

# **Applications of Mathematics (Pilot)**

General Certificate of Secondary Education

Unit **A381/02**: Higher Tier

## **Mark Scheme for June 2012**

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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

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

If the answer space is blank but the correct answer is seen in the body allow full marks. Place the annotation ✓ next to the correct answer.

If the correct answer is seen in the working but a completely different answer is seen in the answer space, then accuracy marks for the answer are lost. Method marks would 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)	1.25[pm] or 13.25	1	Accept in words	Condone 35 minutes to 2 Ignore am
	(b)	2 (hours) 30 (minutes) <b>oe</b>	1 <b>FT</b>		10:35 implies 5h 20min
	(c)	54[.4]	3	<b>M2</b> for $136 \div 2.5$ or $136 \times 60 \div 150$ <b>or</b> <b>M1</b> for $136 \div$ <i>their</i> 2.5[0] or $136 \div$ 2h 30m	For <b>M2 FT</b> <i>their (b)</i> to 2 dp or better with working, otherwise <b>M1</b> only Condone 2.3[0] or 230 or 150 for <i>their</i> 2.5[0]
2	(a)	360, 75, 225, 225	2	<b>M1</b> for any one value from 360, 75 and 225 in correct position	
	(b) (i)	10	2	<b>M1</b> for 2.5 or $4 \times 600 \div 240$ or $600 \div 60$ or 1 portion = 60g	
	(ii)	875	2 <b>FT</b>	<b>M1</b> for 125 or <b>FT</b> <i>their (b)(i)</i> or $50 +$ <i>their</i> sugar for 6 <b>A1</b> 875 or <b>FT (b)(i)</b>	
3		-1.54	2	<b>B1</b> for -1.53[9...] or <i>their</i> pre-rounded answer rounded correctly to 2dp	
4	(a)	37.5p or [£]0.375 or 38p or [£]0.38	1	Accept 37p or £0.37 with working	Condone £0.375p but not 0.375p

Question		Answer	Marks	Part Marks and Guidance	
4	(b)	Small portion + evidence of two comparable prices or number of nuggets	2	<p><b>M1</b> for <math>2.20 \div 6 = 0.36[6\dots]</math> accept rounded or truncated to 2sf.</p> <p><b>or</b></p> <p><b>M1</b> for <math>6 \div 2.2 (= 2.7[27\dots])</math> <b>and</b> <math>10 \div 3.75 (= 2.6[66\dots])</math> with at least one evaluated. Accept rounded or truncated to 2 or more sf</p> <p><b>or</b></p> <p><b>M1</b> for <math>\frac{2.2(0)}{6} \times 10 = [3.67]</math></p> <p>or <math>\frac{3.75}{10} \times 6 = [2.25]</math></p>	<p>Small alone scores 0 Cost of one nugget</p> <p>Number of nuggets for £1 For 2 marks both must be evaluated to sufficient sf to make a valid comparison</p> <p>Cost of 10</p> <p>Cost of 6 Condone working in pence</p>
5	(a)	$\frac{3}{5}$ , $\frac{2}{3}$ , $\frac{7}{10}$ , $\frac{5}{6}$	3	<p><b>B2</b> for 3 in correct order or all four in correct reverse order</p> <p><b>or</b></p> <p><b>M1</b> for conversion to a common denominator with at least two numerators correct or attempt to convert to decimals with at least two correct, <math>\frac{2}{3}</math> and <math>\frac{5}{6}</math> may be rounded or truncated to two decimal places</p>	<p>eg <math>\frac{3}{5}</math> , <math>\frac{7}{10}</math> , <math>\frac{5}{6}</math> , <math>\frac{2}{3}</math></p> <p>Condone equivalent fractions</p>

Question		Answer	Marks	Part Marks and Guidance	
	(b)	Carol 5	2 FT	<b>FT</b> <i>their</i> largest fraction in (a) for 2 marks <b>M1</b> for $\frac{5}{6} \times 30$ or 25 or $\frac{1}{6} \times 30$ or 5 <b>or</b> <b>SC1</b> for correct use of one of the given fractions (other than the candidate's largest) to obtain number of sweets left	<b>FT and SC</b> Amir $\frac{2}{3}$ 10 Behnaz $\frac{3}{5}$ 12 Dafydd $\frac{7}{10}$ 9
	(c)	$\frac{2}{5}$	1		
<b>6</b>	(a)	$6x + 2$ or $2(3x + 1)$	2	<b>M1</b> for $2x + 3 + 3x - 5 + x + 4$ or $6x$ or 2	Condone $2(3x + 1)$ for 2 marks
	(b) (i)	Sides of 19, 19, 12 <b>and</b> 'two equal sides' or equivalent explicitly stated	2	<b>M1</b> for one side correctly evaluated <b>or</b> <b>M1</b> for $2x + 3 = 3x - 5$ solved to give $x = 8$	Condone $19 = 19$ (and 12) for two equal. Sides may be labelled on the given diagram.

