General Certificate of Secondary Education
January 2013

Mathematics (Linear) B **4365**
Paper 2
Higher Tier

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting ensures that the mark scheme covers the candidates' responses to questions and that every examiner understands and applies it in the same correct way. As preparation for the standardisation meeting each examiner analyses a number of candidates' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting they are required to refer these to the Principal Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of candidates' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

Set and published by the Assessment and Qualifications Alliance.

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

M	Method marks are awarded for a correct method which could lead to a correct answer.
M dep	A method mark dependent on a previous method mark being awarded.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
Q	Marks awarded for quality of written communication.
ft	Follow through marks. Marks awarded for correct wording following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.
25.3 …	Allow answers which begin 25.3 e.g. 25.3, 25.31, 25.378.
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Paper 2 Higher Tier

Q	Answer	Mark	Comments
1(a)	(C =) $15x + 20y$ or (C =) $5(3x + 4y)$	B2	Accept $0.15x + 0.2y$ B1 for one correct term Do not ignore further work Do not accept $x15 + y20$
1(b)	150 × 15 or 90 × 20 or 150 × 0.15 or 90 ×0. 20	M1	150 ÷ 5 or 90 ÷ 5 or 15 ÷ 5 or 20 ÷ 5
	150 × 15 and 90 × 20 or 150 × 0.15 and 90 ×0. 20 or 2250 and 1800 or 4050 or 22.5 and 18 or 40.5	M1dep	150 ÷ 5 and 90 ÷ 5 or 15 ÷ 5 and 20 ÷ 5 or 30 and 18 or 3 and 4
	4050 ÷ 5 or 810 or 40.50 ÷ 5 or 8.10	M1dep	30 × 15 and 18 × 20 or 450 and 360 or 810 or 120 and 72 150 × 3 and 90 × 4 or 450 and 360 or 810 or 12 and 16
	4050 – 810 or 40.50 – 8.10 or 4050 ÷ 5 × 4 or 40.50 ÷ 5 × 4	M1dep	 150 × 12 + 90 × 16 or 1800 + 1440 or 3240
	32.40	A1	
2(a)	108	B1	
	Corresponding	Q1	strand (i) Mark is dependent on scoring B1
2(b)	180 – 117	M1	oe
	63	A1	

Q	Answer	Mark	Comments
3	5 × 3.6	M1	
	50 × 5 × 3.6 or 18 or 900 seen	M1dep	
	$\frac{50 \times their 18}{3}$ + 45	M1dep	Dependent on both previous method marks
	£345	A1	
4	8 × 6.5 or 52	M1	8 ÷ 5 or 1.6 or 6.5 ÷ 5 or 1.3
	their 52 ÷ 5 or 10.4	M1dep	their 1.6 × 4 or 6.4 or their 1.6 × 6.5 or 10.4 their 1.3 × 4 or 5.2 or their 1.3 × 8 or 10.4
	their 52 ÷ 5 × 4 or 41.6 or 1040 ÷ (their 5.2) or 200 (hours) 1040 ÷ (their 6.4) or 162.5	M1dep	their 6.4 × 6.5 or 41.6 or their 10.4 × 4 or 41.6 their 5.2 × 8 or 41.6
	1040 ÷ (their 52 ÷ 5 × 4) or 200 ÷ 8 or 162.5 ÷ 6.5	M1dep	1040 ÷ their 41.6
	25	A1	
5	1 1 2 2 2 2 2 3	B2	Any order B1 for two conditions met ie Used 8 cards and at least five 2s eg 1 2 2 2 2 2 3 3 Used 8 cards and twice as many 1s as 3s eg 1 1 1 1 2 2 3 3
6(a)	343	B1	
6(b)	Any two cube numbers from 8 or 27 or 64 or 125 or 216	M1	
	125 and 216	A1	Any order Accept 5^3 and 6^3 Accept 5 and 6

