

Assessment Schedule – 2006

Statistics and Modelling: Solve equations (90644)

Evidence Statement

	Achievement Criteria	Q.	Evidence	Code	Judgement	Sufficiency								
Achievement	Solve equations.	1	$a = 0.5$ (or $\frac{1}{2}$) $b = 5$ $c = -3$	A	No alternative CAO	Achievement : Three of Code A.								
		2	<p>Newton-Raphson method with starting value 1.0 gives iterates equal to 1.222 and 1.1777</p> <p>Bisection method with starting values [1.0,1.5] gives:</p> <p>First iteration $f(1) = -2, f(1.5) = 7.09, f(1.25) = 1.18$ giving a new interval of [1,1.25] or an approximate root of 1.125.</p> <p>Second iteration $f(1.125) = -0.67$, giving a new interval of [1.125,1.25] or an approximate root of 1.1875.</p> <p>ie Answer must be [1.125,1.25] or 1.1875</p>	A	<p>Accept any rounding that is more than 1 sig. fig.</p> <p>For bisection method the solution can be expressed as an interval OR a value.</p> <p>Must show two complete iterates</p> <p>No penalty for</p> <ul style="list-style-type: none"> • extra iterates. • Hashing. 									
		3(b)	<p>EITHER</p> <p>Identify vertices and value of I</p> <table style="margin-left: 20px;"> <tr> <td>(15,12)</td> <td>\$35.55</td> </tr> <tr> <td>(15,40)</td> <td>\$74.75</td> </tr> <tr> <td>(30,30)</td> <td>\$79.50</td> </tr> <tr> <td>(45,12)</td> <td>\$73.05</td> </tr> </table> <p>maximum income when 30 of each soap is produced.</p> <p>OR</p> <p>Use parallel line method to identify the point (30,30) as the optimal solution along with statement of number of each soap needed. [Evidence needed – maybe on the graph.]</p>	(15,12)	\$35.55	(15,40)	\$74.75	(30,30)	\$79.50	(45,12)	\$73.05	A	<p>NB: 3(a) is not needed to gain Achievement.</p> <p>NB: point (15,12) is not needed.</p> <p>Number of each soap produced must be identified.</p>	
(15,12)	\$35.55													
(15,40)	\$74.75													
(30,30)	\$79.50													
(45,12)	\$73.05													

Achievement with Merit	Solve problems involving equations.	4	$8a + 3b + 6c = 145$ $2a + 2b + 10c = 130$ $5a + 8c = 120$ $a = 8$ mins $b = 7$ mins $c = 10$ mins Vitamin E enriched takes the least amount of time.	A	Must have system of equations, solutions and decision.	Merit: Achievement plus Two of Code M OR Three of Code M.
		5	Newton-Raphson method, gives a solution of 10.25 from 3 iterations. Bisection method starting with [10,11] gives a solution of 10.25 from 8 iterations. The last two iterations must agree to 2 DP. Answer must be 10.25	M	Must state starting value(s). Answer must be rounded to 2DP. Accept 10.25 mins = 10 mins 15 s Accept other starting values if reasonable.	
		6(a)	(i) The constraints are: $30x + 40y \leq 1800$ $2x + 5y \leq 190$ $x \geq 10$ $y \geq 15$ (ii) Objective function is $P = 8x + 12y$ EITHER calculate P at the vertices Vertex $P = 8x + 12y$ (10,15) 260 (10,34) 488 (20,30) 520 (40,15) 500 OR Use the parallel line test to identify the optimal vertex. Therefore maximum profit is when Vili produces 20 sun shelters and 30 tents.	M	Inequalities must be formed. Or equivalent. Objective function must be identified. (or implied by correct use in 3 vertices) NB: the point (10,15) is not needed. Three vertices and profits shown bold must be identified. Number of sun-shelters and tents must be identified.	

Achievement with Excellence	Analyse or interpret the outcome or the process used to solve equations or linear programming problems.	6(b)	<p>There will now be multiple solutions as the objective function is now parallel to the constraint $30x + 40y = 1800$. Therefore all solutions will be integer points on the line $30x + 40y = 1800$ between $x = 20$ and $x = 40$.</p> <p>Need</p> <ul style="list-style-type: none"> • more than 2 solutions • where the solutions are • boundaries. <p>Desirable</p> <ul style="list-style-type: none"> • Whole number solutions. 	EMA	A suitable explanation justified mathematically.	Excellence: Merit plus Two of Code E.
		7	<p>Eg: An accurate graph plus explanation of why there is no root in the interval because of function behaviour near $\frac{8}{3}$.</p> <p>An “explanation only” needs to be very carefully worded and accurate.</p> <p>An accurate graph with a statement about the asymptote at $\frac{8}{3}$ gains E (minimum).</p> <p>Statement that there is an asymptote or discontinuity, on its own, is NS.</p> <p>Description of behaviour of asymptote is N.</p>	E	<p>Accept answers that clearly justify that no real root lies in the interval from $x = 2$ to $x = 3$, although there is a sign change in the function.</p> <p>(Eg accurate graphical approach with explanation.)</p>	
		8	<p>$a = -1, b = 6$</p>	EMA	No alternative.	

Judgement Statement

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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.
3 × A	Achievement <i>plus</i>	Merit <i>plus</i>
	2 × M	2 × E
	OR	
	3 × M	