

**Applications of Mathematics (Pilot)**

General Certificate of Secondary Education

Unit **A382/01**: Foundation Tier

**Mark Scheme for November 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
<b>BOD</b>	Benefit of doubt
<b>FT</b>	Follow through
<b>ISW</b>	Ignore subsequent working (after correct answer obtained), provided method has been completed
<b>M0</b>	Method mark awarded 0
<b>M1</b>	Method mark awarded 1
<b>M2</b>	Method mark awarded 2
<b>A1</b>	Accuracy mark awarded 1
<b>B1</b>	Independent mark awarded 1
<b>B2</b>	Independent mark awarded 2
<b>MR</b>	Misread
<b>SC</b>	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.

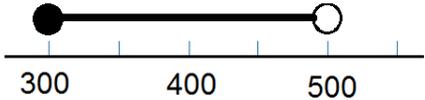
- **figs 237**, for example, means any answer with only these digits. You should ignore leading or trailing zeros and any decimal point eg 237000, 2.37, 2.370, 0.00237 would be acceptable but 23070 or 2374 would not.
- **isw** means **ignore subsequent working** after correct answer obtained and applies as a default.
- **nfw** 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.

## MARK SCHEME

Question			Answer	Marks	Part Marks and Guidance	
1	(a)	(i)	159	1		
		(ii)	11447 to 11448	3 FT	<b>M1</b> for $3 \times 4 \times 6$ or 72 <b>and</b> <b>M1</b> for <i>their</i> $72 \times \text{their } 1\text{a(i)}$	<b>FT</b> their <b>1a(i)</b>
	(b)	(i)	28	1		
		(ii)	2008 2011 2012	1	Three correct years only	
		(iii)	200	1		
	(c)	(i)	6	1		
		(ii)	10 : 100,000 is greater than 3 : 200,000 so breaking the law <b>oe</b>	2	<b>M1</b> for 100 000	
		(iii)	52 to 60	2	<b>M1</b> for evidence of square counting or answer of up to four squares outside range here.	
		(iv)	5200 to 6000	3 FT	<b>M2</b> for $1000 \times \text{their } 1\text{c(iii)} \times 0.1$ <b>oe</b> <b>or</b> <b>M1</b> for 0.1 seen in calculation	<b>FT</b> <i>their</i> <b>1c(iii)</b> for all marks
	(d)	(i)	2 000 000 <b>oe</b>	1		Allow standard form
		(ii)	3 <b>nfww</b>	3	<b>M2</b> for 2.2(...) <b>or</b> <b>M1</b> for <b>figs</b> $2 \div (75000 \times 12)$ or <b>figs</b> $2 = 75000 \times n \times 12$ or correctly evaluated trial $75000 \times n \times 12$ where $n$ is an integer and $1 < n < 20$	May be done in stages

Question		Answer	Marks	Part Marks and Guidance	
	(iii)		2	M1 for correct line segment but ends either not indicated or non-standard or wrong convention used	
	(iv)	$1 \leq n \leq 3$ and $1 \leq n < 4$ only	2	B1 for one or both correct with at most one error or omission	
(e)	(i)	60	1		
	(ii)	63 to 67	2	B1 for 100	
	(iii)	15	1		
	(iv)	2	1		
(f)	(i)	0.05	2	M1 for $\frac{2}{40}$ oe or better seen in working	
	(ii)*	“Best to invest in boom”; it will stop the “probability”/“expectation” of \$0.6 million damage clearly stated supported by working. Or full method shown for longer period of time, e.g. 20 or 40 years, with correct conclusion	3 FT	2 for sight of <i>their</i> $0.05 \times 12$ with correct conclusion or 0.6 and 0.4 with no or incorrect conclusion or correct values for longer period with incorrect conclusion <b>or</b> 1 for <i>their</i> $0.05 \times 12$ or one correct value for a longer period of time	FT <i>their</i> 1f(i) See appendix
(g)	(i)	(55.5 , 25.4)	1		