Q	Answer	Mark	Comments
7	360 ÷ 4 or 90 seen	M1	Right angle symbol may be on diagram May be implied from symmetry line and 45
	360 – 90 – 36 (= 234)	M1dep	If symmetry used 90 ÷ 2 or 45 and 36 ÷ 2 or 18 seen or 63 seen If isosceles triangles used (180 – 90) ÷ 2 or 45 and (180 – 36) ÷ 2 or 72 seen
	their 234 ÷ 2 or 180 – 45 – 18 or 45 + 72	M1dep	Dependent on 1st two Method marks
	117	A1	
Alt7	360 × 4 – 360 or 6 × 180 or 1080	M1	oe
	1080 – 36 × 4 (= 936)	M1dep	
	their 936 ÷ 8	M1dep	
	117	A1	
8	Bearing of 040° from Hospital and Bearing of 270° from Stadium and Location marked (lines cross)	B3	B2 for one line in tolerance and other line intersecting or two lines in tolerance but not intersecting B1 for one line in tolerance
9	$15^2 - 7^2$ or $x^2 + 7^2 = 15^2$	M1	cos 27.(...) = $\frac{x}{15}$ or cos 28 = $\frac{x}{15}$ or sin 62.(...) = $\frac{x}{15}$
	$\sqrt{15^2 - 7^2}$ or $\sqrt{176}$	M1dep	15 cos 27(...) or 15 cos 28 or 15 sin 62(...)
	13.26(…) or 13.3 or 13.27 or 13 or $4\sqrt{11}$	A1	

Q	Answer	Mark	Comments
10(a)	2 squares to the right **and** 3 up	B2	B1 for 2 squares to the right **or** 3 up
10(b)	Rotation	B1	
	90 clockwise or –90	B1	oe Accept $\frac{1}{4}$ of a turn clockwise
	(4, 3)	B1	
11	120 ÷ 6 or $\frac{1}{6}$ seen	M1	oe
	20	A1	SC1 for 100
12	$\frac{42}{300}$ or $\frac{33}{250}$ or $\frac{48}{400}$	M1	oe $\frac{258}{300}$ or $\frac{227}{250}$ or $\frac{352}{400}$ 300 ÷ 42 or 250 ÷ 33 or 400 ÷ 48
	0.14 and 0.13(2) and 0.12 or 0.86 and 0.868 or 0.87 and 0.88	A1	14 and 13.(2) and 12 86 and 86.8 or 87 and 88 (non-faulty) 7.1(428) and 7.5(757) or 7.6 and 8.(3333)
	0.14 or A or 0.86	Q1ft	Strand (iii) Correct conclusion from their three answers with at least one correct
Alt12	Correct scaling for one pair	M1	eg 840 and 792 (out of 6000) A and B 7 and 6.6 (out of 50) A and B
	All three scaled for comparison	A1	eg 840 and 792 and 720 A, B and C 7 and 6.6 and 6 A, B and C 792 and 720 with 7 and 6.6 (B and C with A and B)
	A oe	Q1ft	Strand (iii) Correct conclusion from their three answers with at least one (pair) correct

Q	Answer	Mark	Comments
13(a)	$2a + 6 + 5a - 5$ or $7a + c$ or $na + 1$	M1	Allow one error
	$7a + 1$	A1	Do not accept further work
13(b)	$5c^6d^5$	B2	B1 for two correct terms
13(c)	$\frac{2(x-3)}{x+3}$ or $\frac{2x-6}{x+3}$	B2	B1 for $\frac{2(x-3)^2}{(x-3)(x+3)}$ or $\frac{8(x-3)}{4(x+3)}$ or $\frac{2(x-3)}{1(x+3)}$ Do not accept further work
14(a)	[64, 66]	B1	
14(b)	[53, 55]	B1	
15(a)	$2x(2x - 3y)$	B2	B1 for correct partial factorisation eg $2(2x^2 - 3yx)$ or $x(4x - 6y)$ Do not accept further work
15(b)	$2w - 1 = 8 - 4w$ or $\frac{2w}{4} - \frac{1}{4} = 2 - w$	B1	Do not accept $8w - 4 = 8 - 4w$
	$2w + 4w = 8 + 1$ or $\frac{2w}{4} + w = 2 + \frac{1}{4}$	M1	ft their 4 terms
	$(w =)$ 1.5	A1ft	oe

