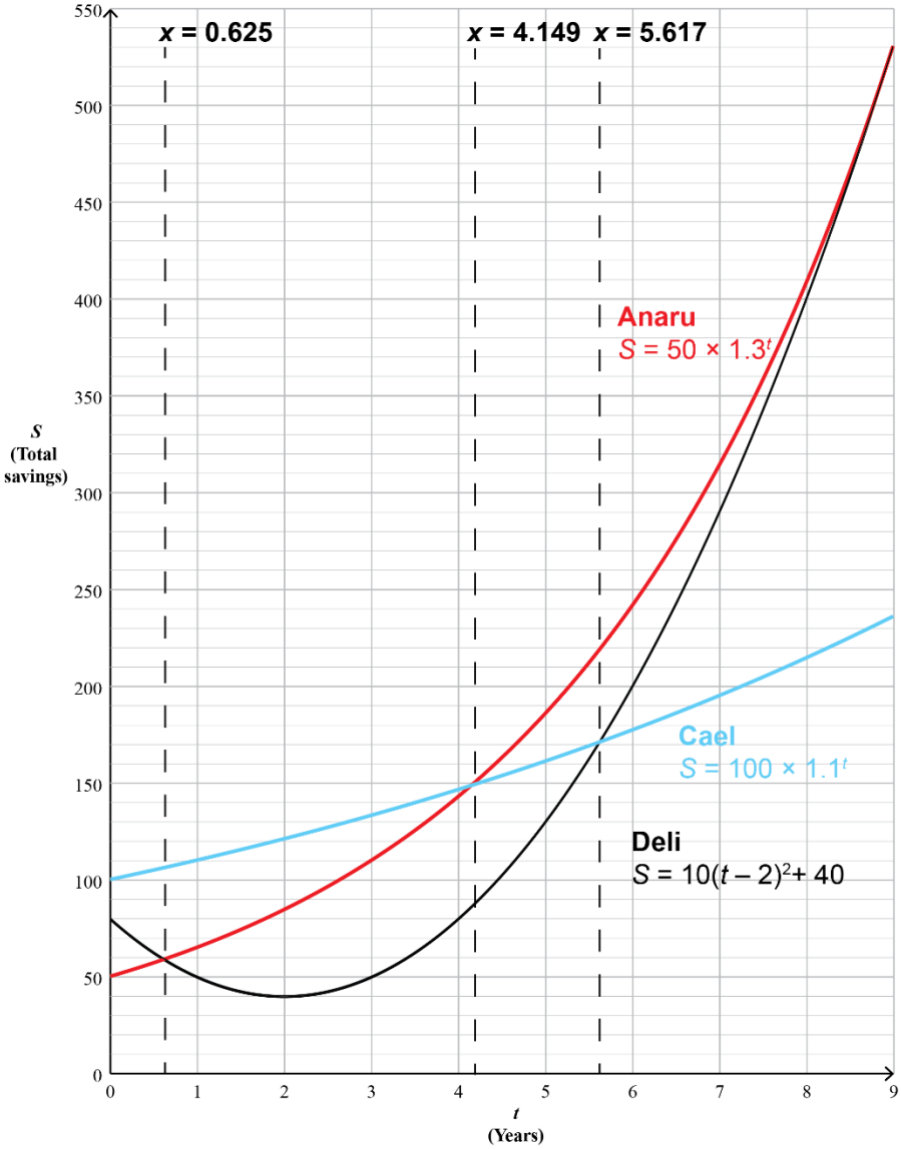
Assessment Schedule – 2020
Mathematics and Statistics: Investigate relationships between tables, equations and graphs (91028)

