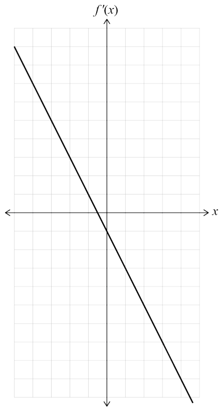
Assessment Schedule – 2017

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

Evidence Statement

Q	Evidence	Achievement (u)	Merit (r)	Excellence (t)
ONE (a)	$f'(x) = 5x^4 + 6x - 7$ $f'(1) = 5 + 6 - 7$ $= 4$	Derivative and gradient found.		
(b)	$f'(x) = 14 - 6x^2$ when $x = 2$ gradient $= 14 - 24 = -10$ $18 = -10 \times (2) + c$ $c = 38$ Equation of line $y = -10x + 38$	Derivative and gradient found.	Equation correct.	
(c)	$v(t) = 0.5t^2 - 2t + 1$ $a(t) = t - 2 = 2.8$ $t = 4.8$ s	Differentiating correctly.	Correctly finding t.	
(d)	$f'(x) = 6x - 4$ $= 2$ Therefore $x = 1$ Since x is 1 for the point where gradient = 2 $y = 3 \times 1^2 - 4 \times 1$ $= 3 - 4$ $= -1$ The gradient of the line through (1,–1) and (5,a) is $\frac{a-(-1)}{5-1} = \frac{a+1}{4} = 2$ $a + 1 = 8$ $a = 7$	Derivative = 2 and x-ordinate calculated for the original function.	Correct y-ordinate found for the original function.	Expressions for gradient found and value of a correct.
(e)	At turning point gradient function $f'(x) = 3x^2 + 2ax + b = 0$ When $x = -1$ $3 - 2a + b = 0$ When $x = 3$ $27 + 6a + b = 0$ $24 + 8a = 0$ $a = -3$, $b = -9$	Derivative found and equated to 0.	$x = -1$ and $x = 3$ substituted into gradient functions.	a and b found.

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	Evidence	Achievement (u)	Merit (r)	Excellence (t)
TWO (a)		Straight line with – ve gradient. x intercept between 0 and –1.		
(b)	$f'(x) = 6x^2 + 2bx$ When $x = -1$ $6x^2 + 2bx = 0$ $6 - 2b = 0$ $b = 3$	Derivative found and equated to 0.	Value of b found.	
(c)	$f'(x) = 8x - 1$ gradient = 15 if the line is a tangent $8x - 1 = 15$ $x = 2$ $y = 4x^2 - x + 4$ $y = 16 - 2 + 4 = 18$ Point (2,18) lies on the curve. Checking the point (2,18) $y = 15x - 12$ $18 = 30 - 12$ Hence (2,18) coincides with the point on the line and curve, and their gradients are the same, so the line is a tangent to the curve.	Derivative found and set to 15.	x and y values found on the original curve and also on the given line – hence a tangent.	
(d)	$f'(x) = 2x + 2$ gradient of line = 6 $6 = 2x + 2$ $x = \frac{4}{2} = 2$ if $x = 2$ in the original equation $y = 4 + 4 - 1 = 7$ For the line $7 = 6 \times 2 + k$ $k = -5$	Derivative found and set to 6.	x and y found.	Value of k calculated.

(e)	$y = 3x^3 - x^4$ $\frac{dy}{dx} = 9x^2 - 4x^3 = 0$ $x^2(9 - 4x) = 0$ Therefore $x = 0$ or $\frac{9}{4}$ Justified – sketching gradient on either side, or second derivative. $\frac{d^2y}{dx^2} = 18x - 12x^2$ when $x = \frac{9}{4}$ Second derivative is –ve, therefore local maximum calculated.	Derivative found.	Cubic equation solved.	Local maximum justified.

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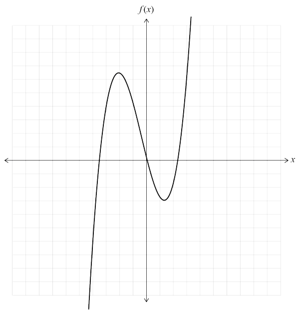
No response; no relevant evidence	Attempt at one question	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

Q	Evidence	Achievement (u)	Merit (r)	Excellence (t)
THREE (a)	$f(x) = 2x^3 - x^2 + 4x + c$ when $x = 1$ $3 = 2 - 1 + 4 + c$ $c = -2$ equation of curve is $y = 2x^3 - x^2 + 4x - 2$	Function correct.		
(b)		Positive cubic shape through the origin.	Maximum and minimum aligned with intercepts.	
(c)(i)	$a(t) = -4$ $v(t) = -4t + c$ If $t = 0$ then $v(0) = 6$ $v(t) = -4t + 6$ When $t = 5$ $v = -14$ cm s^{-1}	Anti-differentiated including constant of integration.	Velocity found.	
(c)(ii)	$s(t) = -2t^2 + 6t + c$ $s(0) = 12$ $c = 12$ $s(t) = -2t^2 + 6t + 12$ for maximum distance $v(t) = -4t + 6 = 0$ $t = 1.5$ $s = 16.5$ cm	Equation for s.	Finding the value of s.	Confirmed that this distance is a maximum by reference to graph, gradient on either side, or second derivative.
3(d)	Sides of the box $20 - 2x$, $30 - 2x$, height of the box x $V = x(20 - 2x)(30 - 2x)$ $= 600x - 100x^2 + 4x^3$ $\frac{dV}{dx} = 600 - 200x + 12x^2$ $= 0$ $x = 12.742$ or 3.9237 Using $x = 3.9237$, $V = 1056.3$ cm^3	Relationship formed and differentiated.	Differentiated and x values found for turning points and volume found	Confirmed that x value is a maximum by reference to graph, gradient on either side, or second derivative.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 8	9 – 14	15 – 20	21 – 24