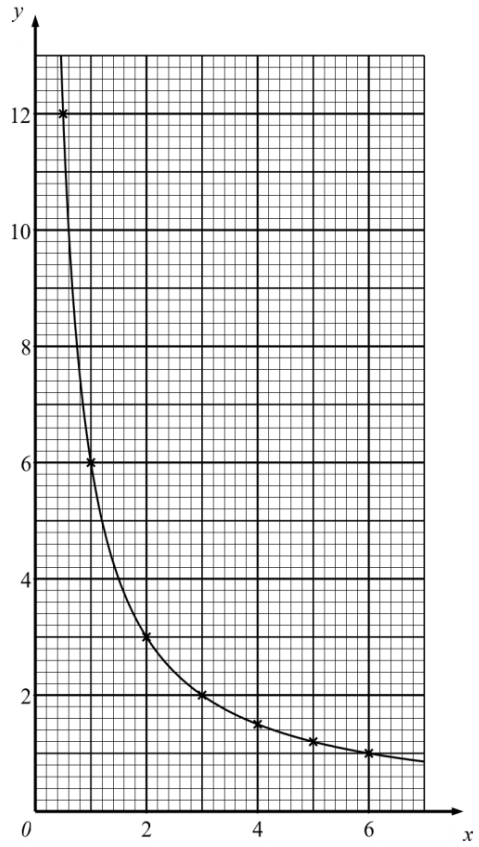
Q	Working	Answer	Mark	Notes
1 (a)	$4y > 12 - 5$		2	M1 Allow $y = \frac{7}{4}$ oe or $y > -\frac{7}{4}$ or $y < \frac{7}{4}$
		$y > \frac{7}{4}$		A1 oe
(b)	$12x - 10$ **or** $2(6x - 5) = 4x - 7$ **or** $6x - 5 = \frac{4}{2}\ \ x - \frac{7}{2}$ oe		3	M1 for removal of fraction **and** multiplying out LHS **or** rearranging to remove the fraction **or** separating fraction (RHS) in an equation
	$12x - 4x = -7 + 10$ oe **or** $6x - \frac{4}{2}\ x = -\frac{7}{2} + 5$ oe			M1 ft (dep on 4 terms) for terms in x on one side of equation and number terms on the other
		$\frac{3}{8}$		A1 (dep M1) oe
				Total 5 marks

2 (a)		1	1	B1
(b)		6	1	B1
(c)	$206 + m - 214 = -3$ oe or $\frac{7^{-3} \times 7^{214}}{7^{206}}$ or $\frac{7^{211}}{7^{206}}$ oe		2	M1 allow $7^{206+m-214} = 7^{-3}$ oe (must be in the form $7^x = 7^y$ where x and y are correct expressions)
		5		A1 accept 7^5
				Total 4 marks

Q	Working	Answer	Mark	Notes
3 (a)		50 000	1	B1
(b)		6×10^{-5}	1	B1
				Total 2 marks

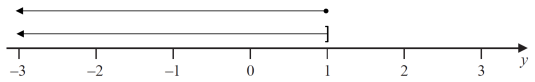
4 (a)		Correct table	2	B2 for all 4 correct values oe (ie $\frac{6}{5}$ or $\frac{3}{2}$) (B1 for 2 or 3 correct values)
(b)		Correct graph 7 points joined by a smooth curve.	2	M1ft (dep B1 in (a)) for 6 or 7 points plotted correctly using their values (within the circles on overlay). May be implied by curve passing through correct point. A1ft only allow one incorrect value from the table in (a), and for a curve that is decreasing throughout for $x = 0.5$ to $x = 6$. Ignore graph to the right of (6, 1) and to the left of (0.5, 12)
				Total 4 marks

x	0.5	1	2	3	4	5	6
y	**12**	6	**3**	2	**1.5**	**1.2**	1

Q	Working	Answer	Mark	Notes
5 (a)		15, 0, −1, 3	2	B2 for 4 correct values (B1 for 2 or 3 correct values)
(b)	(−2, 15) (−1, 8) (0, 3) (2, −1) (3, 0) (4, 3)		2	M1 (dep on B1) ft from (a) for at least 5 points plotted correctly
		correct graph		A1 for a correct graph (clear intention to go through all the points and which must be curved at the bottom) **Note**: If a fully correct graph is shown, but an incomplete table is shown in (a), then award the marks for (a)
				Total 4 marks

