

GCSE

Applications of Mathematics (Pilot)

Unit **A382/02**: Higher Tier

General Certificate of Secondary Education

Mark Scheme for June 2017

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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

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.
- 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.
- 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 $180 \times (\textit{their} \text{'37'} + 16)$, or FT $300 - \sqrt{(\textit{their} \text{'5}^2 + 7^2)}$. 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/Indicative Content	Marks	Guidance	
					Content	Levels of response
1	a		3375	3	M2 for 15^3 M1 for 15	
	b		22.5	3	M2 for $15^2 \div (40 \div 4)$ oe Or M1 for $15^2 \div 40$ or $15^2 \times 4$	$15^2 \times 4 \div 40$
2	a	i	All plots correct $\pm\frac{1}{2}$ small square	2	M1 for at least 2 plots correct $\pm\frac{1}{2}$ small square	
		ii	Annual rail cost not dependent on travel time oe	1		
	b*	i	Total frequency 220 with highest frequency in 40 – 45 class & full correct method using mid-points shown for mean with answer > 45 Two errors in total for total frequency 220, highest frequency in 40 – 45 class & method for mean with answer > 45, but Any two of: total 220, highest frequency in 40 – 45 class, mid-points shown, one correct calculation midpoint x frequency, sum frequency x value in class interval	6 – 5 4 – 3 2 – 1	For lower mark, one error in total or mode or one error in method for mean For lower mark any three of total 220, highest frequency in 40 – 45 class, mid-points shown, one correct calculation midpoint x frequency, sum frequency x value in class interval For lower mark either total 220 or highest frequency in 40 – 45 class or all mid-points shown or one correct calculation midpoint x frequency	For mean use 220 or their total – if their total other than 220 this counts as one error Allow any value within class interval, including both bounds, other than midpoint to count as error only once Midpoints 42.5, 47.5, 52.5, 57.5

3	a*	<p>Assumptions re time at school & time awake stated & used to calculate proportions compared with proportion of accidents calculated using values read from graph with decision Hareen correct that follows their work & Emily incorrect with correct reasoning</p> <p>Correct conclusion for Hareen with at least one assumption stated & calculations shown. May or may not have conclusion for Emily</p> <p>One correct assumption & one relevant reading from bar chart or one correct assumption leading to stated correct conclusion or one relevant reading leading to stated correct conclusion</p>	5	<p>4 – 3 For lower mark no or incorrect conclusion(s) with assumption(s) stated & some calculations working towards comparison with method shown.</p> <p>2 – 1 For lower mark one correct assumption or one relevant reading from bar chart or conclusion Emily incorrect</p>	<p>Treat use of incorrect age group as MR</p> <p>Look for figures on bar chart</p> <p>From bar chart age 10 -14 School injuries 55 – 62 Total injuries 158 – 160</p> <p>Assumptions Time at school 6 – 9 hours Time awake 14 – 18 hours</p> <p>Comparison eg $56/159 < 7/15$</p> <p>Eg Emily incorrect as spend more time at school than anywhere else</p>
	b	i	3	<p>M2 for two –way table with four correct age groups defined & six correct places defined</p> <p>Or M1 for two-way table with either four correct age groups or six correct places or both age groups & places labelled</p> <p>If M0 then SC1 for frequency table with 24 correct unique spaces</p>	<p>For M2, allow at up to two errors or omissions if either label age groups or places given</p>
		ii	1	<p>If 0 then SC1 for 8 in unique space for age 5-9 & sports provided SC1 awarded in (b) (i)</p>	<p>Allow '8' as tally marks or number</p>

	c	Road Public Sports School	3	B2 for two or three correct B1 for one correct	
4	a	25 as 5 rows of 5 with full supporting calculations	4	<p>M3 for $(4.5 \times 5) + (0.3 \times 10)$ or 25.5 & $(3.5 \times 5) + (0.3 \times 10)$ or 20.5 or $26.4 \div 5.1$ or 5.176... & $21.2 \div 4.1$ or 5.170...</p> <p>Or M2 for $(4.5 \times 5) + (0.3 \times 10)$ or 25.5 or $(4.5 \times 4) + (0.3 \times 8)$ or 20.4 or $(3.5 \times 5) + (0.3 \times 10)$ or 20.5 or $(3.5 \times 6) + (0.3 \times 12)$ or 24.6 or $26.4 \div 5.1$ or 5.176... or $21.2 \div 4.1$ or 5.170...</p> <p>Or M1 for any calculation to find number of photos to fit in a row with error in including gap calculation</p> <p>If M0 then SC1 for 25 as 5 rows of 5</p>	Allow for all M marks consistent working with 3mm gaps between each photo ie $(4.5 \times 5) + (0.3 \times 6) [= 24.3]$ & $(3.5 \times 5) + (0.3 \times 6) [= 19.3]$
	b	Design shown that fits & includes at least one of each of the three sizes with at least two of one size with dimensions for photos & gaps given	4	<p>M3 for design shown that fits & includes at least one of each of the three sizes with at least two of one size with some dimensions for photos & gaps given</p> <p>Or M2 for design shown that fits & includes at least one of each of the three sizes with at least two of one size with no dimensions for photos or gaps given</p> <p>Or M1 for design shown that fits & includes at least one of each of the three sizes</p>	

