

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 $16k^2 - 4 \times 2(2k^2 + 3k - 11) \geq 0$ $-24k + 88 \geq 0, k \leq \frac{88}{24} \text{ or } \frac{11}{3}$ 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.
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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)	$\frac{4 \log(u^3)}{\log u} = \frac{12 \log u}{\log u}$ $= 12$	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.
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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)	$9^{8n+6} = 27^{n^2-1} \times 3^{1-3n}$ $(3^2)^{8n+6} = 3^{3(n^2-1)} 3^{1-3n}$ $3^{16n+12} = 3^{3n^2-3+1-3n}$ $16n+12 = 3n^2-3+1-3n$ $3n^2-19n-14=0$ $(3n+2)(n-7)=0$ $n = -\frac{2}{3}$ 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