

Applications of Mathematics (Pilot)

General Certificate of Secondary Education

Unit **A382/01**: Foundation Tier

Mark Scheme for June 2013

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This mark scheme is published as an aid to teachers and students, to indicate the requirements of the examination. It shows the basis on which marks were awarded by examiners. It does not indicate the details of the discussions which took place at an examiners' meeting before marking commenced.

All examiners are instructed that alternative correct answers and unexpected approaches in candidates' scripts must be given marks that fairly reflect the relevant knowledge and skills demonstrated.

Mark schemes should be read in conjunction with the published question papers and the report on the examination.

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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 for a correct final answer, a partially correct 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 $180 \times (\textit{their} '37' + 16)$, or FT $300 - \sqrt{(\textit{their} '5^2 + 7^2')}$. Answers to part questions which are being followed through are indicated by eg FT 3 $\times \textit{their} (a)$.

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 and applies as a default.
 - **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. In questions with no final answer line, make no deductions for wrong work after an acceptable answer (ie **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.
7. In questions with a final answer line following working space,
- (i) if the correct answer is seen in the body of working and the answer given on the answer line 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) if the correct answer is seen in the body of working but the answer line is blank, allow full marks. Place the annotation ✓ next to the correct answer.
 - (iii) if the correct answer is seen in the body of working but a completely different answer is seen on the answer line, 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.
8. In questions with a final answer line:
- (i) If one answer is provided on the answer line, mark the method that leads to that answer.
 - (ii) If more than one answer is provided on the answer line and there is a single method provided, award method marks only.
 - (iii) If more than one answer is provided on the answer line and there is more than one method provided, award zero marks for the question unless the candidate has clearly indicated which method is to be marked.
9. In questions with no final answer line:
- (i) If a single response is provided, mark as usual.
 - (ii) If more than one response is provided, award zero marks for the question unless the candidate has clearly indicated which response is to be marked.
10. 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.

11. 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.
12. Ranges of answers given in the mark scheme are always inclusive.
13. 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.
14. 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) | 1 | 1 | | |
| | | (ii) | 6 g(rams) | 1+1 | Independent marks | |
| | | (iii) | $\frac{3}{4}$ | 2 | M1 for $\frac{15}{20}$ oe | |
| | (b) | (i) | 40 to 100 | 1 | | |
| | | (ii) | 6400 to 16 000 | 1 | FT 160 × <i>their b(i)</i> | |
| | | (iii) | 5120 to 12800 | 2 | FT <i>their b(ii)</i> × 0.8 M1 for <i>their b(ii)</i> ÷ 2 or × 1.6 or × 0.8 | |
| | | (iv) | Yes or no depending on <i>their b(iii)</i> with reference to 500g and/or doubling | 2 | FT <i>their b(iii)</i> M1 for identifying weight × 2 = height or 500g | Yes or no with no supporting numbers gains no credit |
| | | (v) | 76.8 | 2 | M1 for 75 or 1.8 seen Not just 75.36 | |
| 2 | (a) | (i) | US | 1 | | |
| | | (ii) | 50 | 1 | Condone repeat of millions in answer line | |
| | | (iii) | Yes, US produces 330 million tonnes Rest produce (310 – 330) million tonnes | 3 | M1 for US 330 (million tonnes) M1 for Rest 310-330 (million tonnes) | Accept 'about the same' if figures presented are within range given and support this. |
| | | (iv) | 15 15 (±2) million tonnes About 10 times | 3 | 1 for each FT <i>their</i> two values for multiplier to give 10 ± 1.5 For multiplier FT <i>their</i> middle value ÷ 1.5 | |

