

GCSE
Applications of Mathematics (Pilot)

Unit **A382/01**: Foundation Tier
General Certificate of Secondary Education

Mark Scheme for June 2015

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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.

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 × (*their* '37' + 16), or FT 300 – √(*their* '5² + 7²'). 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.

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.

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).
- **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**.

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'.

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).

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.

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.

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 \checkmark 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 \checkmark 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 \times next to the wrong answer.

Ranges of answers given in the mark scheme are always inclusive.

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.

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

1	(a)	$\frac{1}{4}$ oe	1	e.g. $\frac{25}{100}$ isw if further cancelling	
	(b)	£154.80 with appropriate conclusion	3	M2 for 154.8(0) or M1 for $0.1 \times 120 \times 6 \times (2.3 - 0.15)$ or 165.45 AND B1 for a sensible statement comparing <i>their</i> answer with £100s	
	(c)*	21 rolls costing total of £450.45 or 22 rolls costing £471.90	4	3 21 or 22 rolls with incorrect cost or $20.97(\dots) \times 21.45$ with £449.8(0) to 450 or 2 20.97(...) or 21 or 22 or dividing the two correct areas or 1 Area of floor or area of roll found or one correct sum involving division of two comparable lengths or a correct cost for any integer of rolls	Calculations may be done in stages 10 ≤ integer of rolls ≤ 30
	(d)	(i) 3 years $\frac{1}{2}$ year oe Follow through	1 1 1	FT on their (c) ÷ their (b)	Assume units are years unless otherwise stated Rounded or truncated
	(ii)	Light bulbs because they have the smallest payback time or because the saving is more than the cost	2FT	B1 for light bulbs FT their table	See appendix

2	(a)		1:20 to 1:7 oe	2	M1 for either a correct ratio given involving decimals e.g. 0.7 to 7 or for both measurements seen of $0.7 \text{ (cm)} \pm 0.2\text{cm}$ and $7\text{cm} \pm 0.5\text{cm}$ or correct ratio given the wrong way round using integers only e.g. 16:1	Condone ratios involving 'to'
	(b)*		Estimated height of giant as 12m to 30m using scale factor of 8 to 15 and clearly stated assumption of Gulliver's height of 1.5m to 2m	4	<p>3 Full correct solution shown with no assumption stated or scale factor found with assumption stated or answer within range with assumption but no explanation for scale factor</p> <p>or</p> <p>2 Scale factor correctly found within the range 8 to 15 or correct assumption and two comparable head measurements</p> <p>or</p> <p>1 correct assumption of Gulliver's height stated or two comparable head lengths</p>	<p>Full marks available for working in imperial units with heights 5-6.5 feet</p> <p>Scale factors may also be found from the head to the full height – likely to be between 4 and 7</p> <p>Answer within range with no working scores 2</p>
	(c)	(i)	Rule works or is true for 6 times out of 8 times which is 75%, so Seth's first statement is correct	3	<p>M1 for seeking to test the rule at least once AND M1 for identifying the six correct examples or the two incorrect examples AND B1 dep on at least M1 for a correct comparison based on <i>their</i> figures (results of <i>their</i> testing)</p>	

		(ii)	Small or non-representative sample	1		See appendix
	(d)	(i)	All points correct $\pm \frac{1}{2}$ small square	2	M1 for at least 2 points correct $\pm \frac{1}{2}$ small square	Ignore extra points
		(ii)	Reasonable straight ruled line by eye through the plotted points	1		At least two points either side of a line with positive gradient
		(iii)	Outside plotted points oe	1		See appendix. If more than one reason where at least one correct allow mark provided others are not contradictory or incorrect
		(iv)	$n = 4t$ oe	2	M1 for correctly worded equation If M0 then SC1 for $t = 4n$ oe	Allow upper or lower case Accept $n = 4 \times t$ oe Condone x for t and y for n e.g. $y = 4x$
	(e)	(i)	$\div 25.4$ and then in either order $+ 0.5$ round up to nearest $\frac{1}{2}$ oe or $+12.7 \div 25.4$ then round up to nearest $\frac{1}{2}$ oe in this order	3	M2 for any two correct in correct position or M1 for any one correct in correct position or $[n] \div 25.4$ seen in any box	<u>If 2 or 3 marks scored then max 1 penalty if:</u> n also included or implied in two or more "correct" boxes penalise 1 mark e.g. both $n \div 25.4$ & $(n \div 25.4) + 0.5$ seen or 'inch' and/or 'mm' included in two or more "correct" boxes penalise 1 mark

