Assessment Schedule – 2021

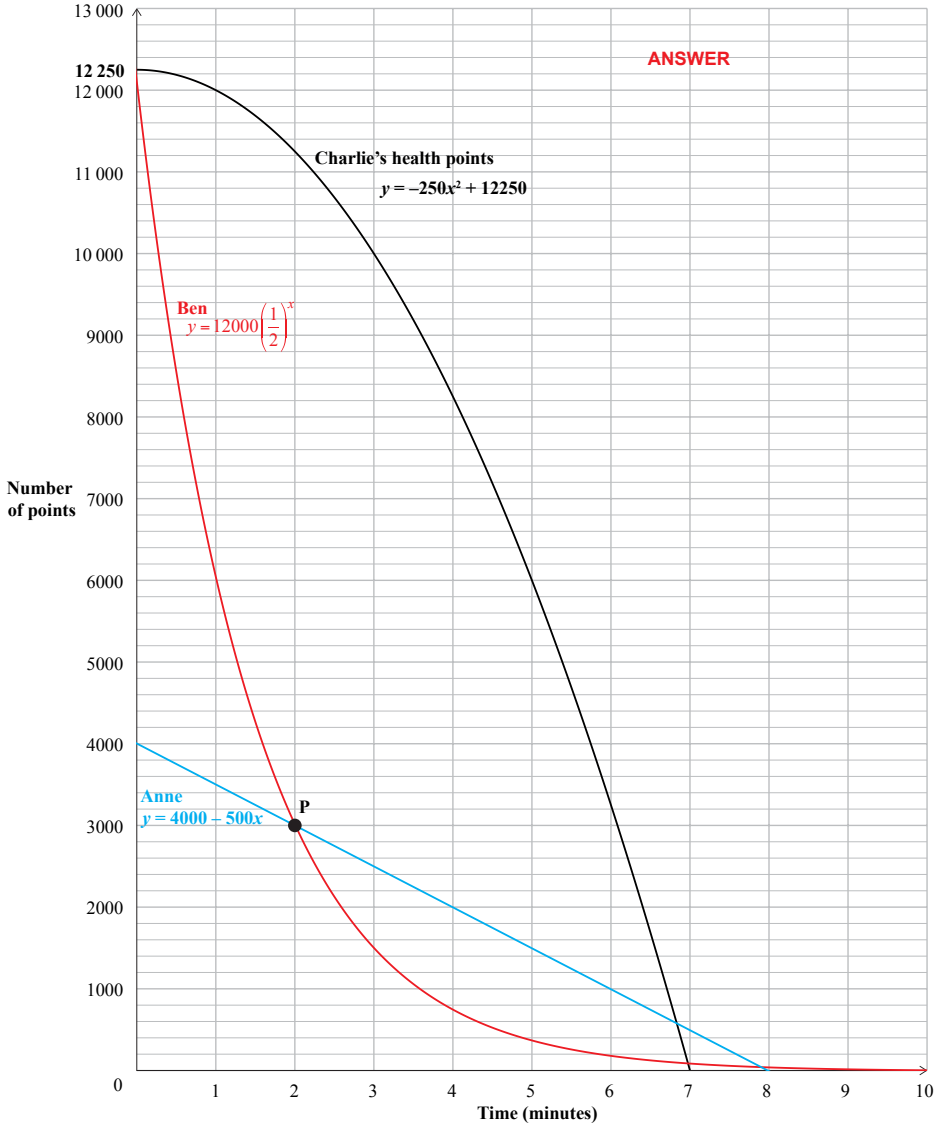
Mathematics and Statistics: Investigate relationships between tables, equations and graphs (91028)

