GCSE

Mathematics (9-1)

Unit **J560/03:** Paper 3(Foundation Tier)

General Certificate of Secondary Education

Mark Scheme for June 2017

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 2017

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

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 <u>not</u> award the marks if the answer was obtained from an incorrect method, ie incorrect working is seen <u>and</u> 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.

    - **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**.

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.

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 ✗ next to the wrong 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	Marks	Part marks and guidance	
1	**(a)**		$\dfrac{27}{100}$ 27 [0].8[0] 80 $\dfrac{3}{100}$ [0].03	**3**	**B1** for each row	
	(b)		$\dfrac{9}{20}$ final answer	**2**	**B1** for $\dfrac{45}{100}$ or equivalent fraction	
	(c)		$\dfrac{1}{5}$ or equivalent fraction	**1**		Ignore attempts to simplify if, for example, $\dfrac{10}{50}$ given. Must be a vulgar fraction not 0.2 or 20%

Question			Answer	Marks	Part marks and guidance	
2			11 424	3	**B2** for 3024 OR **M1** for 8400 × [0].12 or 1008 **M1** for [8400 +] *their* 1008 × 3 If 0 scored **SC1** for 11 801[. ..]	 **M0** if used for compound interest *Their* 1008 must be seen to come from a calculation with 8400 and 12 **Non-calculator methods** Candidates must have equivalent, correct, processes at each stage to score **M** marks Eg 10% so ÷ 10 and 2% so ÷5 then add Answers may be incorrect but process may be implied by correct values Eg (10%) 840 + (2%) 168 From compound interest
3	(a)		7	1		Not 5^7
	(b)		14 −14	2	**B1** for each	$\pm$ 14 with no other incorrect answer scores 2 marks $\pm$ 14 with an incorrect answer scores **1** mark
4	(a)		$3x - 2$ final answer	2	**M1** for $5x - 10$ or $-2x + 8$ or **B1** for $3x + j$ or $kx - 2$ ($k{\neq}0$) final answer	$3x$ **+** – 2 scores **1** mark *j* can be 0
	(b)		$2x(5x + 3)$	2	**B1** for $2(5x^2 + 3x)$ or $x(10x + 6)$	

Question			Answer	Marks	Part marks and guidance	
	(c)		x^{10}	1		Not, $x \times x \times ...$
5	(a)		62 cao	2	**B1** for 48 or 14 or **M1** for 3 × 16 + 2 × 7	
	(b)		11 cao	2	**M1** for 2 + 6 ×1.5 If 0 scored **SC1** for answer −7	
	(c)		$d = \dfrac{c}{7}$ oe	1	Accept $d = c \div 7$ and $\dfrac{c}{7} = d$	$\dfrac{c}{7}$ or $c \div 7$ with no subject scores 0
6	(a)	(i)	certain	1		
		(ii)	evens	1		
	(b)	(i)	6	1		
		(ii)	$\dfrac{21}{55}$ oe	1		Condone correct probability and unlikely for **1** mark Accept [0].3818 to [0].382 or 38.18% to 38.2% but not ratio or in words
		(iii)	$\dfrac{28}{55}$ oe	1		Condone correct probability and likely for **1** mark Accept [0].509 to [0].51 or 50.9% to 51% but not ratio or in words

Question			Answer	Marks	Part marks and guidance	
7			9.64	4	**B2** for 231.36 OR **M1** for 11 × 15.65 soi 172.15 **M1** for 403.51 — *their* 172.15 AND **M1** for *their* 231.36 ÷ 24	Condone £9.64p for 4 marks

8	(a)		576	2	**M1** for [$1=] 40 ÷ 50 or [0].8 or
					     720 ÷ 50 soi 14.4[0] or
					     50 ÷ 40 or 1.25 oe
					
					or **M1** for full scaling method with
					     correct processes (may be
					     implied by correct values) at
					     each stage
						eg [$]50 is [£][40] (process)
						     100 is [80] (× 2)
						     200 is [160] (× 2)
						      20 is [16] (÷ 10)
						And sum 200, 200, 200, 100 and 20

Question		Answer	Marks	Part marks and guidance
(b)		282 or 282.03 or 282.04 or 282.05 final answer	4	**M1** for multiplying four note values by the correct number of notes soi by values shown in final column of scheme **M1** for dividing a value in euros by 1.17 soi by values shown in final column of scheme **M1** for adding four sums of money of the same currency (one from each note value)	**Find total of euros** 50 × 2 (= 100) ÷ 1.17 (=85.47...) 20 × 4 (= 80) ÷ 1.17 (=68.37...) 10 × 9 (= 90) ÷ 1.17 (=76.92...) 5 × 12 (=60) ÷ 1.17 (=51.28...) 100 + 80 + 90 + 60 = [€]330 330 ÷ 1.17 (=282.05...) **Find each denomination in £** 50 ÷ 1.17 (=42.73... 42.73 or **42.74**) 20 ÷ 1.17 (=17.09... **17.09** or 17.10) 10 ÷ 1.17 (=8.54... 8.54 or **8.55**) 5 ÷ 1.17 (=4.273... **4.27** or 4.28) 42.74 × 2 (=85.48) 17.09 × 4 (=68.36) 8.55 × 9 (=76.95) 4.27 × 12 (=51.24) Total = 282.03

