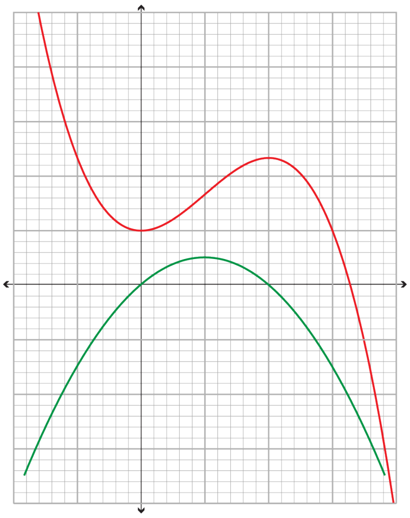
Assessment Schedule – 2024

Mathematics and Statistics: Apply calculus methods in solving problems (91262)

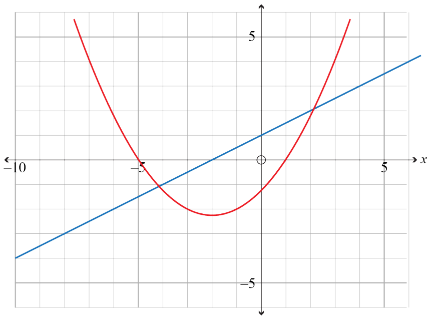
Evidence

Q	Evidence	Achievement	Merit	Excellence
ONE (a)	$f'(x) = 12x^2 - 12x + 5$ $f'(2) = 29$	• Derivative found. AND Gradient at $x = 2$ found.		
(b)	$f(x) = 12x - 2x^2 + 2x^3 + c$ $36 = 12(2) - 2(4) + 2(8) + c$ $c = 4$ $f(x) = 12x - 2x^2 + 2x^3 + 4$	• Correct anti derivative with $+c$.	• Unique $f(x)$ with $c = 4$. Note: Candidate does not need to re-write whole function – just needs line 1 and $c = 4$.	
(c)	$\frac{dy}{dx} = 9x^2 - 18x - 27$ $\frac{dy}{dx} = 0$ when $x = -1$ or $x = 3$ $x = 3$ is the minimum.	• Correct derivative found. AND Set = 0 or implied.	• x coordinates found.	• $x = 3$ stated as the minimum. AND Justifies why using either: - second derivative test - graph of the function - checking gradients.
(d)	$V = \pi r^2 h = 500$ $SA = 2\pi r^2 + 2\pi rh$ Combining to eliminate h: $SA = 2\pi r^2 + \frac{1000}{r}$ $SA' = 4\pi r - \frac{1000}{r^2} = 0$ $r = 4.30$ cm $h = 8.60$ cm	• Sets up area equation in terms of 1 variable AND differentiates.	• Makes $SA' = 0$. AND Finds r.	• Finds both dimensions.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	One point made incompletely.	1u	2u	3u	1r	2r	1t	2t

Q		**Achievement**	**Merit**	**Excellence**
TWO (a)	 Red is original function, green is derivative.	• Intercepts found correctly. OR Negative parabola shape.	• Both intercepts and shape correct.	
(b)	$f'(x) = -12 + 9x^2$ $f'(-2) = 24$ $y - y_1 = m(x - x_1)$ $y - 3 = 24(x + 2)$ $y = 24x + 51$	• Correct derivative found.	• Correct equation for tangent. (Candidate does not need to simplify to $y = mx + c$.)	
(c)(i)	$P'(t) = 3t^2 - 120t + 768$ $P'(10) = -132$ 132 bacteria per day are dying on day 10.	• Correct differential and rate of change calculated.		
(ii)	$P'(t) = 3t^2 - 120t + 768 = 0$ $t = 8$ and 32 $P(8) = 43\,776$ $P(32) = 36\,684$ Population change = 6912	• Correct differential and it is set to zero.	• $t = 8$ and 32 found.	• Correct change in population.
(d)	$a = 8x - x^2$ $b = 16x - 4x^2$ $A = 12x^2 - \frac{5x^3}{2}$ $A' = 24x - \frac{15x^2}{2} = 0$ $x = 3.2,\ A = 40.96$	• Correct expression for the area. • Reasonable area equation that has been differentiated correctly.	• Area equation correct, differentiated, and set equal to zero.	• Maximum area calculated.

NØ	**N1**	**N2**	**A3**	**A4**	**M5**	**M6**	**E7**	**E8**
No response; no relevant evidence.	One point made incompletely.	1u	2u	3u	1r	2r	1t	2t

Q	Evidence	Achievement	Merit	Excellence
THREE (a)	$h'(x) = 0.5x - 2 = 3$ $x = 10,\ y = 9$	• Coordinate found.		
(b)	$a(t) = 0.64$ $v(t) = 0.64t + c$ $c = 0$, as $v = 0$ when $t = 0$. $25 = 0.65t,\ t = \frac{25}{0.64} = 39.0625$ s $d(t) = 0.32t^2 + k$ $k = 0$, as $d = 0$ when $t = 0$ $d(39.0625) = 0.32(30.0625)^2 = 488.3$ m	• Time to reach max velocity found, with evidence that c =0.	• Distance travelled calculated correctly, with evidence $k = 0$.	
(c)(i) and (ii)	 Positive quadratic. Roots at (–5,0) and (1,0) Max located along the line $x = –2$ Min y value –2.25. Gradient line $f'(x) = 0.5x + 1$ Function $f(x) = 0.25x^2 + x + c$ Using (1,0) $c \Rightarrow -1.25$ $f(x)\ = 0.25x^2 + x - 1.25$	• Any TWO of: - positive quadratic shape - roots - correct x-value for minimum - function equation given but with constant.	• Correct function for $f(x)$. AND Graph drawn well – but minimum not correct y-value.	• Graph fully correct. AND $f(x)$ given.
(d)	$y = k - x$ $V = x^2 + 2(k - x)^2$ $V = 3x^2 - 4kx + 2k^2$ $V' = 6x - 4k = 0$ when $x = \frac{2k}{3},\ y = \frac{k}{3}$ $\left(\frac{2k}{3}\right)^2 + 2\left(\frac{k}{3}\right)^2 = \frac{4k^2}{9} + \frac{2k^2}{9} = \frac{2k^2}{3}$	• Value equation found and differentiated.	• Value for x or y found after setting V' equal to zero.	• Final answer shown.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	One point made incompletely.	1u	2u	3u	1r	2r	1t	2t

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 07	08 – 13	14 – 19	20 – 24