

**Methods in Mathematics (Pilot)**

General Certificate of Secondary Education

Unit **B392/02**: Higher Tier

**Mark Scheme for June 2011**

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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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**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 **MO 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  $180 \times (\textit{their '37' + 16})$ , 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.
  - **cao** means **correct answer only**.
  - **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.

## MARK SCHEME

Question		Answer	Marks	Part marks and guidance	
1	(a)	6.71	2	M1 for 6.70[8203 932.... ] or for $\sqrt{45}$ seen  SC1 for wrong answer rounded correctly to 3sf (but must come from answer with >3sf)	
	(b)	0.7143	2	M1 for 0.714[285 714 ...] or for 60 or 84 seen	
2		7	2	M1 for $x - 4 = 3$ or for $2x - 8 = 6$	Allow embedded in answer if not contradicted
3	(a)	36 cm <sup>3</sup>	4	B3 for 36 B1 for cm <sup>3</sup>  M2 for $(2 \times 2 \times 5) + (4 \times 2 \times 2)$ <b>soi</b> or $(2 \times 2 \times 6) + (2 \times 2 \times 3)$ <b>soi</b> or $(6 \times 5 \times 2) - (3 \times 4 \times 2)$ <b>soi</b> or M1 for splitting shape into 2 cuboids with either horizontal division with 4 marked on vertical edge or vertical division with 3 marked on horizontal edge	20 + 16 24 + 12 60 – 24  4 may be evidenced by $2 \times 2 \times 4$ ( $2 \times 2 \times 4$ alone scores M0) 3 may be evidenced by $2 \times 2 \times 3$ ( $2 \times 2 \times 3$ alone scores M0)
	(b)	179.5[9...] [cm <sup>3</sup> ] (179.5 or 179.6 or 180)	2	M1 for $\frac{4}{3}\pi \times 3.5^3$	Do not penalise missing or incorrect units

Question		Answer	Marks	Part marks and guidance		
4		$\frac{3}{20}$ , 0.15 $\frac{3}{8}$ , 37.5% $0.1\dot{6}$ , 16.6%	4	<b>B4</b> for all correct <b>or</b> <b>B3</b> for 4 or 5 correct <b>or</b> <b>B2</b> for 3 correct <b>or</b> <b>B1</b> for 1 or 2 correct  Accept: 0.166, 16.6% 0.167, 16.7%	Allow 0.1666... for recurring	
5	(a)	(i)	108	2	<b>M1</b> for [ext angle =] $360/5$ or $72$ soi or [sum of interior angles =] $3 \times 180$ or $540$	Allow: $6 \times 90$ from $(2n - 4)$ right angles for M1
		(ii)	Explanation: eg $3 \times 108^\circ < 360^\circ$ or $4 \times 108^\circ > 360^\circ$ or 108 does not go into 360 oe or a correct labelled diagram showing 108, 108, 108 and 36	2	<b>B1</b> for 3 angles at a point $< 360$ or for 4 angles round a point $> 360$ or for <i>their (i)</i> does not go into 360 <b>or</b> <b>M1</b> for unlabelled diagram showing an attempt at 3 pentagons plus a "gap"	Max B1 if angle not $108^\circ$ (Any explanation without numbers will score a maximum of 1 mark)
	(b)	(i)	Explanation: eg six of angle D fit round a point so each must be $360 \div 6 [=60^\circ]$	1	Allow clear annotation on diagram as explanation	Condone use of "circle" for point Do not allow explanation stating equilateral triangle unless with a correct explanation
		(ii)	$120^\circ$	1	Condone omission of degree symbol	

Question		Answer	Marks	Part marks and guidance	
	(iii)*	Clear identification and explanation of which sides are equal: ED = DC because pentagon is symmetrical AE = BC because pentagon is symmetrical AE = AB because they meet in the tessellation BC = AB because they meet in the tessellation	3	2 All correct statements with some reasons missing or two correct statements with reasons or 1 One correct statement with reason or at least two statements with no reason	NB AE = AB and BC = AB and AE = BC may be combined (eg AE = AB = BC)  (ignore additional incorrect work or incorrect reason)
6		8.48 to 8.49 or 8.5	3	M2 for $\sqrt{72}$ OR $\sqrt{9^2 - 3^2}$ or 8.4(...) or M1 for a Pythagoras statement  SC1 for $\sqrt{9^2 + 3^2}$ soi by eg $\sqrt{90}$ or 9.4 to 9.5	eg $3^2 + AC^2 = 9^2$  Allow M2 for 8.4(...) from scale drawing
7		£42	2	M1 for finding one part (£14) or $28 \times 1.5$ oe seen	
8		101	3	M2 for $2n + 1$ or add on $2 \times 47$ or $50 + 51$ or M1 for tabulation of term and number of sticks or "goes up by 2" or $n^{\text{th}}$ term = $2n + c$	
9	(a)	2, 0, 2, 6	2	B2 all values correct or B1 2 values correct	

