

GCSE

Applications of Mathematics (Pilot)

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

General Certificate of Secondary Education

Mark Scheme for November 2015

OCR (Oxford Cambridge and RSA) is a leading UK awarding body, providing a wide range of qualifications to meet the needs of candidates of all ages and abilities. OCR qualifications include AS/A Levels, Diplomas, GCSEs, Cambridge Nationals, Cambridge Technicals, Functional Skills, Key Skills, Entry Level qualifications, NVQs and vocational qualifications in areas such as IT, business, languages, teaching/training, administration and secretarial skills.

It is also responsible for developing new specifications to meet national requirements and the needs of students and teachers. OCR is a not-for-profit organisation; any surplus made is invested back into the establishment to help towards the development of qualifications and support, which keep pace with the changing needs of today's society.

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.

© OCR 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

- 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.

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 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 \checkmark 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/Indicative Content	Marks	Part Marks and Guidance	
1	(a)	Two straight lines (1) passing through (0, 5) and (6, 95) (2) passing through (0, 100) and (10, 0)	4	<p>M3 for both lines correct, but one or both not long enough Or one line correct and the other line with correct gradient</p> <p>or</p> <p>M2 for one line correct, may or may not be long enough Or both lines with correct gradient</p> <p>or</p> <p>M1 for two lines where one passes through (0,5) or (6, 95) and the other through (0, 100) or (100, 0) Or at least 3 points correctly plotted, but not joined for at least one line Or one line with correct gradient</p>	
	(b)	(i)	3.8	1 FT	Correct or FT <i>their</i> graph $\pm\frac{1}{2}$ small square Must have two part lines drawn to FT
		(ii)	62	1 FT	Correct or FT <i>their</i> graph $\pm\frac{1}{2}$ small square Must have two part lines drawn to FT
2	(a)	Evidence of counting squares oe for 6 x 6 x <i>their</i> number of squares oe 410 to 505	<p>B1</p> <p>B1</p> <p>B1</p>		May be embedded

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
	(b)	2048	4	<p>M3 for $40 + 2008$ or 40 years Or $4255 \times (4255 \div 5157)^4$ Or at least 3 dates with correct populations or M2 for $4255 \times (4255 \div 5157)^n$ oe where n is an integer or M1 for $4255 \div 5157$ or 0.825 to 0.8251 oe % or $(5157 - 4255) \div 5157$ or 0.1749 to 0.175 oe %</p>	<p>2018 3510 - 3511 2028 2896 – 2897 2038 2390 2048 1972 2058 1627 2068 1342 2078 1107 – 1108</p> <p>Alternative methods using annual decreases may receive full credit</p>
	(c)	9.2 to 9.3	2	M1 for $198.3 \div 21.4$	Accept 9 with working shown
	(d)	(i)	1	False; Area Levelwood is [much] smaller [than Longwood] oe	Allow population Longwood [more] spread out [over bigger area] oe
		(ii)	B1	True, [St Paul's and Levelwood] area's about the same	Allow 1 st B1 provided attempt at reason or calculation
			B1	$69.7 \div 22.6$	Must see calculation, 3 given in question. Allow 2 nd B1 for 'worded calculation' eg 69.7 is about 3 times 22.6

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
3		15 feet 7 inches	4	<p>B3 for 15.6(...) or 187.(...) seen</p> <p>or</p> <p>M2 for $4.65 \times 11.75 / 3.5$ or $4.65 \times (11 \times 12 + 9) / 3.5$</p> <p>or</p> <p>M1 for $h/4.65 = 11.75 / 3.5$ oe or $h/4.65 = (11 \times 12 + 9) / 3.5$ oe</p> <p>If M0 then SC3 for final answer 15' 9" or SC2 for 15.8[1] or 189.7[2] in working or final answer 15' 6" or 15' 3" or SC1 for $4.65 \times 11.9 / 3.5$ or $465 / 2.5$ or $465 / 2.54$ or final answer 15' 8"</p>	For M marks allow working in consistent units, eg cm or metres $11 \times 12 + 9 = 141$
4	(a)	(i)	Camera, lowest insurance cost oe	1	Must have reason
		(ii)	No, if it fails will be covered by manufacturer oe	1	Must have reason
	(b)	(i)	Highest probability oe	1	
		(ii)	No, very likely to continue working oe or unlikely to fail if still working oe	1	Allow very low probability
5	(a)		$=B3+200 \times C3$ oe	2	<p>M1 for 200 correct or B3 and C3 correct</p> <p>Allow 200 & C3 to be swapped</p>
	(b)		Set up costs are fixed oe or set up costs are shared between more PCBs oe	1	Must make reference to set-up costs