Q	Answer	Mark	Comments
16(a)	Midpoints seen or implied 5, 15, 25, 35, 45	B1	
	their Σ*fx* 5 × 5 + 15 × 22 + 25 × 28 + 35 × 21 + 45 × 4 or 25 + 330 + 700 + 735 + 180 or 1970	M1	This mark is for the sum of their midpoints × frequencies but condone one error 5 × 5 = 25 15 × 22 = 330 25 × 28 = 700 35 × 21 = 735 45 × 4 = 180
	their Σ*fx* ÷ 80	M1dep	their 1970 ÷ 80
	24.6(...)	A1	Accept 25 with working shown
16(b)	5 + 22 + 28 or 55	M1	21 + 4 or 25
	$\frac{5+22+28}{80} \times 100$	M1	$\frac{21+4}{80} \times 100$
	68(...)(%) or 69 and No	A1	31.(...)(%) and no
Alt 16(b)	5 + 22 + 28 or 55	M1	21 + 4 or 25
	$\frac{70}{100} \times 80$ or 56	M1	$\frac{30}{100} \times 80$ or 24
	55 and 56 and No or 56 is in the 30 – 40 group so No	A1	24 and 25 and No

Q	Answer	Mark	Comments
17	Setting up a correct equation	B1	eg $7x - 19 = 4x + 2$ or $7x - 19 = 6(x - 2)$
	Collects their 4 terms	M1	eg $7x - 4x = 2 + 19$
	$x = 7$	A1	
	Verifies that one side is equal to 30 or setting up another correct equation or substitutes their x into any expression and evaluates it correctly	B1ft	ft is only for their $x = 7$
	Verifies that all sides are equal	A1	eg Solves A and B then: calculates 3 sides including C and D Solves A and B and A and C then: calculates 2 sides including D Solves A and B and C and D then: calculates one side of each pair e.g. A and C Solves any three pairs

Q	Answer	Mark	Comments
18(a)	Fully correct cumulative frequency diagram using UCBs and 2, 5, 25, 41, 50	B3	Ignore (50, 0) Ignore before 1st point and after last point B2 for one error eg Consistent plotting at mid class intervals with line joining points Consistent plotting at lower bounds with line joining points One error on cumulative frequency values eg 2, 6, 26, 42, 51 eg 2, 5, 25, 51, 60 Points not joined B1 for 2, 5, 25, 41, 50 B1 for bar chart indicating correct heights with no lines
18(b)	**Using correct cumulative frequency graph** [6, 9] or [31, 34]	M1	**Using incorrect cumulative frequency graph** Reading at 72 or reading at 85 ± ½ square tolerance
	[6, 9] and [31, 34]	M1	Reading at 72 and reading at 85 ± ½ square tolerance
	[22, 28]	A1ft	ft from their graph readings at 72 and 85
18(b) ALT	**Using the table or dividing up frequency bars** $\frac{4}{5} \times 20$ or 16 or $\frac{1}{2} \times 16$ or 8	M1	
	$\frac{4}{5} \times 20$ or 16 and $\frac{1}{2} \times 16$ or 8	M1	
	24	A1	

Q	Answer	Mark	Comments
19	1 2 or 3 7 or 8 6 or 7 3	B3	Note: Total must be 20 for B3 eg 1, 2, 8, 6, 3 B2 for 3 or 4 correct or 5 correct with total not equal to 20 or for actual 10% values ie 0.7, 2.1, 7.8, 6.4 and 3 B1 for 1 or 2 correct
20(a)	$R = \frac{k}{A}$ or $R \propto \frac{1}{A}$	M1	oe $R = \frac{1}{kA}$ or $R \propto \frac{1}{kA}$
	$12.1 = \frac{k}{1.5}$ or (k =) 12.1×1.5 or (k =) 18.15 or 18.2 or 18	M1dep	$12.1 = \frac{1}{1.5k}$ or (k =) $\frac{1}{1.5 \times 12.1}$ or (k =) 0.055(...)
	$R = \frac{18.15}{A}$ or $R = \frac{1}{0.055A}$	A1	oe Note: reciprocal of 18.15 is 0.055(...)
20(b)	$\frac{their 18.15}{4}$ or $\frac{1}{4 \times their 0.055}$	M1	oe
	4.5(375)	A1ft	
21	1800×1.04 or 1872	M1	oe $1800 \times 1.04^n = 2000$
	1800×1.04^2 or 1946.88 or 1946 or 1947	M1dep	oe Accept rounding [1946, 1947] $2000 \div 1800 = 1.04^n$
	1800×1.04^3 or 2024.7 ...	M1dep	oe Accept [2023, 2025] Between 2 and 3 years
	3	A1	Must not come from simple interest