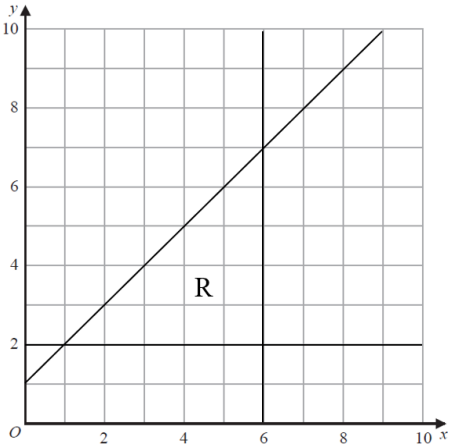
6 (a)		x^9	1	B1 cao
(b)		$64y^6$	2	B2 for $64y^6$ (B1 for ky^6 where $k \neq 64$ **or** $64y^m$ where $m \neq 6$)
(c)	$(n \pm 3)(n \pm 4)$		2	M1 for $(n \pm 3)(n \pm 4)$ or $(n + a)(n + b)$ where $ab = 12$ or $a + b = -7$ Condone use of a different letter to n
		$(n - 3)(n - 4)$		A1
				Total 5 marks

Q	Working	Answer	Mark	Notes
7	$n(3n^2+5n-12n-20)$ **or** $n(3n^2-7n-20)$ **or** $(3n^2+5n)(n-4)$ **or** $(n^2-4n)(3n+5)$ **or** $3n^3+5n^2-12n^2-20n$		2	M1 for a correct partial expansion (may be unsimplified) (allow one error in the expansion of $(n-4)(3n+5)$ e.g. for any 3 correct terms **or** for 4 out of 4 correct terms ignoring signs **or** for $3n^2-7n\ldots$ **or** for $\ldots -7n-20)$
		$3n^3-7n^2-20n$		A1 oe e.g. if correct answer seen allow further factorisation to $n(3n^2-7n-20)$
				Total 2 marks

8	(a)		−2, −1, 0, 1, 2	2	B2 for −2, −1, 0, 1, 2 with no additions or repeats (B1 for 4 of −2, −1, 0, 1, 2 with no additions or repeats **or** for 6 values with no more than one incorrect value e.g. all of −2, −1, 0, 1, 2, 3 **or** for 5 values with one error)
	(b)		Closed circle at $x = 1$ and a line with an arrow to the left	1	B1 for a closed circle at $x = 1$ and a line with an arrow of any length to the left Allow] for a closed circle Allow a line without an arrow if it reaches to at least −3
					Total 3 marks

Q	Working	Answer	Mark	Notes
9		$y = -3x + 5$ oe	2	B2 fully correct equation eg $y = -3x + 5$ or $y - 5 = -3(x - 0)$ If not B2 then B1 for $y = -3x + a$ with $a \neq 5$ or $y = bx + 5$ ($b \neq 0, -3$) or ($L =$) $-3x + 5$
				Total 2 marks

10	30	1	for a start to the process eg, 5406 ÷ 6 (=901) **or** 5400 ÷ 6 (=900) **or** 5000 ÷ 6 (= 833.333..)
		1	process to find the length of one side, eg $\sqrt{901}$ **or** $\sqrt{900}$ **or** $\sqrt{833.33..}$
		1	for 30

Q	Working	Answer	Mark	Notes
11	Lines (solid or dashed) $x = 6$ **and** $y = 2$ drawn		3	B1 The lines $x = 6$ and $y = 2$ should extend far enough to intersect with each other.
	Line (solid or dashed) $y = x + 1$ drawn			B1 The line should extend from at least $x = 1$ to $x = 6$ **or** far enough to intersect with their horizontal and vertical lines.
	Region R shown (shaded or not shaded)  	Correct region identified		B1 dep on B2
				Total 3 marks