Evidence

Q ONE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a) (i)	$y = -\frac{7}{2}x - 3$ OR $y = -3.5x - 3$ or equivalent	Correct equation.		
(ii)	$y = -\frac{7}{2}(x + 10) - 3 + 20$ $y = -\frac{7}{2}x - 18$ or any equivalent.	Vertical shift correct. OR Horizontal shift correct.	Correct simplified equation.	
(b)	Anne's equation: $y = 4000 - 500x$ Ben's equation: $y = 12000\left(\frac{1}{2}\right)^x$ (or $y = 12000 \times 2^{-x}$) Charlie's equation $y = -250\,x^2 + 12250$ Sample Comments: • Anne and Ben both have 3000 after 2 minutes. • Anne and Charlie both have approx. 585 after approx. 6.8 minutes. • Charlie finishes first (7 minutes), then Anne next (8 minutes), Ben wins after 9 minutes. • Ben still has some left (approx. 23.44) when time runs out after 9 minutes. • Charlie is in the lead for most of the game but loses first.	Finding Anne's equation. OR Table of values for Anne and Ben with at least five correct values in both. OR Graph of either Anne or Ben.	**M5 / 1r** Finding Ben's equation. OR Finding Charlie's equation. OR Graphs of Anne and Ben. **M6 / 2r** Finding an equation for either Ben or Charlie. AND Graphs of Anne and Ben. AND At least TWO non-trivial comments.	**E8 / T2** Finding all THREE equations. AND Evidence of a table of values. AND Graphs for Anne and Ben. AND At least TWO non-trivial comments, including comment that Ben plays the longest. **E7 / T1** As above but evidence of table omitted. OR Only one non-trivial comment. OR Minor error in Charlie's equation or the Ben's graph.

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	ONE question attempted towards solution.	1 u	2 u	3 u	1 r	2 r	T1	T2

Q1(b)

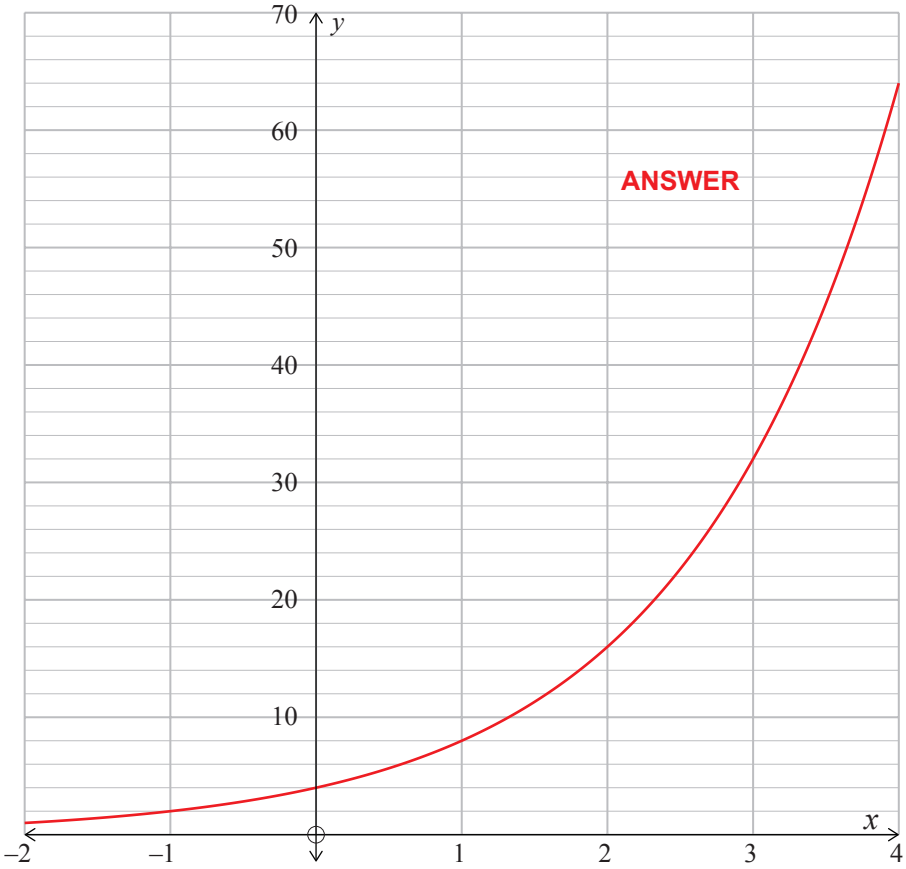


Time	Anne	Ben	Charlie
	$y = 4000 - 500x$	$y = 12000 \times \left(\frac{1}{2}\right)^x$	$y = -250x^2 + 12250$
0	4000	12000	12250
1	3500	6000	12000
2	3000	3000	11250
3	2500	1500	10000
4	2000	750	8250
5	1500	375	6000
6	1000	187.50	3250
7	500	93.75	0
8	0	46.88	-
9	-	23.44	-