9	(a)		7.31 cao	1		
	(b)	(i)	408 000 cao	1		
		(ii)	[0].006 14 cao	1		
10	(a)	(i)	15 11	1		
		(ii)	38 193	1		
	(b)		$4n + 1$ oe	2	**B1** for $4n + k$ k may be 0	Accept $n4$ (if clear this is not n^4) and $n \times 4$ and $4 \times n$ oe $5 + (n - 1) \times 4$ scores 2 marks Condone x =… and n^{th} = … for **2** marks Condone $n = 4n + 1$ for **1** mark

11	(a)		[0].76 cao	2	**M1** for $\dfrac{380}{1000} \times 2$ oe
					
					 or **B1** for figs 76 as answer
						Condone 0.76p for **2** marks
						 Eg 0.38×2
						
						 If using a method of scaling, must be complete **method** eg
						 1000g = £2
						   100g = 20p
						     20g = 4p
						 Their 20p $\times$ 3 + *their* 4p $\times$ 4

	(b)		$\dfrac{300}{20}$ or $\dfrac{280}{20}$ 15 or 14	M1 A1	 15 **dep** on $\dfrac{300}{20}$ and 14 **dep** on $\dfrac{280}{20}$ If **0** scored **SC1** for one of 300 or 280 or 20	Answers from 280.25 ÷ 19, and rounded, score 0 Accept 15 (14) and 15.00 (14.00) **but not** 15.0 (14.0) or 15.00p (14.00p)

12			68.8	3	**M2** for 2 ×(12 + 15 + 7.4) OR **M1** for 15 − 5.8 − 6.3 soi 2.9 **M1** for 12 + 15 + 12 + 6.3 + 7.4 + *their* 2.9 + 7.4 + 5.8 oe	Accept any other complete and correct methods May be 15 − 12.1 If not 2.9 then *their* 2.9 must be seen on diagram in correct place or come from 15 − 5.8 − 6.3
13	(a)		12.65 12.75	2	**B1** for one correct or both correct and reversed	For **B1**, correct value must be in correct place
	(b)		Accept any correctly matched pair in which wood > metal from 8.45 < wood ≤ 8.49[9...] **and** 8.45 ≤ metal ≤ 8.49[9...]	2	Wood > metal does not need to be stated but it must be clear which measurement refers to wood and which to metal **B1** for one measurement in range 8.45 < wood ≤ 8.49[9...] seen or 8.45 ≤ metal ≤ 8.49[9...] seen	Eg "Wood 8.46 [m] but Metal 8.45 [m]" scores **2** marks Wood or 8 Metal or 8.5 For **B1**, measurement must be correctly associated with either wood or metal, as appropriate 8.45 seen as end of range Eg 8.45 ≤ 8.5 < 8.55 scores **1** mark
14	(a)		Correct triangle	2	**B1** for a correct horizontal or a correct vertical movement of **A**	Vertices in circles of overlay. Accept good freehand.
	(b)		Rotation [centre] (0,0) oe 90 clockwise oe	**B1** **B1** **B1**	Not turn Accept origin or O but not vector Accept ⁻90 or 270 [anti-clockwise]	Second and third marks may still be scored if "Rotation" incorrect **0** marks for evidence of a second transformation

15			42 or 41.66…. or 41.7 isw	4	Accept 41.$\dot{6}$ but do not accept 41.6 **B2** for 12 correct options shown or **B1** for options shown with at most 2 errors or omissions or repeats OR **B1** for [4 × 3 =] 12 [combinations] **B1** for FG, FH, AS, MS, ES only AND **M1** for $\dfrac{their\ 5}{their\ 12}$ [× 100] shown AND **B1** for *their* stated fractional probability, with denominator less than 25, correctly converted to percentage	

Table (right column):

F	S		M	S
F	G		M	G
F	H		M	H
A	S		E	S
A	G		E	G
A	H		E	H

Choices with only 1 language

Implied only by [0].416[6..] or [0].417
Their (5 and 12) must come from list or 3 × 4 and *their* 12 ≠ *their* 5

Exact or correctly rounded to nearest integer or 1dp

Alternative method
B3 for $\dfrac{1}{4} + \dfrac{2}{12}$
or
B2 for $\dfrac{1}{4}$ oe **and** $\dfrac{2}{12}$ oe
or
B1 for $\dfrac{2}{12}$ oe

