# 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.

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## 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.<br>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) | ($C$ =) $15x + 20y$<br>or ($C$ =) $5(3x + 4y)$ | B2 | Accept $0.15x + 0.2y$<br><br>B1 for one correct term<br>Do not ignore further work<br>Do not accept $x15 + y20$ |
| 1(b) | 150 × 15 or 90 × 20<br><br>or 150 × 0.15 or 90 ×0. 20 | M1 | 150 ÷ 5 or 90 ÷ 5<br><br>or 15 ÷ 5 or 20 ÷ 5 |
| | 150 × 15 and 90 × 20<br><br>or 150 × 0.15 and 90 ×0. 20<br><br>or 2250 and 1800<br>or 4050<br><br>or 22.5 and 18<br>or 40.5 | M1dep | 150 ÷ 5 and 90 ÷ 5<br><br>or 15 ÷ 5 and 20 ÷ 5<br><br>or 30 and 18<br><br>or 3 and 4 |
| | 4050 ÷ 5<br>or 810<br><br>or 40.50 ÷ 5<br>or 8.10 | M1dep | 30 × 15 and 18 × 20<br>or 450 and 360<br>or 810<br><br>or 120 and 72<br><br>150 × 3 and 90 × 4<br>or 450 and 360<br>or 810<br><br>or 12 and 16 |
| | 4050 – 810<br><br>or 40.50 – 8.10<br><br>or 4050 ÷ 5 × 4<br><br>or 40.50 ÷ 5 × 4 | M1dep | 150 × 12 + 90 × 16<br>or 1800 + 1440<br>or 3240 |
| | 32.40 | A1 | |
| 2(a) | 108 | B1 | |
| | Corresponding | Q1 | strand (i)<br>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<br><br>or 6.5 ÷ 5 or 1.3 |
| | their 52 ÷ 5 or 10.4 | M1dep | their 1.6 × 4 or 6.4<br>or their 1.6 × 6.5 or 10.4<br><br>their 1.3 × 4 or 5.2<br>or their 1.3 × 8 or 10.4 |
| | their 52 ÷ 5 × 4 or 41.6<br><br>or 1040 ÷ (their 5.2) or 200 (hours)<br><br>1040 ÷ (their 6.4) or 162.5 | M1dep | their 6.4 × 6.5 or 41.6<br><br>or their 10.4 × 4 or 41.6<br><br>their 5.2 × 8 or 41.6 |
| | 1040 ÷ (their 52 ÷ 5 × 4)<br><br>or 200 ÷ 8<br><br>or 162.5 ÷ 6.5 | M1dep | 1040 ÷ their 41.6 |
| | 25 | A1 | |
| **5** | 1 1 2 2 2 2 2 3 | B2 | Any order<br><br>B1 for two conditions met<br><br>ie<br>Used 8 cards and at least five 2s<br>eg 1 2 2 2 2 2 3 3<br><br>Used 8 cards and twice as many 1s as 3s<br>eg 1 1 1 1 2 2 3 3 |
| **6(a)** | 343 | B1 | |
| **6(b)** | Any two cube numbers from<br>8 or 27 or 64 or 125 or 216 | M1 | |
| | 125 and 216 | A1 | Any order<br>Accept $5^3$ and $6^3$<br>Accept 5 and 6 |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **7** | 360 ÷ 4 or 90 seen | M1 | Right angle symbol may be on diagram<br>May be implied from symmetry line and 45 |
| | 360 – 90 – 36 (= 234) | M1dep | If symmetry used<br>90 ÷ 2 or 45 and 36 ÷ 2 or 18 seen<br>or 63 seen<br><br>If isosceles triangles used<br>(180 – 90) ÷ 2 or 45 and (180 – 36) ÷ 2 or 72 seen |
| | their 234 ÷ 2<br>or 180 – 45 – 18<br>or 45 + 72 | M1dep | Dependent on 1st two Method marks |
| | 117 | A1 | |
| **Alt7** | 360 × 4 – 360<br>or 6 × 180<br>or 1080 | M1 | oe |
| | 1080 – 36 × 4 (= 936) | M1dep | |
| | their 936 ÷ 8 | M1dep | |
| | 117 | A1 | |
| **8** | Bearing of 040° from Hospital<br>and<br>Bearing of 270° from Stadium<br>and<br>Location marked (lines cross) | B3 | B2 for one line in tolerance and other line intersecting<br>or two lines in tolerance but not intersecting<br><br>B1 for one line in tolerance |
