

90644



NEW ZEALAND QUALIFICATIONS AUTHORITY  
 MANA TOHU MĀTAURANGA O AOTEAROA



For Supervisor's use only

# Level 3 Statistics and Modelling, 2009

## 90644 Solve equations

Credits: Four

9.30 am Friday 20 November 2009

Check that the National Student Number (NSN) on your admission slip is the same as the number at the top of this page.

**Make sure you have a copy of the Formulae and Tables Booklet L3–STATF.**

You should answer ALL the questions in this booklet.

Show ALL working for ALL questions.

If you need more space for any answer, use the page(s) provided at the back of this booklet and clearly number the question.

Check that this booklet has pages 2–12 in the correct order and that none of these pages is blank.

**YOU MUST HAND THIS BOOKLET TO THE SUPERVISOR AT THE END OF THE EXAMINATION.**

<i>For Assessor's use only</i>		<b>Achievement Criteria</b>	
<b>Achievement</b>		<b>Achievement with Merit</b>	<b>Achievement with Excellence</b>
Solve equations.	<input type="checkbox"/>	Solve problems involving equations.	<input type="checkbox"/>
			Analyse or interpret the outcome or the process used to solve equations or linear programming problems. <input type="checkbox"/>
<b>Overall Level of Performance</b>		<input type="checkbox"/>	

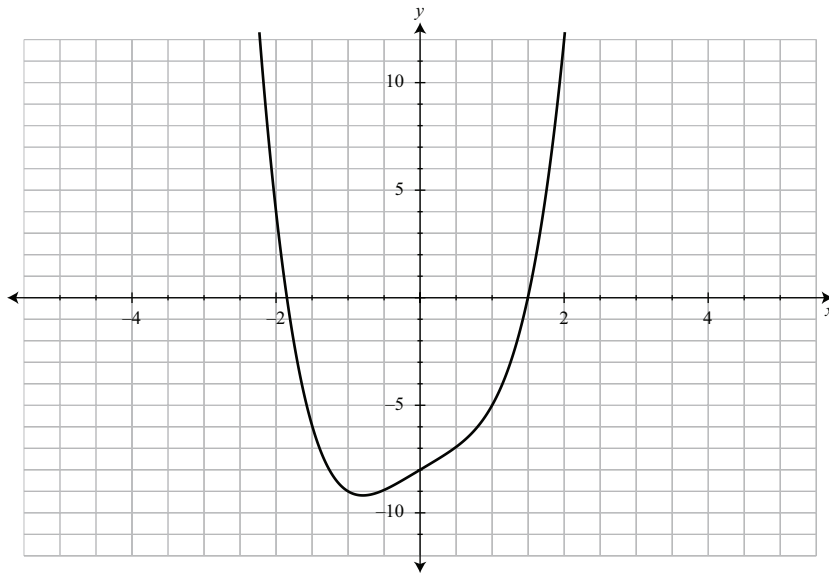






**QUESTION TWO**

The graph of the function  $f(x) = x^4 + 2x - 8$  is drawn below.



- (a) The equation  $x^4 + 2x - 8 = 0$  has a root between  $x_0 = -2$  and  $x_1 = -1$ .

Using the two  $x$  values above as the starting values, complete **TWO** iterations of the **bisection method** to find an approximation to this root.

Show each iterate.

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### QUESTION THREE

Nick is a farmer. He is contracted to deliver a minimum of 10 tonnes and a maximum of 20 tonnes of corn to a local factory. Nick also is contracted to deliver at least 15 tonnes, but no more than 30 tonnes of tomatoes to the same factory.

For every tonne of corn Nick produces, he needs 8 hectares of land and, for every tonne of tomatoes he produces, he needs 11 hectares. He has only 440 hectares available for the two crops.