16	(a)	(i)	Point (0.8, 120) indicated	1		
		(ii)	No oe **and** Correct supporting value(s) and justification	2	**B1** for 200 to 260 visitors expected or about 0 to 1 mm and 320 or line of best fit within overlay or negative trend/correlation or markings in relevant region above 2mm or 2 or more values within overlay and surrounding 2mm	Justification includes Reference to line of best fit (drawn or not) or trend or negative correlation or markings in relevant region above 2mm or surrounding value**s** **See Appendix**
		(iii)	Outside range of data [collected]	1		**Accept** "The data (or diagram) only goes to 5.5 (or 6)" oe **Do not accept** "by 6 to 7 it would give no visitors" oe or There is no data around 9 mm oe The line of best fit does not reach 9 mm oe **Condone** "[Because] there would be a negative number of people" **See Appendix**
	(b)		Total number or number of children is not known oe or The chart only shows proportions/percentages oe	1	Mark the best bit so long as no contradiction	**See Appendix**
17	(a)	(i)	9.6	1		
		(ii)	2500	1		Condone 1 : 2500

	(b)		Arc centre B radius 6 cm meeting AB and CB or AB and bisector of ADC	**2**	**B1** for any arc centre B meeting AB and BC or short arc (at least 1cm) radius 6 cm centre B	Accept dashed or dotted for all marks Freehand, all within template, max **B1** Allow beyond AB and BC for 1 or 2 marks Tolerance 5.8 to 6.2 cm
			Ruled bisector of angle ADC to reach BC with construction arcs or Bisector with construction arcs from BC to *their* arc centre B	**2**	**B1** for correct ruled bisector at least 2cm long by eye with no construction arcs or correct construction arcs with no bisector drawn	Tolerance $\pm$ 2° Construction arcs on AD and on DC and two intersecting arcs from these
			Correct region shaded	**1**	**Dep** on **B1** and **B1** If 0 scored **SC1** for 6 [cm] [= 150] [m] seen	

| 18 | | | 725 | | 4 | **M1** for $\dfrac{4200}{700}$ soi 6

 M1 for 800 × 2 soi 1600

 M1 for $\dfrac{4200 + \text{their } 1600}{\text{their } 6 + 2}$

 Alt method

 M3 for $\dfrac{\frac{4200}{700}}{8} \times 700 + \dfrac{2}{8} \times 800$

 or **M2** for $\dfrac{\frac{4200}{700}}{8} \times 700$

 or **M1** for $\dfrac{2}{8}$ x 800 | *Their* 1600 must come from calculation with 800 and 2

 Expect 5800 ÷ 8

 soi 525 + 200

 soi 525

 soi 200 |
| 19 | | | 12 and 30 | | 3 | **M2** for a complete factor list of 60
 e.g. [1]
 2,3,4,5,6,10,12,15,20,30
 [60]
 or **M1** for the list with at most two errors or
 [6] 12, 18, 24, 30 [36, ...]
 or **B1** for 2 numbers with a HCF of 6 or LCM of 60 | May be seen as products eg 2 × 30

 Error, omission or repeat

 Eg 6 and 12, 12 and 18, 18 and 24
 Eg 4 and 15, 10 and 12, 20 and 30 |

20	(a)	(i)	(table below)	2	**B1** for table completed with no more than 5 errors or omissions	Ignore negative signs

×	1	2	2	3	4
1	1	2	2	3	4
2	2	4	4	6	8
2	2	4	4	6	8
3	3	6	6	9	12
4	4	8	8	12	16

		(ii)	$\frac{9}{25}$ oe	2	**B1FT** for *their* correct numerator **B1** for fraction with denominator 25	Ignore attempts to convert form or simplify Accept [0].36 or 36% but not ratio or in words
	(b)		Spinner completed with 3 negative numbers and 2 positives or 2 negatives and 3 positives	3	**M1** for $\frac{12}{25}$ soi eg by 12 [out of 25] **B1** for spinner with 5 numbers inserted, at least one negative	Do not accept 0 for **3** marks Not just 12 as a number on the spinner Condone 0 (as positive) for **B1**

