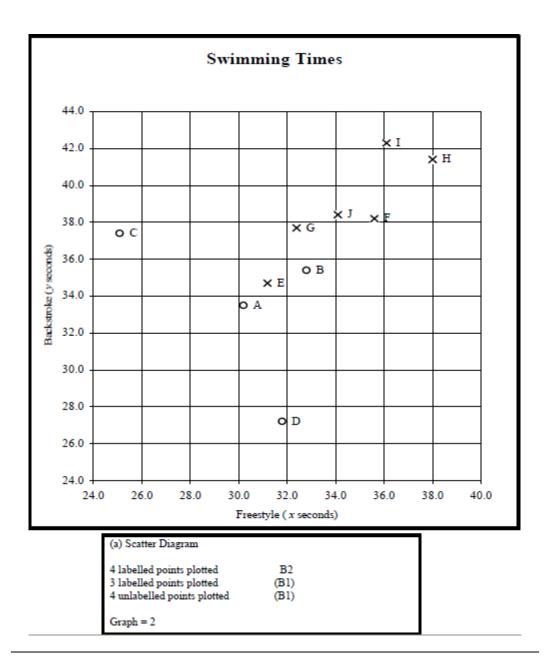
Statistics 1 Correlation and Regression Answers

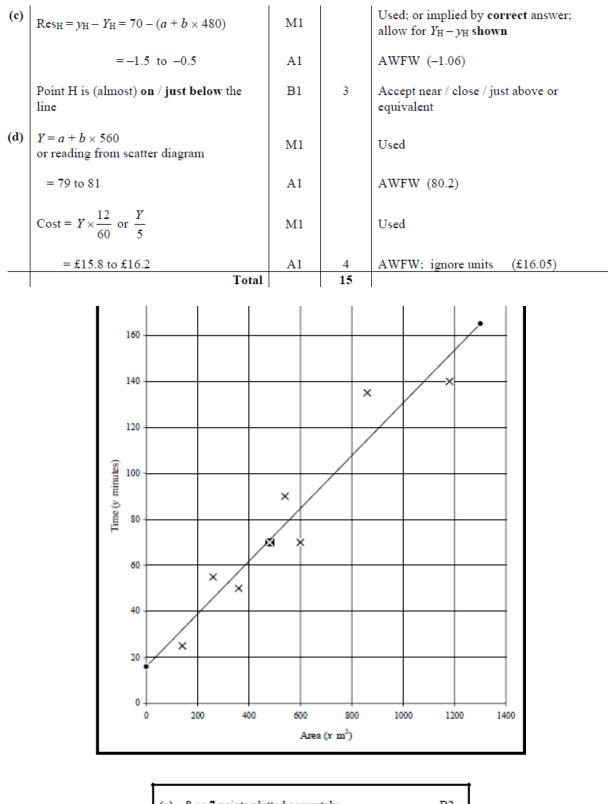
1(a)	Gradient, $b = 0.886$ to 0.887 b = 0.88 to 0.89	B2 (B1)		AWFW AWFW
	Intercept, $a = 2.31$ to 2.33 a = 2.3	B2 (B1)		AWFW AWRT
	Attempt at $\Sigma x \ \Sigma x^2 \ \Sigma y \ \Sigma xy$ or Attempt at $S_{xx} \ S_{xy}$ Attempt at a correct formula for <i>b</i> b = 0.886 to $0.887a = 2.31$ to 2.33	(M1) (m1) (A1) (A1)		72, 624, 87, 720 105.6, 93.6 AWFW AWFW
	Accept a & b interchanged only if y = ax + b stated or subsequently used correctly in either (b) or (c)		4	
(b)	a: average waiting time of 2.32 minutes (139 seconds) when entering empty restaurant	B1		OE; accept minimum waiting time
	b: average increase in waiting time of 0.886 minutes (53 seconds) for each customer in restaurant on entry	B1	2	OE
(c)	Use of $y = a + 5b$ or $y = a + 25b$	M1		
(i)	For $x = 5$ $y = 6.6$ to 6.8			
(ii)	For $x = 25$ $y = 24.3$ to 24.6	A1	2	Both; AWFW
(d)(i)	Reliable as interpolation and small residuals or	B1 B1		Within range OE OE
	Reliable as interpolation but large percentage residuals so inconclusive or	(B1) (B1)		
	Large percentage residuals so unreliable	(B1)		
(ii)	Unreliable as extrapolation	B1	3	Outside range OE
	Total		11	

5(a)	Scatter Diagram or or	B2 (B1) (B1)	2	4 labelled points plotted 3 labelled points plotted 4 unlabelled points plotted
(b)(i)	Positive/linear correlation/relationship except for	B1		OE
	two unusual values/results	B1	2	OE
(ii)	0.462	B1	1	CAO; accept 3 rd /final/last value
(c)	C and D	B1		CAO
	C is likely freestyle champion D is likely backstroke champion	B1		Style identified
	or C is likely freestyle champion D is likely backstroke champion	(B1) (B1)	2	
(d)(i)	r = 0.912 to 0.913	B 3		AWFW
	or $r = 0.91$ to 0.92 or 0.46 to 0.47	B 2		AWFW
	or $r = 0.9$	B 1		AWRT
	Attempt at $\sum x \sum x^2$ $\sum y \sum y^2$ $\sum xy$			270.4, 9188.46 301.6, 11437.84 10246.53
	or Attempt at S _{xx} S _{yy} S _{xy}	(M1)		48.94, 67.52, 52.45
	Attempt at a correct formula for r	(m1)		
	r = 0.912 to 0.913	A1	3	AWFW
(ii)	Boys are faster/slower at both strokes or Boys are equally good at both strokes	B1	1	OE;do not accept freestyle times are proportional to backstroke times
	Total		11	



$ \begin{vmatrix} \sigma \\ r \\ r \\ 0 \\ r \\ r \\ r \\ 0 \\ 1 \\ to \\ 0 \\ r \\ r \\ 0 \\ 1 \\ to \\ 0 \\ r \\ r \\ 0 \\ to \\ 0 \\ r \\ 0 $	1(a)(i)	r = 0.143 to 0.1432	B3		AWFW
$ \begin{array}{c c c c c c c c c c c c c c c c c c c $			B2		AWFW
$\sum_{X,y} \sum_{Y} \sum_{Y$			B1		AWRT
Attempt at $S_{xx} S_{yy} S_{yy}$ M1275994, 15.875, 299.5Attempt at a correct formula for rm1n1r=0.143 to 0.1432A13AWFW(ii)Little/weak/no correlation/relationship/association between number of pages and (retail) priceB12(iii)Size (page, thickness), author, ranking, publicity/marketing, cover design, recommendations on back, publisher, font, popularity, quality, print-run, etcB11(b)(Very) strong/almost exact positive/perfect correlation/relationship/ ssociation between number of pages and sale/new price