| **9** | $15^2 - 7^2$<br><br>or $x^2 + 7^2 = 15^2$ | M1 | cos 27.(...) = $\frac{x}{15}$ or cos 28 = $\frac{x}{15}$<br><br>or sin 62.(...) = $\frac{x}{15}$ |
| | $\sqrt{15^2 - 7^2}$ or $\sqrt{176}$ | M1dep | 15 cos 27(...) or 15 cos 28<br>or 15 sin 62(...) |
| | 13.26(…) or 13.3 or 13.27 or 13<br>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<br>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<br>$\frac{258}{300}$ or $\frac{227}{250}$ or $\frac{352}{400}$<br>300 ÷ 42 or 250 ÷ 33 or 400 ÷ 48 |
| | 0.14 and 0.13(2) and 0.12<br>or<br>0.86 and 0.868 or 0.87 and 0.88 | A1 | 14 and 13.(2) and 12<br>86 and 86.8 or 87 and 88 (non-faulty)<br>7.1(428) and 7.5(757) or 7.6 and 8.(3333) |
| | 0.14 or A or 0.86 | Q1ft | Strand (iii)<br>Correct conclusion from their three answers with at least one correct |
| **Alt12** | Correct scaling for one pair | M1 | eg<br>840 and 792 (out of 6000) A and B<br>7 and 6.6 (out of 50) A and B |
| | All three scaled for comparison | A1 | eg<br>840 and 792 and 720 A, B and C<br>7 and 6.6 and 6 A, B and C<br>792 and 720 with 7 and 6.6 (B and C with A and B) |
| | A oe | Q1ft | Strand (iii)<br>Correct conclusion from their three answers with at least one (pair) correct |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **13(a)** | $2a + 6 + 5a - 5$<br>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 $\frac{2(x-3)}{1(x+3)}$<br>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<br>eg<br>$2(2x^2 - 3yx)$<br>or $x(4x - 6y)$<br>Do not accept further work |
| **15(b)** | $2w - 1 = 8 - 4w$<br>or $\frac{2w}{4} - \frac{1}{4} = 2 - w$ | B1 | Do not accept $8w - 4 = 8 - 4w$ |
| | $2w + 4w = 8 + 1$<br>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<br>5, 15, 25, 35, 45 | B1 | |
| | their Σ*fx*<br>5 × 5 + 15 × 22 + 25 × 28 + 35 × 21 + 45 × 4<br>or 25 + 330 + 700 + 735 + 180<br>or 1970 | M1 | This mark is for the sum of their midpoints × frequencies but condone one error<br>5 × 5 = 25<br>15 × 22 = 330<br>25 × 28 = 700<br>35 × 21 = 735<br>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 |
| | $\frac{5+22+28}{80}$ × 100 | M1 | $\frac{21+4}{80}$ × 100 |
| | 68(...)(%) or 69 and No | A1 | 31.(...)(%) and no |
| **Alt 16(b)** | 5 + 22 + 28 or 55 | M1 | 21 + 4 or 25 |
| | $\frac{70}{100}$ × 80 or 56 | M1 | $\frac{30}{100}$ × 80 or 24 |
| | 55 and 56 and No<br>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<br>$7x - 19 = 4x + 2$<br>or $7x - 19 = 6(x - 2)$ |
| | Collects their 4 terms | M1 | eg<br>$7x - 4x = 2 + 19$ |
| | $x = 7$ | A1 | |
| | Verifies that one side is equal to 30<br><br>or setting up another correct equation<br><br>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<br><br>Solves A and B then:<br>calculates 3 sides including C and D<br><br>Solves A and B and A and C then:<br>calculates 2 sides including D<br><br>Solves A and B and C and D then:<br>calculates one side of each pair e.g. A and C<br><br>Solves any three pairs |

| Q | Answer | Mark | Comments |
|---|---|---|---|