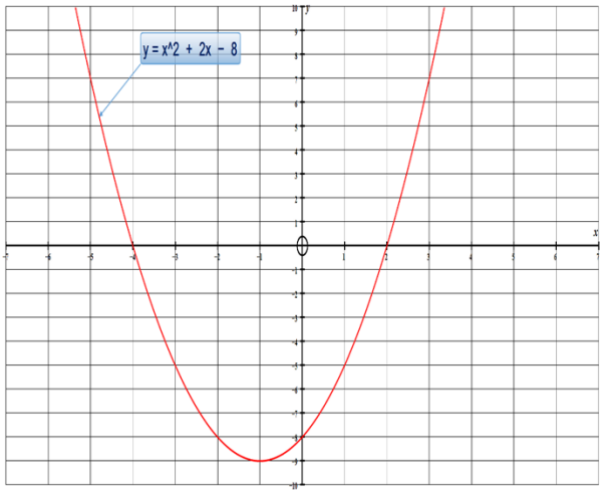
Evidence

Q ONE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	$y = -3x + 10$ or equivalent.	Correct equation.		
(b) (i)	$t = 0$ so $S = \$50$ (Units not required.)	Correct answer.		
(b) (ii)	$S = 50 + 40t$ Accept if equation is given as $y = 40x + 50$	Rate of change / Gradient (40) identified in a linear equation. OR Constant / y-intercept (50) identified in a linear equation.	Correct equation for Bahman's savings plan.	
(b) (iii)	$S = 100 \times 1.1^t$ Accept if equation is given as $y = 100 \times 1.1^x$ Accept: $y = 110(1.1)^{(x-1)}$	Value of 100 identified in an exponential equation. OR Value of 1.1 identified in an exponential equation.	Correct equation for Cael's savings plan.	
(b) (iv)	Graph of Anaru's Saving Plan produced. Graph of Cael's Saving Plan produced. Table of Anaru, Cael and Deli produced. Comparison comments made. Samples comments are: • Cael starts with the most money ($100) compared to the others, who start with only $50 and $80. • After approx. 0.625 years, Anaru and Deli have the same amount (approx. $59) but Cael has more, with $106. • After approx. 4.1 years, Anaru and Cael have the same amount (approx. $147), but Deli has only $84. • After approx. 5.6 years, Cael and Deli have the same amount (approx. $170), but Anaru has more with approx. $217. • As time goes on, Anaru and Deli have almost the same amount, whilst Cael will lag further behind. *Where the candidate has used their graph for their values, the values found can be accepted as less accurate.*	A complete table and / or a graph with all three plans (if no comments given) OR ONE valid **comparison** comment regarding values of savings plans WITH supporting evidence of: ONE of: • relevant table of values constructed with at least THREE correct values • relevant graph attempted. *Allow consistency for incorrect equation for Cael from (b)(iii) if exponential equation.*	A complete table and graphs with one valid **comparison** comment OR TWO valid **comparison** comments regarding values of savings plans WITH supporting evidence of: ONE of: • relevant table of values constructed with at least THREE correct values • relevant graphs drawn. *Allow consistency for incorrect equation for Cael from (b)(iii) if exponential equation.*	Correct and clear representation of the situation AND TWO valid **comparison** comments regarding values referencing **all three** savings plans WITH supporting evidence from table (for A, C and D) AND graphs drawn (for both A and C). *Allow consistency for incorrect equation for Cael from (b)(iii) if exponential equation.*



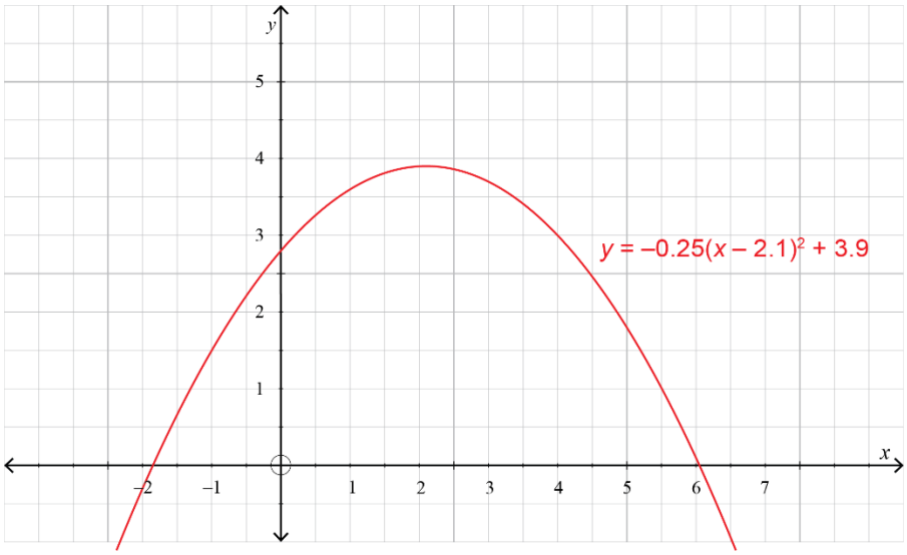
Y	Anaru	Cael	Deli
	$S = 50 \times 1.3^t$	$S = 100 \times 1.1^t$	$S = 10(t-2)^2 + 40$
1	65	110	50
2	84.5	121	40
3	109.85	133.10	50
4	142.80	146.41	80
5	185.64	161.05	130
6	241.34	177.16	200
7	313.74	194.87	290
8	407.86	214.35	400
9	530.22	235.79	530

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	Partial lack of detail in solution to (b)(iv).	Full solution to (b) (iv).