sale price appears to be determined by mumber of pagesB12(b)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1or equivalent(iiii)Gradient, $b = -3.24$ to -3.26 $a = 260$ to 270 Attempt at $\Sigma \Sigma \Sigma^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \Sigma^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \Sigma^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \Sigma^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \Sigma^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \delta^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \delta^2$ $\Sigma \Sigma \Sigma \Sigma v_0$ or Attempt at $\Sigma \Sigma \delta^2$ $\Sigma \Sigma \Sigma V \delta v_0$ Attempt at $\Sigma \Sigma \delta^2$ $\Sigma \Sigma \Sigma \delta^2$ $a = 262$ to 264 A1 A1 Attempt at $\Sigma \Sigma \delta^2$ $\Sigma \Sigma \Sigma \delta^2$ $a = 262$ to 264 A1 A1 A1B1 AWFW(ii)Gradient, $b:$ Decrease in pressure Change in pressureB2 A1 A1 A1AWFW(iii)Intercept, $a:$ Initial infector or pressure at $x = 0$ B1 B1(iii)Intercept, $a:$ Initial pressure or pressure at $x = 0$ B1 B1(iii)Intercept, $a:$ Initial pressure		$\Sigma y \Sigma y^2$			47.00, 292.0000
r = 0.143 to 0.1432A13AWFW(ii)Little weak ino correlation/relationship/association between number of pages and (retail) priceB12or equivalent: but not poor context(iii)Size (page, thickness), author, ranking, publicity/marketing, cover design, recommendations on back, publisher, font, popularity, quality, print-run, etcB11or any sensible variable but not pictures, coloured pictures, age, words, weight, mass(b)(Very) strong/almost exact positive/perfect correlation/relationship/ association between number of pages and sale/new price Sale price appears to be determined by number of pagesB12or equivalentTotal83(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFW(-3.25) AWFWAttempt at $\Sigma x \ \Sigma x^2 \ \Sigma y \ \Sigma xy$ or Attempt at $\Sigma x \ \Sigma x^2 \ \Sigma y \ \Sigma xy$ or Attempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b $b = -3.24$ to -3.26 Altempt at a correct formula for b B1B2 Altempt at a correct formula for b B1(ii)Gradient, b: Decrease in pressure per month Change in pressureB2 B			M1		275994, 15.875, 299.5
(ii)Little/weak/no correlation/relationship/association between number of pages and (retail) priceB1Ior equivalent; but not poor context(iii)Size (page, thickness), author, ranking, publicity/marketing, cover design, recommendations on back, publisher, font, popularity, quality, print-run, etcB11or any sensible variable but not pictures, coloured pictures, age, words, weight, mass(b)(Very) strong/almost exact positive/perfect correlation/relationship/ association between number of pages and sale/new price Sale price appears to be determined by number of pagesB12or equivalent3(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFW AWFW(-3.25)3(a)(i)Gradient, $b = -3.24$ to -3.26 $a = 260$ to 270B2 B1AWFW AWFW(262.58)Attempt at $\Sigma \Sigma \Sigma^2 \Sigma \Sigma \Sigma \gamma$ or Attempt at a correct fomula for b $b = -3.24$ to -3.26 A1 Attempt at a correct fomula for b $b = -3.24$ to -3.26 A1 A1M1 A1AWFW ACcept a & b interchanged only if identified correctly in (b) and (c)(ii)Gradient, b: Decrease in pressure per month Change in pressure or pressure at $x = 0$ B2 B1or equivalent; not y-intercept		Attempt at a correct formula for r	ml		