| **18(a)** | Fully correct cumulative frequency diagram using UCBs<br>and 2, 5, 25, 41, 50 | B3 | Ignore (50, 0)<br>Ignore before 1st point and after last point<br><br>B2 for one error<br>eg Consistent plotting at mid class intervals with line joining points<br><br>Consistent plotting at lower bounds with line joining points<br><br>One error on cumulative frequency values<br>eg 2, 6, 26, 42, 51<br>eg 2, 5, 25, 51, 60<br><br>Points not joined<br><br>B1 for 2, 5, 25, 41, 50<br>B1 for bar chart indicating correct heights with no lines |
| **18(b)** | **Using correct cumulative frequency graph**<br><br>[6, 9] or [31, 34] | M1 | **Using incorrect cumulative frequency graph**<br><br>Reading at 72 or reading at 85<br>± ½ square tolerance |
| | [6, 9] and [31, 34] | M1 | Reading at 72 and reading at 85<br>± 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**<br><br>$\frac{4}{5} \times 20$ 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<br>2 or 3<br>7 or 8<br>6 or 7<br>3 | B3 | Note: Total must be 20 for B3<br>eg 1, 2, 8, 6, 3<br><br>B2 for 3 or 4 correct<br><br>or 5 correct with total not equal to 20<br><br>or for actual 10% values<br>ie 0.7, 2.1, 7.8, 6.4 and 3<br><br>B1 for 1 or 2 correct |
| **20(a)** | $R = \frac{k}{A}$ or $R \propto \frac{1}{A}$ | M1 | oe<br>$R = \frac{1}{kA}$ or $R \propto \frac{1}{kA}$ |
| | $12.1 = \frac{k}{1.5}$<br>or $(k =)$ 12.1 × 1.5<br>or $(k =)$ 18.15 or 18.2 or 18 | M1dep | $12.1 = \frac{1}{1.5k}$<br><br>or $(k =) \frac{1}{1.5 \times 12.1}$<br><br>or $(k =)$ 0.055(...) |
| | $R = \frac{18.15}{A}$ or $R = \frac{1}{0.055A}$ | A1 | oe<br>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<br>$1800 \times 1.04^n = 2000$ |
| | $1800 \times 1.04^2$ or 1946.88 or 1946 or 1947 | M1dep | oe<br>Accept rounding [1946, 1947]<br>$2000 \div 1800 = 1.04^n$ |
| | $1800 \times 1.04^3$ or 2024.7 ... | M1dep | oe<br>Accept [2023, 2025]<br>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<br>sin 20 = $\frac{3}{x}$<br>cos 70 = $\frac{3}{x}$<br>$\frac{6}{\sin 40} = \frac{x}{\sin 70}$ |
| | ($h$ =) [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<br>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<br>or<br>B2 for **b** – 2**a** or 2**a** – **b**<br>or $\frac{1}{2}(2\mathbf{b} - 4\mathbf{a})$ or $\frac{1}{2}(4\mathbf{a} - 2\mathbf{b})$<br><br>B1 for 2**b** – 4**a** or 4**a** – 2**b** |

| | | | |
|---|---|---|---|
| **Alt 23(a)** | **b** – **a** or – **a** + **b** | B3 | **Midpoint theorem**<br><br>B2 if answer unsimplified<br>or<br>B2 for – 3**a** + $\frac{1}{2}(4\mathbf{a} + 2\mathbf{b})$<br><br>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<br>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<br>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 |
| | $(x =)\ \frac{-2 \pm \sqrt{2^2 - 4(2)(-5)}}{2 \times 2}$<br>or $\frac{-2 \pm \sqrt{44}}{4}$ | A1 | oe<br>fully correct |
| | $(x =)$ 1.16 and –2.16 | A1 | $(x =)$ 1.16 and $(y =)$ 5.16<br>or<br>$(x =)$ –2.16 and $(y =)$ 1.84 |
| | $(x =)$ 1.16 and $(y =)$ 5.16<br>and<br>$(x =)$ –2.16 and $(y =)$ 1.84 | A1 | |