5	a		Open three days each week oe	1		
	b	i	270	2	M1 for $(440 + 200 + 170) \div 3$ or $265 + ((170 - 155) \div 3)$ or $260 + ((440 - 410) \div 3)$	
		ii	Fully correct $\pm\frac{1}{2}$ small square	3	M2 for all points correct, trend line missing or incorrect Or trend line and at least 5 points correct $\pm\frac{1}{2}$ small square Or M1 for trend line correct or at least 5 points correct $\pm\frac{1}{2}$ small square	
		iii	Numbers consistent across four weeks	1		
6	a		27573.15	5	M4 for $28200 + (0.015 \times 28200) - (0.09 \times (29000 - 17335))$ Or M3 for $0.09 \times (29000 - 17335)$ and 0.015×28200 Or M2 for $0.09 \times (29000 - 17335)$ or 0.015×28200 & either 0.09×29000 or 0.09×17335 Or M1 for 0.015×28200 or 0.09×29000 or 0.09×17335	May be done in stages Accept numerically correct values not given correctly in £/pence $0.015 \times 28200 = 423$ $0.09 \times (29000 - 17335) = 1049.85$ $0.09 \times 29000 = 2610$ $0.09 \times 17335 = 1560.15$ $29000 - 17335 = 11665$

	b		$0.09 \times (29000 - 17335) \times 25$ 26246.25 < 28200 Or $0.09 \times (29000 - 17335) \times 24$ 25196.4[0] < 27573.15	M1 A1 B1 OR M1 A1 B1	For M mark allow <i>their</i> values from (a) & 25 or 24 years For B mark allow <i>their</i> answer compared with 28200 or <i>their</i> (a) Allow also if assumption of compound interest or simple interest & correct working seen & comparison made
7	a		$[\sqrt{20} =] \sqrt{(2^2 + 4^2)}$ $[\sqrt{5} =] \sqrt{(1^2 + 2^2)}$	2	M1 for $[20 =] 2^2 + 4^2$ or $[5 =] 1^2 + 2^2$
	b		$23 \div 5$ or $[\sqrt{20} = \sqrt{(4 \times 5)} =] 2 \times \sqrt{5} = 2 \times 2.3$	2	M1 for $22 \div 5$ or $\sqrt{2^2 + 4^2} \div 5$ or $2 \times \sqrt{5} = 2 \times 2.3$
8	a		Smallest 5.01×10^7 Largest 1.659×10^8	2 2	M1 for $1.08 \times 10^8 - 5.79 \times 10^7$ or figs 501 M1 for $1.08 \times 10^8 + 5.79 \times 10^7$ or figs 1659 If M1 & M1 only also SC1 for answers reversed
	b	i	As distance from sun increases orbit time increases [at an increasing rate] oe	1	
		ii	2000	1	

9	a	$s \geq 5$ $s + f \leq 18$ $2 \leq f \leq 8$	B1 B1 B2	B1 for $f \geq 2$ or $f \leq 8$	
	b	Fully correct all lines and shading	4	M3 for 3 lines with correct shading or all lines with no / incorrect shading Or M2 for 2 lines with correct shading or 3 lines with no / incorrect shading Or M1 for 1 line with correct shading or 2 lines with no / incorrect shading	
	c	147 8 coaching & 10 supermarket	3	M2 for $8 \times 9 + 10 \times 7.5$ or 8 coaching & 10 supermarket with no or incorrect total Or M1 for calculation $9 \times f + 7.5 \times s$ seen where f & s both satisfy correct inequalities	
10		24.06 or 25 with correct working shown	5	M3 for $\sqrt{29.5 \times 2 \times 9.815}$ or 24[.064 ..] Or M2 for $\sqrt{\text{value above } 29 \text{ \& } \leq 29.5 \times 2 \times \text{value above } 9.8 \text{ \& } \leq 9.815}$ Or M1 for value above 29 & $\leq 29.5 \times 2 \times$ value above 9.8 & ≤ 9.815 AND B1 for 29.5 or 9.815 stated	
11	a	6 complete hoops & 2 part hoops	2	M1 for either correct	

	b	167.1[2] Allow 167 with working shown	3	M2 for $\frac{1}{2} \times \pi \times 30 + 2 \times 60$ Or M1 for $\frac{1}{2} \times \pi \times 30$ oe	47[.12...] + 120 47[.1...]
	c	$\cos x = 5/15$ $\cos^{-1}(5/15)$ [=70.5[28...] or 109.47...] 18.46 to 18.5 and 28.66 to 28.7	B1 B1 3	M2 for 18.46 to 18.5 or 28.66 to 28.7 Or M1 for <i>their</i> angle / $360 \times \pi \times 30$ provided <i>their</i> angle < 180 & $\neq 30, 45, 60, 90, 135, 120, 150$ If M1 then also SC1 for two answers that sum to 47.[12]	
12		1.25 litres oe	4	M2 for 2.25 [- 1] Or M1 for 1.5 x 1.5 AND B1 for have $b : y = 1.5 : 1$ or want $b : y = 1 : 1.5$	

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