$$x^2 - 6x + y^2 = 0$$

$$y = 2x - 3$$

$$x(y + 1) = 4$$

Analyse the logo design following the steps below:

- Find the location of the white dot and the black dot.
- A new dark grey line is being added to the design, with a dark grey dot placed wherever the dark grey line intersects the white “line”. This may be outside the circle. Find an equation for the dark grey line so that only one dark grey dot is added to the logo design and the location of the dark grey dot.
- How could the constant term for the equation of the black line in the design be changed so that the black line becomes a tangent with the circle?

Submit your analysis and related evidence used in considering new features of the design. This could include sketches for the final design of the logo, equations you have used, and any relevant calculations or graphs.

The quality of your reasoning and how well you link the context to generalisations of systems of equations will determine the overall grade. Clearly communicate your findings using appropriate mathematical statements.

Assessment schedule: Mathematics and Statistics 91269 Logo Design

Evidence/Judgements for Achievement	Evidence/Judgements for Achievement with Merit	Evidence/Judgements for Achievement with Excellence
<ul style="list-style-type: none"> The student has applied systems of equations in solving problems. The student correctly selects and uses methods with systems of equations. They have demonstrated knowledge of concepts and terms and communicated using appropriate representations. <p><i>For example:</i> <i>For either the black dot or the white dot, the student has selected two equations from those provided and solved them simultaneously to find the co-ordinates of the point(s) of intersection.</i></p>	<ul style="list-style-type: none"> The student has applied systems of equations, demonstrating relational thinking in solving problems. The student has connected different concepts or representations and has selected and carried out a logical sequence of steps. The student has related their findings to the context or communicated their thinking using appropriate mathematical statements. <p><i>For example:</i> <i>The student has connected the location of the black dot in the design to the point of intersection of the circle and the black line. They have solved a system of equations by forming a quadratic equation and found both solutions. The student has then selected the correct values of x and y to describe the location of the black dot, rounding appropriately.</i> <i>In considering the equation for the new dark grey line, the student has identified that only one dot to be added means the new line must be parallel to the existing line. The student has found the co-ordinates of the new dark grey dot. The placement of the dark grey dot may be outside of the circle.</i> <i>In considering the tangent, the student has used the general form of the line parallel to the black line to form a quadratic equation which could be used to provide conditions for the constant.</i></p>	<ul style="list-style-type: none"> The student has applied systems of equations, using extended abstract thinking, in solving problems. The student has used correct mathematical statements or communicated mathematical insight. <p><i>For example:</i> <i>The student has generalised the situation for a tangent to a circle to set up a system of simultaneous equations. The student has linked the type of solution for the simultaneous equations (only one solution) to the correct geometrical representation (only one intersection between the line and the circle, i.e. a tangent), and found suitable values for the constant term for the equation of the black line. The student has presented the possible values for the constant term in the equation of the black line, using correct mathematical statements.</i></p>

Final grades will be decided using professional judgement based on a holistic examination of the evidence provided against the criteria in the Achievement Standard.