

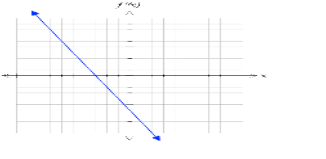
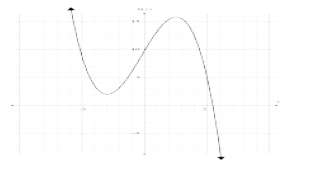
Assessment Schedule – 2014

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

Evidence Statement

ONE		Achievement (u)	Merit (r)	Excellence (t)
		Apply calculus methods in solving problems.	Apply calculus methods, using relational thinking, in solving problems.	Apply calculus methods, using extended abstract thinking, in solving problems.
(a)	$g'(x) = 3x^2 - 4$ $g'(2) = 8$	Derivative found AND gradient found.		
(b)	$f(x) = x^3 + 2x^2 - x - 9$	Anti-derivative AND function found. $f(x)$ not required. $C = -9$ accepted.		
(c)	$d'(t) = 2.5t - 4$ $2.5t - 4 = 0$ $t = 1.6$ $d(1.6) = -3.2$	Derivative found AND equated to 0 OR $t = 1.6$.	Time for minimum AND depth found. Accept 3.2 with evidence of substitution of 1.6 into $d'(t)$. Units not required.	
(d)	$f'(x) = -2x + k$ $-2x + k = 0$ $k = 2x$ Since $x = 3$, $k = 6$ $f(x) = -x^2 + 6x - 5$ $f'(x) = -2x + 6$ $f'(4) = -2$	Derivative found AND $k = 6$ found.	Gradient found.	
(e)	$g'(x) = 2x^2 + 3x - 20$ $2x^2 + 3x - 20 = 0$ $(2x - 5)(x + 4) = 0$ $x = 2.5, -4$ Check gradient: $g'(0) = -20 < 0 \Rightarrow$ decreasing. OR shape of graph + ve cubic OR $g''(x)$ test. $-4 < x < 2.5$	Derivative found AND $= 0$ or < 0 .	Derivative found and the x values of turning point found ($g'(x) = 0$ may be implied)	Region correctly identified AND justified using one of the methods. Can be in words.
(f)	$v(t) = 0.5625t^2 - 4.5t + 21$ $a(t) = 1.125t - 4.5$ $1.125t - 4.5 = 0$ $t = 4$ $s(4) = 60.5$ km	Velocity equation found.	Acceleration equation found AND set equal to 0 ($s''(x) = 0$ may be implied).	Distance found. Units not required.

N0	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

TWO		Achievement (u)	Merit (r)	Excellence (t)
(a)		Straight line with negative gradient AND x-intercept -3 .		
(b)	$g(x) = x^2 - 5x + c$ $c = 0$ $g(3) = -6$	Anti-derivative AND y-coordinate found.		
(c)	$R'(t) = 300t - 2250$ $300t - 2250 = -150$ $t = 7$ years	Derivative found AND set to -150 .	t found. TE for \$150 gives $t = 8$. Accept one MEI with evidence. Set to -150 can be implied.	
(d)		Negative cubic with minimum at $(-3, 2)$ OR negative cubic with TP's at $x = -3$ and $2 < x < 3$.	Negative cubic with minimum at $(-3, 2)$ AND the second TP indicated in the range $2 < x < 3$.	
(e)	$9x - 3x^2 = 0$ $3x(3 - x) = 0$ $x = 0, 3$ Max at $x = 3$ $\frac{d^2y}{dx^2} = 9 - 6x$ When $x = 3$, $\frac{d^2y}{dx^2} = -9 < 0 \Rightarrow \text{max}$ OR shape of graph -ve cubic OR Check gradient: $y'(2) = 6 > 0$ $y'(4) = -12 < 0 \Rightarrow \text{MAX}$ Hence passes through $(3, -4)$ $y = 4.5x^2 - x^3 + c$ $-4 = 4.5x^2 - x^3 + c$ $c = -17.5$ $y = 4.5x^2 - x^3 - 17.5$	x values of turning points identified. OR Correct integration set equal to -4 .	Maximum turning point at $x = 3$ identified, justified and the point $(3, -4)$ used using one of the three methods.	Equation of curve found in $y=$ form.

(f)	$\frac{dy}{dx} = 2px + 4$ When $x = 3, y = 9p + 7$ and $\frac{dy}{dx} = 6p + 4$ $y - (9p + 7) = (6p + 4)(x - 3)$ Subst. (0,4), $p = -1$ Equation of tangent is $y + 2 = -2(x + 3)$ OR gradient of tangent at $x = 3$ is -2 . When $x = 3, y = -2$ Equation of tangent is $y + 2 = -2(x - 3)$ OR $y = -2x + 4$	Expression for the gradient found when $x = 3$.	Value of p found.	Equation of tangent found.
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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

THREE		Achievement (u)	Merit (r)	Excellence (t)
(a)	$f'(x) = 4 - 2x$ $4 - 2x = 10$ $x = -3$	Gradient function AND solution found.		
(b)	$V(h) = 20h^2 + 40h$ $V'(h) = 40h + 40$ $V'(0.75) = 70$	Derivative found AND rate of change found. Units not required.		
(c)	$\frac{dV}{dr} = 4\pi r^2$ $288\pi = \frac{4}{3}\pi r^3$ Plus 1 line For given volume $r = 6$ Rate of change = 144π or 452.4 .	Derivative found AND attempt to find r using correct equation $288\pi = \frac{4}{3}\pi r^3$ – one correct rearrangement required.	Rate of change found. Units not required.	
(d)	$V'(x) = 900x - 36x^2 = 0$ $900x - 36x^2 = 0$ $x(900 - 36x) = 0$ $x = 25$ cm Since $h + x + 3x = 150$ then $h = 50$ cm	Derivative found, set to 0, AND x found. $V'(x) = 0$ can be implied.	h found. Units not required.	
(e)	$g'(x) = (x - 2)^2 - 1$ $= x^2 - 4x + 3$ $g(x) = \frac{x^3}{3} - 2x^2 + 3x + c$ $c = 0 \Rightarrow g(x) = \frac{x^3}{3} - 2x^2 + 3x$ When $x = 1$, $g(1) = m = \frac{4}{3}$		$g(x)$ found – particular solution with evidence $c = 0$.	m found. Ignore rounding.
(f)	$v(t) = -3.3t + c$ $t = 0, v = 70$ $\Rightarrow v(t) = -3.3t + 70$ $s(t) = -1.65t^2 + 70t + c$ $t = 0, s = 0$ $\Rightarrow s(t) = -1.65t^2 + 70t$ $4 = -3.3t + 70$ $\frac{4 - 70}{-3.3} = 20$ $t = 20$ $s(20) = 740$ metres	Velocity function found.	Distance function found.	Distance found. Units not required.

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

Cut Scores

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