Question	Answer	Marks	Part Marks and Guidance	
	(ii)* Another value of $x$ found with working shown and a third value of $x$ shown to give one 'side' with a negative value eg $3x - 5 = x + 4$ leading to $x = 4\frac{1}{2}$ <b>oe</b> All 3 sides found; 12, $8\frac{1}{2}$ , $8\frac{1}{2}$ $2x + 3 = x + 4$ leading to $x = 1$ One side would be -2, not possible	4	Accept negative for -2 throughout  Two values of $x$ found but sides only checked for one value  Two sides equated, solved and sides checked or other two sides equated, solved and sides checked or both pairs of sides equated and solved but sides not checked  One pair of sides equated and solved but not checked  <b>3:</b> $3x - 5 = x + 4$ leading to $x = 4\frac{1}{2}$ <b>oe</b> $2x + 3 = x + 4$ leading to $x = 1$ <b>and</b> All 3 sides found; 12, $8\frac{1}{2}$ , $8\frac{1}{2}$ or one side would be -2, not possible  <b>2:</b> $3x - 5 = x + 4$ leading to $x = 4\frac{1}{2}$ <b>oe</b> All 3 sides found; 12, $8\frac{1}{2}$ , $8\frac{1}{2}$ or $2x + 3 = x + 4$ leading to $x = 1$ One side would be -2, not possible or $3x - 5 = x + 4$ leading to $x = 4\frac{1}{2}$ <b>oe</b> $2x + 3 = x + 4$ leading to $x = 1$  <b>1:</b> $3x - 5 = x + 4$ leading to $x = 4\frac{1}{2}$ <b>oe</b> or $2x + 3 = x + 4$ leading to $x = 1$  If <b>0</b> then <b>SC1</b> for showing that $x = 1$ gives one side of -2, not possible	
7	$x + y = 20$ $4x + 2y = 58$  $2x + 2y = 40$ or $4x + 4y = 80$  $2x = 18$ or $2y = 22$ $x = 9$ and $y = 11$	B1  M1  M1  A1	Condone change of variable  Substitution method: <b>M1</b> for $x = 20 - y$ or $y = 20 - x$ substituted into second equation, condone 1 error  Condone reversed answers if correct working seen	

Question		Answer	Marks	Part Marks and Guidance	
8		135	3	<p><b>M2</b> for <math>45 \times 3</math> or <math>27 \times 5</math> or <math>3 \times 5 \times 9</math></p> <p><b>OR</b></p> <p><b>M1</b> for factors of 27, [1], 3, 9, [27] or multiples of 27, 54, 81, 108, 135 or prime factors 3 [x] 3 [x] 3</p> <p><b>and</b></p> <p><b>M1</b> for factors of 45, [1], 3, 5, 9, 15, [45] or multiples of 45, 90, 135 or prime factors 3 [x] 3 [x] 5</p> <p>If <b>0</b> scored then <b>SC1</b> for multiple of 135</p>	Condone errors beyond 135
9	(a)	Corresponding angles	1		Condone F angles
	(b)	<p><math>\angle BED = 45</math> and corresponding angles <math>\angle BDE = 60</math> and corresponding angles [Similar because] triangles have equal angles</p> <p><b>or</b></p> <p>any two of <math>\angle ADF = \angle DBE</math> (corresponding angles) <math>\angle BDE = \angle DAF</math> (corresponding angles) <math>\angle AFD = \angle BED</math> (both corresp. to <math>\angle ECF</math>) and triangles have equal angles</p>	2	<p>Accept alternatives provided reasons given at each step</p> <p><b>B1</b> for one pair of angles with reason or two pairs of angles (angles may appear on diagram)</p>	For 2 marks condone three pairs of angles matched but with reasons given for only two pairs and triangles have equal angles
	(c)	(D is the) midpoint (of AB) <b>oe</b>	1		

