

90644



NEW ZEALAND QUALIFICATIONS AUTHORITY  
 MANA TOHU MĀTAURANGA O AOTEAROA



*For Supervisor's use only*

## Level 3 Statistics and Modelling, 2007

### 90644 Solve equations

Credits: Four

9.30 am Thursday 29 November 2007

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.

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 2–16 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.	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 THREE**

The Outdoor NIK-NAKS company makes two items to place around ponds, plaster gnomes and plaster frogs. The table below summarises the production data:

Item	Time needed to make one item (hours)	Cost of material used per item (\$)	Profit per item (\$)
gnome	6	18	9
frog	4	24	16

Let  $x$  be the number of gnomes produced per week and  $y$  be the number of frogs produced each week.

The company has available a maximum of 240 worker hours per week for these products, and can afford to spend no more than \$1080 on material per week for them.

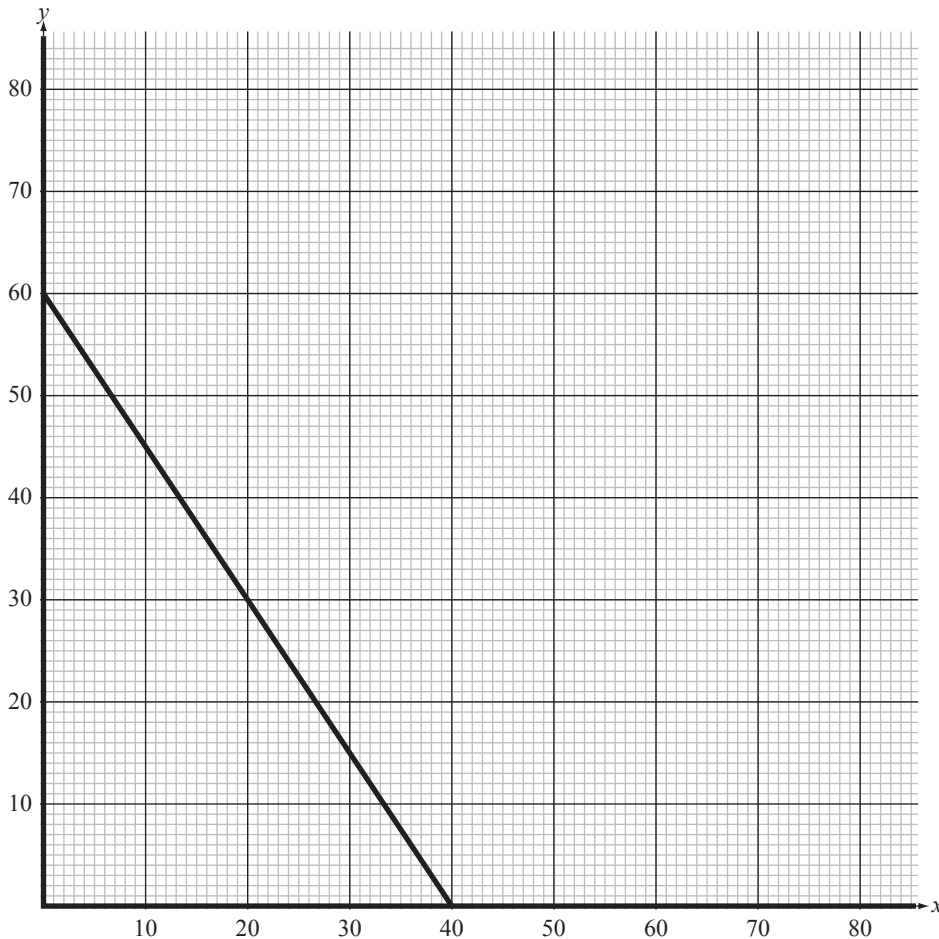
The company can sell as many of the products as it can produce.