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priceB12context(iii)Size (page, thickness), author, ranking, publicity/marketing, cover design, recommendations on back, publisher, font, popularity, quality, print-run, etcB11or any sensible variable but not pictures, coloured pictures, age, words, weight, mass(b)(Very) strong/almost exact positive/perfect correlation/relationship/ association between number of pages and sale/new price Sale price appears to be determined by number of pagesB12or equivalent1TotalB12context3(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2AWFW(-3.25) $AWFW$ 3(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B1AWFW(262.8§) $AWFW$ Attempt at $\Sigma x \Sigma \lambda^2 \Sigma y \Sigma xy$ or Attempt at a correct formula for b $b = -3.24$ to -3.26 $a = 260$ to 270B1AWFWAttempt at $x \infty \Sigma \lambda^2 \Sigma y \Sigma xy$ or Attempt at a correct formula for b $b = -3.24$ to -3.26 $a = -262$ to 264M1M1(ii)Gradient, b: Descue appeared only if identified correctly in (b) and (c)M1AWFW(iii)Gradient, b: Descue appeared only if identified correctly in (b) and (c)B2or equivalent or better(iii)Intercept, a:Intercept, a:B2or equivalent	(ii)	correlation/relationship/association	B1		or equivalent; but not poor
publicity/marketing. cover design. recommendations on back, publisher, fort, popularity, quality, print-run, etccoloured pictures, age, words, weight, mass(b)(Very) strong/almost exact positive/perfect correlation/relationship/ association between number of pages and sale/new price Sale price appears to be determined by number of pagesB1or equivalent3(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFW AWFW(-3.25)3(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFW AWFW(-3.25)Attempt at $\Sigma x \ \Sigma x^2 \ \Sigma y \ \Sigma y$ or Attempt at $\Sigma x \ \Sigma x^2 \ \Sigma y \ \Sigma y$ or Attempt at $S_x \ S_x$ M1 A1 A1540, -1755Attempt at $S_x \ S_x$ Attempt at $S_x \ S_x$ M1 A1 A14Accept $a \notin b$ interchanged only if identified correctly in (b) and (c)M1 B1 B1 Change in pressure per month Change in pressure per month Change in pressure or pressure at $x = 0$ B2 B1(ii)Intercept, a : Initial pressure or pressure at $x = 0$ B1		• • • •	B1	2	context
positive/perfect correlation/relationship/ associationB1or equivalentassociationB12contextnumber of pages and sale/new price Sale price appears to be determined by number of pagesB12contextTotalB2or equivalentor equivalentTotal83(a)(i)Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFWAWFW (-3.25) AWFWIntercept, $a = 262$ to 264 $a = 260$ to 270 B2 B1AWFWAWFW (262.88) AWFWAttempt at $\Sigma_X \Sigma_X^2 \Sigma_Y \Sigma_X y$ or Attempt at $S_X S_{Xy}$ M1 M1 $b = -3.24$ to -3.26 $A1$ $a = 262$ to 264 M1 A1Accept a & b interchanged only if identified correctly in (b) and (c)B2 m1 M1 Attempt at b interchanged only if identified correctly in (b) and (c)or equivalent or better(ii)Gradient, b : Decrease in pressureB2 B1or equivalent or better(iii)Intercept, a : Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept	(iii)	publicity/marketing, cover design, recommendations on back, publisher,	B1	1	coloured pictures, age, words, weight,
number of pagesB2or equivalentTotalB2or equivalent \mathbf{Total} B2or equivalent $3(\mathbf{a})(\mathbf{i})$ Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFWIntercept, $a = 262$ to 264 $a = 260$ to 270 B2 	F a b r	positive/perfect correlation/relationship/ association between number of pages and sale/new price		2	
$3(a)(i)$ Gradient, $b = -3.24$ to -3.26 $b = -3.2$ to -3.3 B2 B1AWFW AWFW(-3.25) AWFWIntercept, $a = 262$ to 264 $a = 260$ to 270 B2 B1AWFW(262.88)Attempt at $\Sigma x \Sigma x^2 \Sigma y \Sigma xy$ or Attempt at $a correct formula for b$ $b = -3.24$ to -3.26 $a = 262$ to 264 M1 m1 A1108, 1836, 2015, 22425(ii)Gradient, b: Decrease in pressure per month Change in pressureB2 B1AWFW(iii)Intercept, $a:$ Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept		number of pages	B 2		or equivalent
$b = -3.2$ to -3.3 B1AWFWIntercept, $a = 262$ to 264 B2AWFW $a = 260$ to 270 B1AWFWAttempt at $\Sigma x \Sigma x^2 \Sigma y \Sigma xy$ or Attempt at a correct formula for b $b = -3.24$ to -3.26 M1 A1540, -1755Attempt at $a = 262$ to 264 A1A $b = -3.24$ to -3.26 A1 $a = 262$ to 264 A1 A1Accept a & b interchanged only if identified correctly in (b) and (c)B2 B1or equivalent or better(ii)Gradient, b : Decrease in pressureB2 B1or equivalent or better(iii)Intercept, a : Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept	I	Total		8	
$a = 260 \text{ to } 270$ B1AWFWAttempt at $\Sigma x \Sigma x^2 \Sigma y \Sigma xy$ or Attempt at $S_{xx} S_{xy}$ M1 m1 Attempt at a correct formula for b $b = -3.24 \text{ to } -3.26$ $a = 262 \text{ to } 264$ M1 m1 A1540, -1755(ii)Gradient, b: Decrease in pressure per month Change in pressureB2 B10 or equivalent or better(iii)Intercept, a: Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept	3(a)(i)				
Attempt at $\Sigma x \Sigma x^2 \Sigma y \Sigma xy$ or Attempt at $S_{xx} S_{xy}$ M1 m1 At m1 A1108, 1836, 2015, 22425 $b = -3.24$ to -3.26 $a = 262$ to 264 M1 m1 A1 A1AWRT AWFWAccept a & b interchanged only if identified correctly in (b) and (c)AWRT AWFW(ii)Gradient, b: Decrease in pressure per month Change in pressureB2 B1or equivalent or better(iii)Intercept, a: Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept		Intercept, $a = 262$ to 264	B2		AWFW (262.88)
or Attempt at $S_{xx} S_{xy}$ M1 m1 Attempt at a correct formula for b $b = -3.24$ to -3.26 $a = 262$ to 264 M1 m1 A1540, -1755AWRT AWFW $AWRT$ AWFWAccept a & b interchanged only if identified correctly in (b) and (c)4 $AWRT$ AWFW(ii)Gradient, b: Decrease in pressure per month Change in pressureB2 B12or equivalent or better(iii)Intercept, a: Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept		a = 260 to 270	B1		AWFW
