Assessment Schedule – 2016

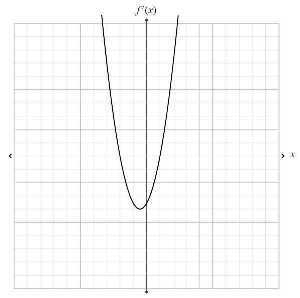
Mathematics and Statistics: Apply calculus methods in solving problems (91262)

Evidence Statement

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
ONE (a)	$f'(x) = 12x^2 - 14x + 2$ $f'(2) = 48 - 28 + 2$ $= 22$	Derivative found and gradient evaluated.		
(b)	$f' = 6x - 2$ tangent gradient = 1 $6x - 2 = 1$ $x = 0.5 \quad y = 3.75$ Coordinates (0.5,3.75)	Derivative found and gradient used. E.g. $f'(0.5)$ or $f'(x) = 1$.	Using $f(0.5)$ to find 3.75 or use the straight line formula to verify tangent equation.	
(c)	For turning point $\frac{\mathrm{d}y}{\mathrm{d}x} = 6x^2 + 2kx = 0$ When $x = 1, \quad k = -3$ Maximum turning point when $6x^2 - 6x = 0$ $x = 0$ or $x = 1$ Maximum turning point at (0,5)	Derivative found and equated to 0, and $k = -3$ evaluated.	Coordinates of maximum turning point found.	
(d)	At the point (3, 4) the gradient $= 0$ $2 \times 3 - a = 0$ $a = 6$ $y = x^2 - ax + c$ $= x^2 - 6x + c$ $4 = 9 - 18 + c$ $c = 13$ $y = x^2 - 6x + 13$	Derivative equated to 0 and $a = 6$ evaluated.	Anti-derivative found. $y = x^2 - 6x + c$	Equation correct – can be left as $c = 13$.
(e)	$y = x^4 - 4x^3$ $y' = 4x^2(x-3)$ $4x^3 - 12x^2 = 0$ $x = 0$ or 3. Minimum $x = 3$, and $y = -27$	Derivative found and equated to 0. Can be implied from solving.	Both x values found.	Confirmed that $x = 3$ for the local minimum giving $y = -27$ justified by reference to graph, gradient on either side or second derivative.

Evidence Statement

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at one question.	1 of u	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)		Parabolic shape with intercepts at $x = -2$ and $x = 1$		
(b)	Question Two (b) has been amended from that used in the examination, and this answer has been amended to match. $\frac{dy}{dx} = 4x - 3$ at (2,3) $m = 5$ therefore $a = 5$ $3 = 5 \times 2 + b$ $b = -7$	Derivative found and $m = 5$ evaluated.	a (or m) and b evaluated. Can be expressed as $y = 5x - 7$.	
(c)	$f'(x) = -4 + 10x + 3ax^2$ $-4 + 10x + 3ax^2 = 3$ = gradient when $x = 1$ $3 = -4 + 10 + 3a$ $3a = -3$ $a = -1$	Derivative found and equated to 3.	a evaluated.	
(d)	$A = \pi(0.1t + 2)^2$ $= \pi(0.01t^2 + 0.4t + 4)$ $\frac{dA}{dt} = 0.02\pi t + 0.4\pi$ $r = 10$ $0.1t = 8$ $t = 80$ $\frac{dA}{dt} = 1.6\pi + 0.4\pi$ $= 2\pi \text{ cm}^2 \text{ s}^{-1}$ or equivalent.		Relationship formed and derivative found (units not required).	Rate of change of area calculated, units not required. $2\pi = 6.28$ (2dp).
(e)	$\frac{dy}{dx} = 9x^2 - 4a^2 < 0$ $9x^2 < 4a^2$ x is $-\frac{2a}{3} > x$ and $x < \frac{2a}{3}$ Decreasing function between $-\frac{2a}{3}$ and $\frac{2a}{3}$. Or $-\frac{2a}{3} < x < \frac{2a}{3}$ Or clearly shown on a graph.	Derivative found.	x evaluated or equivalent.	Interval found.

Evidence Statement

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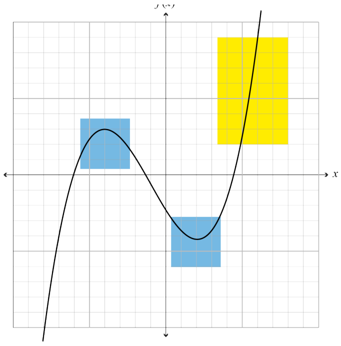
No response; no relevant evidence.	Attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

Q	Expected Coverage	Achievement (u)	Merit (r)	Excellence (t)
THREE (a)	$y = x^3 - 5x + c$ $c = 4$ $y = x^3 - 5x + 4$	Equation found.		
(b)		Positive cubic shape or negative cubic with correct turning points.	Positive cubic shape and turning points at $x = -4$ and $x = 2$.	
(c)(i)	$a = 0.6$ $v = 0.6t + c$ $t = 0, v = 5$ $v = 0.6t + 5$ rate after 10 seconds $= 6 + 5$ $= 11$ (m s^{-1})	Anti-derivative formula found. Obvious use of any physics formula, without calculus, not accepted.	Velocity formula must contain variable t and show evidence of $t = 0$, $v = 5$. Speed after 10 seconds found, units not required.	
(c)(ii)	$s = 0.3t^2 + 5t + c$ $t = 0,\ s = 0, c = 0$ $s = 0.3t^2 + 5t$ $v = 8$ $0.6t + 5 = 8$ $t = 5$ $s(5) = 0.3 \times 5^2 + 5 \times 5$ $= 32.5$ m	Distance equation formed with $+c$.	Finds the distance formula **evidence of $t = 0$, $s = 0$, $c = 0$**. AND finding $t = 5$ when $v = 8$.	Finds the distance travelled, units not required.
(c)(iii)	$v = 8$ $a = -0.2$ $v = -0.2t + c$ $t = 0, v = 8$, so $c = 8$ $y = -0.2t + c$ $s = -0.1t^2 + 8t + c$ $t = 0, s = 0$, so $c = 0$ $6 = -0.2t + 8$ $0.2t = 2$ $t = 10$ distance after 10 seconds = 70 Distance past P = 102.5 m	Anti-derivative found.	Finds the distance formula **evidence of $t = 0$, $s = 0$, $c = 0$** AND finding $t = 10$ when $v = 6$.	Alternate method $c = 9$, $t = 15$, get to 102.5 m without getting 70 m first. Calculated the distance travelled past P. Units not required.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 14	15 – 20	21 – 24