OCR
RECOGNISING ACHIEVEMENT

GCSE

# Mathematics A

General Certificate of Secondary Education

Unit **A502/02:** Mathematics B (Higher Tier)

# Mark Scheme for June 2012

Oxford Cambridge and RSA Examinations

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Annotations used in the detailed Mark Scheme.

| Annotation | Meaning |
|---|---|
| ✓ | Correct |
| × | Incorrect |
| BOD | Benefit of doubt |
| FT | Follow through |
| ISW | Ignore subsequent working (after correct answer obtained), provided method has been completed |
| M0 | Method mark awarded 0 |
| M1 | Method mark awarded 1 |
| M2 | Method mark awarded 2 |
| A1 | Accuracy mark awarded 1 |
| B1 | Independent mark awarded 1 |
| B2 | Independent mark awarded 2 |
| MR | Misread |
| SC | Special case |
| ∧ | Omission sign |

These should be used whenever appropriate during your marking.

The **M**, **A, B** etc annotations must be used on your standardisation scripts for responses that are not awarded either 0 or full marks.
It is vital that you annotate these scripts to show how the marks have been awarded.
It is not mandatory to use annotations for any other marking, though you may wish to use them in some circumstances.

**Subject-Specific Marking Instructions**

1 **M** marks are for using a correct method and are not lost for purely numerical errors.
**A** marks are for an accurate answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
**B** marks are independent of **M** (method) marks and are awarded for a correct final answer or a correct intermediate stage.
**SC** marks are for special cases that are worthy of some credit.

2 Unless the answer and marks columns of the mark scheme specify **M** and **A** marks etc, or the mark scheme is 'banded', then if the correct answer is clearly given and is not from wrong working **full marks** should be awarded.

Do not award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen and the correct answer clearly follows from it.

3 Where follow through (**FT**) is indicated in the mark scheme, marks can be awarded where the candidate's work follows correctly from a previous answer whether or not it was correct.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, eg FT 180 × (*their* '37' + 16), or FT 300 – √(*their* '$5^2 + 7^2$'). Answers to part questions which are being followed through are indicated by eg FT 3 × *their* (a).

For questions with FT available you must ensure that you refer back to the relevant previous answer. You may find it easier to mark these questions candidate by candidate rather than question by question.

4 Where dependent (**dep**) marks are indicated in the mark scheme, you must check that the candidate has met all the criteria specified for the mark to be awarded.

5 The following abbreviations are commonly found in GCSE Mathematics mark schemes.

- **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
- **isw** means **ignore subsequent working** (after correct answer obtained).
- **nfww** means **not from wrong working**.
- **oe** means **or equivalent**.
- **rot** means **rounded or truncated**.
- **seen** means that you should award the mark if that number/expression is seen anywhere in the answer space, including the answer line, even if it is not in the method leading to the final answer.
- **soi** means **seen or implied**.

6 Make no deductions for wrong work after an acceptable answer unless the mark scheme says otherwise, indicated for example by the instruction 'mark final answer'.

7 As a general principle, if two or more methods are offered, mark only the method that leads to the answer on the answer line. If two (or more) answers are offered, mark the poorer (poorest).

8 When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **M** marks are not deducted for misreads.

9 Unless the question asks for an answer to a specific degree of accuracy, always mark at the greatest number of significant figures even if this is rounded or truncated on the answer line. For example, an answer in the mark scheme is 15.75, which is seen in the working. The candidate then rounds or truncates this to 15.8, 15 or 16 on the answer line. Allow full marks for the 15.75.

10 If the correct answer is seen in the body of working

i. and the answer given in the answer space is a clear transcription error allow full marks unless the mark scheme says 'mark final answer'. Place the annotation ✓ next to the correct answer.

ii. but the answer space is blank, allow full marks. Place the annotation ✓ next to the correct answer.

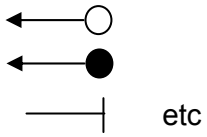
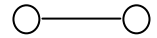
iii. but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks could still be awarded. Use the M0, M1, M2 annotations as appropriate and place the annotation ✗ next to the wrong answer.

11 Ranges of answers given in the mark scheme are always inclusive.

12 For methods not provided for in the mark scheme give as far as possible equivalent marks for equivalent work. If in doubt, consult your Team Leader.

