Assessment Schedule – 2020

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

Evidence

Q ONE	Evidence	Achievement (u)	Achievement with Merit (r)	Achievement with Excellence (t)
(a)	$f(x) = x^3 - 2x^2 + 5$ $\Longrightarrow f'(x) = 3x^2 - 4x$ $f'(4) = 32$	Correct solution.		
(b)	$h(x) = 0.5x^2 + 3x - 1$ $\Longrightarrow h'(x) = x + 3$ $x + 3 = 5 \Longrightarrow x = 2$	Correct solution.		
(c)	$g'(x) = 2x + 5$ $g'(2) = 9$ $g(x) - 14 = 9(x - 2)$ $g(x) = 9x - 4$	Finds the gradient.	Correct equation.	
(d)	$f'(x) = px - 4$ $f(x) = \frac{px^2}{2} - 4x + c$ $f(4) = 8p - 16 + c = 12 \Longrightarrow c = 28 - 8p$ $f(-6) = 18p + 24 + c = 2 \Longrightarrow c = -22 - 18p$ $28 - 8p = -22 - 18p \Longrightarrow p = -5, c = 68$ Hence, $f(x) = \frac{-5x^2}{2} - 4x + 68$	Integrates $f'(x)$ correctly.	Correct equation for $f(x)$	
(e)	$a(t) = 0.5$ $v(t) = 0.5t + 3$ $s(t) = 0.25t^2 + 3t + 80$ $s(t + 1) - s(t) = 0.5t + 3.25 = 11.75$ km $t = 17$ So in the 18th hour, the boat travels 11.75 km.	Finds correct velocity equation.	Finds correct distance equation.	T1: Forms equation for distance travelled in 1 hour but minor error made in working leading to a solution, such as an algebraic or numerical slip. T2: Correct solution.

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	A valid attempt at one question.	1 of u	2 of u	3 of u	1 of r	2 of r	T1	T2

Q TWO	Evidence	Achievement (u)	Achievement with Merit (r)	Achievement with Excellence (t)
(a)	Positive parabola with x-intercepts in the 3rd square to the left of the y-axis and in the 7th square to the right (not on a grid line).	Correct graph.		
(b)	$y'(x) = 6x^2 - 84x + 240 = 0$ at turning points $6(x^2 - 14x + 40) = 0$ $(x - 4)(x - 10) = 0$ $x = 4$ or 10 Correct use of any test to show that the maximum occurs at $x = 4$, such as showing clearly that: • $y(4) > y(10)$ • $y'(3.9) > 0$ while $y'(4.1) < 0$ • $y''(4) < 0$	$y'(x)$ correct and set to 0.	Clear reasoning to show that maximum occurs when $x = 4$.	
(c)	$v(t) = 3t^2 - 5t$ $a(t) = 6t - 5$ $a(2) = 7$	Correct answer.		
(d)	Negative cubic with a minimum and x-intercept at (c,0) and a maximum 10 squares to the right of the x-axis. Accept cubics that do not have point symmetry.	Negative cubic.	TPs correct.	
(e)	$f(x) = ax^3 + bx^2 + cx + d$ $f'(x) = 3ax^2 + 2bx + c$ $27a + 6b + c = 0$ $75a - 10b + c = 0$ Eliminating $b \Rightarrow c = -45a$ OR To have turning points at $x = 3$ and $x = -5$, $f'(x) = k(x - 3)(x + 5)$ $f'(x) = kx^2 + 2kx - 15k$ $\therefore f(x) = \frac{k}{3}x^3 + kx^2 - 15kx + d$ So $a = \frac{k}{3} \Rightarrow k = 3a$ and $c = -15k \Rightarrow c = -45a$	Correct expression for $f'(x)$ involving a, b and c.	Forms the two equations utilising the TP information.	T1: Correct expression obtained but with incorrect working or incorrect mathematical statements. T2: Correct expression obtained with correct working and mathematical statements.

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No response; no relevant evidence.	A valid attempt at one question	1 of u	2 of u	3 of u	1 of r	2 of r	T1	T2

Q THREE	Evidence	Achievement (u)	Achievement with Merit (r)	Achievement with Excellence (t)
(a)	$f(x) = x^3 - x^2 - 4x + c, \quad c = 4$ $f(x) = x^3 - x^2 - 4x + 4$	Correct answer.		
(b)	$A = \pi r^2 = \pi (0.7t)^2 = 0.49\pi t^2$ $\frac{dA}{dt} = 0.98\pi t$ $\frac{dA}{dt} = 0.98\pi \ x \ 20$ $= 19.6\pi = 61.58 \text{ m}^2 \text{ s}^{-1}$ (units not required)	Expression for $\frac{dA}{dt}$.	Correct answer.	
(c)	$h'(x) = \frac{-2}{3}x + 2$ $h(x) = \frac{-1}{3}x^2 + 2x + c$ Since $h(0) = 4$, $h(x) = \frac{-1}{3}x^2 + 2x + 4$	Anti-differentiation.	Correct answer.	
(d)	$f'(x) = 3kx^2 + 9$ $f'(2) = 3k(2)^2 + 9 = 15$ $12k + 9 = 15$ $k = 0.5$	Correct answer.		
(e)	Let length of the base be x. $A = \frac{1}{2}x(mx - x^2)$ $= \frac{1}{2}mx^2 - \frac{1}{2}x^3$ $A' = mx - \frac{3}{2}x^2 = x(m - \frac{3}{2}x) = 0$ Since $x \neq 0$, $\frac{3}{2}x = m \Rightarrow x = \frac{2m}{3}$ Max A: $A = \frac{m}{3}\left(\frac{2m^2}{3} - \frac{4m^2}{9}\right) = \frac{2m^3}{27}$	Correct differentiation of an expression for the area of OAB.	Finds m or x.	T1: Minor error but otherwise correct. T2: Correct expression obtained.

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Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 8	9 – 13	14 – 18	19 – 24