GCSE

Applications of Mathematics (Pilot)

Unit **A382/01:** Applications of Mathematics (Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for November 2015

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 <u>using a correct method</u> and are not lost for purely numerical errors.
   A marks are for an <u>accurate</u> answer and depend on preceding **M** (method) marks. Therefore **M0 A1** cannot be awarded.
   B marks are <u>independent</u> of **M** (method) marks and are for a correct final answer, a partially correct answer, or a correct intermediate stage.
   SC marks are for <u>special cases</u> 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 <u>not from wrong working</u> **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 × (*their* '37' + 16), or FT 300 – √(*their* '5^2 + 7^2'). Answers to part questions which are being followed through are indicated by eg FT 3 × *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	Guidance	
1	(a)			B2	**B1** for 2 correct in correct position	
	(b)	(i)	12.6	2	**M1** for figs 9 x figs 4 x figs 35 or figs 126 as answer	
		(ii)	27.5	2	**M1** for 14 for first part or 13.5 for second part	
	(c)			B4	**B1** for each box correctly filled up to 4 marks	
	(d)	(i)	=B3+200*C3 oe	2	**M1** for B3 correct or 200 **and** C3 correct	
		(ii)	Set up costs are fixed oe or set up costs are shared between more PCBs oe	1	e.g. because you are paying the same set up cost to manufacture many more PCBs	Must make reference to set-up costs

Question			Answer	Marks	Guidance	
2	(a)		Three correctly labelled sectors 	3	**M2** for 3 correct size sectors but no or incorrect labelling or only two correctly labelled sectors. **or** **M1** for 1 labelled correct size sector	Order of sectors does not matter. Must be their sectors.
	(b)		Password **and** 123456	1	Need both, in either order	
	(c)	(i)	10	2	**M1** for 600 or 600 000 ÷ 1000 or 600 000 ÷ 60 000	
		(ii)	166 to 167 hours	2	**M1** for 600 000 ÷ 60 or 10 000 seen or *their* '10 000' ÷ 60	Maybe seen as ÷ 3600
		(iii)	$\dfrac{1}{600\,000}$	2	**M1** for correct numerator or denominator isw or **SC1** for 0.0000016 to 0.0000017	Must be seen as a fraction for two marks
	(d)	(i)	3	1		
		(ii)	15	1		
		(iii)	21	1		
	(e)		456 976	2	**M1** for division of any two consecutive terms or 17576 x 26 or 11881376 ÷ 26	

Question			Answer	Marks	Guidance	
	(f)	**(i)**	$52^2 = 2704$ oe	**1**	e.g. 52 x 52 = 2704	Need both 52^2 and 2704
		(ii)*	At least one correctly evaluated trial with clear indication of "5 letters" as the final answer.	**3**	**M2** for answer given as "5 letters" but no clear attempt to list trials logically or lucky hit on "5" or two correctly evaluated trials with incorrect or no value chosen **or** **M1** for one correctly evaluated trial	<table><tr><td>n</td><td>52^n</td></tr><tr><td>2</td><td>2 704</td></tr><tr><td>3</td><td>140 608</td></tr><tr><td>4</td><td>7 311 616</td></tr><tr><td>5</td><td>380 204 032</td></tr><tr><td>6</td><td>19 770 609 664</td></tr></table> Accept integer trials only
	(g)	**(i)**	10 000	**1**		
		(ii)	365 to 366	**1**		
		(iii)	3333.3... or 3333 or 3334	**M1**	*their* 10 000 ÷ 3 or *their* 365 to 366 x 3	Maybe done by dividing *their* 10 000 by *their* 365 to 366 and saying it is not 3 to score M1 and M1
			3333 is greater than 365 soi	**M1**	Comparison with either *their* 10 000 or *their* 365 to 366	
			Shu is wrong oe	**A1**	Correct conclusion for Shu FT *their* values	FT *their* number of 4-digit PINS and *their* number of 'birthday numbers'
3	**(a)**	**(i)**	Kia (Rio) or £9395 or Rio	**1**		
		(ii)	Best fuel economy is Peugeot or 91.1	**B1**	or VW Golf or £22 000 as the most expensive	Mark which methods to the benefit of candidates. . Candidates may mix both methods
			Best CO_2 is Peugeot or Skoda or 82	**B1**	state it is not the best fuel economy	
			It is not the most expensive at 18570	**B1**	nor the lowest CO_2 If B0 then SC1 for all three correct names or numbers	

Question			Answer	Marks	Guidance	
	(b)*		18.75 [>15] with full correct working shown	**4 – 3**	For lower mark 18.75 with no or incomplete working Or calculation(s) of average speed using all 7 lap times may have errors Or at least three average speeds, for individual lap times which account for time conversion	NB working with just the median can score max 2 marks for $1.5 \div (4.6 \div 60) = 19.565\ldots$ Allow rot for individual speeds, 20, 30, 14.2…, 15.7…, 17.6…, 20.45…, 19.56…
			Two calculations involving 7 laps and either total distance or time conversion to be the same eg 7 x 1.5 and $(4.5+3+5.8+6.3+5.1+4.4+4.6)\div60$ or $1.5/(4.5+3+5.8+6.3+5.1+4.4+4.6)\div7$ or $(4.5+3+5.8+6.3+5.1+4.4+4.6)\div7\div60$ Or average speed found for one of the lap times which account for time conversion	**2 – 1**	For lower mark one calculation of average speed, may or may not account for time conversion Or calculation involving all 7 laps eg 7 x 1.5 or $(4.5+3+6.3+5.7+5.1+4.4+4.6)\div7$ or $(4.5+3+6.3+5.7+5.1+4.4+4.6)\div60$ or median, 4.6, explicitly stated	Eg $1.5 \div 4.6 = 0.326..$ [miles/min] $7 \times 1.5 = 10.5$ $33.6 \div 7 = 4.8$ $33.6 \div 60 = 0.56$
	(c)	**(i)**	Choy	**1**		Allow 5300 for 1 mark
		(ii)	The slower the average speed the better the fuel economy oe The faster you drive the more fuel is used The higher the speed the lower the fuel economy oe	**1**		Allow inverse proportion or negative correlation Do not allow The higher your speed the less fuel you would use oe
4	**(a)**		24	**1**		
	(b)		10 by 15 by 20	**2**	**M1** for any two correct values or 2 x 3 x 4	Lengths can be in any order