Question		Answer	Marks	Part Marks and Guidance	
	(ii)*	Straight line drawn between the two places and final cost of 144 to 156 million with no errors  Drawn and measured line or correct line and <i>their</i> distance $\times 10$	4 – 3  2-1	For lower mark cost of 144 to 156 million but no line in evidence or <i>their</i> distance $\times 10 \times 3$ with correct line  For lower mark just line drawn between two installations or 4.8 – 5.2 <b>seen</b>	Mark for intent at a straight line
	(iii)	125	2	<b>M1</b> for 60 – 65 <b>oe seen</b> in working	
(h)	(i)	Correctly drawn net	3	<b>M2</b> for 3 correctly sized rectangles added but incorrect net <b>or</b> <b>M1</b> for 2 correctly sized rectangles added	Mark for intent – accept some “wobble” in straight lines.
	(ii)	11 (cuboids)	4	<b>M1</b> for $3 \times 4 \times 8$ or 96 <b>seen</b> <b>and</b> <b>M1</b> for $1000 \div$ <i>their</i> $3 \times 4 \times 8$ <b>oe</b> <b>and</b> <b>B1</b> for <i>their</i> answer rounded up	Award 3 marks for 10.4(...) <b>seen</b>
	(iii)	D A E	2	<b>B1</b> for 2 correct	
	(i)	Position of Cronos correctly placed with lengths $\pm 0.2$ cm and evidence of arcs	3	<b>M2</b> for triangle drawn with two correct sides but no arcs or a reflection of correct triangle with arcs <b>or</b> <b>M1</b> for triangle drawn with just one correct side or reflection of correct triangle without arcs	AC = 8cm $\pm 0.2$ cm BC = 8cm $\pm 0.2$ cm

Question			Answer	Marks	Part Marks and Guidance	
2	(a)		280	3	<p><b>M2</b> for <math>0.5 \times (16 + 6 + 6) \times (8 + 6 + 6)</math></p> <p>or</p> <p><b>M1</b> for <math>16 + 6 + 6</math> and <math>8 + 6 + 6</math></p> <p>If <b>M0</b> scored allow</p> <p><b>SC1</b> for <math>0.5 \times \textit{their length} \times \textit{their width}</math></p> <p>E.g. 154 scores <b>SC1</b></p>	<p><math>0.5 \times 28 \times 20</math></p> <p>28 and 20</p> <p>For their length &amp; width allow 16, 22, 28 &amp; 8, 14, 20 respectively</p>
	(b)		Showing that $51^2 = 24^2 + 45^2$ by, for example, correct evaluation of value(s) E.g. $45^2 + 24^2 = 2601$ and $2601 = 51^2$ or $\sqrt{2601} = 51$	2	<p><b>M1</b> for clear use of Pythagoras, but insufficient detail</p> <p>E.g. <math>\sqrt{45^2 + 24^2} = 51</math> or <math>45^2 + 24^2 = 51^2</math> or <math>\sqrt{51^2 - 24^2} = 45</math></p>	
	(c)		8600	3	<p><b>M2</b> for 8620</p> <p>or</p> <p><b>M1</b> for <math>160 \times 15</math> or 2400 <b>seen</b></p> <p>If <b>M0</b> or <b>M1</b> then <b>SC1</b> for <i>their</i> total rounded to the nearest 100</p>	<p>May be in working or in table</p> <p>Allow <b>SC1</b> for 6200 otherwise their total must be seen and correctly rounded</p>
	(d)		Bank is cheaper by £33.18 or £33 or £30	3	<p><b>M1</b> for Bank: <math>12 \times 420 (=5040)</math> <b>seen</b> and</p> <p><b>M1</b> for Council: <math>6 \times 845[.53]</math> or 5073.18 or 5070 <b>seen</b></p>	<p><u>Alternative method for 2 marks</u></p> <p><math>420 \times 2 = 840</math></p> <p><math>845.53 - 840 = 5.53</math></p> <p>so Bank cheaper</p>
3	(a)	(i)	8	1		
		(ii)	75%	3 FT	<p><b>M2</b> for <math>\frac{24}{32}</math> or better <b>seen</b> in working</p> <p>or</p> <p><b>M1</b> for 24 or <math>32 - \textit{their 3a(i)}</math> <b>seen</b> in working</p>	<p><b>FT</b> <i>their 3a(ii)</i> for all marks</p>

Question		Answer	Marks	Part Marks and Guidance	
	(iii)	0 oe	1		
(b)	(i)	8.6	1		
	(ii)	Any general conclusion from table	1	1 for any one of: • teeth get worse as get older • sweet factory workers have worse teeth or other general comments Do not accept reference to specific cell numbers	Allow equivalent for better/worse e.g. smaller/greater DMFT  See appendix
	(iii)	Regular brushing Electrical factory worker	1 1		
	(iv)	Any general conclusion derived from the bar chart	1+1	1 for any (max. of 2) of: • regular brushing improves oral health of electrical factory workers more • brushing more helps oral health more • no brushing at all gives both poor oral health or other general comments – Do not accept reference to one column only	Allow equivalent for better/worse e.g. smaller/greater DMFT  See appendix
(c)	(i)	0 oe	1		
	(ii)	2.8	2	M1 for attempt at ordered list with no more than 3 errors	2.1 2.3 2.5 2.8 2.8 3.4 3.7 4.7 5.2