	(ii)	17 $\frac{1}{2}$ or 17.5	3	M2 for $(4 \times 106) \div 25.4$ oe + $\frac{1}{2}$ oe or answer 17 or M1 for $(4 \times 106) \div 25.4$ oe or answer 16.6 to 16.7 If M0 then SC2 for answer 5 Or SC1 for $106 \div 25.4 + \frac{1}{2}$ or $(106+12.7) \div 25.4$	Condone 35/2 oe $((4 \times 106) + 12.7) \div 25.4$ 424 $\div 25.4$ oe $4 \times 4.173 \dots$ $((4 \times 106) + 12.7)$ soi by 436.7 4.6 to 4.7
3	(a)	252	2	M1 for 251.5(...) or 251	
	(b) (i)	2	1		
	(ii)	4	1		
	(iii)	75 96 01 03 04 05 07 oe	2	M1 for at least 4 correct years with no more than one wrong year or SC1 for just the two years (19)96 and (20)03 given and no others.	
	(c) (i)	900			Condone ± 20 from 900
	(ii)	10			
	(iii)	Bounced oe 3 times or comes to rest at 50 seconds or 30 seconds later	1 1dep	Dependent on first mark	
	(d) (i)	Mars Science Laboratory or 900	1	Condone clear reference to 2012 only	
	(ii)	4	1		
	(iii)	11 launched 7 successful	1 1		

		(iv)	Full explanation that success rate has been increasing and is likely to continue	2	B1 for partial explanation or reference to small data set	See appendix
	(e)	(i)	19	1		
		(ii)	(-48, 22) plotted	1		
		(iii)	(40,15)	2	B1 for either co-ordinate correct	
		(iv)	$d + 20$	1	Ignore $T =$	
		(v)	$d - 20 > T > d + 20$ <input type="checkbox"/> $d - 20 \leq T \leq d + 20$ <input checked="" type="checkbox"/> $d - 20 \geq T \geq d + 20$ <input type="checkbox"/> $d + 20 < T > d - 20$ <input type="checkbox"/> $d + 20 \geq T \geq d - 20$ <input checked="" type="checkbox"/> $d + 20 > T < d - 20$ <input type="checkbox"/>	2	B1 for each	Treat extras as choice
	(f)	(i)	1220 to 1360m	2	M1 for a correct measurement of 6.1 to 6.8 seen or their measurement $\times 200$	Their measurement must be close to acceptable range
		(ii)	3830 to 4273	2FT	M1 for π or $3.14 \times$ their part f(i) FT their part f(i)	
	(g)	(i)	-24.08	3	M2 for 24.08 or -24.1 or adding the five numbers and then dividing by 5 or M1 for adding the five numbers or a total of (-) 120.4 seen in working or their total $\div 5$	
		(ii)	-23.4	1		

	(h)	Two general observations such as the temperature decreases initially then rises during the day before dropping towards the end of the day	2	1 for each section correctly described or all the temperatures are below zero	Do not accept references to single points on the graph
	(i)	334 to 335	1		
	(ii)	1478 to 1479	1		
	(j)	Carbon dioxide 95.5% to 97%	2	B1 for each	
	(ii)	76% to 78% 1.5% to 3%	2	B1 for each	
	(k)	C B	2	B1 for each	
	(l)	Correctly indicated region	3	M1 for an arc of radius 6 cm \pm 0.2cm AND M1 for an arc of radius 8cm \pm 0.2cm A1 for <i>their</i> correct region indicated based on at least one correct arc	Do not allow freehand circles
	(ii)	3300 to 3700	3	M2 for 3100 to 3299 or 3701 to 3900 or M1 for 31 to 39 seen in working or <i>their</i> squares \times 100 correct or clear evidence of counting squares	20 \leq Number of squares \leq 40 soi by 2000 \leq n \leq 4000 outside correct range where n is a multiple of 100
	(m)	(i)	3	M1 for correct rectangle in correct place AND M1 for correctly sized trapezium AND M1 for correctly orientated correct trapezium in correct place	
	(ii)	7	1		

		(iii)	28	2FT	M1 for <i>their m(ii) × 4 given as answer</i> FT <i>their m(ii)</i>	
		(iv)	Two problems clearly stated		B1 for each correct reason e.g. 10 cm might be too big Gets stuck in a loop Does not say how far to left/right	See appendix
				90		

APPENDIXExemplar responses for Q.1(d)(ii)

