Assessment Schedule – 2022

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

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$\frac{2x-3}{x+4}=3$ $2x-3=3x+12$ $x=-15$	Correct solution.		
(b)(i)	$6x^3y-15x^2\sqrt{y}=3x^2\sqrt{y}\left(2x\sqrt{y}-5\right)$ Accept $3x^2y\left(2x-\frac{5}{\sqrt{y}}\right)$	Obtains $3x^2\left(2xy-5\sqrt{y}\right)$	Correct expression.	
(ii)	$\frac{6x^2-x-12}{3x^2-5x-12}=\frac{(2x-3)(3x+4)}{(3x+4)(x-3)}$ $=\frac{2x-3}{x-3}$ Don't penalise hashing a correct answer	Correct simplified fraction.		
(c)(i)	Sum of orange corners: A + A + 24 = 2A + 24 [A + B] Sum of blue corners: A + 21 + A + 3 = 2A + 24 [(A+3) + (B – 3)] Therefore sum of orange corners = sum of blue corners, no matter where you start the square.	Correct algebraic evidence but no conclusion.	Two sums compared and conclusion explicitly drawn.	
(ii)	Product of orange corners: A(A + 24) = A^2 + 24A Product of blue corners: (A + 21)(A + 3) = A^2 + 24A + 63 If these products are equal: A^2 + 24A + 63 = A^2 + 24A ** So 63 = 0 Which is impossible. Or a statement that 63 cannot equal zero. OR An argument based on the orange corners being A and B, and the blue corners being A + 3 and B – 3, leading to 3B – 3A – 9 = 0 B – A = 3 ## This cannot true if B is on a different row, and, as this is not true, the products cannot be equal. [or equivalent arguments with different valid expressions for the corners]		Correct algebraic evidence up to line **. OR Simplified relationship between A and B (line ##) but no conclusion	Correct and complete algebraic reasoning. OR Correct algebraic evidence with conclusion.

(d)	For a rectangle M wide and N tall: Sum of orange corners: $A + [A + (M - 1) + 7(N - 1)]$ $= 2A + M + 7N - 8$ Sum of blue corners: $[A + 7(N - 1)] + [A + (M - 1)]$ $=2A + M + 7N - 8$ Both sums have the same expression so are always equal. Accept alternative approaches that are valid arguments.		Reasoning valid but M and / or N used for the corners. OR Correct algebraic evidence but no conclusion.	Correct and complete reasoning with conclusion stated.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	A valid attempt at one question.	1u	2u	3u	1r	2r	1t	2t

Q	Evidence	Achievement	Merit	Excellence
TWO (a)	$(x-\frac{1}{3})(x+\frac{2}{7})$ $= (3x - 1)(7x + 2)$ $= 21x^2 - x - 2$ a = 21, b = –1, c = –2	Correct values of a, b, and c.		
(b)(i)	$(-12)^2 - 4(2)(7) = 88$	Correct discriminant OR		
(ii)	So $(-12)^2 - 4(2)(k)$ [= 0] 8k = 144 k = 18 accept use of inequality	substitution made (line 1)	Correct value of k.	
(c)	$\sqrt{2x+3} = 3x$ $2x+3 = 9x^2$ $9x^2 - 2x - 3 = 0$ $x = 0.6991$ or $x = -0.4768$ (4sf)	Obtains correct quadratic.	Obtains both correct solutions.	
(d)(i)	$fx^2 + gx + h = hx^2 + gx + f$ $(f - h)x^2 + (h - f) = 0$ $(f - h)(x^2 - 1) = 0$ $x^2 = 1$ $x = 1$ or $x = -1$ Accept $\pm\sqrt{\frac{-(h-f)}{(f-h)}}$ or equivalent.		Correct working to obtain one solution only.	Both correct solutions obtained.

