Assessment Schedule – 2016

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

Evidence Statement

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
ONE (a)	$\left(\frac{c^2}{3b}\right)^4 = \frac{c^8}{81b^4}$	Negative or fourth power correctly used.	Correct answer.	
(b)	$x^2 - 8x + 10 = (x-4)^2 - 6$	Correct arrangement or p and q given. ($p = 4$ and $q = -6$ not required)		
(c)(i)	When $x^2 + x - 56 = 0$ $(x+8)(x-7) = 0$ $x = -8$ or 7. When $4x^2 + x - 14 = 0$ $(4x-7)(x+2) = 0$ $x = \frac{7}{4}$ or -2 So the solutions of the first quadratic are four times those of the second.	Both equations factorised correctly if solution is incorrect.	Both quadratics solved and relationship stated.	
(c)(ii)	Solutions of $dx^2 + ex + f = 0$ are $\frac{-e \pm \sqrt{e^2 - 4df}}{2d}$ and those of $x^2 + ex + df = 0$ are $\frac{-e \pm \sqrt{e^2 - 4df}}{2}$ So the solutions of the second quadratic are d times those of the first.	One set of solutions found.	All solutions found.	Devised a strategy and developed a chain of logical reasoning to solve the problem.
(d)	$\left(x + \frac{1}{2}\right)\left(x - \frac{2}{3}\right) = 0$ $(2x+1)(3x-2) = 0$ $6x^2 - x - 2 = 0$ So $a = 6$, $b = -1$ and $c = -2$ or any other correct values of a, b, and c.	Quadratic found with correct values of a, b, and c.	Correct values of a, b and c stated.	

(e)	To have rational roots, the discriminant is • ≥ 0 (accept > 0 at achieved and merit) • a perfect square Hence $16k^2 - 4 \times 2(2k^2 + 3k - 11) \geq 0$ $-24k + 88 \geq 0$, $k \leq \frac{88}{24}$ or $\frac{11}{3}$ Cases, k integer $k = 0$ not possible as told k positive $k = 1$, $\Delta = 64$ which is a square $k = 2$, $\Delta = 40$ which is not a square $k = 3$, $\Delta = 16$ which is a square $k \geq 4$ not possible as Δ negative So only possible values are $k = 1$ or 3.	Values substituted into discriminant.	$k \leq \frac{11}{3}$ or unsimplified. OR One value for k found with reason. OR Discriminant used correctly with one restriction on k given.	Both values of k found with logical chain of reasoning.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at ONE question.	1 of u OR partial solution in TWO questions.	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
TWO (a)	$x^2 - 10x - 3 = 0$ discriminant = $100 + 4 \times 3$ $= 112$	Correct discriminant found.		
(b)	$\frac{4\log\left(u^3\right)}{\log u} = \frac{12\log u}{\log u}$ $= 12$	Power rule for logs in numerator used.	Correct answer.	
(c)	$P = 24\,990(0.88)^t$ $12\,495 = 24\,990(0.88)^t$ $0.5 = 0.88^t$ $t = \frac{\log 0.5}{\log 0.88}$ $= 5.422$ So it takes 5.422 years to halve in value.	CAO or equation set up and error made in solving.	Correct equation solved to find value of t. Accept $t = 6$ if working shown.	
(d)(i)	$x = 8^{\frac{2}{3}}$ $= 2^2 = 4$	Correct value found.		
(d)(ii)	If $u = \log_8 x$ Then $6u^2 + 2u - 4 = 0$ $u = \frac{2}{3}$ or -1 Either $\log_8 x = \frac{2}{3}$ "or" $\log_8 x = -1$ $x = 8^{\frac{2}{3}}$ or 8^{-1} so $x = 4$ or $\frac{1}{8}$	CAO. OR Quadratic formed..	Both values for u found.	Devised a strategy and developed a chain of logical reasoning to solve the problem. Both values of x found.

(e)	Let the sides of the triangle be $3y$, $4y$, and $5y$ for some real positive number y. Area of triangle is $\frac{1}{2} \times 3y \times 4y = 6y^2$ Path has width 1. So path area is $12y + \pi$ $2(12y + \pi) - 6y^2 = 2\pi$ $24y + 2\pi - 6y^2 - 2\pi = 0$ $24y - 6y^2 = 0$ $6y(4 - y) = 0$ So $y = 4$ (as can't be 0) and length of longest side of triangle is $5 \times 4 = 20$ m. (Longest side 22.35m accepted as an alternative interpretation.)	Quadratic established.	Quadratic solved for y, or consistently solved from incorrect quadratic.	Correctly solved and dimensions given.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at ONE question.	1 of u OR partial solution in TWO questions.	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

	Expected Coverage	**Achievement (u)**	**Merit (r)**	**Excellence (t)**
THREE (a)	$12x^2 - x - 6 = (4x - 3)(3x + 2)$ $x = \frac{3}{4}$ or $-\frac{2}{3}$	Correct solutions.		
(b)	$\log_x 216 = 3$ $x^3 = 216$ so $x = 6$ or $\sqrt[3]{216}$	Correct answer.		
(c)	$\frac{4x}{5} = \frac{y(x+3)}{2}$ $8x = 5y(x+3)$ $x(8-5y) = 15y$ $x = \frac{15y}{8-5y}$	Terms involving x collected to one side.	Correctly solved.	
(d)	$9^{8n+6} = 27^{n^2-1} \times 3^{1-3n}$ $\left(3^2\right)^{8n+6} = 3^{3(n^2-1)}3^{1-3n}$ $3^{16n+12} = 3^{3n^2-3+1-3n}$ $16n+12 = 3n^2-3+1-3n$ $3n^2-19n-14 = 0$ $(3n+2)(n-7) = 0$ $n = -\frac{2}{3}$ or 7	Base changed to 3 in all terms.	Quadratic established.	Devised a strategy and developed a chain of logical reasoning to solve the problem. Correct values for n found.
(e)(i)	Assuming origin is at the centre of the bridge, vertex of middle parabola is (0,3), so form of parabola is $y = ax^2 + 3$ $x = 20$, $y = 15$ gives $15 = a(400) + 3$ So $a = \frac{3}{100}$ $y = \frac{3}{100}x^2 + 3$ When $x = 10$, $y = \left(\frac{3}{100} \times 100\right) + 3$ $= 6$ as required.		Equation formed and $y = 6$ when $x = 10$ shown.	

(e)(ii)	For the second parabola on right using the same origin. $y = a(x-30)^2$ When $x = 20, y = 15$ so $15 = a(-10)^2$ $a = \frac{15}{100}$ $6 = \frac{15}{100}(x-30)^2$ $(x-30)^2 = 40$ $x - 30 = \pm 6.32$ $x = 30 \pm 6.32$ $x = 30 - 6.32$, as other value beyond end of bridge. So $x = 23.575$ metres and the horizontal distance is 23.675 – 10 or 13.675 metres.		Model for second parabola given and used to find value of x. (Accept other forms of parabolas.)	Devised a strategy and developed a chain of logical reasoning to solve the problem. Correct length found.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0–7	8–13	14–19	20–24