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
6	(a)	Volume: 14.1[...] or 4.5π	2	M1 for $\pi \times 0.5^2 \times 18$	Accept 14 provided working seen
		SA: 58.1[...] or 18.5π	2	M1 for $2 \times \pi \times 0.5^2 + 2 \times \pi \times 0.5 \times 18$ If M1 & M1 also SC1 if answers reversed	Accept 58 provided working seen Award 3 marks if answers reversed with no working
	(b)	Volume: 14.1[...] or 4.5π	2	M1 for $\frac{4}{3} \times \pi \times 1.5^3$	Accept 14 provided working seen
		SA: 28.27 to 28.3 or 9π	2	M1 for $4 \times \pi \times 1.5^2$ If M1 & M1 also SC1 if answers reversed	Accept 28 provided working seen Award 3 marks if answers reversed with no working
	(c)	Linking surface area & quantity of skin	1		May quote answers to part (a) & (b) in support & may be in context
		Linking volume & weight	1		
	(ii)	May make mistakes with the formula oe Or don't need to do a calculation oe Or Only one measurement needed for body weight oe	1		Condone its quicker or don't need a calculator to work out Not for 'its easier' on its own

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
7	(a) *	18.75 [>15] with full correct working shown Two calculations involving 7 laps and either total distance or time conversion to be the same eg 7×1.5 and $(4.5+3+5.8+6.3+5.1+4.4+4.6) \div 60$ or $1.5 / (4.5+3+5.8+6.3+5.1+4.4+4.6) \div 7$ or $(4.5+3+5.8+6.3+5.1+4.4+4.6) \div 7 \div 60$ Or average speed found for one of the lap times which account for time conversion	4 – 3 2 – 1	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 For lower mark one calculation of average speed, may or may not account for time conversion Or calculation involving all 7 laps eg 7×1.5 or $(4.5+3+6.3+5.7+5.1+4.4+4.6) \div 7$ or $(4.5+3+6.3+5.7+5.1+4.4+4.6) \div 60$ or median, 4.6, explicitly stated	NB working with just the median can score max 2 marks for $1.5 \div (4.6 \div 60) = 19.565\dots$ Allow rot for individual speeds, 20, 30, 14.2..., 15.7..., 17.6..., 20.45..., 19.56... Eg $1.5 \div 4.6 = 0.326\dots$ [miles/min] $7 \times 1.5 = 10.5$ $33.6 \div 7 = 4.8$ $33.6 \div 60 = 0.56$
	(b)	(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
8	(a)		Thursday	1	
	(b)		Sunday	1	
	(c)		7	2	M1 for 10 – 3 or both 10 and 3 only seen
	(d)		Range	1	

Question		Answer/Indicative Content	Marks	Part Marks and Guidance	
9	(a)	Thursday [0]1:40	1 2		
	(b)	[0]6:30	2	M1 for 20:40 + 21 hours + 8 hours oe	
	(c)	Add 30 minutes oe	1		Allow [0]6[:]50 for M1
10	(d) *	28 days and full correct working leading to 35 days Clear evidence of working for number of days in October & 7 days March/April leading to 35 days & 28 days stated Evidence working on number of days in October eg 1 st to 29 th , 2 nd to 30 th , ... 7 th to 28 th	5 4 – 3 2 – 1	Lower mark for evidence working on number of days in October eg 1 st to 29 th , 2 nd to 30 th , ... 7 th to 28 th and 7 days (March/April) Lower mark for 7 days (March/April) or answer 28 days with no or insufficient working	For 5 marks, must see complete working Allow marks if working in weeks not days Do not penalise candidates whose working also accounts for part days as Australian time is ahead of UK time
	(a)	January	1		Must only offer one month; ignore year
	(b)	December	1		Must only offer one month; ignore year
	(c)	Represents frequency by area oe	1		
	(d)	Dec 1854 radius 4.5 – 4.7 [cm] Jan 1855 radius 6 – 6.2 [cm] <i>their</i> radii squared Yes as 41 is approximately double 21 oe Or No 38 is not quite double 23 oe	B1 B1 M1 A1 dep	A mark dep on M mark	FT <i>their</i> radii values & allow embedded in sector area or circle area 20.25 – 22.09 and 36 – 38.44 Must have reason that uses radii squared

