Assessment Schedule – 2018

Mathematics and Statistics: Apply algebraic methods in solving problems (91261)

Assessment Criteria

Achievement	Merit	Excellence
Apply algebraic methods in solving problems involves: • selecting and using methods • demonstrating knowledge of algebraic concepts and terms • communicating using appropriate representations.	*Apply algebraic methods, using relational thinking, in solving problems* must involve one or more of: • selecting and carrying out a logical sequence of steps • connecting different concepts or representations • demonstrating understanding of concepts • forming and using a model and also relating findings to a context, or communicating thinking using appropriate mathematical statements.	*Apply algebraic methods, using extended abstract thinking, in solving problems* involves one or more of: • devising a strategy to investigate or solve a problem • identifying relevant concepts in context • developing a chain of logical reasoning, or proof • forming a generalisation and also using correct mathematical statements or communicating mathematical insight.

Evidence Statement

One	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)	$25^{\frac{1}{2}}\left(m^{16}\right)^{\frac{1}{2}}$ $= 5m^8$	Correct answer.		
(b)	$\left(\frac{3a}{4}\right)^2 = \left(\frac{9a^2}{16}\right)$	Correct answer.		
(c)	$\frac{4(3c)}{3c} - \frac{b+8c}{3c} = \frac{4c-b}{3c}$	Fractions written with a common denominator.	Final simplification.	
(d)	$4bx + 2xy - 6ab - 3ay$ $= 2x(2b + y) - 3a(2b + y)$ $= (2x - 3a)(2b + y)$	Complete factorisation.		
(e)	$h = \frac{1}{4}(w + 60) = \frac{1}{4}w + 15$ (or $w = 4h - 60$) $A = 60w + 2 \times wh + 2 \times 60h$ $= 60w + 2wh + 120h$ $7400 = 60w + 2w(\frac{1}{4}w + 15)$ $+ 120(\frac{1}{4}w + 15)$ $\Rightarrow \frac{1}{2}w^2 + 120w - 5600 = 0$ (or $8h^2 + 240h - 11\,000 = 0$) $w = 40, -280$ (or $h = 25, -55$) Hence $h = \frac{1}{4}(40 + 60) = 25$ cm	Expression for height or area formed.	Quadratic formed.	Height found.
(f)	$3x^2 - 36xy + xy - 12y^2 - 2x^2 + 32xy - xy + 16y^2$ $= x^2 - 4xy + 4y^2$ $= (x - 2y)^2$ $a = x$, $b = -2y$ (or vice versa)	Correct expansion.	Correct simplification.	Square completed and a and b identified correctly.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Evidence leading to a correct answer.	1u	2u	3u	1r	2r	1t	2t

Two	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)	$x^5 = 243 \Rightarrow x = 3$ Accept $\sqrt[5]{243}$.	Correct solution.		
(b)	$4m - 1 = 3^2$ $4m = 10 \Rightarrow m = \frac{5}{2}$ or equivalent	Correct solution.		
(c)	$\frac{3^{4x+1}}{\left(3^2\right)^x} = \left(3^3\right)^{\frac{w}{3}}$ $\frac{3^{4x+1}}{3^{2x}} = 3^w \Rightarrow 4x+1-2x = w$ $2x = w-1$ $x = \frac{w-1}{2}$	Expressed as powers of 3.	Correct answer.	
(d)	$\mathrm{k} = \frac{2.43}{(1.8)^2} = 0.75$ $h = 0.75x(3.6 - x) = 2.7x - 0.75x^2$ $0.75x^2 - 2.7x + 0.5 = 0$ $x = 3.4041, 0.1958$ Length of rail $= 3.4041 - 0.1958$ $= 3.208$ metres	Finds k.	Forms a quadratic.	Length of rail found.
(e)(i)	$25\,000 = 20\,000(1.0385)^n$ $\log 1.25 = n \log 1.0385$ $n = \frac{\log 1.25}{\log 1.0385} = 5.91$ Hence 6 years. Whole year required by question.	Taking *log* of both sides and *n* as a factor OR $n = 5.91$ years	Correct answer.	
(ii)	$2 = \left(1 + \frac{r}{100}\right)^{12}$ $1 + \frac{r}{100} = \sqrt[12]{2} = 1.0595$ Hence $r = 5.95$ and interest rate is 5.95%.	Sets up correct equation.	Finds $1 + \frac{r}{100}$.	Interest rate found.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Evidence leading to a correct answer.	1u	2u	3u	1r	2r	1t	2t

Three	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)(i)	$12x^2 - 5x - 2 = 0$ $(4x + 1)(3x - 2) = 0$ $x = \frac{-1}{4}$ or $\frac{2}{3}$ or equivalent	Correct solutions.		
(a)(ii)	$x^2 + x - 3 = 0$ $x = 1.303, -2.303$	Correct solutions.		
(b)	Discriminant $\Delta = b^2 - 4ac$ $= (-5)^2 - 4 \times 2 \times 6 = -23 < 0$ The function does not have real roots.	Discriminant found.	Explanation given.	
(c)	$3(3)^2 + k(3) - 12 = 0$ $27 + 3k - 12 = 0$ $k = -5$ $3x^2 - 5x - 12 = 0$ $(3x + 4)(x - 3) = 0$ $x = \frac{-4}{3}$ OR $(3x + e)(x - 3) = 3x^2 + kx - 12$ Equating coefficients for constant term, $e = 4$ Hence other root is $-\frac{4}{3}$	Forms a factor of $(x - 3)$ and uses it in a valid way. OR Finds $k = -5$.	Correct answer.	
(d)	For equal roots $\Delta = (2(k + 1))^2 - 4(-k^2 - 2k - 5) = 0$ $\Rightarrow 4k^2 + 8k + 4 + 4k^2 + 8k + 20 = 0$ $8k^2 + 16k + 24 = 0$ $k^2 + 2k + 3 = 0$ and for this quadratic $\Delta = 2^2 - 4 \times 1 \times 3 = -8$ (or -512 etc.) < 0, or $(k + 1)^2 = -2$ etc. So there are no real solutions and hence no values of k for which the original equation has equal roots.	Correct discriminant substitution.	Simplified quadratic set equal to 0.	Correct conclusion. 1t: Concluded that there are no real roots with little or no working shown. 2t: Shows $\Delta < 0$ from quadratic, or draws graph to conclude that no real roots exist.

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No response; no relevant evidence.	Evidence leading to a correct answer.	1u	2u	3u	1r	2r	1t	2t

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 8	9 – 14	15 – 19	20 – 24