21	(a)		8	1		
	(b)		Correct curve	2	**B1FT** for 4, 5 or 6 points plotted correctly	½ square tolerance **B1** max if line ruled (between any points)
	(c)		⁻0.9 to ⁻0.6 2.6 to 2.9	2	**B1** for each If 0 scored **SC1** for (⁻0.9 to ⁻0.6, 2) and (2.6 to 2.9, 2) If 0 scored SC1 for answer as an inequality Eg $-0.8 \leq x \leq 2.7$	If more than two answers mark the worst two Condone for **2** marks when both answers in body but only one given on answer line
22			4.653 to 4.655 or 4.65 or 4.7 or 5	5	**Volume of cuboid** **M1** for 90 × 90 × 150 soi 1 215 000 **Volume of cylinder** **M1** for $\pi \times 45^2 \times 80$ soi 508 680 to 509 004 **Total volume** **M1** for *their* 1 215 000 + *their* 508 938.1 soi 1 723 680 to 1 723 938.1 **Find mass using density** **M1** for any of *their* volumes $\times$ 2.7	Answers of 4.7 or 5 require supporting working Answers from values of π π = 508 938.0099 3.142 = 509 004 3.14 = 508 680 *Their* volumes must be seen to come from the product of three relevant lengths Dependent on a calculated volume for cuboid, cylinder or total If total consists of one volume and one non-volume but is × 2.7, final **M1** scored

APPENDIX
Exemplar responses for Q16(a)(ii)

Response	Mark
(line drawn on graph) no, following the scatter diagram points there would be an estimate of around 240 visitors *Take "following the scatter diagram points" refers to the line and a supporting value*	**2**
No we expect 250 (reference to line or markings drawn)	**2**
No, a line of best fit would show 250 (no line)	**2**
No, 0-1 mm shows 320 but we would expect less as it is decreases/negative trend	**2**
No, (point below 2mm and point above 2mm stated) so there is a negative trend	**2**
no as with 1mm rain its 280 visitors so with 2mm you should get around 245 *B1 for 245 expected at 2mm but no reference to trend*	**1**
having drawn a line of best fit the scatter diagram wouldn't support this as it's too big a number *No explicit supporting value used*	**1**
no, by looking at the diagram you would expect about 240 *Supporting value in range but no justification*	**1**
no because with 1mm there's less than 320 visitors *1 mm and 320 are the supporting values but no reference to trend*	**1**
no because there were 320 visitors on a day with 0mm rainfall *0 mm and 320 are the supporting values but no reference to trend*	**1**
No we expect 250 (nothing else)	**1**
(No valid comment) line of best fit within overlay	**1**
No, 0-1 mm shows 320	**1**
No, 320 is for 1mm	**1**
No, negative trend	**1**
No, (point below 2mm and point above 2mm stated)	**1**
the scatter diagram doesn't support his statement as there isn't any rainfall that is 2mm *No supporting value*	**0**
no it doesn't because when the rainfall was 2mm he didn't have any visitors *Wrong*	**0**
the closest amount of visitors to 2mm of rainfall is 290 *An estimate that is out of range and is probably referring to the nearest point plotted. No reference to trend*	**0**
No, as on a day with 1mm there are fewer customers	**0**
Yes …	**0**

Exemplar responses for Q16(a)(iii)

Response	Mark
Outside range of data collected *Perfect!!*	**1**
because there is no data to show above 6mm of rainfall *Equivalent answer*	**1**
because the values of 7 and 8mm are not plotted, therefore it would be hard to estimate 9mm *Similar to "no data around 9mm"*	**0**
no record of any visitors are shown at 9mm of rainfall. Visitors stop coming when it hits 6mm of rainfall *Equivalent to "no data for 9mm"*	**0**
because there is not enough data to estimate the amount of visitors for 9mm of rainfall *Does not say "no data beyond 5.5 (or 6) mm"*	**0**
we don't have the data to do a line of best fit *Wrong*	**0**
there is nothing recorded *Wrong*	**0**
you can't plot this data the graph isn't big enough *Wrong*	**0**
because that would create an outlier or anomalous piece of data *Maybe but wrong*	**0**
it wouldn't be on the line *Wrong*	**0**
there would be under 50 visitors so it would be hard to get an accurate number *Wrong*	**0**
because the experiment was only tested for 10 days, you would need to have more evidence to estimate how many visitors would come on 9mm rainfall *Probably correct but has missed the point that THESE data do not extend beyond 5.5 mm*	**0**
because the rain might be too heavy for visitors to come *True but not answering the question*	**0**

Exemplar responses for Q16(b)

Response	Mark
The total number of visitors is not known *True*	**1**
there is no value of the amount of visitors that day *For value read number*	**1**
because there are more children and it **don't say how many there are in total** *Mark the best bit and no contradiction*	**1**
there is no numbers to help us find our answer *Too vague, could be referring to angles or number of adults*	**0**
the pie chart doesn't show any figures or percentages *Too vague, could be referring to angles or number of adults (and final part incorrect)*	**0**
they don't have enough information *Too vague*	**0**
because you can't tell what the percentage is *Wrong*	**0**
the tourist attraction could be aimed at children *Wrong*	**0**
its different every day *Wrong*	**0**
the pie chart is not as accurate as others *Wrong*	**0**

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