Question			Answer	Marks	Guidance	
	(c)		5 x 5 x 120 or 5 x 10 x 60 or 5 x 15 x 40 or 10 x 10 x 30 or 5 x 20 x 30	2	**M1** for cuboid using 24 bricks such as 1 x 1 x 24 1 x 2 x 12 1 x 3 x 8 2 x 2 x 6 1 x 1 x 24	Lengths can be in any order but do not accept 10 by 15 by 20 nor 2 x 3 x 4 as they were previous answers
	(d)		144 or *their* 24 x 6 correct	2FT	**FT** *their* 4(a) x 6 or **M1** for *their* 4(a) x 3 If **M0** then **SC1** for 6 x 3 (=18)	
	(e)		 D E B	3	**B1** for each correct	
	(f)	**(i)**	$\dfrac{2}{9}$ oe	2	**M1** for correct numerator or denominator If **M0** allow **SC1** for 0.222(…) or 22.2(…) %	Answer must be a fraction for two marks
		(ii)	Would expect about 4 times or $\dfrac{2}{9} = \dfrac{4}{18}$ 6 times is a little bigger or "not large enough to be certain"	B1 B1	**B1** for suitable calculation to allow comparison AND **B1** for correct conclusion following their calculation dependent on the previous mark If **B0** then **SC1** for recognition that a sample size of 18 is insufficient	e.g. $\dfrac{6}{18} = \dfrac{3}{9} = \dfrac{1}{3}$ e.g. 6 times is a little bigger or 6 times is close to 4 so cannot make a true decision

Question			Answer	Marks	Guidance	
	(g)		120 or 125 to 126	4	**M3** for $\pi \times 200 \div 5$ oe or **M2** for $\pi \times 200$ or $\pi \times 2 \div 5$ or **M1** for $\pi \times 2$ or "number" $\div 5$	Allow values for π as 3 or 3.1 or 3.14 or 22/7 Allow 628(…) or Allow 6.28(…) i.e. "circumference" ÷ figs 5
5	(a)		1.88 and 2.82	3	**M1** for $4.7 \div 5$ or better (0.94) seen **and** **A1** for correct values reversed or one correct value in correct place	
	(b)	(i)	3	1		
		(ii)	$\dfrac{1}{2}$	1		
	(c)		$30 \geq g \geq 55$ .... $30 \geq g \leq 55$ .... $30 \leq g \leq 55$ ✓ $30 < g < 55$ .... $30 < g > 55$ .... $30 \leq g \geq 55$	1	Allow any unambiguous indication of the correct inequality	
	(d)	(i)	18	1		
		(ii)	No correlation or connection between coin's weight and gold content oe	1	Accept weight stays roughly the same regardless of gold percentage content	e.g. No matter what the gold content the weight stays between 4.6 & 4.8

Question			Answer	Marks	Guidance	
6	**(a)**		["4 fingers" is] (7.8 to 8.2) cm soi	**1**		All four initial marks may be awarded if candidates' scale drawing fits within the tolerance on the overlay.
			["Their" 4 fingers scaled] (1.6 to 1.7)cm	**1FT**		
			Correctly scaled "arms length" (12 cm)	**1FT**		The alternative approach of drawing the 8° (± 1°) "right-angled" triangle and then showing that (7.8 to 8.2) cm gives an arm's length of about 60 cm can be marked in the same spirit as the method indicated on the left.
			Angle stated as (6 to 9)°	**1**		
			Statement answers the initial question consistent with candidates' stated angle.	**1**	Yes / No	
	(b)	**(i)**	8°	**1**		
		(ii)	(75 m, 8°) **or** (150 m, 4°) correctly indicated on graph	**1FT**	FT (75, *their* 6b(i)) as co-ordinate on the graph	
		(iii)	Fairly close or close	**B1**	**B1** for a sensible response based on *their* plotted point(s)	Accept close etc. if this fits at least one of the plotted points in relation to the curve.
			Gives bigger angles or plotted points are above the curve	**B1**		

Question			Answer	Marks	Guidance	
7	**(a)**		Two correctly located points with two pairs of correct arcs	5	**M1** for Hassan is 9 km away from storm. AND **M1** for at least one correct arc for Hassan FT *their* 9km = 9 cm ± 0.2cm AND **M1** for at least one correct arc for Tim of radius 8 cm ± 0.2cm AND **B1** for each correct point	9km may be inferred from the diagram such as a mark on the line 9 cm ± 0.2cm from Hussain Arcs are not single points found
	(b)		Risk of being struck by lightning in a year = $\dfrac{(30 \ \text{to} \ 60)}{60 \, \text{million}}$ or equivalent fraction Correct comparison with $\dfrac{1}{\text{million}}$	2 **B1dep**	**B1** for correct numerator or denominator or **B1** for each correct value used in suitable division sum AND FT *their* risk dependent on at least **B1** above	e.g. 60 million ÷ 45 = 1333333 so yes it is about right

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