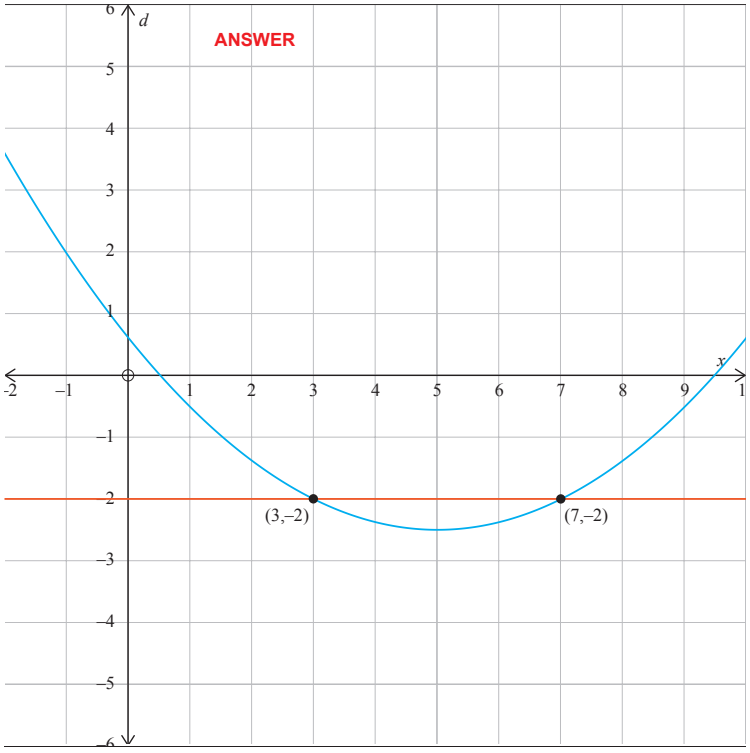
Q TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Graph drawn with smooth curve, showing accuracy through (–1,2), (0,4), (1,8), (2,16), (3,32).	Graph drawn.		
(b) (i)	$x = 2.5$ $y = –1.8$ Allow –1.8 m. No units required.	Depth of 1.8 metres. Allow C.A.O.		
(ii)	Sample comments: • Reducing the coefficient of 0.8 will make the hole less deep (or less steep). • Changing the intercepts so they are closer together e.g. $y = 0.8(x – 1)(x – 2)$ will make the hole shallower. • Adding a positive number < 1.8 to the end of the equation will make the hole less deep	One valid comment.	Two valid comments.	
(iii)	Equation found $y = 2^{-x}$ OR $y = 0.5^x$ OR $y = \frac{1}{2^x}$ Allow C.A.O.	Recognition of equation as exponential of the format $y = 2^x$.	Correct equation.	
(iv)	Equation of curve is $y = 0.125(x – 5)^2 – 2.5$ OR $y = \frac{1}{8}(x-5)^2 - 2.5$ OR $y = 0.125x^2 – 1.25x + 0.625$ DO NOT allow C.A.O. Method 1: Depth of water surface is 2 m gives $–2 = 0.125(x – 5)^2 – 2.5$ $0.5 = 0.125(x – 5)^2$ $4 = (x – 5)^2$ $\pm 2 = x – 5$ $x = 7$ or $x = 3$ So width of hole at water level will be 4 metres. Method 2: Find equation of the hole, using algebra, and then solves: $–2 = 0.125x^2 – 1.25x + 0.625$ $0 = 0.125x^2 – 1.25x + 2.625$ (allow use of G.C from here onwards) $0 = x^2 – 10x + 21$ $0 = (x – 7)(x – 3)$ $x = 3$ or $x = 7$ So width of hole at water level will be 4 metres. Method 3: Find equation of hole and draw accurate graph, reading off intersection of curve and $y = –2$.	Giving equation of the curve as $y = k(x – 5)^2 – 2.5$ OR Consistent recognition of solving equation $= – 2$ OR C.A.O.	Correct equation of the curve. OR Consistent solving of equation $= – 2$ OR Correct graph of the curve showing the surface of the water.	**E8 / T2** Width of the hole calculated with fully justified working (algebraic or graphical) **E7 / T1** Width calculated with minor error. OR Consistent solving of correct equation $= + 2$

N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	ONE question attempted towards solution.	1 u	2 u	3 u	1 r	2 r	T1	T2

Q2(a)



