

**GCSE (9–1)**

**Mathematics**

**J560/05: Paper 5 (Higher tier)**

General Certificate of Secondary Education

**Mark Scheme for November 2022**

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.

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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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## MARKING INSTRUCTIONS

### PREPARATION FOR MARKING RM ASSESSOR

1. Make sure that you have accessed and completed the relevant training packages for on-screen marking: *RM Assessor Online Training*; *OCR Essential Guide to Marking*.
2. Make sure that you have read and understood the mark scheme and the question paper for this unit. These are available in RM Assessor.
3. Log-in to RM Assessor then mark and annotate the **required number** of practice responses (“scripts”) and the **required number** of standardisation responses.

### MARKING

1. Mark strictly to the mark scheme.
2. Marks awarded must relate directly to the marking criteria.
3. The schedule of dates is very important. It is essential that you meet the RM Assessor 50% and 100% deadlines. If you experience problems, you must contact your Team Leader (Supervisor) without delay.
4. If you are in any doubt about applying the mark scheme, consult your Team Leader via the RM Assessor messaging system.
5. Where a candidate has crossed out a response and provided a clear alternative then the crossed out response is not marked. Where no alternative response has been provided, examiners should give candidates the benefit of the doubt and mark the crossed out response where legible.
6. When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.
7. On each blank page the annotation **BP** must be inserted to confirm that the page has been checked. For additional objects (if present), a tick must be inserted on each page to confirm that it has been checked.

8. There is a NR (No Response) option. Award NR (No Response)
- if there is nothing written at all in the answer space
  - OR if there is a comment which does not in any way relate to the question (e.g. 'can't do', 'don't know')
  - OR if there is a mark (e.g. a dash, a question mark) which is not an attempt at the question.








The hash key (#) on your keyboard will enter NR.

Note: Award 0 marks for an attempt that earns no credit (including copying out the question).

9. The RM Assessor **comments box** is used by the Principal Examiner or your Team Leader to explain the marking of the practice responses. Please refer to these comments when checking your practice responses. **Do not use the comments box for any other reason.**

If you have any questions or comments for your Team Leader, use the RM Assessor messaging system.

10. Assistant Examiners should send a brief report on the performance of candidates to their Team Leader (Supervisor) by the end of the marking period. Please follow the direction of your Team Leader about which questions you should report on and how to submit your report. Your report should contain notes on particular strengths displayed as well as common errors or weaknesses.
11. Annotations available in RM Assessor. These **must** be used whenever appropriate during your marking.

Annotation	Meaning
	Correct
	Incorrect
	Benefit of doubt
	Follow through
	Ignore subsequent working (after correct answer obtained), provided method has been completed
	Method mark awarded 0
	Method mark awarded 1

<b>M2</b>	Method mark awarded 2
<b>A1</b>	Accuracy mark awarded 1
<b>B1</b>	Independent mark awarded 1
<b>B2</b>	Independent mark awarded 2
<b>MR</b>	Misread
<b>SC</b>	Special case
<b>^</b>	Omission sign
<b>BP</b>	Blank page
<b>SEEN</b>	Seen

For a response awarded zero (or full) marks a single appropriate annotation (cross, tick, M0 or ^) is sufficient, but not required.  
For responses that are not awarded either 0 or full marks, you must make it clear how you have arrived at the mark you have awarded and all responses must have enough annotation for a reviewer to decide if the mark awarded is correct without having to mark it independently.

**It is vital that you annotate standardisation scripts fully to show how the marks have been awarded.**

**Subject-Specific Marking Instructions**

12. **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.
13. 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 e.g. 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**.
  - **soi** means **seen or implied**.
  - **dep** means that the marks are **dependent** on the marks indicated. You must check that the candidate has met all the criteria specified for the mark to be awarded.
  - **with correct working** means that full marks **must not** be awarded without some working. The required minimum amount of working will be defined in the guidance column and **SC** marks given for unsupported answers.
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.
15. Unless the command word requires that working is shown and the working required is stated in the mark scheme, 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, i.e. incorrect working is seen and the correct answer clearly follows from it.

16. 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. 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.

Figures or expressions that are being followed through are sometimes encompassed by single quotation marks after the word *their* for clarity, e.g. FT  $180 \times (\textit{their} '37' + 16)$ , or FT  $300 - \sqrt{(\textit{their} '52 + 72')}$ . Answers to part questions which are being followed through are indicated by e.g. FT  $3 \times \textit{their} (a)$ .