Question			Answer/Indicative Content	Marks	Part Marks and Guidance	
11	(a)	(i)	0.14 to 0.142 nfwv	4	<p>M2 for $\frac{1}{2} (220 + 50) \times 2.6 + \frac{1}{2} \times 50 \times (9 - 2.6)$ or better</p> <p>or</p> <p>M1 for $\frac{1}{2} (220 + 50) \times 2.6$ or better</p> <p>and</p> <p>B1 for change to consistent units eg <i>their</i> calculated area $\div (60 \times 60)$</p>	<p>351 + 160 or 511</p> <p>351</p> <p>If attempt to change to consistent units first step follow <i>their</i> method for M marks</p>
		(ii)	Divide into smaller intervals oe	1		
	(b) *		<p>Calculated value (+ or -), without error, from correct horizontal & vertical measures with consistent units</p> <p>Calculated value from correct horizontal & correct vertical measures, no time conversion or <i>their</i> vertical \div <i>their</i> horizontal, at least one correct $\pm 2\text{mm}$ and time units the same</p> <p><i>Their</i> vertical or <i>their</i> horizontal measure $\pm 2\text{mm}$; should be seen on diagram Allow their measure to be counting squares & allow if seen in working provided tangent drawn & triangle indicated</p>	<p>5</p> <p>4 – 3</p> <p>2 - 1</p>	<p>For lower mark <i>their</i> vertical \div <i>their</i> horizontal $\pm 2\text{mm}$, at least one using correct scale from graph or attempt to convert measures to same time units in calculation</p> <p>For lower mark ruled tangent drawn at 5 seconds</p>	<p>Eg 32 000 m/h² or 8.9 m/h/second</p> <p>Eg: 65 \div 7.3</p> <p>Eg: (7.3 / 60 x 60)</p> <p>Eg: 65 or 7.3</p>

Question		Answer/Indicative Content	Marks	Part Marks and Guidance		
12	(a)	3833 to 3834 Allow 3830 or 3800 with working shown	3	M2 for $6370 \times \cos 53$ oe or M1 for $\cos 53 = r / 6370$ oe		
	(b)	(i)	2743 Allow awrt 2740 with working shown or 2700 with working shown	3	M2 for $41/360 \times 2 \times \pi \times$ <i>their</i> (a) or M1 for $41 / 360$	
		(ii)	Internet map includes turns in the roads oe	1		Allow internet or map with reason Do not accept just, 'it's the driving distance' for reason
13	(a)	$1.25x + 0.75y \leq 25$ $(1.25x + 0.75y \leq 25) \times 100 / 25$ oe leading to the given inequality	B1 B1			
	(b)	30 Kit X:5 & Kit Y:25	1 1	If 0 scored then SC1 for a complete and valid solution that is not the maximum	Eg 5 of kit X & 15 – 24 of kit Y 6 of kit X & 14 – 23 of kit Y etc	

OCR (Oxford Cambridge and RSA Examinations)
1 Hills Road
Cambridge
CB1 2EU

OCR Customer Contact Centre

Education and Learning

Telephone: 01223 553998

Facsimile: 01223 552627

Email: general.qualifications@ocr.org.uk

www.ocr.org.uk

For staff training purposes and as part of our quality assurance programme your call may be recorded or monitored

Oxford Cambridge and RSA Examinations
is a Company Limited by Guarantee
Registered in England
Registered Office; 1 Hills Road, Cambridge, CB1 2EU
Registered Company Number: 3484466
OCR is an exempt Charity

OCR (Oxford Cambridge and RSA Examinations)
Head office
Telephone: 01223 552552
Facsimile: 01223 552553

© OCR 2015