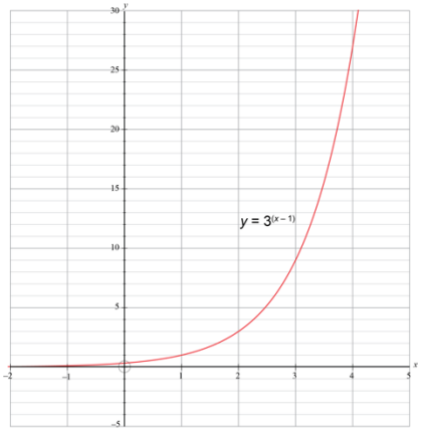
Q TWO	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Graph drawn with smooth curve, showing intercepts with axes and minimum point. 	Graph drawn.		
(b) (i)	Substitute $x = 0$ into the equation of the path giving $H = -0.2\,(0 + 2)(0 - 8) = 3.2$ So the ball will be $3.2 - 2.4 = 0.8$ metres above the net.	Correct value of 0.8 metres. Allow C.A.O.		
(b) (ii)	Sample comments are: • Altering the coefficient of –0.2 to something like –0.3 will make the ball go higher over the net. • Altering the coefficient of –0.2 to something like –0.1 will make the ball go lower so it won't make it over the net. • However, altering the coefficient of –0.2 will also alter the path of the ball in other ways, so that the path of the ball will not go through the original positions, so Tui will need to hit the ball from a different starting point. • The current maximum height of the ball is at (3,5). Altering the $(x + 2)$ and $(x - 8)$ will alter the co-ordinates of this maximum point. So the whole graph could be shifted to the left by altering the values in the brackets, e.g. $H = -0.2(x + 4)(x - 6)$ will shift the whole graph left by 2 metres.	ONE valid non-trivial statement.	TWO valid non-trivial statements.	

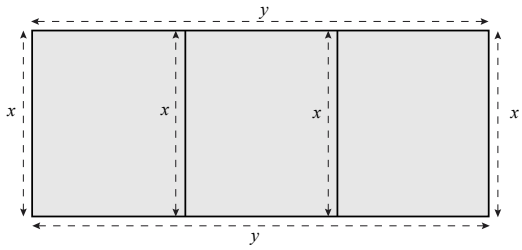
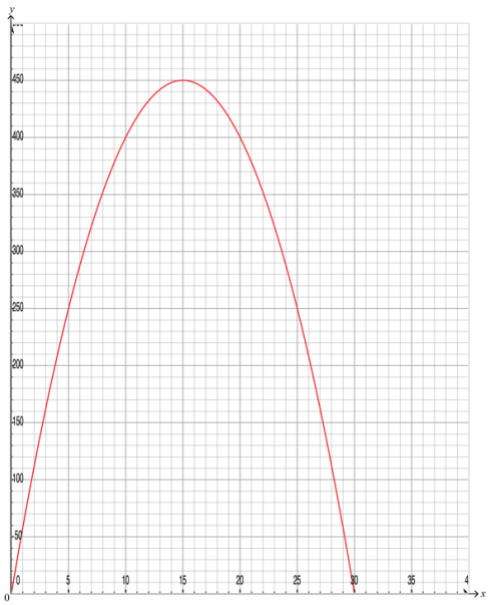
(c) (i)	$H = k(x - 1.8)^2 + 4.8$ Using $x = -3.2$ and y = 2.3 gives $2.3 = k(-3.2 - 1.8)^2 + 4.8$ $2.3 = k(-5)^2 + 4.8$ $2.3 - 4.8 = 25k$ $-2.5 = 25k$ $k = -0.1 = \frac{-1}{10}$ So $H = -0.1(x - 1.8)^2 + 4.8$ OR $H = -0.1x^2 + 0.36x + 4.476$ Do not penalise the use of *y* instead of *H*.	No k–value considered, i.e. equation given as $H = (x - 1.8)^2 + 4.8$ OR Attempt made to find the value of *k* in a correct set-up of the equation.	Correct equation for *H*. OR C.A.O.	
(c) (ii)	$0 = -0.25(x - 2.1)^2 + 3.9$ $0.25(x - 2.1)^2 = 3.9$ $(x - 2.1)^2 = \frac{3.9}{0.25}$ $(x - 2.1)^2 = 15.6$ $x - 2.1 = \pm\sqrt{15.6}$ $x = 2.1 \pm 3.95$ $x = 6.05$ or $x = -1.85$(ignore) i.e. Ball will land 6.05 metres from the net. Do not penalise the negative value not being considered. OR Graph drawn and used to identify *x*-value(s). OR Simplification to the quadratic equation $0.25x^2 - 1.05x - 2.7975 = 0$ and then subsequent use of graphical calculator to find the *x*-value(s).	Equating the equation of the path of the ball to 0. OR Graph attempted with at least two correct points. OR C.A.O.	Reaching the stage in the working of $x - 2.1 = \sqrt{15.6}$ OR Reaching the stage in the working of $0.25x^2 - 1.05x - 2.7975 = 0$ OR Finding the value of *x* with an error in the working. OR Graph drawn with errors / lack of accuracy and a consistent value of *x* identified.	Finding the correct value of *x*, with clear justification and evidence. (Accept use of graphical calculator from an appropriate quadratic equation.) OR Value of approx. $x = 6$, with evidence that this has been read from an accurate and smooth graph.

