

GCSE

Applications of Mathematics (Pilot)

Unit **A382/02**: Applications of Mathematics 2 (Higher Tier)

General Certificate of Secondary Education

Mark Scheme for November 2016

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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.

OCR will not enter into any discussion or correspondence in connection with this mark scheme.

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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).

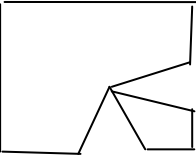
8. When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the MR annotation. **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.
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/Indicative Content	Marks	Part Marks and Guidance	
1	(a)	(i)	$\frac{1}{2}$ of $(80+1) = 40.5$ & 40 th & 41 st is 25 Or $15+4+5=24$ so 40 th number must be 25 oe	2	M1 for [$\frac{1}{2}$ of $(80+1) =$] 40.5 or 40 th / 41 st number [is 25] or full unambiguous description with no mention of 40.5, 40 th , 41 st	Condone $\frac{1}{2}$ of 80 with correct description for M mark For M1 must clearly be implying all 80 values
		(ii)	24.625	3	M2 for $(20 \times 15 + 23 \times 4 + 24 \times 5 + 25 \times 30 + 26 \times 18 + 30 \times 8) \div 80$ or M1 for all 6 products 20x15 23x4 24x5 25x30 26x18 30x8 or sum of at least 4 products	$1970 \div 80$ Allow M2 for 24.6 or 24.62 or 24.63 300 92 120 750 468 240
		(iii)	Any correct general statement eg Most or on average people saw the line in Picture B as smaller	1		
	(b)		Any correct general statement eg Most did not see C and D the same [length] or most saw D as longer oe	1		
	(c)		All 6 points plotted correctly ± 1 mm by eye	2	M1 for at least 3 points plotted correctly ± 1 mm by eye	
	(d)		Plotted points for women similar pattern to those for men oe	1		
	(e)	(i)	Line $y = x$ drawn through at least the plotted points	1		Allow line straight by eye
		(ii)	[Points / people plotted] below [the line]oe	1		
		(iii)	Not good, more points above line oe	1FT		FT <i>their</i> graph MUST have reason

Question			Answer/Indicative Content	Marks	Part Marks and Guidance	
2	(a)	(i)	402	3	M2 for $(6 \times 50) + (5 \times 11) + 33 + 14$ or M1 for attempt to sum widths of at least 7 characters with no incorrect value	50+11+50+11+50+11+50+33+50+11+50+11+14
		(ii)	36	1		
	(b)		23.7	3	M2 for $\text{figs } 6 \times \text{figs } 79 \div \text{figs } 20$ oe or M1 for $h/\text{figs } 79 = \text{figs } 6/\text{figs } 20$ oe or $h/\text{figs } 6 = \text{figs } 79/\text{figs } 20$ oe or $h:\text{figs } 79 = \text{figs } 6:\text{figs } 20$ oe or $h:\text{figs } 6 = \text{figs } 79:\text{figs } 20$ oe	Allow all marks whether or not conversion to same units FT method using tan to find angle
	(c)		September 2049 to February 2051	2	M1 for 2049 / 50 or any correct month & year in range Sept 2049 - Feb 2051	
3	(a)		131 – 132 inclusive	1		
	(b)	(i)	32	1		Condone (0, 32) or 0, 32
		(ii)	2.25	3	M2 for vertical reading \div horizontal reading provided both readings $\pm \frac{1}{2}$ small square or M1 for <i>their</i> vertical reading \div <i>their</i> horizontal reading provided attempt at triangle seen on graph	Allow 2.2 – 2.3 inclusive Max 2 marks for embedded gradient of correct value
		(iii)	X 2.25 + 32	2 FT	M1 for one correct	X <i>their</i> (b) (ii) + <i>their</i> (b) (i)

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
	(c)	80	4	B2 for 212 seen or M1 for $100 \times 9/5 + 32$ And M1 for $(their\ 212 - their32) \div their\ 2.25$ or $(100 \times 9/5) \div their\ 2.25$ or sensible value(s) read from graph where values total $their\ 212 + 32$	Allow 180 seen if final box of flow diagram in part (b) (iii) is 32 FT <i>their</i> values from part (b) (iii) Allow all marks for 'correct' result from $(212 - their32) \div their\ 2.25$
4	(a)	2 or 3 or 4 or [range] 2 – 3 or 2 – 4 or 3 - 4	1		
	(b)	'peaks' at 30, 40, 50 and 60	1		
	(c)	Similarity: age range or distribution of ages Difference: more females [aged 20-30] or more females in 70-80 age range	1 1		Be generous Be harsh
	(d)	From ~ age 45 populations males and females greater in 1961 than 1911 or more people aged 50 – 80 in 1961 or more older people in 1961 oe	1		
	(e)	1920 or 1921 and 1946 or 1947 or 1948	3	M2 for 1961 - 40 (or 1961 - 41) or 1961 - 14 (or 1961 - 13) (or 1961 – 15) or M1 for 13 or 14 or 15 and 40 or 41 soi	Allow all marks if answers given as ranges eg 1920-1921 and 1947 - 1948

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
5	(a)	Correct size net with 3 circles centres indicated (or 3 circles indicated) on correct faces to make paperweight design	3	M2 for correct size net with at least two circles that would appear on adjacent faces or net of a cube, may not be correct size, with 3 circles indicated on correct faces to make paperweight design or M1 for net of a cube, may not be correct size, with at least one circle	
	(b)	(i) Square with circle at centre	1		0 if additional lines
		(ii) Square with two triangles missing on adjacent sides, apex's meet at centre & bases on edges 	3	M2 for square with:- -one triangle cut out apex at centre or -two triangles cut outs apex's at centre, but on opposite sides or -two triangles on adjacent sides, but do not meet at centre base or M1 for square with:- -one triangle cut out or -two semi-circle cut out's on adjacent sides	All triangles by eye
	(c)	(i) 800 or 8×10^2	3	M2 for $0.04 \div 5 \times 10^{-5}$ oe or M1 for both values changed to same units 0.04 and 5×10^{-5} or 4 and 5×10^{-3} or 40000 and 50 or figs 4 \div figs 5	