A linear programming problem for this situation has the following constraints:

$$\begin{aligned} \text{A: } & 6x + 4y \leq 240 \\ \text{B: } & 18x + 24y \leq 1080 \\ \text{C: } & x \geq 0 \\ \text{D: } & y \geq 0 \end{aligned}$$

*If you need to redraw this graph, use the grid on page 13.*

- (a) Show the feasible region formed by the constraints on the axes below. Three of the lines that you need have been drawn for you.









**QUESTION SIX**

The Outdoor NIK-NAKS company has created wooden butterflies to mount on the outside wall of houses. It has two types, the *standard butterfly* and the *monarch butterfly*. Both butterflies use the same amount of wood and take the same amount of time to build, but the monarch butterfly takes longer to paint and is also more expensive to paint.

It takes 40 minutes to fully paint a standard butterfly, while a monarch butterfly takes 90 minutes to paint.

The paint for a standard butterfly costs \$8, while for a monarch it costs \$12.

On a given day the company has 36 worker hours available for painting butterflies and can afford to spend no more than \$336 on paint.

The company has to produce at least 9 of each type of butterfly each day, but there is enough demand for the products so that the company could sell as many of the butterflies as can be produced.

The profit the company makes on each standard butterfly is \$18, and the profit the company makes on each monarch butterfly is \$60.

- (a) (i) Write down the four constraints that are needed to find the number of each type of butterfly that should be produced each day to maximise the profit.

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- (ii) Calculate how many of each type of butterfly should be produced each day in order to maximise the profit. The graph grid on the opposite page is provided to help you.

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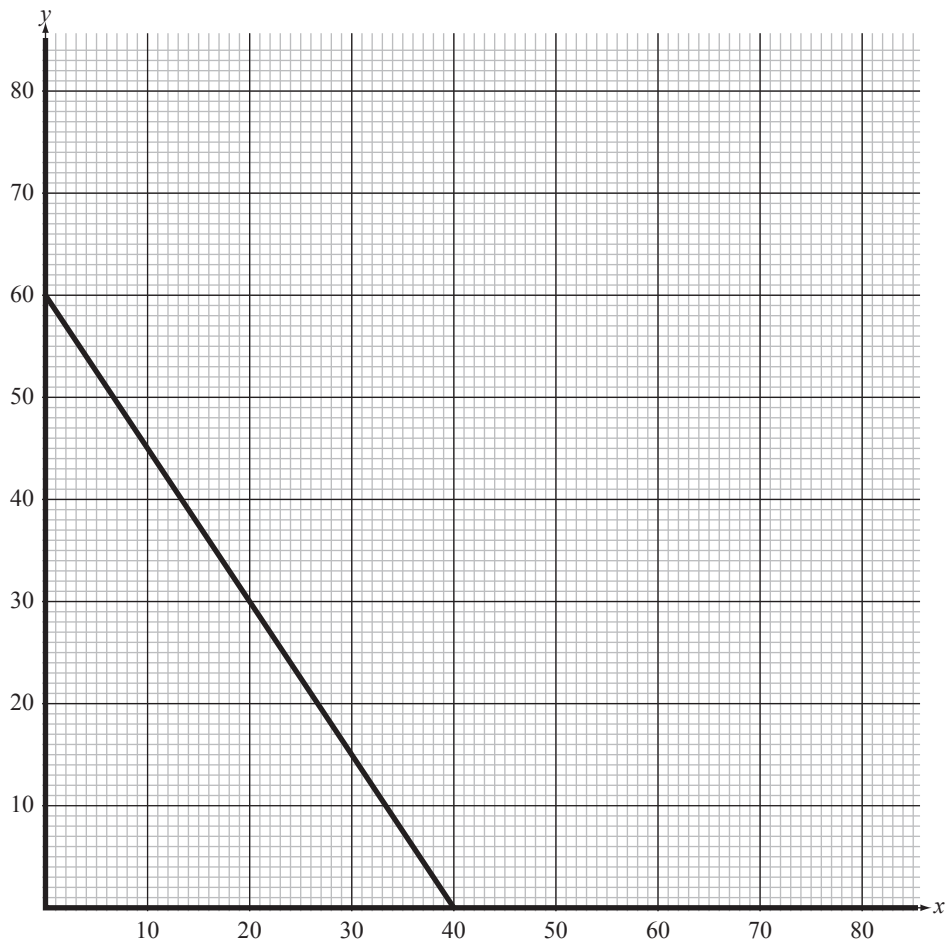