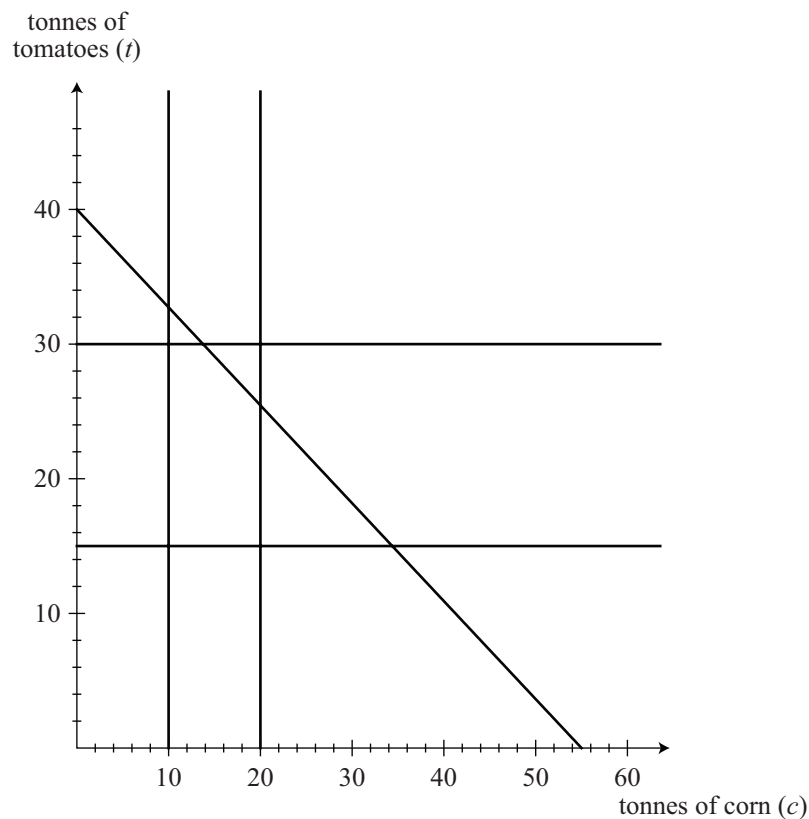
Nick's income from each tonne of corn is \$1 250 and from each tonne of tomatoes is \$3 000.

Let  $c$  = the number of tonnes of corn produced  
and  $t$  = the number of tonnes of tomatoes produced.

A linear programming problem for Nick's situation has the following constraints:

$$10 \leq c \leq 20 \quad 15 \leq t \leq 30 \quad 8c + 11t \leq 440$$

The graph below is drawn to assist you with this question.



Nick's income (\$) is given by the objective function:

$$\text{Income} = 1250c + 3000t$$

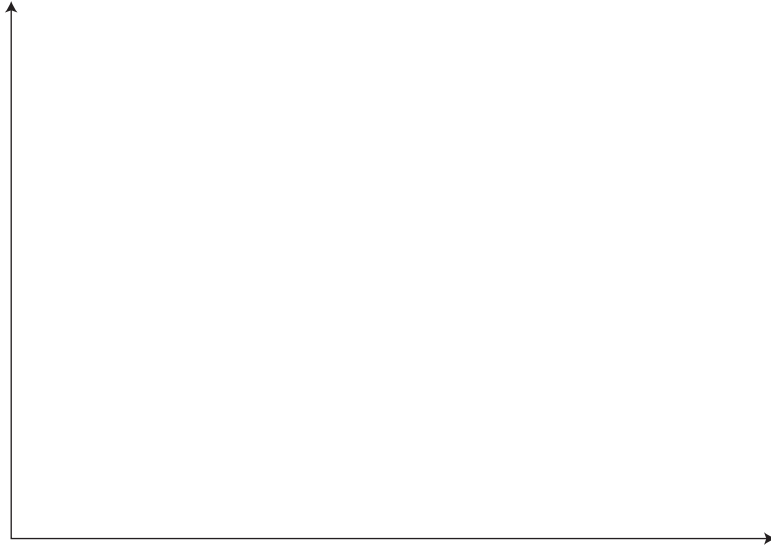




- (.) A linear programming problem may have multiple solutions.

On the axes below, show how this occurs and explain how your diagram shows this.

*If you need  
to redraw this  
graph, use the  
grid at the bottom  
of page 12.*



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