17. In questions **with no final answer line**, make no deductions for wrong work after an acceptable answer (i.e. **isw**) unless the mark scheme says otherwise, indicated by the instruction 'mark final answer'.
18. In questions **with a final answer line and incorrect answer given**:
- (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 if there is no other method leading to the incorrect answer. Use the **M0**, **M1**, **M2** annotations as appropriate and place the annotation ✕ next to the wrong answer.
19. 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. A correct step, value or statement that is not part of the method that leads to the given answer should be awarded **M0** and/or **B0**.
  - (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 marks for the poorer response unless the candidate has clearly indicated which method is to be marked.
20. 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 marks for the poorer response unless the candidate has clearly indicated which response is to be marked.
21. 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. If a candidate corrects the misread in a later part, do not continue to follow through, but award **A** and **B** marks for the correct answer only.

22. 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.
23. Ranges of answers given in the mark scheme are always inclusive.
24. 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.
25. If in any case the mark scheme operates with considerable unfairness consult your Team Leader.



Question		Answer	Marks	Part marks and guidance																	
1		16.8[0]	3	<p><b>M2</b> for <math>14 \times \left(1 + \frac{20}{100}\right)</math> oe</p> <p>or <b>M1</b> for <math>14 \times \frac{20}{100}</math> oe soi</p>	<p>M0 for <math>14 \times (1 + 20\%)</math> without further working</p> <p>M1 implied by 2.8[0] or answer 11.2[0]</p> <p>M0 for <math>14 \times 20\%</math> without further working</p>																
2		-1, 0, 1, 2, 3	3	<p><b>B2</b> for 5 correct values with one extra or for 4 correct with no extras</p> <p>or for <math>-1 \leq x &lt; 4</math></p> <p>or <b>M1</b> for <math>-4 + 3 \leq x</math> or <math>x &lt; 1 + 3</math> oe</p>	<p>For M1, condone incorrect inequality sign or equals</p>																
3	(a)	<table border="1" style="margin-left: auto; margin-right: auto;"> <tr> <td></td> <td>2</td> <td>5</td> <td>8</td> </tr> <tr> <td>2</td> <td>4</td> <td>7</td> <td><b>10</b></td> </tr> <tr> <td>5</td> <td>7</td> <td>10</td> <td><b>13</b></td> </tr> <tr> <td>8</td> <td><b>10</b></td> <td>13</td> <td>16</td> </tr> </table>		2	5	8	2	4	7	<b>10</b>	5	7	10	<b>13</b>	8	<b>10</b>	13	16	1		
	2	5	8																		
2	4	7	<b>10</b>																		
5	7	10	<b>13</b>																		
8	<b>10</b>	13	16																		
3	(b)	$\frac{2}{9}$ oe	2	<p>FT <i>their</i> completed table</p> <p><b>M1</b> for 4 and 16 identified FT <i>their</i> table and no others</p>	<p>Do not accept ratio or words isw conversion/cancelling</p> <p>M1 implied by <math>\frac{2}{15}</math></p>																
4	(a)	$\frac{2}{5}$	1	Accept any equivalent fraction	isw attempts to simplify to a fraction																

Question		Answer	Marks	Part marks and guidance	
4	(b)	55[%]	4	<p><b>M3</b> for <math>1 - \left( \frac{18}{100} \div \text{their } \frac{2}{5} \right)</math> oe</p> <p>or for <math>\frac{\text{their } 40 - 18}{\text{their } 40}</math> oe</p> <p>or <b>M2</b> for <math>\frac{18}{100} \div \text{their } \frac{2}{5}</math> oe</p> <p>or for <i>their</i> 40 – 18 oe</p> <p>or <b>M1</b> conversion of values to a common form</p> <p>e.g <i>their</i> 40% or <math>\frac{18}{100}</math> or <math>\frac{82}{100}</math> seen</p> <p>or <i>their</i> 0.4 <b>and</b> 0.18 or <i>their</i> 0.4 <b>and</b> 0.82 seen</p> <p style="text-align: center;">OR</p> <p>Alternative method using a value for the number of sweets eg if using 50 sweets ...</p> <p><b>M3</b> for fraction of Layla’s share <math>\frac{20 - 9}{20}</math></p> <p>or <b>M2</b> for Layla eats 20 – 9</p> <p>or <b>M1</b> for Layla receives 20 or is left with 9</p>	<p>M3 implied by 0.55 oe</p> <p><i>their</i> 40 is <i>their</i> (a) converted to %, accept both 40 and 18 as decimals for M3 or M2 Accept FT conversion to 2 figs rot</p> <p>M2 implied by 0.45 oe, 45[%] or 22[%]</p> <p>M3 for any fraction leading to 0.55</p> <p>M2 for 40%FT for <i>their</i> (a) of <i>their</i> sweets – 18% of <i>their</i> sweets</p> <p>M1 for 40%FT for <i>their</i> (a) of <i>their</i> sweets or 18% of <i>their</i> sweets</p>