(c)(ii)



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	Partial lack of detail in solution to (c)(ii).	Clearly justified solution to (c)(ii).

Q THREE	Evidence	Achievement	Achievement with Merit	Achievement with Excellence
(a)	Graph drawn with smooth curve, showing accuracy through (1,1), (2,3), (3,9), (4,27).  	Graph drawn.		
(b) (i)	Greatest vertical height at (2,15) i.e. 15 metres above sea level. $h = 15$.	Height of 15 metres stated. Allow C.A.O.		
(b) (ii)	$h = -\frac{9}{6}x + c$ $x = 10$ and $y = 0$ gives $c = 15$ $h = -\frac{9}{6}x + 15$ OR equivalent form OR by using the point (4, 9) OR with alternative methods. Accept if equation is given as $y = \frac{-9}{6}x + 15$	Gradient correct OR y–intercept correct.	Correct equation.	
(b) (iii)	Sample comments are: • Altering the coefficient of –1.5 to something like –2.5 will make the bird's flight path steeper but will not change its greatest height reached i.e. still at (2, 15). • Altering the coefficient of –1.5 to something like –0.5 will make the bird's flight path less steep but will not change its greatest height reached, i.e. still at (2, 15). • Altering the value inside $(x – 2)^2$ alone will shift the maximum point to the right (or left) but will not actually change the value of the maximum height. Also, with a larger shift to the right, the flight path of the bird will not actually take off from the cliff. • Not altering the value inside $(x – 2)^2$ but by changing the value of the constant term of "+15" will alter the vertical value of the maximum point of the bird's flight path. But, by increasing this value will also increase the position of the bird taking off from the cliff. • So altering all three values in the equation could lead to a higher maximum height and also leaving the cliff at the same point.	ONE valid non–trivial statement.	TWO valid non–trivial statements.	

(c)	 Perimeter = $4x + 2y$ $120 = 4x + 2y$ $60 = 2x + y$ $y = 60 - 2x$ Area = xy $A = x(60 - 2x)$ Minimum area = 0 (theoretically). Maximum area = 450 m² When x = 15 m and y = 30 m. Table of values showing areas with various x–values drawn up. Graph of area and x–values drawn. **x** / **$y = 60 - 2x$** / **Area = xy** 0 / 60 / 0 5 / 50 / 250 10 / 40 / 400 15 / 30 / 450 20 / 20 / 400 25 / 10 / 250 30 / 0 / 0 	Calculation of at least two correct areas in the table OR Forming equation for area in terms of only one variable OR C.A.O.	A correct symmetrical table or graph that could be used to find the maximum area. OR Maximum area found with at least three correct areas.	Correct value of maximum area, with correct and clear justification, fully explained and demonstrated AND Showing evidence of the use of ALL of: • equations • tables • graphs.

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	Partial lack of detail in solution to (c).	Full solution to (c).

Cut Scores

Not Achieved	Achievement	Achievement with Merit	Achievement with Excellence
0 – 6	7 – 13	14 – 18	19 – 24