Attempt at $S_{xx} S_{xy}$ M1 m1 M1 m1 Attempt at a correct formula for b $b = -3.24$ to -3.26 $a = 262$ to 264 M1 m1 A1AWRT AWFWAccept a & b interchanged only if identified correctly in (b) and (c)A1 AAWWFW(ii)Gradient, b: Decrease in pressure per month Change in pressureB2 B1or equivalent or better(iii)Intercept, a: Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept					108, 1836, 2015, 22425
 (ii) Gradient, b: Decrease in pressure per month Change in pressure (iii) Intercept, a: Initial pressure or pressure at x = 0 B1 B1 B1 B1 B1 Or equivalent or better or equivalent or equivalent; not y-intercept 		Attempt at S_{xx} S_{xy} Attempt at a correct formula for b b = -3.24 to -3.26	m1 A1	4	AWRT
Decrease in pressure per month Change in pressureB2 B1or equivalent or better(iii)Intercept, a : Initial pressure or pressure at $x = 0$ B1or equivalent; not y-intercept		Accept $a \otimes b$ interchanged only if			
Initial pressure or pressure at $x = 0$ B1 or equivalent; not y-intercept					
	(ii)	 identified correctly in (b) and (c) Gradient, b: Decrease in pressure per month 		2	

	Value for $b = 2 \times [\text{gradient or } b \text{ from} (a)(i)]$	M1		accept 2b; ignore sign
	(a)(1) = -6.4 to -6.6	A1√	2	AWFW (-6.5) $\sqrt{10}$ from (a)(i) but must be < 0
(ii)	$P_8 = 265 - 6.5 \times 8$	M1		must use 265 and $x = 8$ and $2 \times [b (< 0) \text{ from } (a)(i)]$
	= 212 to 214 (< 220)	A1	2	or [from (b)(i) (< 0)] AWFW AG
	Total		12	
(a)	$0.5 \le \text{Value} \le 0.95$	B2		Value is actually 0.8
()	Positive value < 1 (and > 0)	(B1)		variae is actually 0.0
(b)	$-0.2 \leq Value \leq +0.2$	B1		Value is actually 0.0
(c)	$-0.95 \le \text{Value} \le -0.5$ Negative value $> -1 \text{ (and } < 0 \text{)}$	B2 (B1)	5	Value is actually -0.7
	Total		5	
(a)	8 or 7 points plotted accurately	B2	2	
(a)	8 or 7 points plotted accurately (6 or 5 points plotted accurately)	B2 (B1)	2	
(a) (b)			2	AWFW (0.11469)
	(6 or 5 points plotted accurately) Gradient, $b = 0.114$ to 0.115	(B1) B2	2	AWFW (0.11469) AWFW (16.00824)
	(6 or 5 points plotted accurately) Gradient, $b = 0.114$ to 0.115 (b = 0.11 to 0.12) Intercept, $a = 15.9$ to 16.1	(B1) B2 (B1) B2 (B1)	2	
	(6 or 5 points plotted accurately) Gradient, $b = 0.114$ to 0.115 (b = 0.11 to $0.12)Intercept, a = 15.9 to 16.1(a = 13 to 19)Attempt at \sum x, \sum x^2, \sum y and \sum xyor$	(B1) B2 (B1) B2	2	AWFW (16.00824)
	(6 or 5 points plotted accurately) Gradient, $b = 0.114$ to 0.115 (b = 0.11 to 0.12) Intercept, $a = 15.9$ to 16.1 (a = 13 to 19) Attempt at $\sum x$, $\sum x^2$, $\sum y$ and $\sum xy$ or Attempt at S_{xx} and S_{xy} Attempt at correct formula for b	(B1) B2 (B1) B2 (B1) (M1) (m1)	2	AWFW (16.00824) 4420, 3230800, 635 and 441300 788750 and 90462.5
	(6 or 5 points plotted accurately) Gradient, $b = 0.114$ to 0.115 (b = 0.11 to $0.12)Intercept, a = 15.9 to 16.1(a = 13 to 19)Attempt at \sum x, \sum x^2, \sum y and \sum xyorAttempt at S_{xx} and S_{xy}$	(B1) B2 (B1) B2 (B1) (M1)	2	AWFW (16.00824) 4420, 3230800, 635 and 441300