Question		Answer	Marks	Part marks and guidance	
(b)			2	<p><b>B1</b> for at least four of <i>their</i> points correctly plotted</p> <p><b>B1</b> smooth curve through correct points, below x- axis at vertex</p>	<p>Tolerance = ±1mm (½ square)</p> <p>Tolerance = ±2mm (1 square) (Condone one occurrence of multiple lines)</p>
(c)		-2.8, 1.8 (both ± 0.1)	2	<p><b>B1, B1</b> (or <b>FT</b> <i>their</i> curve)</p> <p>If 0 scored, <b>M1</b> evidence of reading from <math>y = 5</math></p>	Accept any answers given as part of a co-ordinate
10	(a)	Explanation eg there should be 4 dp in the answer or the answer should be smaller than 0.41 (or 0.21) or because $0.4 \times 0.2 = 0.08$	1	Clear sensible reason ( <b>not</b> just giving the actual answer with no working or explanation)	Condone: Multiplying two decimals means a smaller number oe
	(b)	Explanation eg The answer should be bigger than 1 because $\frac{2}{3}$ is bigger than $\frac{1}{2}$ or the answer should be bigger than $\frac{2}{3}$ but $\frac{3}{5}$ is smaller than $\frac{2}{3}$	1		Exemplars for 1 mark <ul style="list-style-type: none"> <li>• “you don’t add fractions by adding tops and bottoms”</li> <li>• “you don’t add the denominators”</li> <li>• “you have to find a common denominator first”</li> <li>• <math>\frac{2}{3}</math> is larger than <math>\frac{3}{5}</math></li> <li>• <math>\frac{2}{3} + \frac{1}{2}</math> is obviously <math>&gt; 1</math></li> </ul>

Question		Answer	Marks	Part marks and guidance					
11	(a)	7	2	M1 for correct pairs of numbers from any "window" multiplied eg $11 \times 17 - 10 \times 18$					
	(b)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td><math>e+1</math></td> </tr> <tr> <td><math>e+7</math></td> <td><math>e+8</math></td> </tr> </table>		$e+1$	$e+7$	$e+8$	2	B2 for all correct or B1 for 1 or 2 correct	
	$e+1$								
$e+7$	$e+8$								
	(c)	<p><i>Their</i> <math>(e+7)(e+1)</math> <b>and</b> <i>their</i> <math>e(e+8)</math>            Correctly expands their double brackets            Correctly expands their other bracket(s) with 2 terms in at least one bracket  <math>e^2 + 8e + 7 - (e^2 + 8e) = 7</math> oe</p>	<p>1 1 1 1</p>	<p>eg <math>e^2 + 7e + 1e + 7</math>            eg <math>e^2 + 8e</math></p>	<p>Condone missing brackets</p> <p><math>e^2 + 8e + 7 - e^2 - 8e = 7</math> seen nfw            gets B4</p>				
12	(a)	$[y =]x^3 - 3x + 5$	1	If answers not seen in answer spaces, look for (a) (b) (c) written next to correct equations in equation box – allow any clear indication of matching graph to correct equation					
	(b)	$[y =]4 - x^2$	1						
	(c)	$[y =]\sin x$	1						
13	(a)	125	2	M1 for $100/0.8$ or $100 = 80\%$ or $0.8x = 100$ oe eg $100 \times 1.25$					

Question		Answer	Marks	Part marks and guidance	
	(b)	66.7% or $66\frac{2}{3}\%$ or 67%	3	M2 for eg choosing a price, finding special offer price and attempt to find % increase from offer price to normal price or [y=] 1.667 or 1/0.6 or 1.666666.. seen or M1 for “multiply by 0.6” oe seen or choosing a price and finding special offer price or for figs 166 seen	
14	(a)	1280	4	M3 for $y = 2.5x^3$ or $2.5 \times 8^3$ or M2 for $k = 2.5$ or M1 for $y = kx^3$	Alternative method: M3 for $512 \times 2.5$ or M2 for [multiplier] 2.5 or M1 for $2 \Rightarrow 8$ and $8 \Rightarrow 512$
	(b)	7.36(8....) or 7.4 or 7.37	2	M1 for $1000 = 2.5x^3$ oe eg $x^3 = 400$	Allow <i>their</i> k for M1
15	(a)	$\frac{\pi}{2}$	3	M2 area of circle $\pi \times 1 \times 1$ or area semicircle in decimal form or M1 for finding AC 2cm or radius of semicircle 1cm or area of circle in decimal form	