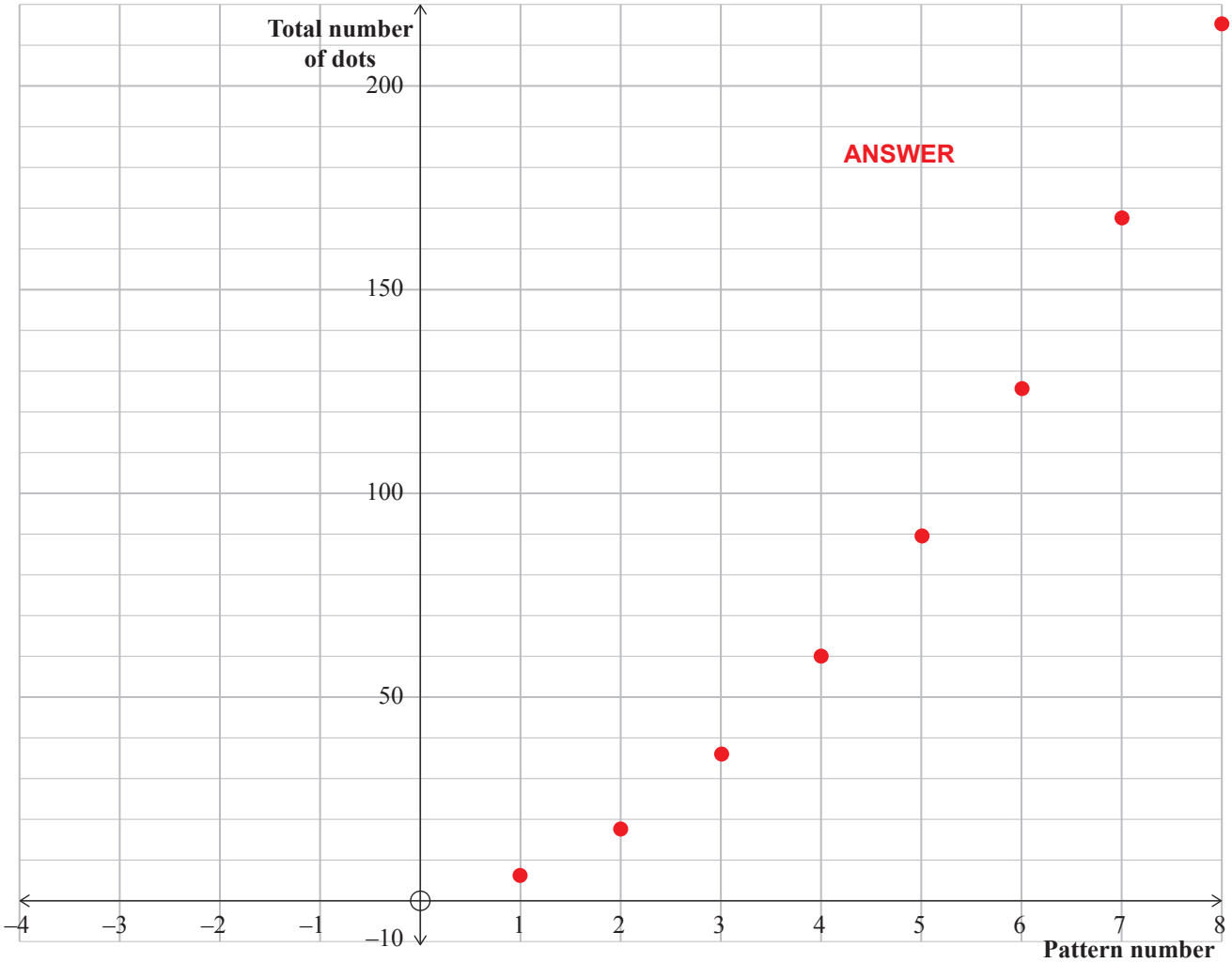
Q2 (b)(iv)