	(6 or 5 points plotted accurately) Gradient, $b = 0.114$ to 0.115 (b = 0.11 to 0.12) Intercept, $a = 15.9$ to 16.1 (a = 13 to 19) Attempt at $\sum x$, $\sum x^2$, $\sum y$ and $\sum xy$ or Attempt at S_{xx} and S_{xy} Attempt at correct formula for b b = 0.114 to 0.115	(B1) B2 (B1) B2 (B1) (M1) (M1) (M1) (A1)	2	AWFW (16.00824) 4420, 3230800, 635 and 441300 788750 and 90462.5 AWFW



(a)	8 or 7 points plotted accurately (6 or 5 points plotted accurately	B2 B1)
(b)	Line plotted accurately (Evidence of correct method for ≥ 2 points	B2 M1)
		(Graph = 4)

1(a)	r = -0.526 to -0.525	B3		AWFW
	or $r = -0.53$ to -0.52	(B2)		AWFW; ignore sign
	r = -0.6 to -0.4	(B1)		AWFW; ignore sign
	OR			
	Attempt at $\sum x$, $\sum x^2$, $\sum y$, $\sum y^2$ and $\sum xy$ or Attempt at S_{xx} , S_{yy} and S_{xy}	(M1)		260, 6970, 143, 2083 and 3671 210, 38.1 and -47
	Attempt at a correct formula for r	(m1)		
	r = -0.526 to -0.525	(A1)	3	AWFW
(b)	Weak/some/moderate negative correlation (relationship/association) between	B1		OE; must qualify strength and indicate negative B0 for strong/poor/reasonable/average B0 if $r > 0$ or $r < -1$ B0 if contradictory statements
	length and (maximum) diameter	B1		Context
	Ignore subsequent comments (as below) only if B1 B1 already scored			
	OR			
	Some evidence that large lengths are associated with small diameters	(B1) (B1)		OE; must qualify strength and indicate negative
	OR			
	Longer melons tend to have smaller diameters / be thinner	(B1) (B1)	2	OE; must qualify strength and indicate negative
	Total	I	5	

5(a)	Time taken depends upon temperature	B 1	1	OE; not x set values
(b)	b (gradient) = -0.0873 to -0.087 b (gradient) = -0.09 to -0.08	B2 (B1)		AWFW $(-0.087\dot{2}\dot{7})$ AWFW; $-8.73^{-02} \Rightarrow B0$
	a (intercept) = 5.94 to 5.96 a (intercept) = 5.6 to 6.1	B2 (B1)		AWFW AWFW (5.9509)
	Attempt at $\sum x$, $\sum x^2$, $\sum y$ and $\sum xy$ or Attempt at S_{xx} and S_{xy} Attempt at correct formula for b	(M1) (m1)		396, 16016, 30.9 and 958.8 1760 and -153.6
	b = -0.0873 to $-0.087a = 5.94$ to 5.96	(A1) (A1)	4	AWFW AWFW
	Accept <i>a</i> and <i>b</i> interchanged only if then identified correctly later in question			
(c)(i)	Each 1 °C rise in temperature results in an (average) decrease of 0.087 m (5 s) in time taken for pellets to dissolve	B1 B1	2	Quantified rise in x (results in) Decrease in y OE
(ii)	<i>a</i> is <i>y</i> -value at $x = 0$ at which water is solid/ice/frozen so pellets cannot dissolve	B1 B1	2	Indication that it is y at $x = 0$ Mention of solid or ice or frozen
(ii)	<i>a</i> is <i>y</i> -value at $x = 0$ at which water is solid/ice/frozen so pellets cannot dissolve	B1 B1	2	Indication that it is y at $x = 0$ Mention of solid or ice or frozen
(d)(i)	When $x = 30$ y = 3.3 to 3.4 y = 2.9 to 3.7	B2 (B1)		AWFW AWFW (3.3327)
	If B0, use of their equation with $x = 30$	(M1)	2	
(ii)	When $x = 75$ y < 0 or negative which	B1 ↑Dep↑		OE
	is impossible Total	B1	2 13	OE; not extrapolation