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|---------|--|-----------------------|--|--|
| | (b) (i) | 1080 | 1 | | |
| | (ii) | $\frac{14}{20}$ oe isw | 2 | M1 for correct numerator (14) or denominator (20) in fraction < 1 | eg 0.7 or 70%, |
| | (iii) | <p>If Banji pays the \$300 he will make (<i>their</i> 1080 – 300)=\$780. If he does not he can expect to make $\frac{14}{20}$ of <i>their</i> 1080 or \$756. He should not take a chance or he should pay the \$300</p> <p>If Banji pays the \$300 he will make (<i>their</i> 1080 – 300) = <i>their</i> \$780 or correct answer to calculations over several seasons</p> | <p>4-3</p> <p>2-1</p> | <p>Recognition of reduction of takings to \$780, some attempt to calculate the expected taking if no payment of \$300 to water company eg $0.7 \times \textit{their}$ 1080 or full correct calculations and conclusion over several seasons.</p> <p>Reference to <i>their</i> probability of rain or <i>their</i> 1080 – 300 incorrectly worked out.</p> | Allow follow through from part (i) and (ii). |
| | (iv) | (Plot) 1 | 1 | | |
| | (v) | (Plot) 4 | 1 | | |
| | (c) (i) | Any correct temperature $0 < T < 44$ | 1 | | Obviously 0 and 44 not allowed |
| | (ii) | $25(^{\circ}\text{C}) \leq$ or $< T(\text{emperature}) \leq$ or $< 32(^{\circ}\text{C})$ | 2 | B1 for one “end” correct | |

| Question | | | Answer | Marks | Part Marks and Guidance | |
|----------|-----|-------|-------------------------------|--------|---|---|
| 3 | (a) | (i) | $\frac{37}{40}$ oe isw | 1 | eg 92.5% or 0.925 | oe fraction / decimal / percentage Condone rounding to 2dp provided correct fraction or correct working seen Do not penalise arithmetical error if change of form Do not allow ratio, 'out of' or 'in' |
| | | (ii) | $\frac{54}{60}$ oe isw | 1 | eg 90% or 0.9 | oe fraction / decimal / percentage Do not penalise arithmetical error in change of form If answer given in consistent incorrect format as 3(a)(i) & both would've been correct, do not penalise in 3(a)(ii) |
| | (b) | | 2.3 | 3 | M2 for $(11 + 2 \times 14 + 3 \times 12 + 5 + 6 \times 2) \div 40$ Or M1 for $11 + 2 \times 14 + 3 \times 12 + 5 + 6 \times 2$ or 92 If M0 then SC2 for 80.3 Or SC1 for attempt at sum of products $\div 40$ | $92 \div 40$ Condone up to 2 errors / omissions in sum 92 ie not involving the brackets ie no working for <i>their</i> 92 |
| 4 | (a) | (i) | 1610.51 | 1 | | |
| | | (ii) | (£)2138.43 | 1 | | |
| | | (iii) | 7 (months) 9 to 10 (times) | 1 1 | | |

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|---------|---|-------|---|---|
| | (b) (i) | Correct conclusion of 7 compared to <i>their</i> months in 4(a)(iii) | 2 | FT <i>their</i> months in 4(a)(iii) M1 for $70 \div 10$ or 7 | Mere yes gains no credit |
| | (ii) | 70 | 1 | | |
| 5 | (a) (i) | 0.14 | 1 | | |
| | (ii) | 70 | 1 | | |
| | (iii) | 1: 500 000 000 | 3 | M2 for 1: figs 5 Or M1 for 0.2 to 100 000 oe or either 100 000 000g or 0.0002kg | Accept answer in index form. |
| | (b) (i) | 500 to 650 | 1 | | |
| | (ii) | 60 to 80 | 2 | M1 for use of line of best fit | |
| | (iii) | Large diamond worth more than equivalent small diamonds supported by some prices of equivalent points based on scatter graph. | 3 | M2 for some diamond prices totalled with 'small' points total close to that of a 'large' points diamond and incorrect or no conclusion M1 for the price of either 'small' diamonds or a large diamond | Mere yes/no gains no credit. |
| | (c) | Gold increase 4 times; diamond increase about 2 times; gold better or get more from gold Or gold as increase about twice as much as diamond increase Or $14050 \times 4.1 = 57605$, buy gold | 2 | M1 for either gold increase 4 times or $410 \div 100$ or diamond increase about 2 times or $29100 \div 14050$ or better with no or incorrect conclusion If M0 then SC1 for gold increases by 400% and diamond increases by 200% Or $14050 \times$ figs 41 | Allow equivalent % or index comparison ie 207 (or 200) compared with 410 or diamond increase by 100% & gold increase by 300% Allow examples using money Allow sensible rounded values used for 29100 and 14050 & for 4.1 Gold with no reason or just quoting values scores 0 marks |