Q	Working		Answer	Mark	Notes
12	$n^2t^3 = 4d + t^3$	$n^2 = \frac{4d}{t^3} + 1$		4	M1 for multiplying by the denominator **or** for dividing the RHS by t^3
	$t^3\left(n^2 - 1\right) = 4d$ oe	$n^2 - 1 = \frac{4d}{t^3}$			M1 for isolating terms in t^3 **and** factorising the correct expression of the equation **or** for isolating the $\frac{4d}{t^3}$ term
	$t^3 = \frac{4d}{(n^2-1)}$ oe	$t^3 = \frac{4d}{(n^2-1)}$			M1 for making t^3 the subject
			$t = \sqrt[3]{\frac{4d}{(n^2-1)}}$		A1 oe eg $t = \sqrt[3]{\frac{4d}{(n^2-1)}}$ or $t = \left(\frac{4d}{n^2-1}\right)^{\frac{1}{3}}$ SC B2 for $t = t = \sqrt[3]{\frac{4d}{(n^2+1)}}$
					Total 4 marks

Q	Working	Answer	Mark	Notes
13 (a)		48	1	B1 allow 47 – 49 Accept $\frac{n}{110}$ where n is in the range 47 – 49
(b)		46	1	B1 allow 45.5 – 46.5
(c)	40 **and** 56		2	M1 for both values. LQ of 40 – 41 and UQ in the range 56 – 58. **or** for use of 15 and 45 (eg indicated by marks on horizontal axis that correspond to 15 and 45 on the vertical axis.) **or** for use of 15.25 and 45.75 (eg indicated by marks on horizontal axis that correspond to 15.25 and 45.75 on the vertical axis.
		16 to 18		A1 accept 16 to 18
(d)		Yes and correct reason	1	B1ft dep on M1 in (c) but ft their reading of the horizontal axis. For stating yes **and** the IQR for the Algebra test is greater than IQR for the Geometry test oe If using value in (c) less than 9, only accept 'no' and IQR for the Algebra test is less than the IQR for the Geometry test oe.
(e)	60 – '50' (= 10)		3	M1 may be seen embedded as $\frac{10}{60} = (\frac{1}{6})$ oe (eg reading of 50 from graph stated or indicated by marks on vertical axis that correspond to 64 on the horizontal axis). Allow 60 – '50' – 1 (= 9) oe
	$\frac{'10'}{60} \times \frac{'10'-1}{59}$			M1 for use of $\frac{n}{60} \times \frac{n-1}{59}$ with any integer n such that $2 \le n \le 59$
		$\frac{3}{118}$		A1 oe (accept 0.025 or better) Allow $\frac{6}{295}$ (= 0.02 or better) if using $\frac{9}{60} \times \frac{8}{59}$

Q	Working	Answer	Mark	Notes
				Total 8 marks

Q	Working	Answer	Mark	Notes
14	$\frac{12}{4x}+\frac{2(x+2)}{4x}+\frac{x}{4x}$ oe **or** $\frac{12+2(x+2)+x}{4x}$oe $\frac{3(8x)}{8x^2}+\frac{4x(x+2)}{8x^2}+\frac{2x^2}{8x^2}$ oe **or** $\frac{3(8x)+4x(x+2)+2x^2}{8x^2}$ oe		3	M1 for three correct fractions with a common denominator **or** a single correct fraction
	$\frac{12+2x+4+x}{4x}$ oe **or** $\frac{24x+4x^2+8x+2x^2}{8x^2}$ oe **or** $\frac{6x^2+32x}{8x^2}$ oe **or** $\frac{3x^2+16x}{4x^2}$ oe **or** $\frac{6x+32}{8x}$ oe			M1 for a correct single fraction with brackets expanded
		$\frac{3x+16}{4x}$		A1 oe $\frac{16+3x}{4x}$
				Total 3 marks

Q	Working	Answer	Mark	Notes
15	*ABC* = 90° **and** *ACB* (= *ADB*) = 180 – 90 – 55 (= 35) **or** *ABO* = 55° **and** *AOB* = 180 – 2 × 55 (= 70) **or** *BDC* = 55°, *ADC* = 90° **and** *ADB* = 90 – 55 (= 35)		4	M1
		35		A1 for *ADB* = 35
	Angles in a semicircle are 90° Angles in a triangle add to 180° (Angles in a triangle add to 180°) Angles in the same segment (are equal) OR angles at the circumference subtend(ed) from the same arc/chord of the circle (are equal) **or** Angles in an isosceles triangle (are equal) Angles in a triangle sum to 180º (Angles in a triangle add to 180°) Angle at the centre is 2 × (double) angle at circumference / angle at circumference is ½ angle at centre **or** Angles in the same segment (are equal) OR angles at the circumference subtend(ed) from the same arc/chord of the circle Angles in a semicircle are 90°			B2 (dep on M1) for all 3 reasons appropriate to their method B1 (dep on M1) for one correct circle theorem appropriate to their method) NB For the third method only 2 reasons are required
				Total 4 marks