Question	Answer	Marks	Part Marks and Guidance
10	108	4	<p><b>M1</b> for <math>[1 - \frac{5}{6} =] \frac{1}{6}</math> and <math>[1 - \frac{2}{3} =] \frac{1}{3}</math></p> <p><b>M1</b> for <math>\frac{1}{6} \times \frac{1}{3}</math> or <math>\frac{1}{18}</math></p> <p><b>M1</b> for <math>18 \times 6</math> or <math>6 \div</math> <i>their</i> <math>\frac{1}{18}</math></p> <p><u>Alternative</u></p> <p><b>M1</b> for <math>\frac{5}{6} \times \frac{1}{3}</math> or <math>\frac{5}{18}</math></p> <p><b>M1</b> for good attempt at <math>\frac{2}{3} +</math> <i>their</i> <math>\frac{5}{18}</math></p> <p><b>M1</b> for <math>18 \times 6</math> or <math>6 \div</math> <i>their</i> <math>\frac{1}{18}</math></p> <p><u>Alternative</u></p> <p><b>M1</b> for <math>\frac{1}{6} \equiv 6</math> pages</p> <p><b>M1</b> for <math>[\frac{5}{6} \equiv] 5 \times 6 (= 30 \text{ pages})</math></p> <p><b>M1</b> for <math>3 \times</math> (<i>their</i> <math>30 + 6</math>)</p> <p>Fraction used for adverts</p> <p>Fraction not used for adverts Correct common denominator and at least 1 correct numerator</p> <p><u>Alternative</u></p> <p><b>M2</b> for <math>\frac{2x}{3} + \frac{5}{6} \cdot \frac{x}{3} + 6 = x</math></p> <p><b>and</b> <b>M1</b> for <math>12x + 5x + 6 \times 18 = 18x</math> or for 3 terms correct in either</p>
11	53p or £0.53 or 52p or £0.52	4	<p><b>B3</b> for 25.51 - 25.524</p> <p><b>or</b></p> <p><b>M2</b> for <math>\frac{24.99 \times 1.20}{1.175}</math> <b>oe</b></p> <p><b>or</b></p> <p><b>M1</b> for <math>\frac{24.99}{1.175}</math> or 21.26(...) or 21.27</p> <p><u>Alternative</u></p> <p><b>M3</b> for <math>\frac{24.99 \times 0.025}{1.175}</math> <b>oe</b></p>

Question		Answer	Marks	Part Marks and Guidance	
12	(a)	8.1 - 8.16 nfw	3	<p><b>M2</b> for <math>\sqrt[3]{\frac{1000}{400}}</math> or 1.35 – 1.36</p> <p>or <math>\sqrt[3]{\frac{400}{1000}}</math> or 0.736 – 0.737 or 0.74</p> <p>or <math>\sqrt[3]{540}</math></p> <p><b>or</b></p> <p><b>M1</b> for <math>\frac{400}{1000}</math> or 0.4 or <math>\frac{1000}{400}</math> or 2.5</p> <p>or <math>\left(\frac{x}{6}\right)^3 = \frac{1000}{400}</math> or its reciprocal</p> <p>or 400 : 1000 or 1000 : 400 or better</p>	<p><u>Alternative</u></p> <p><b>M3</b> for <math>400 \times \left(\frac{8.1}{6}\right)^3 = 984(. \dots)</math></p> <p><b>and</b> <math>400 \times \left(\frac{8.15}{6}\right)^3 = 1002(. \dots)</math></p> <p><b>or</b></p> <p><b>M2</b> for <math>\left(\frac{8.1}{6}\right)^3</math> or <math>\left(\frac{6}{8.1}\right)^3</math></p> <p><b>or</b></p> <p><b>M1</b> for <math>\frac{8.1}{6}</math> or <math>\frac{6}{8.1}</math></p>
	(b)	14.19 - 14.30	2	<p><b>M1</b> for <math>19.3 \times \sqrt[3]{\frac{400}{1000}}</math> <b>oe</b></p> <p>or for <math>19.3 \div \sqrt[3]{\frac{1000}{400}}</math> <b>oe</b></p>	<p><u>Alternative</u></p> <p><b>M1</b> for <math>\frac{6 \times 19.3}{8.1 \text{ to } 8.16}</math></p>

Question		Answer	Marks	Part Marks and Guidance	
13	(a)	$E = 16v^2$ or $E = 16 \times v^2$	3	<b>M2</b> for $K = 16$ <b>or</b> <b>M1</b> for $E = kv^2$	If no incorrect working in <b>(a)</b> and $E = 16v^2$ seen in <b>(b)</b> award 3 marks in <b>(a)</b>
	(b)	75 <b>nfww</b>	3	<b>M2</b> for 25% or $\frac{1}{4}$ <b>or</b> <b>M1</b> for $\left(\frac{1}{2}\right)^2$ <b>seen</b>	<u>Alternative</u> <b>M2</b> for $\frac{100}{400}$ <b>oe</b> <b>or</b> <b>M1</b> for $k \times 2.5^2$ to find energy (= 100)

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