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|---------|---|-------|---|---------------------------|
| 6 | (a) | 360000 | 2 | M1 for figs 36 as answer or 60000 or $0.2 \times 300\ 000$ oe or $1.2 \times 300\ 000$ oe | |
| | (b) | 0.5 to 1.0 | 1 | | |
| | (c) (i) | $\frac{1}{4}$ oe | 1 | Accept fraction in range $\frac{1}{5}$ oe to $\frac{1}{4}$ oe | Answer must be a fraction |
| | (ii) | 20 to 25 hours | 2 | M1 for 5 (hours) seen | |
| | (d) | 480000 to 502720 | 2 | M1 for $\pi \times 400 \times 400$ | |
| | (e) (i) | 280 000 to 360 000 | 2 | M1 for figs 7 to 9 seen in context of square counting in one corner or not-watered total = 28 to 36 or M1 for $1200^2 - \pi \times 600^2$ | |
| | (ii) | 15 to 19 | 2 | M1 for 1.5 to 1.9 or 5.5 to 5.9 or 55 to 59 | |
| | (f) (i) | 0.8 | 1 | | |
| | (ii) | $0.6 \times 50\ 000 = 30\ 000$ oe | 2 | M1 for 0.6 seen | |
| | (iii) | $r = 5g$ oe | 2 | M1 for correct word equation or $5g$ or $\frac{r}{5}$ seen | |
| | (g) (i) | $(=)A4^3 - 0.1(* \text{ or } \times)A4^2$ | 1 | Condone the correct algebraic expression involving A4 | |

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|-------|---|-------|--|--|
| | (ii) | 12 nfwf with at least two correctly evaluated trials | 3 | M2 for two improving correctly evaluated trials or M1 for one correctly evaluated trial If MO then SC1 for answer of 12 without working | Trials must be between 10 and 20 |
| | (iii) | 40 | 1 | | |
| | (iv) | Correct 5 sheets | 2 | -1 for each error or omission or extra | |
| 7 | (a) | Correct layout of 12 panels showing overall dimensions or overall dimensions implied and gap dimensions from edge of roof eg 2 rows of 6 each panel $1.2 \leftrightarrow$ & $0.9 \updownarrow$ with horizontal gap total of 0.8 or vertical gap total 0.9 with all edge gaps ≥ 0.3 | 3 | B2 for correct layout of 12 panels showing a gap from each edge and a minimum of one panel dimension or total dimensions of block(s) of the 12 panels Or B1 for a layout of 12 panels that can physically fit on the roof with a gap from at least two adjacent sides If B0 then SC2 for correct layout of 13 or 14 panels with correct dimensions of panels and gaps shown Or SC1 for correct layout of 13 or 14 panels showing a gap from each edge and a minimum of one panel dimension or total dimensions of block(s) of the 13 or 14 panels | Allow layouts with gaps between panels with dimensions shown |
| | (b) | 10.5 hours or 630 minutes oe | 1 | | Do not accept a time such as 10:30 |

| Question | | Answer | Marks | Part Marks and Guidance | |
|----------|-----|--|-------|--|--|
| | (c) | Payback time is 20 years assuming that electricity costs (or other costs) do not change with suitable conclusion | 4-3 | Correct payback of 20 years with either assumption or conclusion or $8000 \div \textit{their} 400$ with assumption and conclusion | |
| | | Payback time correct (20 years) or $8000 \div \textit{their} 400$ with assumption or conclusion | 2-1 | 0.4×1000 oe or 400 or $8000 \div \textit{their} 400$ | |