13 Anything in the mark scheme which is in square brackets […] is not required for the mark to be earned, but if present it must be correct.

| Question | | | Answer | Marks | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| 1 | (a) | (i) | $\frac{7}{24}$ final answer | 2 | **M1** for common denominator ie $\frac{x}{24n}$ | **0** for decimals in (i) and (ii) |
| | | (ii) | $3\frac{1}{3}$ | 3 | **B2** for $\frac{10}{3}$ or $3\frac{2}{6}$ oe<br><br>Or **M1** for $\frac{5}{6} \times \frac{4}{1}$ soi by $\frac{20}{6}$<br><br>If **0** scored then **SC1** for any correct conversion from top heavy to mixed or for correct cancelling of any fraction | isw after a correct or partially correct answer<br><br>Condone $3.\dot{3}$ for **3** marks<br>3.3 etc scores **0**<br><br>eg $\frac{20}{24} = \frac{5}{6}$ |
| | (b) | | 4, $\frac{4}{1}$ oe | 1 | | **0** for $\frac{1}{0.25}$ |
| 2 | | | 759 | 3 | **M2** for $660 + (\frac{15}{100} \times 660)$ oe<br><br>Or **M1** for $(\frac{15}{100} \times 660$ or 99 seen) | eg 660 + 66 + 33<br>Condone 1 error eg 660 + 60 + 30<br><br>eg 66+33 Condone 1 error<br>561 seen implies **M1** |
| 3 | (a) | | $x < 60$ isw | 2 | **B1** for $\frac{x}{4} < 15$ or $x - 20 < 40$<br>or for a correct 2nd step leading to $x <$ or $x >$ following an incorrect 1st step<br><br>Or **SC1** for $x = 60$ | eg $\frac{x}{4} - 5 < 10$<br>$x - 5 < 40$<br>$x < 45$ |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | (b) | | Any reasonable representation | 1FT | Correct or FT *their* (a); mark intention | eg  etc<br>Arrow/line any length<br>but not  <br>However ignore any symbol at ⁻20 |
| **4** | | | 100 | 3 | **M2** for 540 – (90 + 70 + 130 + *their* 150) or 180 – [360 – (30 + 110 + 50 + 90)]<br><br>Or **M1** for 360 – 210 soi by 150 or [360 – (30 + 110 + 50 + 90)] or (method leading to) 540 | *Their* 150 ≠ 210<br>If exterior angles used<br><br>Could be on diagram<br>If exterior angles used |
| **5** | (a) | (i) | No correlation / relation(ship) oe | 1 | | Allow 'None', 'No pattern'<br>Not 'Random', 'No', 'Neutral' |
| | | (ii) | 'No' + reasonable comment about the lack of correlation | 1 | Yes with or without reason scores **0** | Comment must describe zero correlation or give an example where increased height does not give decreased temp.<br>Mark best bit |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | (b) | (i) | Labelled scatter graph of latitude against average temp | 4 | **B2** for both axes scaled and labelled<br>Or **B1** for one axis scaled and labelled or for both axes either scaled or labelled<br><br>AND<br>**B2** for ≥ 9 points correctly plotted<br>Or **B1** ≥ 4 points correctly plotted<br><br>If **0** scored then **SC1** for attempt at graph of latitude against height | Overlay available<br>Scale must fit on grid and be linear ie not labelling latitude as 0, 4, 8, 15 etc<br><br>ie 2, 1 or 0 wrong points<br>Mark points within range of *linear* scale covering most points<br>Tolerance ±1 whole square<br><br>Ignore any line of best fit or other trend line |
| | | (ii) | 'Yes', 'No', 'Partially', 'Maybe' etc and convincing explanation relating to whole data set | 2 | **B1** for 'Yes' or 'No' and partial explanation<br>Mark best part for **B1** | **Complete**<br>Temp between latitude 0° and 15° are high, then they drop and beyond latitude 30° to 35° they are cooler.<br>Apart from Khartoum, temperatures from 0° to 30° are about the same, then there is a negative correlation<br>There is a (weak) negative correlation meaning that countries near the equator are warmer. Two points are outliers<br>Yes only Khartoum is wrong<br>Yes but first 3 are wrong<br>**Partial**<br>Countries near the equator are warmer or<br>Countries far from the equator are cooler or<br>No – negative correlation<br>Yes – negative correlation |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| **6** | (a) | | Ruled line of best fit | 1 | Within tramlines, any length<br>Allow not passing through (0, 0) | Overlay available<br>If extended must stay within tramlines |
| | (b) | | Answer in range 10-14 | 2 | **M1** for (vertical change) / (horizontal change) soi<br>or for correct gradient but wrong form | Can be implied from a triangle drawn on line of best fit or from any 2 points eg 12*x* etc |
| | (c) | | (Average) Price (per Satsuma) | 1 | eg They cost 11p | Allow costs in range 10-14 or FT<br>**0** for a description of correlation |
| | (d) | | $y$ = (*their* 12)$x$ + *their c* oe | 2 | **B1** for $y$ = (*their* 12)$x$ + any $c$ | Allow correct or FT<br>Tolerance ±2 for $c$ (look at extension if line does not cross $y$-axis) |
| **7** | (a) | | $x \geq 5$ | 1 | Condone >;<br>Allow $5 \leq x$ | If $x$ = ≥ 5 or $x$ = > 5 penalise first time only in all 3 parts<br><br>If candidate clearly labels all shaded regions in (a), (b) and (c) as 'unwanted' oe penalise first time thereafter condone |
| | (b) | | $y \leq 2$ | 1 | Condone < | |
| | (c) | | $y \leq x$ | 1 | Condone <<br>If **0** scored in all three parts allow **SC1** here if *all* signs reversed | |
| **8** | (a) | (i) | $\frac{5}{2}$, $2\frac{1}{2}$ or 2.5 | 1 | | |
| | | (ii) | Any correct shape | 1 | eg regular octagon, square, semicircle, sphere etc | Not just 'octagon' |