Question		Answer	Marks	Part Marks and Guidance	
	(iii)	3.14 or 3.1	3	<p><b>M1</b> for 31.4 or attempt to add the ten values and  <b>M1</b> for <i>their</i> total <math>\div</math> 10 <b>soi</b></p> <hr/> <p><b>SC2</b> for candidate has correct figures with full working for both median and mean but in the wrong order (but must obviously have scored zero for (ii) and (iii) so far).</p>	Minimum 8 values added
	(d)	1 for each correct general observation	3	<p><b>1</b> for each (max. of <b>3</b>); any of:</p> <ul style="list-style-type: none"> <li>Germany peaked then went down</li> <li>Poland decreased then went up then started to go down</li> <li>Poland has been greater than Germany for about the last 10 years</li> <li>In the early 80s they were close to each other</li> </ul>	<p>Allow equivalent for better/worse e.g. smaller/greater DMFT</p> <p>Do not accept comments about one year</p> <p>See appendix</p>
	(e) (i)	Point (0.5, 3.3) indicated	1		
	(ii)	<p>Little or no correlation (between number of dentists and dental health)</p> <p>Reason such as points are scattered or other valid reason e.g. no pattern</p>	<p>1</p> <p>1</p>		Accept reference to line of best fit
	(f) (i)	<p>May not use mouthwash</p> <p>Six months may not be long enough</p>	2	<p><b>B1</b> for any one correct that is not contradicted <u>and</u> is about either the mouthwash or the time frame</p> <p>Ignore extra that do not contradict or are irrelevant</p>	See appendix

Question		Answer	Marks	Part Marks and Guidance	
	(ii)	Any possibility that does not fit the given responses e.g. twice/month or three times/day	1		
	(iii)	At least 3 non-overlapping options with no gaps	1		e.g. Every day, Sometimes, Never

## APPENDIX

Exemplar responses for Q.1(f)(ii)

Response	Mark
$0.05 \times 12 = 0.6$ 0.6 is bigger than 0.4 so it is better to invest in boom	3
In 20 years expected loss = 12 million, Boom cost would be $20 \times 0.4 = 8$ million. So buying boom would be expected saving of 4 million – so buy boom	3
Over 40 years expect 2 spills so lose $2 \times 12 = 24$ million. Cost of boom would be $40 \times 0.4 = 16$ million. Buy boom because you would save 8 million.	3
$0.05 \times 12 = 0.6$ 0.6 is bigger than 0.4 so do not buy boom	2
If 0.5 in <b>1f(i)</b> then $0.5 \times 12 = 6$ million and no further work	1
Buy boom to avoid possible large losses	0
$12 \div 0.4 = 30$ so it will take 30 years to cover 12 million	0

Exemplar responses for Q.3(b)(ii)

Response	Mark
DFMT gets worse as people get older	1
DFMT is lower in the electrical factory	1
People over the age of 25 have high DFMT in the sweet factory	1
The average DFMT in both aged 35 to 44 were close	0

Exemplar responses for Q.3(b)(iv)

Response	Mark
Brushing your teeth is more important than where you work	2
Not only is DFMT higher in the sweet factory and regular brushing helps keep DFMT down	2
Overall the electrical workers have less DFMT	1
Regular and occasional brushing were lower DFMT in the electrical factory whereas no brushing had the same in both factories	1 BOD
No brushing is the same in both factories	0

Exemplar responses for Q.3(d)

Often answers included two or more of the following statements so their score will be cumulative

Response	Mark
Both countries have decreased their DFMT over the 20 year period	2
Germany decreased DFMT all the way through whereas Poland varies	2
Germany has decreased DFMT since 1987	1
Poland's DFMT has been fluctuating during these years	1
In the later years Poland had higher DFMT than Germany	1
From 1982 to 1989 Germany had worse DFMT	1
Germany had the highest DFMT in 1980	0
Germany had the biggest raneg of DFMT	0
Poland have increased DFMT since 1988	0

Exemplar responses for Q.3f (i)

Response	Mark awarded
Not specified how often to use mouthwash	1
Usual mouthwash may be different	1 BOD
May not always use it	1
May only use it once or twice	1
Could ask people to use it for longer	1
Some may have better teeth	0
Ask more people	0
Some may have better diets	0
Don't know what toothpaste they use	0

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