(ii)	Roots of Q(x) are $x = \frac{-g \pm \sqrt{g^2 - 4fh}}{2f}$ Roots of Q*(x) are $x = \frac{-g \pm \sqrt{g^2 - 4hf}}{2h}$ If $A = \frac{-g - \sqrt{g^2 - 4fh}}{2f}$, then one of the roots of Q*(x) will be $kA = k\left(\frac{-g - \sqrt{g^2 - 4hf}}{2h}\right) = \frac{-g - \sqrt{g^2 - 4fh}}{2h}$ so $k = \frac{f}{h}$ OR If roots of Q(x) are A and B, $AB = \frac{h}{f}$ If roots of Q*(x) are kA and kB, **(kA)(kB) =** $\frac{f}{h}$ So it follows that: $k^2AB = k^2\frac{h}{f} = \frac{f}{h}$ and $k^2 = \frac{f^2}{h^2}$ and k = $(\pm)\frac{f}{h}$ OR If roots of Q(x) are A and B, $A+B = \frac{-g}{f}$ If roots of Q*(x) are kA and kB, **kA + kB =** $\frac{-g}{f}$ So it follows that: $k(A+B) = k\left(\frac{-g}{f}\right) = \frac{-g}{h}k$ and $k = \frac{f}{h}$	Correct expressions for all 4 roots obtained (may be combined) OR $AB = \frac{h}{f}$ OR $A + B = \frac{-g}{f}$	Correct **expression** involving k as function of f,g and / or h OR Finds $k = \frac{h}{f}$ [this results from saying the root of Q(x) is kA and that of Q*(x) is A]	Finds $k = \frac{f}{h}$

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	A valid attempt at one question.	1u	2u	3u	1r	2r	1t	2t

Q	Evidence	Achievement	Merit	Excellence
THREE (a)(i)	$\sqrt{49y^{36}} = 7y^{18}$	Correct response.		
(ii)	$x\log(2) = \log(2022)$ $x = 10.98$ Accept $\log_2(2022)$	Correct solution.		
(b)	$\log(3a) + 2\log\left(\frac{a}{6}\right)$ $= \log(3a) + \log\left(\left(\frac{a}{6}\right)^2\right)$ $= \log\left(3a\left(\frac{a}{6}\right)^2\right)$ $= \log\left(\frac{a^3}{12}\right)$	Fraction not correctly simplified but otherwise correct.	Correct expression obtained with fraction correctly simplified.	
(c)(i)	$\log_2(x - \mathrm{a}) - \log_2(x + \mathrm{a}) = \mathrm{c}$ $\log_2 \frac{x - \mathrm{a}}{x + \mathrm{a}} = \mathrm{c}$ $\frac{x - \mathrm{a}}{x + \mathrm{a}} = 2^{\mathrm{c}}$ $x - \mathrm{a} = 2^{\mathrm{c}}(x + \mathrm{a}) = x2^{\mathrm{c}} + \mathrm{a}2^{\mathrm{c}}$ $x(1 - 2^{\mathrm{c}}) = \mathrm{a} + \mathrm{a}2^{\mathrm{c}} = \mathrm{a}(1 + 2^{\mathrm{c}})$ so, $x = \mathrm{a}\frac{1 + 2^{\mathrm{c}}}{1 - 2^{\mathrm{c}}}$	Log expressions combined correctly.	Correct exponential equation obtained (line 3).	Correct mathematical statements lead to the required expression.
(ii)	Using the expression from (c) part (i) … Firstly, if x is not defined, there will be no solutions, so that means that $1 - 2^{\mathrm{c}} \neq 0$, so $2^{\mathrm{c}} \neq 1$, and $\mathrm{c} \neq 0$. Hence c cannot be zero. Secondly, if $\mathrm{a} = 0$, then $x = 0$, but then the logs will be undefined. Hence, a cannot be zero. [Although, in the original equation, if $\mathrm{a} = 0$ **and** $\mathrm{c} = 0$, any strictly positive x-value is a solution, but the expression for x is undefined] Thirdly, for the original equation to be defined, both $x - \mathrm{a} > 0$ and $x + \mathrm{a} > 0$ (accept one or the other, or both).		One constraint identified with reasoning.	Two constraints identified with reasoning.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	A valid attempt at one question.	1u	2u	3u	1r	2r	1t	2t

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 12	13 – 18	19 – 24