Question		Answer	Marks	Part marks and guidance	
5		12 with correct working	6	<p><b>B2</b> for <math>\frac{37}{40}</math> oe or <math>\frac{3}{40}</math> oe</p> <p>or <b>M1</b> for <math>\frac{1}{8} + \frac{4}{5}</math> oe soi</p> <p><b>M2</b>dep on M1 for [distance in m =] <math>900 \div \left(1 - \text{their } \frac{37}{40}\right)</math> oe</p> <p>or <b>M1</b>dep on M1 for <math>900 = 1 - \text{their } \frac{37}{40}</math></p> <p><b>M1</b> for <i>their</i> distance <math>\div 1000</math> soi with no further incorrect conversion</p> <p>If 0, 1 or 2 scored then instead award <b>SC3</b> for answer 12 If 0 or 1 scored then instead award <b>SC2</b> for answer 12000</p>	<p>“Correct working” requires evidence of at least M1M2 or convincing pictorial/alternate convincing approach</p> <p>0.925 or 92.5% or 0.075 or 7.5%</p> <p>0.125 + 0.8 or 12.5% + 80%</p> <p>eg <math>900 \div 3 = 300</math> and <math>300 \times 40 = 12000</math></p> <p>allow M1 for <math>900 \div 1000</math> with no further incorrect conversion seen Must see written distance to convert</p>
6	(a)	Point correctly plotted	1		Accuracy $\pm \frac{1}{2}$ small square radially, use overlay as a guide
6	(b)	320	2	<b>B1</b> for answer <b>figs</b> 32 or for 4160 or 4480	Don't accept percentages

Question		Answer	Marks	Part marks and guidance	
6	(c)	Only part of vertical scale is shown oe	1		<p>e.g. Because the population axis starts at 4000, 4.0 [thousand] Vertical axis does not start at 0 She may have just looked at the steepness of the graph <b>and</b> not the scale of the graph/numbers Accept it only goes up by 540</p> <p>See AG Any incorrect statements/incorrect specific values scores zero</p>
6	(d)	Increasing trend continues oe	1		<p>e.g. The population growth will continue the same as in previous years People will not leave the village and the increase continues If a number is given with the increase then it should be at least 60</p> <p>See AG Any incorrect specific values scores zero</p>

Question		Answer	Marks	Part marks and guidance	
7		103 with correct working	5	<p><b>B3</b> for <math>x = 42</math> or <b>M2</b> for <math>4x = 180 - 35 + 23</math> oe or <math>3x - 23 = 103</math> or better</p> <p>or <b>M1</b> for <math>3x - 23 + x + 35 = 180</math> oe <b>A1</b> for <math>x = 42</math></p> <p>AND <b>M1</b> for <math>3 \times \textit{their } x - 23</math> or <math>\textit{their } x + 35</math></p> <p>If <b>0</b> or <b>1</b> scored, instead award <b>SC2</b> for answer 103 with no or insufficient working</p> <p>If <b>0</b> scored, instead award <b>SC1</b> for <math>[x =] 42</math></p>	<p>“Correct working” requires evidence of at least M2 or M1M1 Accept equivalents for M2 e.g. <math>(180 - 35 + 23) \div 4</math> if no algebra seen Accept e.g. <math>3x - 23</math> and <math>x + 35 = 180</math></p> <p>Using trial, allow correct substitution into <math>3x - 23 + x + 35</math> to imply M1 if 180 also stated</p> <p>SC marks may be seen on diagram</p>
8	(a)	Circle radius 3 cm	2	<p><b>B1</b> for circle any radius or for 3 indicated as the radius</p> <p>or for correct circle with internal lines</p>	<p>Allow freehand for 2 marks or for B1 if vertical and horizontal diameters are consistent</p> <p>6 indicated as diameter implies B1 B1 could be implied on a diagram</p> <p>but condone for 2 marks if correct circle and internal lines are diameter or radius</p>