Q	Answer	Mark	Comments
22	6 seen	B1	May be on diagram
	tan 70 = $\frac{h}{(\text{their } 6) \div 2}$	M1	oe, x being an equal side of isosceles triangle sin 20 = $\frac{3}{x}$ cos 70 = $\frac{3}{x}$ $\frac{6}{\sin 40} = \frac{x}{\sin 70}$
	(h =) [8.2, 8.3]	A1ft	[8.7, 8.8] eg 8.77
	$\frac{1}{2}$ × their 6 × their h	M1	$\frac{1}{2}$ × their 6 × their 8.77 × sin 70 or $\frac{1}{2}$ × their 8.77^2 × sin 40
	[24.3, 24.9]	A1ft	

23(a)	**b** – **a** or – **a** + **b**	B3	B2 if answer unsimplified or B2 for **b** – 2**a** or 2**a** – **b** or $\frac{1}{2}(2\mathbf{b} - 4\mathbf{a})$ or $\frac{1}{2}(4\mathbf{a} - 2\mathbf{b})$ B1 for 2**b** – 4**a** or 4**a** – 2**b**

Alt 23(a)	**b** – **a** or – **a** + **b**	B3	**Midpoint theorem** B2 if answer unsimplified or B2 for $-3\mathbf{a} + \frac{1}{2}(4\mathbf{a} + 2\mathbf{b})$ B1 for $\frac{1}{2}(4\mathbf{a} + 2\mathbf{b})$

Q	Answer	Mark	Comments
23(b)	$(\overrightarrow{MC} =)\ \mathbf{a} + 2\mathbf{b} - 4\mathbf{a} + \mathbf{b}$	M1	oe
	$\overrightarrow{MC} = 3(\mathbf{b} - \mathbf{a})$ or 3**b** – 3**a**	A1	
	MC is parallel to *MN* **and** *M* is a common point or $\overrightarrow{MC} = 3\overrightarrow{MN}$ (must be vectors)	Q1	strand (iii) for both facts stated or vector statement
Alt 23(b)	$(\overrightarrow{NC} =)\ \mathbf{b} - 2\mathbf{a} + \mathbf{b}$	M1	oe
	$\overrightarrow{NC} = 2(\mathbf{b} - \mathbf{a})$ or 2**b** – 2**a**	A1	
	NC is parallel to *MN* **and** *N* is a common point or $\overrightarrow{NC} = 2\overrightarrow{MN}$ (must be vectors)	Q1	strand (iii) for both facts stated or vector statement
24	$2x^2 + 3x - 1 = x + 4$	M1	$2(y-4)^2+3(y-4)-1=0$
	$2x^2 + 2x - 5 = 0$ or $2x^2 + 2x = 5$	M1dep	$2y^2 - 14y + 19 = 0$ or $2y^2 - 14y = -19$
	$(x =)\ \frac{-2 \pm \sqrt{2^2 - 4(2)(-5)}}{2 \times 2}$	M1dep	Allow one error
	$(x =)\ \frac{-2 \pm \sqrt{2^2 - 4(2)(-5)}}{2 \times 2}$ or $\frac{-2 \pm \sqrt{44}}{4}$	A1	oe fully correct
	$(x =)$ 1.16 and –2.16	A1	$(x =)$ 1.16 and $(y =)$ 5.16 or $(x =)$ –2.16 and $(y =)$ 1.84
	$(x =)$ 1.16 and $(y =)$ 5.16 and $(x =)$ –2.16 and $(y =)$ 1.84	A1	