Response	Mark
Light bulbs because you pay them back in a short time	2
Loft lagging as it pays for itself quickly (FT <i>their</i> payback time of 0.1 years)	2
Light bulbs because the saving is double the cost of buying them	2
Light bulbs because you save more than what you paid for them	2
Light bulbs as they are the cheapest	1
Light bulbs – no reason given	1
Boiler because it saves the most	0
Loft lagging because it saves you the most	0

Exemplar responses for 2(c)(ii)

Response	Mark
He only asked 8 people and his estate will have more than 8 people	1
He should have asked a lot more people	1
Seth has not had a large enough sample to see if his hypothesis is correct or not	1
It may not be right because he would need more information to make a more accurate conclusion	1
He only asked his friends	1 bod
He's not asked everyone on the estate and everybody's will be different	0
Size varies so you cannot be sure it will work for everyone	0
Seth could be wrong because people on his estate could be different to his friends	0
The people on the estate could have medical problems and have huge thumbs	0

Exemplar responses for Q 2(d)(iii)

	Decision	Justification
There were no measurements of 105 or more	1	
There are no measurements taken up to 105 and the line does not reach 105	1	given for the first part of the statement, not the second & this is not contradictory
Not similar to other data	1	
Because no thumbs are close to 105	1	
Because there are no results that reach 105mm	1	
As it will be too far off the other measurements	1	
Because there is no data and line of best fit doesn't cover 105mm	BOD	taken together sufficient for BOD, but each statement on its own would be awarded 0
Because nobody had 105mm	BOD	
Because 105 would be an outlier	BOD	
No-one with a thumb measurement of 105 has been found	BOD	
Anything past 100 would be off my chart	0	
The thumb measurement for 105 is not on the graph	0	
Because it is not on the graph	0	
Because the neck size in proportion is not on the graph	0	does not imply extrapolation
Because you cannot use your line of best fit	0	
Because no thumbs are that big	0	
Because it would not fit the line of best fit. It would be anomalous	0	
Because it is not on the graph therefore we cannot see what it is	0	

Because 105 times 4 = 420 which would not fit on the graph	0	
Because it does not fit the data pattern therefore it would be anomalous	0	
Because the neck size goes off the graph past 400mm	0	
Because the neck measurement will be higher than 400	0	
Because 105 is too far away from the line of best fit	0	
Because it does not go past it	0	
Because the measurement would be off the graph	0	
Because the neck would get too big	0	

Exemplar responses for 3(b)(iv)

Response	Mark
Because from Viking 1 the success rate went up and will probably keep rising	2
The 4 most recent flights were all successful so the success rate is increasing	2
The last four had successful landings	1
Over time technology got better	1
Because over the years it will get better. It won't stay the same	1
She only looked at 11 crafts	1
She should gather more data	1
There could have been more success or failures that were not recorded	1
The next probability could be 8/12	0
She does not know what will happen in the future	0

Exemplar responses for Q.3(h)

Response	Mark
The temperature decrease at the start and then warms up throughout the day before falling again later	2
The temperature decreases for 5 hours and then reaches a peak in the middle of the day	2
It rises between 5 and 15 hours but then drops again at the end	2
The temperature goes up during the day and then drops again in the evening	2
From around 5 a.m. the temperature rises and it decreases from around 3 p.m.	2
All the temperatures are below zero	1
In a typical day the first 5 hours are the coldest	1
The temperature decreases at the start of the day	1
It starts and ends near the same temperature though it goes up during the day	1
The temperature fluctuates	1 bod
The lowest temperature was -88 and the highest was -34	0
The lowest temperature was at 6	0
The highest temperature was -34	0
The peak temperature is at 15 hours	0

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

Response	Mark	Justification
It keeps moving in circles if there is an obstacle if it moves to the left and right. There may be an obstacle 5cm away from it without knowing it	2	Considers both the loop and the problem of moving 10cm forwards
If the first two answers are yes he will end up at the same place	1	Loop idea
The machine could end up going round in circles if there is an obstacle and then no obstacle	1	Loop idea contained in the first part
They are always going round in circles because they are going to have to go back to the start	1	Loop idea
There might be an object to the left and the right	1	Obstacles on left or right
It does not tell you how far to move left or right	1	
There might be an obstacle ahead on the left and the right and ahead	1	Obstacles
You may not be able to move forward 10cm as there might be an obstacle in the way	1	Obstacles in front
It may need to move more than 10cm	0	
There are obstacles both sides of the chart so either way you are going to come across them	0	

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