Question		Answer	Marks	Part marks and guidance	
8	(b)	Rectangle 6 cm (width) by 4 cm (height)	2	<b>B1</b> for any rectangle with no internal lines or for correct rectangle but good freehand	All lines must be ruled for 2 marks If <u>both</u> (a) and (b) are reversed but otherwise correct allow SC2 If one correct and reversal is clear allow SC1
9		$[(\frac{1}{10})^2 =] \frac{1}{100}$ or 0.01 $[\sqrt{0.25} =] 0.5$ or $\frac{1}{2}$ $[4^{-1}] = \frac{1}{4}$ or 0.25	<b>M3</b>	<b>M1</b> for each	For all method marks accept oe %'s If e.g. $[(\frac{1}{10})^2 =] \frac{1}{100} = 0.1$ then M0  Accept $-0.5$ or $\pm 0.5$ oe for $\sqrt{0.25}$ or $\frac{5}{10}$
		No oe and $(\frac{1}{10})^2, 4^{-1}, \sqrt{0.25}$ oe	<b>A1</b>		Accept equivalents Accept No oe and $4^{-1}$ and $\sqrt{0.25}$ need to swap places oe  If $-0.5$ oe for $\sqrt{0.25}$ , then accept order is $\sqrt{0.25}, (\frac{1}{10})^2, 4^{-1}$ oe

Question	Answer	Marks	Part marks and guidance
10	<p>[x = ] 7.5 oe                      [y = ] 12.5 oe                      with correct working</p>	6	<p><b>M4</b> for 20 and <math>x + y</math> or 20 and <math>(3 + 5)</math> oe                      or  <b>M3</b> for 40 and <math>2(x + y)</math>                      or  <b>M2</b> for <math>8 \times 5</math> soi by 40 and <math>\frac{4}{2}(x + y)</math> oe                      or  <b>M1</b> for <math>8 \times 5</math> soi by 40 or <math>\frac{4}{2}(x + y)</math> oe</p> <p>AND</p> <p><b>M1</b> for <i>their</i> <math>20 \div (3 + 5)</math></p> <p><u>Alternative if trials used for the trapezium:</u>  <b>M4</b> for [parallelogram =] 40 and <math>\frac{4}{2}(x + y)</math>                      correctly evaluated with <math>x + y = 20</math>                      or  <b>M3</b> for 40 and <math>\frac{4}{2}(x + y)</math> correctly evaluated                      with <math>x : y</math> in the ratio 3 : 5 but <math>x \neq 3</math> <math>y \neq 5</math>                      or  <b>M2</b> for <math>8 \times 5</math> soi by 40 and <math>\frac{4}{2}(x + y)</math> correctly                      evaluated using any <math>x</math> and <math>y</math>                      or  <b>M1</b> <math>8 \times 5</math> soi by 40 or substitution into  <math>\frac{4}{2}(x + y)</math> with any <math>x</math> and <math>y</math></p> <p>If <b>0</b>, <b>1</b> or <b>2</b> scored, instead award  <b>SC3</b> for answer [x =] 7.5 and [y =] 12.5 with no                      or insufficient working</p> <p>If <b>0</b> or <b>1</b> scored, instead award  <b>SC2</b> for answer [x =] 9 and [y =] 15</p> <p>‘Correct working’ requires evidence of at                      least M3                      For all method marks allow for <math>x + y</math>                      e.g. <math>\frac{3}{5}y + y</math>, <math>a + b</math> oe or other variables,                      Method may be seen in stages</p> <p>Implied by two answers in the ratio  <math>x : y = 3 : 5</math></p> <p>e.g. 40 and <math>\frac{4}{2}(2 + 18) = 40</math></p> <p>e.g. 40 and <math>\frac{4}{2}(6 + 10) = 32</math></p> <p>e.g. <math>8 \times 5</math> and <math>\frac{4}{2}(3 + 5) = 16</math></p> <p>e.g. <math>\frac{4}{2}(4 + 5)</math></p>

