Assessment Schedule – 2008

Statistics and Modelling: Solve equations (90644)

Evidence Statement

Question	Evidence	Code	Judgement
One	$x = 6$ $y = 12$ $z = 2$ 2 m^3 of small size stones were ordered.	 **A**	 CAO Must answer question in context.
Two	Form the system of the equations: $40A + 60B + 100C = 3600$ $A = 3 + C$ $B = 6 + 2C$ $A = 15$ $B = 30$ $C = 12$ The cost of plant C is \$12.	 **M A**	 Or equivalent equations. Must form the equations **AND** Must answer question in context
Three	$15D + 5E + 20F = 500$ $D + E + F = 75$ $E = D + 2F$ Solving produces a result that shows the system of equations is inconsistent. Therefore it is not possible for the gardener to purchase 75 plants under the required conditions and stay within the \$500 budget.	 **MA** **E**	Must form the equations **AND** Must solve the equations (ie provide evidence that the system of equations is inconsistent – there is no solution). Must show algebraic evidence of solution. **AND** Must interpret the result.
Four	**Newton-Raphson** method with starting value 2 gives iterates equal to 2.857 and 2.599 (4sf). **Bisection method** with starting values [2,3] gives: *First iteration* $f(2) = -6$, $f(3) = 8$, $f(2.5) = -0.875$ giving a new interval of [2.5 , 3]. *Second iteration* $f(2.75) = 3.046875$, giving a new interval of [2.5 , 2.75] or an approximate root of 2.625.	 **A**	 No penalty for extra iterates. For bisection method the solution can be expressed as an interval or a value. Accept any rounding that is more than 1 sig. fig. Must show iterates.

Question	Evidence	Code	Judgement
Five	Newton-Raphson method with any starting value between –2 and –1 gives a solution of –1.3. Bisection method starting with [–2,–1] gives a solution of –1.3. *Note: the last two iterations MUST agree to the required rounding – otherwise insufficient iterations are completed.*	**M A**	Must identify starting value(s). Accept other starting values if justified. Answer must be rounded to 1 DP.
Six	Identifies that the Newton-Raphson method converges to the root between $x = 1$ and $x = 2$. Justifies in words or by drawing on the diagram how the tangent to the curve at $x = –6$ produces a new estimate (above $x = 0$) which then converges to the greater root.	**E**	Root must be identified **AND** Clear explanation given.
Seven (a) (b)	Line passing through (0,90) and (90,0) evident and feasible region shown Points for optimisation: (30,45) I = \$1 425 000 (60,30) I = \$1 350 000 (80,10) I = \$1 050 000 **OR** Parallel line method The grower should plant 30 hectares of tomatoes and 45 hectares of artichokes	**A**	Line shown **AND** These 3 key vertices must be shown on the feasible region with values of I calculated for each. **OR** Evidence of parallel line test **AND** Conclusion statement needed.

<table>
<tr><th>Question</th><th>Evidence</th><th>Code</th><th>Judgement</th></tr>
<tr><td>Eight
(a)</td><td>x = sheep, y = cows
$0.3x + 0.4y \leq 120$
$180x + 150y \leq 54\,000$
$y \leq 250$

Intersection points for feasible region are
<table><tr><th></th><th></th><th>Income</th></tr><tr><td>A</td><td>(0,250)</td><td></td></tr><tr><td>B</td><td>$(66\frac{2}{3},250)$</td><td></td></tr><tr><td>C</td><td>$(133\frac{1}{3},200)$</td><td></td></tr><tr><td>D</td><td>(300,0)</td><td></td></tr></table>Points of particular interest are at
(66,250) = $258 700 income
(67,249) = $258 550 income
(133,200) = $263 100 income
(132,201) = $263 250 income

The farmer should run 132 sheep and 201 cows (accept also 133 sheep and 200 cows).</td><td>M A</td><td>Must form correct constraints
AND
Must show evidence of optimisation (most likely at points B and C)
AND
Must show answer (with a whole number of sheep).</td></tr>
<tr><td>(b)</td><td>Optimisation equation has changed to $560x + 850y$.

New income is $249 730 (from 68 sheep and 249 cows)
OR
New income is $249 460 (from 66 sheep and 250 cows).</td><td>E M</td><td>Must show change of optimisation equation (or clearly imply new equation)
AND
Must show new income with some justification.</td></tr>
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Judgement Statement

To meet the minimum requirement of this standard, the candidate must gain Achievement in TWO out of the three skills (ie two examples of evidence from Question One and Question Two only, or two examples of evidence from Question Four and Question Five only, are not sufficient for Achievement).

Achievement	Achievement with Merit	Achievement with Excellence
Solve equations.	Solve problems involving equations.	Analyse or interpret the outcome or the process used to solve equations or linear programming problems.
2 **A** (from different skill areas)	3 **M** OR 2 **M** + 2 **A**	2 **E** + 3 **M** OR 2 **E** + 2 **M** + 2 **A**

The following Mathematics-specific marking conventions may also have been used in marking this paper:

- errors are circled
- a caret ($\wedge$) indicates an omission
- **NS** indicates there is not sufficient evidence to award a grade
- **CON** indicates "consistency" where an answer is obtained using a prior – but incorrect – answer, and **NC** indicates the answer is not consistent with wrong working
- **CAO** indicates the "correct answer only" is given but that the Assessment Schedule indicates that more evidence is required
- # indicates that a correct answer is obtained but then further (unnecessary) working results in an incorrect final answer
- **RAWW** indicates "right answer, wrong working"
- **R** indicates "rounding error" and **PR** is "premature rounding", either of which results in a significant round-off error in the answer (if the question requires evidence for rounding)
- **U** indicates incorrect or omitted units (if the question requires evidence for units)
- **MEI** indicates where a minor error has been made and ignored.