Assessment Schedule – 2015

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

Evidence

ONE	Expected coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)	$f'(x) = 4x^3 + 4x$ $f'(-1) = -4 - 4$ $= -8$	Derivative found and gradient found. No alternative		
(b)	$3 + 2x - x^2 = 0$ $x = -1$ or 3 Function is decreasing for $x < -1$ or $x > 3$ e.g. –ve cubic, –ve quadratic, second derivative, or checking of gradients.	Derivative found and equated to 0 and solving $x = -1$ and $x = 3$.	Regions identified OR Excellence criteria satisfied with one minor aspect missing.	Regions identified and justified where it is a decreasing function. Justification from: graph of function or gradient function, gradient on each side of the points, second derivative or substitution in to the function. $-1 > \quad > 3$ not accepted for excellence.
(c)	$V(x) = x^3$ $V'(x) = 3x^2$ When $x = 5$ $V'(x) = 3 \times 25$ $= 75$ (cm^3 / cm)	Derivative found. Units not required.	Rate of change of V calculated. Units not required.	
(d)(i)	Greatest speed when $a = 16 - 2t = 0$ $t = 8$ $v(t) = 16t - t^2 + 40$ $= 104$ m s^{-1}	Equating $a(t)$ to 0 and solving $t = 8$. OR equation for velocity	Velocity equation found, and evaluating for $t = 8$. Units not required.	
(ii)	Stops when $v(t) = 0$ $16t - t^2 + 40 = 0$ $t = 18.2$ sec or $t = -2.2$ t must be positive. $s(t) = 8t^2 - \dfrac{t^3}{3} + 40t + c$ When $t = 0$, $s = 0$ Therefore c = 0 When $t = 18.2$ $s(t) = 1368$	Identifies when $v = 0$ and finds valid values of t OR Equation for distance with c = 0 shown. Allow consistency from d(i) from an incorrect constant.	Identifies when $v = 0$ and finds valid values of t AND Equation for distance with c = 0 shown.	Calculates the distance travelled past the signal.

NØ	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	Attempt at one question demonstrating a correct integral or derivative	1 of u	2 of u	3 of u	1 of r	2 of r	1 of t	2 of t

TWO	Expected coverage	Achievement (u)	Merit (r)	Excellence (t)

(a)	$f(x) = 2x^2 - 3x + c$ (4,6) lies on the line $6 = 32 - 12 + c$ $c = -14$ $f(x) = 2x^2 - 3x - 14$	Equation found. No alternative		
(b)(i)	$g'(x) = 2x - 3$ grad = 0 when $x = 1.5$ y = 15.75	Derivative given and solving x=1.5	Equation of tangent found with y=15.75 Or equivalent correct equation.	
(ii)	The point (1.5, 15.75) is the minimum point of the curve.	Coordinates of turning point found and described as a TP, vertex or min (not max).		
(c)(i)	$h'(x) = -x + 3$ $0=-x+3$ $x = 3$ maximum height is $-0.5 \times 9 + 9 - 1.5 = 3$ m	Derivative found and set to 0 and solving $x = 3$.	Maximum height found. Units not required.	
(c)(ii)	Gradient = 0.5 $-x + 3 = 0.5$ $x = 2.5$ $h = 2.875$ distance below the height of the mound is 0.125 m	Found value of x.	Finds height of where tangent meets the curve.	Difference in height found. Consistency with height from c(i)
(c)(iii)	$h' = r^2 - 4r + 3 = 0$ $(r - 3)(r - 1) = 0$ For turning point $r = 1$ or 3 $r = 1, h = \frac{4}{3}$ $r = 3, h = 0$ For this curve the height is within the height restrictions. Increasing when $x < 1$, max at $x = 1$, Decreasing $1 < x < 3$, min at $x = 3$ Increasing when $x>3$	r values of turning points found.	Coordinates of both turning points found. OR Excellence criteria satisfied with one aspect missing.	Coordinates of both turning points found, statement regarding height compliance. WITH Justification from: graph of function or gradient function, gradient on each side of the points, second derivative or substitution in to the function.

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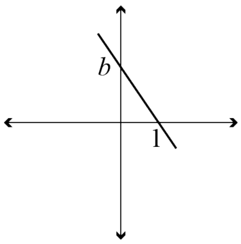
THREE	Expected coverage	Achievement (u)	Merit (r)	Excellence (t)
(a)	$a = 12t^2 - 2t + 2$	Correct equation found. No alternative.		
(b)	$f'(x) = 3x^2 - 4x + 1$ At the point (2,2) gradient = 5 $y = 5x + c$ if $x = 2$ and $y = 2$ $c = -8$ Tangent $y = 5x - 8$	Derivative and gradient found.	Equation of tangent found, or equivalent correct equation.	
(c)	For maximum height $20 - 10t = 0$ $t = 2$ $h = 40 - 20$ $= 20$ m Firework will not break restriction.	Derivative found and equated to 0 and t value of turning point found.	Maximum height found and conclusion correctly stated. Units not required.	
(d)	$f(x) = -ax^2 + 2ax + c$ $f'(x) = -2ax + 2a$ $f'(x) = -2ax + b$ $= -bx + b$ 	Equation of gradient function found, using either 2a or b.	Graph sketched with one intercept correctly identified. $x = 1$ can be expressed algebraically rather than being plotted on the graph.	Graph sketched with both axes correctly labelled – with y intercept as b and x intercept as 1. Accept $2a$ for b. $x = 1$ can be expressed algebraically rather than being plotted on the graph.
(e)	$P = x^2y$ $= 2x^2(x - 3)$ $= 2x^3 - 6x^2$ $P'(x) = 6x^2 - 12x$ $= 6x(x - 2)$ For minimum or maximum value $x = 0$ or 2 Maximum $x = 0$, $y = -6$ and $P = 0$ Minimum $x = 2$, $y = -2$ and $P = -8$	Relationship formed and correctly differentiated.	Values of the product found or both y values found OR Excellence criteria satisfied with one minor aspect missing.	Values of the product and either: Justification from: graph of function or gradient function, gradient on each side of the points, second derivative or substitution in to the function.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 14	15 – 19	20 – 24