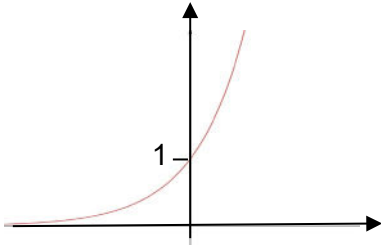
Question		Answer	Marks	Part marks and guidance	
11		$\frac{3}{11}$ cao	3	<b>B2</b> for $\frac{27}{99}$ oe fraction or <b>M1</b> for 27.27....	
12	(a)	The two events are dependent oe  and  $\frac{40}{60} \times \frac{39}{59}$ isw	2	<b>B1</b> for either  Accept e.g. The second probability is not $\frac{2}{3}$ oe The second probability is wrong oe The second probability is $\frac{39}{59}$ There is one less for the second pick oe It is out of 59 for the 2 <sup>nd</sup> pick oe Any incorrect statement is B0	

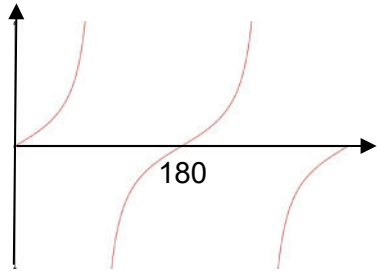


Question		Answer	Marks	Part marks and guidance	
12	(b)	$\frac{48}{95}$ oe with correct working	5	<p><b>M4</b> for <math>2\left(\frac{8}{20} \times \frac{12}{19}\right)</math> oe</p> <p>or <b>M3</b> for <math>\frac{8}{20} \times \frac{12}{19}</math> oe</p> <p>or <b>M2</b> for <math>\frac{8}{20}</math> and <math>\frac{12}{19}</math> or <math>\frac{8}{19}</math> and <math>\frac{12}{20}</math> oe seen</p> <p>or <b>M1</b> for <math>\frac{8}{20}</math> or <math>\frac{12}{20}</math> oe seen</p> <p>If <b>0</b> or <b>M1</b> scored, instead award</p> <p><b>SC2</b> for <math>\frac{8}{n} \times \frac{12}{n-1}</math> oe or for <math>2\left(\frac{8}{20} \times \frac{12}{20}\right)</math> oe</p> <p>or for answer <math>\frac{48}{95}</math> oe with no or insufficient working</p> <p>If <b>0</b> scored</p> <p><b>SC1</b> for <math>\frac{8}{n}</math> and <math>\frac{12}{n-1}</math> or <math>\frac{8}{n-1}</math> and <math>\frac{12}{n}</math> seen</p> <p>or for answers <math>\frac{24}{95}</math> oe or <math>\frac{12}{25}</math> oe with no or insufficient working</p>	<p>'Correct working' needs evidence of M2</p> <p>Must be proper fractions and <math>n \leq 60</math></p> <p>Must be proper fractions and <math>n \leq 60</math></p>

Question	Answer	Marks	Part marks and guidance	
13	<p>Angle AED = angle BEC and [vertically] opposite            Angle DAE = angle EBC and same segment            Angle ADE = angle ECB and same segment</p> <p>[Triangle AED is similar to triangle BEC] [corresponding] angles are equal oe or AAA oe</p> <p>OR</p> <p>After two pairs of angles with reasons gives 3<sup>rd</sup> pair of equal angles with a reason</p>	<p><b>M2</b></p> <p><b>A1</b></p>	<p>For <b>M2</b> only two of the three statements and reasons are required  <b>M1</b> for one pair of angles with a reason</p> <p>With no errors or incorrect statements seen</p> <p>If 0 scored, <b>SC1</b> for at least two correct pairs of angles identified with no / incorrect reasons</p>	<p>Allow any unambiguous labelling for angles e.g. DAE or DAC or A, but not E            For reason accept e.g. opp <math>\sphericalangle</math>'s            For same segment, accept same arc but not same chord            Accept 3<sup>rd</sup> angle in triangle oe for reason with final angle if other two given correctly with correct reasons</p> <p>Accept they have the 'same/equal angles' oe, AA <b>and</b> similar. Accept symbol <math>\sim</math> for similar</p> <p>Condone angles identified on diagram for <b>SC1</b></p>
14	<p>[a = ] 25 000            [b = ] [0].94</p>	4	<p><b>B1</b> for 25 000</p> <p>AND</p> <p><b>B3</b> for 0.94 oe            or  <b>B2</b> for <math>\frac{23500}{25000}</math> or 94% oe            or <math>\frac{25000 - 23500}{25000}</math> or 0.06 oe            or  <b>M1</b> for <math>23500 = ab^{[1]}</math> or <math>23500 = 25000b^{[1]}</math></p>	