Q	Working	Answer	Mark	Notes
16	$3(x^2 + 4x) + 19$ **and** $3[(x + 2)^2 - 2^2] + 19$ **or** $3\left(x^2 + 4x + \frac{19}{3}\right)$ **and** $3\left((x+2)^2 - 2^2 + \frac{19}{3}\right)$ **or** $a = 3$ and $2ab = 12$ oe and $b^2a + c = 19$ oe **or** $a = 3$ and $b = \frac{12}{2\times 3}$ oe and $c = -\frac{12^2}{4\times 3} + 19$ oe			M1 for correctly taking out a factor of 3 and correctly completing the square **or** for equating coefficients by expanding $a(x+b)^2 + c = ax^2 + 2abx + b^2a + c$ **or** for equating coefficients by using $ax^2 + bx + c = a\left(x + \frac{b}{2a}\right)^2 - \frac{b^2}{4a} + c$
		$3(x + 2)^2 + 7$		A1 accept $a = 3$, $b = 2$, $c = 7$
				Total 2 marks

17	(i)		19	1	B1
	(ii)		0	1	B1
	(iii)		11	1	B1
	(iv)		28	1	B1
					Total 4 marks

18	(a)(i)		(−6, 1)	2	B1

Q	Working	Answer	Mark	Notes
(ii)		(−2, −4)		B1
(b)	(−1, 6), (3, −2), (7, 6)	Fully correct graph	2	B2 for a fully correct graph (B1 for a V shape with least value at (3, −2))
(c)		−3, 4	2	B2 for 2 correct values in any order (B1 for 1 correct value)
				Total 6 marks

Q	Working	Answer	Mark	Notes
19		$-\frac{4}{3}$	1	B1
				Total 1 mark
20	E.g. n, $n+1$, $n+2$ $(n^2 =)n^2$ $((n+1)^2 =)n^2+n+n+1=n^2+2n+1$ oe $((n+2)^2 =)n^2+2n+2n+4=n^2+4n+4$ oe or E.g. $n-1$, n, $n+1$ $((n-1)^2 =)n^2-n-n+1=n^2-2n+1$ oe $(n^2 =)n^2$ $((n+1)^2 =)n^2+n+n+1=n^2+2n+1$ oe		3	M1 for 3 appropriate terms for their 3 numbers **and** for correctly finding the expansion of at least 2 squares (Allow 2 × middle number + 2)
	$n^2+n^2+2n+2n+4\ (=2n^2+4n+4)$ oe and $2(n+1)^2=2n^2+2n+2n+2(=2n^2+4n+2)$ oe or $n^2-2n+1+n^2+2n+1\ (=2n^2+2)$ oe			M1 for finding the sum of first and last square **and** double the square of the middle (Allow 2 × middle number + 2)
	E.g. $2n^2+4n+4=2n^2+4n+2+2$ oe or $2(x+1)^2+2=2(x+1)^2+2$ oe or $2n^2+2=2n^2+2$ oe	Complete proof		A1 for conclusion from two correct expressions e.g. $2n^2+4n+4$ **and** $2n^2+4n+2$

Q	Working	Answer	Mark	Notes
				Total 3 marks

21	Line drawn at (2, 1) with a positive gradient that does not intersect the curve at any other point.		3	M1 for a tangent drawn at $x = 2$
				M1 (dep M1) for a correct method to work out the gradient of the tangent.
		1.5 to 3		A1 for 1.5 to 3 accept answers in the range 1.5 – 3 so long as a tangent at $x = 2$ has been drawn.
				Total 3 marks