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
	(ii)	2.1cm or 21mm	5	M4 for $\sqrt{((4^3 - 35) \div 2\pi)}$ or 2.1[48...] or M3 for $4^3 - 3 \times \frac{1}{3} \times \pi \times r^2 \times 2 > 35$ oe or M2 for 4^3 and $3 \times \frac{1}{3} \times \pi \times r^2 \times 2$ or $(4^3 - 35) \div 3$ and $\frac{1}{3} \times \pi \times r^2 \times 2$ or M1 for $\frac{1}{3} \times \pi \times r^2 \times 2$ soi or $(4^3 - 35) \div 3$	If incorrect height for cone treat as MR-1 for M3, M2 & M1 Allow = in place of > 64 and $2\pi r^2$ or $6.28...r^2$ 2.09... r^2
	(iii)	6.75 [hours] oe or 6 hours 45 minutes or 405 minutes	3	M2 for $2 \times (6/4)^3$ or M1 for $(6/4)^3$ 3..375	isw if 6.75 seen
6	(a)	1 [is an] impossible [score] oe	1		
	(b)	5 5 & 4 6 & 6 4 for 10 AND 2 2 & 1 3 & 3 & 1 for 4 Or P(10) = P(4) = 3/36 oe	2	M1 for 2 correct ways listed for 10 and 2 correct ways listed for 4 Or P(10) = 3/36 or P(4) = 3/36	
	(c)*	No with full correct explanation eg all ways of getting a 6 and one way of getting a 2 or P(6) = 5/36 and P(2) = 1/36 All ways of getting a 6 or P(6) = 5/36 and one way of getting 2 or P(2) = 1/36 with no or incorrect conclusion P(2) = 1/36 or P(6) = 5/36 or at least four ways listed for either 2 or 6	3 2 1		$\frac{6}{15}$ $\frac{2}{4}$ $\frac{3}{3}$ $\frac{4}{2}$ $\frac{5}{1}$ $\frac{2}{11}$ If consistently repeating 1 1 for score of 2 & 3 3 for score of 6 & correct explanation allow 1 marks

Question		Answer/Indicative Content	Marks	Part Marks and Guidance		
7	(a)	Either 7 with 29 days & 6 with 30 days Or 6 with 29 days & 7 with 30 days Or 5 with 29 days & 8 with 30 days	2	M1 for $29m + 30n$ where $m+n=13$ or $383 - 29m$ or $384 - 29m$ or $385 - 29m$ where $3 \leq m \leq 10$	M1 is for T&I method within these parameters	
	(b) *	$384\,400 \div \cos 89.853$ = $149\,800\,000 - 150\,000\,000$ incl $384\,400 \div \cos 89.853$ $\cos 89.853 = 384\,400/d$	3 2 1		FT method using tan & Pythagoras eg 2 marks for $\sqrt{384400^2 + (384400 \times \tan 89.853)^2}$	
	(c)	$1558.9 - 1559$ or 1560	3	M2 for $14 / 360 \times 2 \times \pi \times 6380$ And M1 for $n / 360 \times 2 \times \pi \times 6380$	$0 < n < 90$	
8	(a)	Virtual money Equal lowest rate, but no interest on interest in a year oe	2	M1 for Virtual with a correct comparison eg lower % than Seeds &/or paid less often/each quarter with Floyds	For 2 marks insufficient to just say interest paid less often (than Floyds), need an explanation of the effect this has on total interest	
	(b)	(i)	$4000 \times 0.03 \div 4 [= 30]$	2	M1 for 4000×0.03 oe or $0.03 \div 4$ oe or $3 \times 4000 \div 4$ oe	
		(ii)	121.35 or 121.36	4	M3 for $4000 \times 1.0075^4 - 4000$ or $30 + 30.22(5) + 30.45 + 30.68$ or M2 for 4000×1.0075^4 or 4030×1.0075^3 or $30.45(\dots)$ or $30.68(\dots)$	For $30.22(5)$ allow 30.22 or 20.23 $4121.35 - 4121.36$ May be done in stages

Question			Answer/Indicative Content	Marks	Part Marks and Guidance	
					<p>or M1 for 4030×0.0075</p> <p>If M1 then also SC1 for $30 +$ <i>their</i> $30.23 +$ <i>their</i> $30.45 +$ <i>their</i> 30.68</p> <p>If M0 then SC3 for $121.(...)$ Or SC2 for $4121.(...)$</p>	<p>30.22(5) or 30.23</p> <p><i>their</i> values must be from attempt to use compound interest, but with arithmetic errors ie NOT $30 + 30 + 30 + 30$</p>
		(iii)	3.03	2	M1 for answer (b) (ii) $\div 40$ oe	Allow M mark for 3.034 or 3.033...
	(c)	(i)	$4000 \times (2 \div 100) \div 365$	1		Condone * for x and / for \div
		(ii)	$[B3] = B2 + D2$	1		Condone = sign missing
		(iii)	$[D5] = B5 \times (C5/100)/365$	1		Condone * for x and = sign missing
9	(a)		$1.2m + 8d \leq 40$	1		Condone <
	(b)		$1.7m + 5d \leq 42.5[0]$	2	M1 for $1.7m + 5d = 42.5[0]$	Allow x for m and y for d
	(c)		(16, 3) marked	1		

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