Question		Answer	Marks	Part marks and guidance	
15	(a)	$3\sqrt{5}$ final answer	2	B1 for $\sqrt{45}$ or $[\sqrt{15} = ]\sqrt{5}\sqrt{3}$	
15	(b)	$\frac{8\sqrt{15}}{3}$ or $\frac{8\sqrt{5}\sqrt{3}}{3}$ final answer	3	B2 for $\frac{40\sqrt{15}}{15}$ or $\frac{40\sqrt{5}\sqrt{3}}{15}$ or M1 for $\frac{40}{\sqrt{15}} \times \frac{\sqrt{15}}{\sqrt{15}}$ or better	
15	(c)	81	2	M1 for $\sqrt[3]{27^4}$ soi or B1 for $\sqrt[3]{27} = 3$	
16	(a)	$36 \div 20$	1		Accept $\frac{36}{20}$
16	(b)	Tangent drawn to graph at $t = 10$  1[.0] to 1.5	B1  B2	Dep on tangent or close attempt M1dep for rise/run with values substituted	
17		$14\sqrt{2}$ final answer	3	M1 for $\frac{1}{2} \times 8 \times 7 \times \sin 45$ oe B1 for $\sin 45 = \frac{1}{\sqrt{2}}$ or better	
18	(a)	$(x + 11)(x + 7) [= 0]$	M2	M1 for $(x + a)(x + b) [= 0]$ where $ab = 77$ or $a + b = 18$ or for $x(x + 11) + 7(x + 11)$ or $x(x + 7) + 11(x + 7)$	
		-11 and -7	B1	FT <i>their</i> factors if of the form $(x + a)(x + b)$ with $a, b$ integers	

Question			Answer	Marks	Part marks and guidance	
18	(b)	(i)	$(x + 9)^2 - 4$ final answer	3	<p><b>B1</b> for <math>(x + 9)^2</math></p> <p><b>B2FT</b> for <math>[+] 77 - (\text{their } a)^2</math> after <math>(x + \text{their } a)^2</math> correctly evaluated or <b>B1</b> for <math>[+] 77 - (\text{their } a)^2</math> shown</p> <p>If 0 scored, <b>SC2</b> for final answer <math>(x + 9) - 4</math></p>	FT can be implied e.g. $(x + 10)^2 - 23$ gets B2FT
18	(b)	(ii)	$(-9, -4)$	2	<p><b>FT</b> <i>their</i> 18(b)(i) if in form <math>(x + a)^2 + b</math></p> <p><b>B1FT</b> for each value</p>	
19	(a)		<p>Correct sketch with <math>y</math> – intercept indicated at 1</p> 	2	<p><b>B1</b> for correct increasing shape or any sketch with <math>y</math> – intercept at 1</p>	For 2 marks, condone curve touching but not crossing $x$ - axis

Question			Answer	Marks	Part marks and guidance	
19	(b)		<p>Correct sketch through (0, 0), (180, 0) and (360, 0) indicated</p> 	2	B1 for three correct sections but joined and/or 180 not indicated	
20			<p><math>10^2 + 6^2 + 4^2</math> oe or better</p> <p>152 oe or better</p> <p>Does not fit and <math>13^2 = 169</math> or <math>\sqrt{152}</math> lies between 12 and 13 oe</p>	<p>M2</p> <p>A1</p> <p>A1</p>	<p>M1 for <math>10^2 + 6^2</math> or <math>6^2 + 4^2</math> or <math>10^2 + 4^2</math> all oe or better</p> <p>Dep on M2A1</p>	<p>M1 implied by 136, 52, or 116</p> <p>eg <math>\sqrt{152}</math></p> <p>Accept No and <math>\sqrt{152}</math> is less than 13 or No and <math>\sqrt{152} = 12</math>. [...]</p>
21	(a)		$[k = ] 0$	1		
21	(b)	(i)	<p><math>y = 3x - 1</math> ruled</p> <p>0.1 to 0.3 and 2.1 to 2.3</p>	<p>M2</p> <p>A2</p>	<p>M1 for correct freehand or short line or for <math>y = 3x - k</math> ruled or <math>y = ax - 1</math> ruled but not <math>y = -1</math></p> <p>A1 for each After A0, SC1 for both values correct</p>	<p>For M2 must cross curve twice Accuracy <math>\pm 1\text{mm}</math> at (0, -1) and (1, 2)</p> <p>Only award if M2 scored previously 0.15287... , 2.1804....</p>