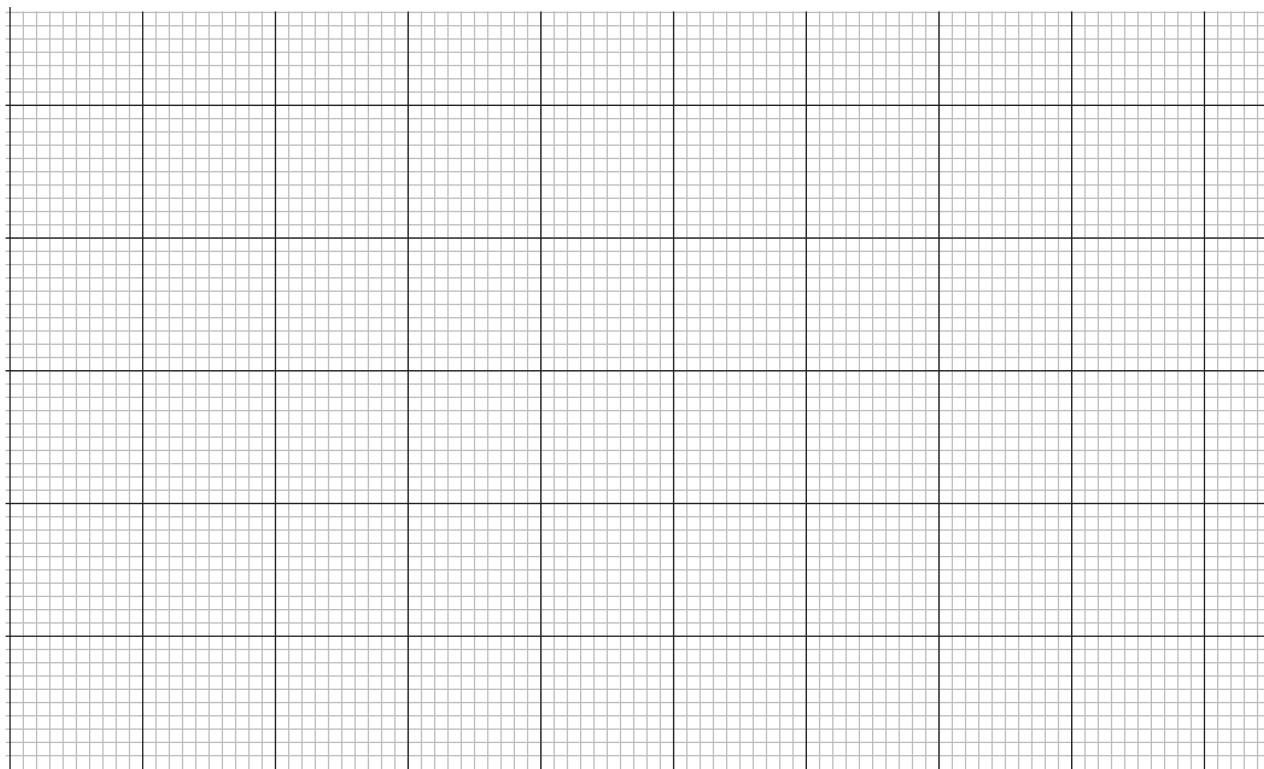
If you need to redraw the graph from Question Three, draw it on the grid below.

Assessor's  
use only



If you need to draw a graph as part of your answer to Question Five, use this grid.

Assessor's  
use only



If you need to redraw the graph from Question Six, draw it on the grid below.

Assessor's  
use only

