

MATHEMATICS AND STATISTICS MXO2143Y1 INTERNAL ASSESSMENT ACTIVITY

ACHIEVEMENT STANDARD 91269 (VERSION 3) MATHEMATICS AND STATISTICS 2.14

Apply systems of equations in solving problems Level 2, Internal assessment 2 credits

STUDENT INSTRUCTIONS

Overview:

In this assessment activity, you will:

• apply systems of equations to investigate a situation involving linear and non-linear equations.

Conditions:

- This is an open book assessment activity so you may refer to any related modules or any other resources.
- This must be your own work.
- There is no time limit for the completion of this activity but you should allow up to two hours.
- Resource 1 Formula reference sheet, contains important information for your investigation.
- Any scientific, graphical, CAS calculator or a computer with appropriate software may be used.
- Plagiarism detection software may be used to check this is your own work.

You will need:

• quad paper or lined paper or a computer based word programme.

Supervisor requirements

A supervisor must be present for the entire time you are working on this assessment. You must provide the full name of the supervisor and their relationship to you (e.g. parent, teacher, teacher aide, friend etc.) when you upload your assessment to the MXO2143Y1 OTLE assessment dropbox.



ASSESSMENT CRITERIA

ACHIEVEMENT STANDARD 91269 (VERSION 3) MATHEMATICS AND STATISTICS 2.14

Apply systems of equations in solving problems

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.

ASSESSMENT RESOURCES

RESOURCE 1

FORMULA REFERENCE SHEET

You may find these formulae useful.

The general form of the equation of a straight line is y = mx + c

The general form of the equation of a rectangular hyperbola is $y = \frac{a}{x}$

If $ax^2 + bx + c = 0$, then $x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$ and $\Delta = b^2 - 4ac$

ASSESSMENT ACTIVITY MATHEMATICS AND STATISTICS

INSTRUCTIONS

- Read the introduction and the information in the tasks carefully.
- Write your evaluation on your own paper or use an appropriate computer programme.
- Write your name and Te Kura ID on each page used.
- If you use any technology to complete part or all of this activity, you need to submit a copy of what you produced with this technology.
- Your supervisor must be present to observe you.

INTRODUCTION - INTERSECTING ROADS

A construction engineer is designing a possible new road layout. The engineer is considering the impact on the intersection of a new straight road and two curved roads that can be modelled by a hyperbola.

In the task you are to find where the new straight road intersects the two curved roads. You will investigate all possible different positions of the new straight road and its points of intersection with the curved roads.

In your investigation you should:

- show all the calculations that you use to solve problems
- include mathematical statements to show what you are calculating
- interpret and present the solutions in the context of the situations
- discuss and justify the decisions you make in the process of solving problems.

The quality of your discussion and reasoning and how well you link this to the context will determine the overall grade.

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TASK

- 1. The graph below shows:
 - the two existing curved roads are represented by a rectangular hyperbola

with the equation: $y = \frac{4}{x}$

One curved road passes through the point (2, 2) and the other passes through (2 , 2).

• a new straight road, represented by a line passing through the points (0, 4) and (-16, 0).



- a. Form a pair of equations and use them to find the coordinates of the points of intersection of the straight road with the two curved roads.
- b. Interpret and present your solutions in the context of the situation.

- 2. Investigate how any straight roads passing through (0, 4) can be laid out so that there may be 0, 1 or 2 points of intersection with the two curved roads.
 - a. **Show and describe** each of the possible situations of the intersection, in context. You should include all essential details.
 - b. The gradient of the line that represents any straight road passing through (0, 4) can be denoted by m.

Investigate the range of values of m for the situations where a straight road intersects the two curved roads at 0, 1 or 2 points.

Show your working and reasoning clearly for each of the possible situations of the intersection and interpret your answers in context of the situation.



Reminder: Upload your assesment to the MXO2143Y1 OTLE assesment dropbox.

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STUDENTS - PLACE STUDENT ADDRESS LABEL BELOW OR WRITE IN YOUR DETAILS.		
Full Name		
ID No.		
Address (If changed)		