Q	Working	Answer	Mark	Notes
22	$(\overrightarrow{ON} =)\lambda(\mathbf{a}+\mathbf{b})(=\lambda\mathbf{a}+\lambda\mathbf{b})$ **or** $(\overrightarrow{NY} =)(1-\lambda)(\mathbf{a}+\mathbf{b})(=(1-\lambda)\mathbf{a}+(1-\lambda)\mathbf{b})$		5	M1 for finding a vector for $\overrightarrow{ON}$ **or** $\overrightarrow{NY}$ **or** $\overrightarrow{NO}$ **or** $\overrightarrow{YN}$ in terms **a** and **b** and using λ oe (can be embedded)
	$(\overrightarrow{MN} = \overrightarrow{MO} + \overrightarrow{ON} =) -0.5\mathbf{a} + \lambda\mathbf{a} + \lambda\mathbf{b}(=(\lambda-0.5)\mathbf{a}+\lambda\mathbf{b})$ **or** $(\overrightarrow{MZ} = \overrightarrow{MO} + \overrightarrow{OZ} =) -0.5\mathbf{a} + 3\mathbf{b}$ **or** $(\overrightarrow{MN} = \overrightarrow{MX} + \overrightarrow{XY} + \overrightarrow{YN} =)0.5\mathbf{a} + \mathbf{b} + (\lambda-1)(\mathbf{a}+\mathbf{b})(=(\lambda-0.5)\mathbf{a}+\lambda\mathbf{b})$			M1 for finding a vector for $\overrightarrow{MN}$ **or** $\overrightarrow{NM}$ **or** $\overrightarrow{MZ}$ **or** $\overrightarrow{ZM}$
	$(\overrightarrow{MN} = \mu\overrightarrow{MZ} =)\mu(-0.5\mathbf{a}+3\mathbf{b})(=-0.5\mu\mathbf{a}+3\mu\mathbf{b})$ **or** $(\overrightarrow{ON} = \overrightarrow{OM} + \overrightarrow{MN} =)0.5\mathbf{a} + \mu(-0.5\mathbf{a}+3\mathbf{b})(=(0.5-0.5\mu)\mathbf{a}+3\mu\mathbf{b})$ **or** $(\overrightarrow{NY} = \overrightarrow{NM} + \overrightarrow{MX} + \overrightarrow{XY} =) -\mu(-0.5\mathbf{a}+3\mathbf{b}) + 0.5\mathbf{a} + \mathbf{b}(=(0.5+0.5\mu)\mathbf{a}+(1-3\mu)\mathbf{b})$			M1 for finding a vector for $\overrightarrow{MN}$ or $\overrightarrow{ON}$ or $\overrightarrow{NY}$ or $\overrightarrow{NM}$ or $\overrightarrow{NO}$ or $\overrightarrow{YN}$ using another variable e.g. μ oe
	$-0.5\mu = -0.5 + \lambda$ oe $3\mu = \lambda$ oe	$1-\lambda = 0.5\mu + 0.5$ oe $1-\lambda = 1-3\mu$ oe		M1 for setting up **two** simultaneous equations using the components of **a** and **b** for $\overrightarrow{MN}$ or $\overrightarrow{ON}$ or $\overrightarrow{NY}$ oe
		$\frac{3}{7}$		A1 (allow $\frac{3}{7}$ = 0.42(8571…) to 2 sf truncated or rounded)
				Total 5 marks

Q	Working	Answer	Mark	Notes
22 ALT	$(\overrightarrow{ON} =)\lambda(\mathbf{a}+\mathbf{b})(=\lambda\mathbf{a}+\lambda\mathbf{b})$ **or** $(\overrightarrow{NY} =)(1-\lambda)(\mathbf{a}+\mathbf{b})(=(1-\lambda)\mathbf{a}+(1-\lambda)\mathbf{b})$		5	M1 for finding a vector for $\overrightarrow{ON}$ **or** $\overrightarrow{NY}$ **or** $\overrightarrow{NO}$ **or** $\overrightarrow{YN}$ in terms **a** and **b** and using λ oe
	$(\overrightarrow{MN} = \overrightarrow{MO} + \overrightarrow{ON} =) -0.5\mathbf{a} + \lambda\mathbf{a} + \lambda\mathbf{b} (= (\lambda - 0.5)\mathbf{a} + \lambda\mathbf{b})$ **or** $(\overrightarrow{MN} = \overrightarrow{MX} + \overrightarrow{XY} + \overrightarrow{YN} =) 0.5\mathbf{a} + \mathbf{b} + (\lambda - 1)(\mathbf{a} + \mathbf{b}) (= (\lambda - 0.5)\mathbf{a} + \lambda\mathbf{b})$			M1 for finding a vector for $\overrightarrow{MN}$ **or** $\overrightarrow{NM}$ in terms **a** and **b** and using λ oe
	$(\overrightarrow{NZ} = \overrightarrow{NO} + \overrightarrow{OZ} =) -\lambda(\mathbf{a}+\mathbf{b}) + 3\mathbf{b} (= -\lambda\mathbf{a} + (3-\lambda)\mathbf{b})$ **or** $(\overrightarrow{NZ} = \overrightarrow{NY} + \overrightarrow{YZ} =)(1-\lambda)(\mathbf{a}+\mathbf{b}) - \mathbf{b} - \mathbf{a} + 3\mathbf{b} (= -\lambda\mathbf{a} + (3-\lambda)\mathbf{b})$			M1 for finding a vector for $\overrightarrow{NZ}$ or $\overrightarrow{ZN}$ in terms **a** and **b** and using λ oe
	$\frac{\lambda - 0.5}{-\lambda} = \frac{\lambda}{3-\lambda}$ oe			M1 for setting up an equation using the components of $\overrightarrow{MN}$ and $\overrightarrow{NZ}$ oe
		$\frac{3}{7}$		A1 (allow $\frac{3}{7} = 0.42(8571\ldots)$ to 2 sf truncated or rounded)
				Total 5 marks

