Assessment Schedule – 2023

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

Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)(i)	$\frac{2}{n}$	• Correct simplified expression with positive index, as given.		
(ii)	$\left(\frac{n^3}{16n^6}\right)^{-0.5} = \sqrt{16n^3}$ $= 4n^{\frac{3}{2}}$	• Correct interpretation of negative power. OR Interprets power of 0.5 as square root. OR Obtains unsimplified equivalent fraction or numerical coefficients such as 2^2 or $\frac{1}{0.25}$.		
(b)	$\frac{2\left(10x^2-11x+3\right)}{x(5x-3)} = \frac{2(2x-1)(5x-3)}{x(5x-3)}$ $= \frac{2(2x-1)}{x}$ $= 4-\frac{2}{x}$ $A = 4$ and $B = -2$	• Correct factorisation of numerator.	• Correct values for A and B (if not explicitly stated, line 3 is required).	
(c)	Initially $t = 0$ $900 = 40 + k\text{e}^0$ $k = 860$ $450 = 40 + 860\text{e}^{-0.5t}$ $860\text{e}^{-0.5t} = 410$ $\text{e}^{-0.5t} = 0.477$ Take log of both sides: $\ln\left(\text{e}^{-0.5t}\right) = \ln 0.477$ $-0.5t = \frac{\ln 0.477}{\ln \text{e}}$ $t = 1.48$ years	• t = 0 substituted.	• k correctly found using $t = 0$.	• Correctly solved.

(d)	$x^2 - k(2x+29) + 32k = 0$ $x^2 - 2kx + 3k = 0$ using $b^2 - 4ac = 0$ $4k^2 - 12k = 0$ $k = 0$ and $k = 3$ So, $k = 3$, so quadratic can be written as $y = \frac{x^2}{6} + 16$ When $x = 0$, $y = 16$	• First step in solving simultaneous equations: substitution for x or y, or equivalent, to give an equation in **one variable** only OR y-intercept correc	• Setting discriminant = 0 for relevant equation (allow minor error) OR Calculus used correctly to obtain both k and y-intercept correctly	T: k correct. TT: both k and y-intercept correct.

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

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TWO (a)(i)	$3m+1=2^4$ $3m=15,\ m=5$	• Correct solution.		
(ii)	$\log_x 64=2$ $x^2=64$ $x=\pm 8$ As base cannot be negative, $x=8$ OR $x^6=64^3$ $x=\sqrt[6]{262\,144}$ $x=\pm 8$ As base cannot be negative, $x=8$	• Written in an index form. OR $x = 8$ obtained with no consideration of $x = -8$.	• Correct answer with justification or evidence of negative value being disregarded.	
(b)	$\frac{5^{7x+6}}{5^{-2x}}=\left(5^3\right)^p$ $5^{7x+6-(-2x)}=5^{3p}$ $9x+6=3p$ $p=3x+2$ OR $p=\log_{125}\left(\frac{5^{7x+6}}{25^{-x}}\right)$ $=\log_{125}\left(\frac{5^{7x+6}}{5^{-2x}}\right)$ $=\log_{125}\left(5^{9x+6}\right)$ $=\log_5\left(\frac{5^{9x+6}}{3}\right)$ $=3x+2$	• Conversion to either 5^{3p} or 5^{-2x}. OR $x=\frac{p-2}{3}$ OR Log expression up to line 1, which is only one possible log approach.	• Correct answer (simplification not required)	
(c)	$6+\log_b\left(b^{-3}\right)+\log_b\left(b^{\frac{1}{2}}\right)=6-3\log\left(b\right)+\frac{1}{2}\log_b\left(b\right)$ $=6-3+\frac{1}{2}$ $=3\frac{1}{2}$	• Combine logs into 1 log term, e.g. $\log_b(b-2.5)$.	• Rewriting both log terms bringing down the power.	• Correct value, even if the candidate goes direct to the numerical values

(d)	$4^x - 10 = 3 \times 4^x$ $4^{2x} - 3 \times 4^x - 10 = 0$ Let $u = 4^x$ $u^2 - 3u - 10 = 0$ $(u+2)(u-5) = 0$ $4^x = -2$ *or* $4^x = 5$ Negative value not valid so: $\log 4^x = \log 5$ $x = \dfrac{\log 5}{\log 4}$ $x = 1.16$ Accept $\log_4(5)$	• Obtains 4^{2x} OR 16^x OR $(4^x)^2$) OR 3G4^x	• Solved for 'u'.	• Correct value.

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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)	$(5x-2)(x+3)=0$ $x=\frac{2}{5}$ or -3	• Both values correct.		
(ii)	$\frac{(3x-4)(x-2)}{(3x+4)(3x-4)}=\frac{x-2}{3x+4}$	• Correct expression.		
(b)	Does not touch the x-axis so: $b^2-4ac<0$ $8^2-4(2)p<0$ $64-8p<0$ Accept $p\geq 8$ Could also use completing the square.	• Set up inequality (line 3). • OR • $p=8$ • OR • $p<8$.	• Correct answer.	
(c)	$\frac{x^2+2x+k}{(x+5)(x+2)}=\frac{x-3}{x+2}$ $x^2+2x+k=(x-3)(x+5)$ $x^2+2x+k=x^2+2x-15$ Therefore, $k=-15$ Or equivalent approach.	• Makes progress towards solution by eliminating denominators, or equivalent.	• Value found.	
(d)	Equation $y=a(x+1.25)(x-1.25)$ $y=a(x^2-1.5625)$ $x=0, y=-3$ $-3=-1.5625a$ $a=1.92$ $y=1.92(x+1.25)(x-1.25)$ $x=1.1, y=-0.678$ No, boat will not float. OR Using vertex form: $y=a(x-h)^2+k$ $y=ax^2$ $3=a(1.25)^2$ $a=1.92$ $y=1.92(1.1)^2$ $y=2.3232$ The edge of the canal is only 0.6768 m below the water surface, so the boat won't float. Accept other correct variations of these approaches.	• General equation, fitting the context, formed in any correct format.	• Coefficient of x^2 found..	• Depth of canal at appropriate width, or width of canal at 1m depth, calculated. AND Statement that boat will not float or similar comment.

(e)	$2\pi rh + 2\pi r^2 = 8rh + 4r^2$ $\pi rh + \pi r^2 = 4rh + 2r^2$ $\pi h + \pi r = 4h + 2r$ $\pi h - 4h = 2r - \pi r$ $h(\pi - 4) = r(2 - \pi)$ $h = r\dfrac{(2-\pi)}{(\pi-4)}$ $= \dfrac{r(\pi-2)}{(4-\pi)}$ i.e. $h = 1.33r$		• Sets up initial equation. OR gives r correctly in terms of h. box is incorrect ^{2} OR If surface area of **and** SA $= Ar + Bhr$, where B ≠ 0, accept consistent, possibly unsimplified, answer of $h = \dfrac{r\left(\pi - \dfrac{A}{2}\right)}{\left(\dfrac{B}{2} - \pi\right)}$????? indecipherable	T: Correct expression but not simplified. TT: Correct expression.

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