Question		Answer	Marks	Part marks and guidance	
	(b)	(ii)			
		$1 = (3x - 1)(x - 2)$	<b>M1</b>		Allow recovery from missing brackets for M1 or ' $= 1$ '
		$3x^2 - x - 6x + 2$	<b>B2</b>	For correctly expansion of brackets B1 for 3 terms correct in expansion	For B2 accept $3x^2 - 7x + 2$ For B1 $-7x$ counts as two terms
		$3x^2 - 7x + 1 = 0$	<b>A1</b>	Dep on M1B2 with no errors or omissions	

## APPENDIX Q6c

	Response	Mark
1	It/the graph/ [y] axis/the population/the scale does not start at zero	1
2	Hasn't realised the population is only going up by 100 each time, so it isn't a huge increase ( <i>BOD implied axis and info on scale provided – huge increase implies steepness</i> )	1
3	It has only gone up by 540 [people] ( <i>accept reference to the value of the increase if value is correct</i> )	1
4	The graph has gone up by a lot but it is only around 500 ( <i>accept reasonable approximation of increase with steepness implied</i> )	1
5	The line on the graphs varied significantly but the value changed by only 600 ( <i>value is incorrect and no ref to steepness</i> )	0
6	Each big tile is on the graph shows 100 people ( <i>not enough – need to refer to graph not starting as zero or steepness</i> )	0
7	The steepness on the graph makes him think it has gone up a lot but the graph is going up in 1000s ( <i>1000s is incorrect we would accept 100s or 0.1s</i> )	0
8	The y axis is too small so it makes it look like there has been a huge increase ( <i>lacks detail about scale on y axis</i> )	0
9	The scale makes it look like it has gone up a lot when it really only a little ( <i>not enough – needs to ref steepness and scale</i> )	0
10	He used the steepness of the line to judge the increase ( <i>needs detail about scale</i> )	0
11	The continuing rising of the graph population and not reading the numbers properly ( <i>not enough – steepness and scale needed</i> )	0
12	Rowan didn't read the graph correct. 2015=4100, 2020=4630. Not a huge increase ( <i>Error with one value 4630 – otherwise we would accept with accurate values also</i> )	0
13	May have been misled by not reading the graph properly as it only went up by 640 ( <i>specific value given which is incorrect</i> )	0
14	By not looking at the figures and going by the plots rising. ( <i>implies steepness but too vague with vertical scale</i> )	0
15	Because of how much the line is rising may seem there is a rapid increase. ( <i>no ref to scale</i> )	0
16	He may think it goes up by thousands, but there has been less than a thousand people	0
17	By just looking at the plots on the graph and not looking at the actual numbers ( <i>right idea but need to ref steepness and scale</i> )	0
18	As the graph is only going up 100 between each box yet he sees it large by the depth ( <i>not enough - if steepness rather than depth then fine</i> )	0
19	Just because the line gets higher doesn't mean its a huge increase ( <i>need to ref scale</i> )	0
20	Because the line increased by a lot, but the numbers didn't ( <i>not enough – need more detail about the scale</i> )	0
21	May have been misled by the sharp diagonal line on the graph ( <i>no detail on scale</i> )	0

## APPENDIX 6d

	Response	Mark
1	The population will increase at the same/constant rate	1
2	The population will continue to increase	1
3	The population will increase by [more than] a thousand/600/60	1
4	The population will keep growing by birth or migration	1
5	The population will increase by 60/ the population increases by more than 60	1
6	The graph will follow the same trend	1
7	That the population will carry on rising like the past years	1
8	He has estimated this through the constant population increase <i>(trend is implied, ignore constant)</i>	1
9	The graph will continue growing in the same way and shape as it was this morning <i>(Fine describes trend – ignore ref to morning)</i>	1
10	Because of how the previous years were going he thinks it will stay in that pattern <i>(BOD stay in that pattern for trend)</i>	1
11	The birth rate will stay the same <i>(not enough to imply population will increase – deaths etc?)</i>	0
12	2022 will be greater than 4800 if 2021 is a population of 4740 <i>(not enough as repeats what is in the question)</i>	0
13	Blake may not be right as the population was increasing <i>(does not describe the assumption)</i>	0



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