| Question | | | Answer | Marks | Answer |
|---|---|---|---|---|---|
| | | (iii)* | Correct proof well explained. | 3–2 | Angles between tangent and radii = 90°<br>Therefore AD parallel to BC<br>Therefore it is a trapezium<br><br>For lower mark there will be any or all of<br>• small use of poor mathematical language<br>• conclusion unclear<br>• both facts given in working/answer but no reason. Labels not necessary provided not contradictory |
| | | | (A) and (B) = 90° or (AD) parallel (to BC) stated<br>These could be marked on diagram (ie 'boxes' or numbers, arrows). | 1–0 | For lower mark – nothing of any worth. |
| | (b) | (i)* | Correct proof well explained. | 3–2 | Eg 12/8 = 1.5<br>9/5 = 1.8 or 9cm should be 7.5cm<br>So triangles not similar<br><br>For lower mark there will be any or all of<br>• small use of poor mathematical language<br>• conclusion unclear<br>• a reasonable argument but without any calculation/use of ratios or scale factors<br>• one ratio may be incorrect |
| | | | Any mention of ratio, division, factor, enlargement etc. | 1–0 | For lower mark – nothing of any worth. |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | | (ii) | Change either 9 to 7.5 oe<br>or 12 to $14\frac{2}{5}$ oe<br>or 5 to 6<br>or 8 to $6\frac{2}{3}$ oe | 3 | **M2** for an appropriate ratio × appropriate length<br><br>Or **M1** for an appropriate ratio calculated<br><br>Condone 6.66 – 6.67 | eg $\frac{8}{5}\times 9$<br>eg $\frac{8}{5}$<br>Calculations may be in (b)(i) |
| **9** | (a) | | 3 ÷ 0.5 = 6 oe | 1 | Need to see either an approximation or 3.18 | Mark best bit |
| | (b) | (i) | 5.6604 | 1 | | |
| | | (ii) | 1 or 2 sf or dp | 1 | | **0** for just '2' or '1' |
| | | (iii) | 6 or 5.7 or 5.66 | 1 | | Condone a different accuracy to b(ii) |
| **10** | | | Correct shape | 3 | **B2** if wrong centre used<br>or correct intention for 4 or more points<br>Or **B1** if wrong SF used | Overlay available<br>Condone freehand |
| **11** | (a) | | $9a^6b^8$ final answer | 3 | **B1** for each of 9, $a^6$ and $b^8$ where final answer is in correct form<br><br>Or **SC1** for incorrect form with at least one of 9, $a^6$ and $b^8$ correct | <br><br>eg $9a^6 + b^8$ scores **SC1** |
| | (b) | | 6 nfww | 3 | **B2** if 4 and ($^-$2) seen<br>Or **B1** if 4 or ($^-$2) seen | As answers to f(3) and f(1),<br>eg 1 – 3 = $^-$2 scores **0** |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|---|---|---|---|---|---|---|
| | (c) | | $\frac{1}{5}$ or 0.2 | 2 | **B1** for $\frac{1}{125^{\frac{1}{3}}}$ or $\frac{1}{\sqrt[3]{125}}$ or $5^{-1}$ or $\sqrt[3]{125}$ or $\sqrt[3]{-125}$ or 5 or -5 or $-\frac{1}{5}$ | |
| | (d) | | $4\sqrt{6}$ or $4\sqrt{2}\sqrt{3}$ final answer | 2 | **B1** for $\frac{24}{\sqrt{6}} \times \frac{\sqrt{6}}{\sqrt{6}}$ or better | |