Q	Working	Answer	Mark	Notes

				Edexcel averages: scores of candidates who achieved grade:								
Qn	**Mean score**	**Max score**	**Mean %**	**ALL**	**9**	**8**	**7**	**6**	**5**	**4**	**3**	**U**
1	4.45	5	89	4.45	4.92	4.85	4.78	4.22	3.66	2.03	0.59	0.00
2	3.61	4	90	3.61	3.97	3.86	3.75	3.47	2.98	2.10	1.05	0.00
3	1.84	2	92	1.84	1.94	1.89	1.87	1.82	1.70	1.55	1.22	0.00
4	3.69	4	92	3.69	3.92	3.83	3.73	3.64	3.47	2.84	1.75	0.00
5	3.54	4	89	3.54	3.90	3.77	3.64	3.29	3.05	2.32	1.25	0.00
6	4.44	5	89	4.44	4.94	4.85	4.54	4.14	3.65	2.48	1.48	0.00
7	1.62	2	81	1.62	1.92	1.86	1.67	1.38	1.15	0.37	0.33	0.00
8	2.35	3	78	2.35	2.71	2.62	2.40	2.10	1.62	1.33	0.44	0.00
9	1.52	2	76	1.52	1.95	1.88	1.51	1.07	0.52	0.24	0.00	0.00
10	1.36	3	45	1.36	2.76	2.58	2.11	1.79	1.21	0.83	0.67	0.42
11	1.86	3	62	1.86	2.77	2.22	1.51	0.77	0.39	0.09	0.04	0.10
12	2.46	4	62	2.46	3.70	2.76	1.87	1.28	0.60	0.25	0.04	0.00
13	4.24	8	53	4.24	6.22	4.40	3.29	2.48	1.45	1.01	0.29	0.00
14	1.71	3	57	1.71	2.54	1.86	1.31	1.02	0.61	0.03	0.00	0.00
15	1.87	4	47	1.87	2.86	2.05	1.36	0.85	0.48	0.34	0.19	0.00
16	0.97	2	49	0.97	1.67	0.92	0.58	0.29	0.22	0.03	0.00	0.00
17	1.54	4	39	1.54	2.49	1.47	1.04	0.61	0.40	0.23	0.18	0.00
18	2.74	6	46	2.74	4.81	2.90	1.44	0.54	0.23	0.13	0.04	0.00
19	0.44	1	44	0.44	0.82	0.40	0.20	0.08	0.01	0.00	0.00	0.00
20	1.33	3	44	1.33	2.38	1.43	0.52	0.29	0.10	0.06	0.00	0.00
21	1.17	3	39	1.17	2.16	1.16	0.40	0.16	0.10	0.01	0.00	0.00
22	1.04	5	21	1.04	2.18	0.67	0.24	0.08	0.03	0.00	0.00	0.00
	49.79	**80**	**62**	**49.79**	**67.53**	**54.23**	**43.76**	**35.37**	**27.63**	**18.27**	**9.56**	**0.52**

Q	Working	Answer	Mark	Notes

Suggested grade boundaries

Grade	9	8	7	6	5	4	3
Mark	61	49	39	31	23	14	8