APPENDIX 1

Exemplar responses for questions **1b(iv)**

| Response | Mark awarded |
|---|--------------|
| Yes because the more gunpowder the higher it goes (200g in 1b(iii)) | 0 |
| No the weight of gunpowder would be too big (6400g) | 0 |
| Yes because every weight of gunpowder doubles for the height (8g) | 1 |
| 1km = 1000m 500g = 1000m (155g) | 1 |
| Yes – to get to the height you would need 500g of gunpowder (396.8g) | 1 |
| Yes they can as we have more than 500g of gunpowder (6400g) | 2 |
| No it would only reach 300m (150g) | 2 |

Exemplar responses for questions **2b(iii)**

| Response | Mark awarded |
|---|--------------|
| He should pay the extra \$300 to ensure he gets crops | 0 |
| Take a chance on there being enough rain as the probability is 14/20 just like last season | 1 |
| He should not buy because there is a 70% chance it will rain which is 20% more than half so it should be fine | 1 |
| It's 1080 – 300 | 1 |
| Pay \$300 because he is going to make a profit of \$780 rather than maybe make none | 2 |
| He earns \$270 in one year (from 2b(ii)) so he would make a loss of \$30 so do not buy | 2 |
| He would gain \$780 and this is more than 0.6×1080 (0.6 in 2b(ii)) | 3 |
| $1080 = \text{all maize}$ $1080 - 300 = 780$ 1080×0.6 (from 2b(ii)) = 648 so he should pay the \$300 to ensure he gets \$132 more | 4 |

Exemplar responses for questions **5b(iii)**

| Response | Mark awarded |
|--|--------------|
| Larger diamonds are better because you can make many small ones from it | 0 |
| Small diamonds are worth £500 to £1000 whereas large ones are worth £2500 to £4000 | 1 |
| 1 large diamond would be around £4000 4 25g ones would be about $4 \times £400 = £1600$ so small is better | 2 |
| $100 = 4050$ $25 = 400 \times 4 = 1600$ Large | 3 |
| $100 \div 20 = 5$ $5 \times 250 = 1250$ (100g) 4050 (100g) Big diamond | 3 |

Exemplar responses for questions **5c**

| Response | Mark awarded |
|--|--------------|
| Diamond as it is 29100 whereas gold is only 400 | 0 |
| Diamond has gone up by 14050 and gold has gone up by 300 so diamond | 0 |
| Gold as increase has more than doubled since 1990 | 1 |
| $29100 \div 14050 = 2$ | 1 |
| Gold because it has gone from 100 to 400 whereas diamond has only slightly over doubled | 2 bod |
| Diamond £200 would become about £400 whereas gold same would be over £800 so choose gold | 2 |
| Diamond has gone up by 100% whereas gold has gone up by 300% so gold | 2 |

Exemplar responses for questions **7c**

| Response | Mark awarded |
|--|--------------------------------|
| No as we rarely get a decent summer | 0 |
| $8000 \div 1000 = 8$ so he will repay in 8 years so it is a good idea | 0 |
| 40% = 3200 It will take 2.5 years to repay all 8000 and from then on he will save 3200 every year | 1 (implied $8000 \div 3200$) |
| 40% = £400 but it's rarely summer | 1 |
| 40% = 400 $8000 \div 40 = 200$ so 200 days so yes he should buy | 1 |
| 20 years to pay back | 2 |
| £1000 40% = £400 $8000 \div 400 = 20$ so 20 years | 2 |
| It will take 20 years so he should buy the panels | 3 |
| 40% = £400 $£8000 \div 400 = 25$ years This is too long so he should not buy the panels | 3 |
| £400 $£8000 \div 400 = 20$ 20 years He should buy the panels especially because the price of electricity is likely to increase so he will save even more | 4 |

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