**APPENDIX 1**

Exemplar responses for question **5aii**

Lizzie thinks there is a **negative** correlation.
Therefore an acceptable answer is 'No' followed by

- There is no correlation, pattern etc ♥
- There is no negative correlation ∅
- egs of places (or a place) that contradict a negative correlation ℜ

Answer 'NO' followed by

| Response | Mark awarded |
|---|---|
| The highest point is hotter than the lowest. ℜ | 1 |
| Some of the cities near sea level are still colder than some cities that are not. ℜ | 1 |
| There is no clear pattern ♥ whether the temperature increases. At 580m it is 20°C, which is what it was at, at 12m (*mark best part and we condone using values not in the table)*. | 1 |
| If you look at the graph places that are closer to sea level are cold and warm. ♥ | 1 |
| Lizzie's view would require a negative correlation but there is no link between height and temperature. ♥ | 1 |
| If it did there would be a strong negative correlation. ∅ | 1 |
| In general the higher it is the warmer it is, there is no correlation. ♥ (*mark the best part)* | 1 |
| It also gets cooler after a high amount of sea level change.<br>*Which way does it change* | 0 |
| The graph does not prove that the higher the sea level the higher the temperature because there isn't positive correlation. | 0 |
| Yes most of the results that are closer to sea level area hotter with exceptions in one answer.<br><br>*Always 0 if 'Yes'* | 0 |

Exemplar responses for question **5bii**

| Answer | | Score | Reasoning |
|---|---|---|---|
| Yes | Because the further away from the equator you get the colder it gets, however there a few anomalies just north of the equator that are hottest. | 2 | Showing negative correlation, but understands that this pattern does not fit with the whole data set. |
| Yes | After the latitude goes past 15 the average June temperature decreases. | 2 | Implying that the negative correlation for data after 15 degrees latitude does not hold true for data before 15. |
| Yes | It does show that the closer you got to the equator the hotter it got. But when you got really close it seemed to cool down. | 2 | Showing negative correlation, but understands that this pattern does not fit with the whole data set. |
| Mostly | With the exceptions of latitudes 0-14, the lower the latitude the hotter the temperature. However, Libreville, Bangui & Freetown do not follow this pattern. | 2 | Showing negative correlation for majority of data but that this is not true for all data, specifically that near the equator. |
| Yes | At 15° latitude the temperature is 34°C and at 59° the temperature is 15°C. | 1 | A specific example that shows they are thinking of negative correlation, but does not cover full data set. |
| Yes | The closer you are to the equator the hotter you will be. | 1 | Implying negative correlation, but fails to address issue of temperatures near equator not fitting this pattern. |
| Yes | There is a strong negative correlation - the further away from the equator, the colder the June average temperature. | 1 | States negative correlation, but fails to address issue of temperatures near equator not fitting this pattern. |
| No | As temps nearer the equator are about 25°C, whereas the highest temp recorded, 34°C was at latitude 15° - a lot hotter than nearer the equator. | 1 | Implying positive correlation for data near the equator thus supporting 'No', but fails to address change of pattern for subsequent data thus not covering the full data set. |

Exemplar responses for question **9a**

| Response | Mark awarded |
|---|---|
| 0.53 rounds to a half ( *No calculation)* | 0 |
| 3 multiplied by 0.50 is 6 *("multiplied" is wrong)* | 0 |
| 3 divided by a ½ = 6 and 0.53 is close to a half | 1 |
| When you times a number by 0.5 it halves and the area is 3 and 6 is double that | 1 bod |
| You need to divide the area by 0.53 *(No approximation)* | 0 |
| 0.53 is close to 0.5 and 6 × 0.5 = 3 | 1 |
| Half of 6 is 3 and 0.53 is slightly over half | 1 |
| It needs to be near to double the area as the other length is near to a half | 1 bod |
| If the 0.53 was exactly 0.50cm then the length would be exactly 6cm *(No calculation shown)* | 0 |

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