Question	Answer	Marks	Part marks and guidance
(b)*	<p>Fully correct and clear working showing that shaded area is <math>\frac{1}{4}</math> of the circle</p> <p>e.g.            Whole circle has area <math>16\pi \text{ cm}^2</math>            BC = 6 cm            Radius of semicircle with diameter BC = 3 cm            Semicircle with diameter BC has area <math>\frac{9\pi}{2} \text{ cm}^2</math></p> <p>Lower shaded area is <math>\left(8\pi - \frac{9\pi}{2}\right)</math></p> <p>Total shaded area is <math>\frac{\pi}{2}</math>  <math>+ \left(8\pi - \frac{9\pi}{2}\right) = 4\pi</math></p> <p>So shaded area is <math>\frac{1}{4}</math> of the circle.</p>	5	<p><b>4</b> Areas worked out clearly but may be as decimals rather than in terms of <math>\pi</math> and/or final step showing that the shaded area is <math>\frac{1}{4}</math> of the circle omitted</p> <p><b>or</b></p> <p><b>3</b> The lower shaded area worked out with a clear and unambiguous method (to reach <math>3.5\pi</math> or 10.99 to 11) or a complete method for the whole shaded area with errors</p> <p><b>or</b></p> <p><b>2</b> The area of semicircle, with diameter BC, worked out with a clear and unambiguous method (to reach <math>4.5\pi</math> or 14.1(...)) or lower shaded area found without sufficient supporting evidence</p> <p><b>or</b></p> <p><b>1</b> Working out area of whole circle or length BC or radius of relevant semicircle (with diameter BC). or area of semi-circle, with diameter BC, found without sufficient supporting evidence or complete strategy stated eg "shaded semi-circle (diam AC) + big semi-circle (diam AB) – unshaded semi-circle (diam BC)"</p> <p>Allow maximum of 3 marks if method is correct but diameter is consistently used in place of radius</p> <p>Allow maximum of 2 marks if method is correct but <math>\pi d</math> is used consistently in place of <math>\pi r^2</math></p>
(c)	1 : 3	1	Accept 4 : 12 or $4\pi : 12\pi$

Question		Answer	Marks	Part marks and guidance	
16		10.6 (or better)	5	<b>B1</b> one angle of triangle <b>B1</b> second angle of triangle then <b>M2</b> for $BC = \frac{6.8 \sin 47}{\sin 28}$ oe or <b>M1</b> for $\frac{6.8}{\sin 28} = \frac{BC}{\sin 47}$ oe	A = 47°, B = 105°, C = 28°  Using their marked angles
17	(a)	$[b =] \frac{2T}{h} - a$ oe	3	<b>M2</b> for $\frac{2T}{h} = a + b$ or $hb = 2T - \left(\frac{ha}{2}\right)$ or <b>M1</b> for $2T = h(a + b)$ or $\frac{hb}{2} = T - \frac{ha}{2}$  <b>SC2</b> for formula correctly rearranged to make <i>a</i> the subject	
	(b) (i)	$(x + 2)(x - 1)$	2	<b>M1</b> Factors using integers, excluding 0, giving two terms correct when expanded or $(x \pm 2)(x \pm 1)$	
	(ii)	$\frac{x - 1}{x - 2}$	2	<b>M1</b> Factors for denominator using integers, excluding 0, giving two terms correct when expanded or $(x \pm 2)(x \pm 2)$	
18		$\frac{13}{99}$	2	<b>M1</b> for [100x =] 13.13[131313....]	Note: it is possible to get full marks by doing this on the calculator.

Question		Answer	Marks	Part marks and guidance
19		$\frac{1}{2}$ oe	4	<p><b>M1</b> for <math>4x^2 - 3x + 1 = x</math></p> <p><b>M1</b> for <math>4x^2 - 4x + 1 = 0</math></p> <p><b>M1</b> for <math>(2x - 1)^2 = 0</math> or <math>\frac{4 \pm \sqrt{(16-16)}}{8}</math></p> <p>correct equation in x getting all terms to 1 side factorise (or use formula)</p> <p>Use of diagram/graph leading to correct answer scores 4 marks</p> <p>Condone <math>\frac{1}{2}</math> as part of a co-ordinate eg (<math>\frac{1}{2}</math>, <math>\frac{1}{2}</math>)</p>

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