Q THREE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	$y = -(x + 1)^2 + 9$ OR $y = -(x + 4)(x - 2)$ OR $y = -x^2 - 2x + 8$	Correct equation. Allow C.A.O.		
(b) (i)	$n = 4 \quad T = 60$ $n = 5 \quad T = 90$	Both T-value answers required.		
(ii)	$T = 3n^2 + 3n$ OR $T = 3n(n + 1)$ OR $y = 3x^2 + 3x$	Establish a quadratic with $3n^2$.	Correct formula.	
(iii)	Graph drawn. Allow consistency from part (ii). Graphs should be only the integer value dots, At least $1 \le n \le 8$ i.e. discrete values, not including negatives or 0, according to the context.	Graph drawn, but including negative values and / or as a continuous line. OR Incorrect graph with discrete values.	Graph drawn, with the discrete values only for at least $1 \le n \le 5$. Allow (0,0) if a discrete graph.	
(c)	Table produced of the relationship between the two lengths of wood and their area. Graph produced relating length of one stick and area. Area = $x(60 - x)$ Sample comments: • Maximum area is 900 cm² and / or when both lengths are 30 cm • Graph and area size is symmetrical. • Minimum area is 0 cm² (theoretically). • Rate of increase of the area changes for different x-values. • The graph will be a continuous one as all different x-values are possible, if measurements are taken accurately. • In reality, some of the x-values close to 0 or close to 60 are likely to be impossible for Lizzy to cut. • As the two sides of the rectangle get closer together in length the area increases.	Forming equation for area in terms of only one variable. OR Table only with one non-trivial comment. OR Graph only with one non-trivial comment. OR Finding maximum area only. OR Table and graph drawn with no comments.	Evidence of only two aspects of tables, equations, and graphs with two non-trivial comments.	**E8 / T2** Evidence of table of values AND graph drawn AND formula for area provided AND at least three valid non-trivial comments. **E7 / T1** Evidence of table of values AND graph drawn AND formula for area provided BUT only maximum area discussed. OR **E7 / T1** As evidence for **E8** but graph is of poor quality.

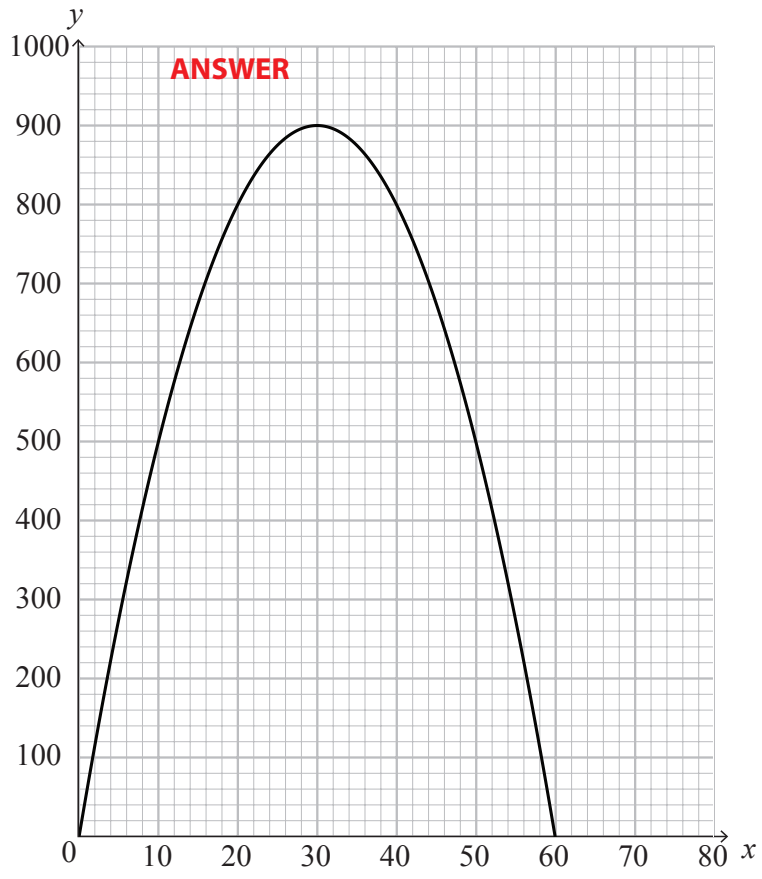
N0	N1	N2	A3	A4	M5	M6	E7	E8
No response; no relevant evidence.	ONE question attempted towards solution.	1 u	2 u	3 u	1 r	2 r	T1	T2

Q3(b)(iii)



Q3(c)

First part of stick x	Second part of stick $60 - x$	Area $x(60 - x)$
0	60	0
4	56	224
8	52	416
12	48	576
16	44	704
20	40	800
24	36	864
28	32	896
32	28	896
36	24	864
40	20	800
44	16	704
48	12	576
52	8	416
56	4	224
60	0	0
30	30	900



Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 7	8 – 13	14 – 18	19 – 24