OCR
Oxford Cambridge and RSA

Higher

GCSE

Mathematics - Paper 6

J560/06: Paper 6 (Higher tier)

General Certificate of Secondary Education

Mark Scheme for June 2025

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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.

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 and mark 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% (traditional 40% Batch 1 and 100% Batch 2) 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 by telephone, email or via the RM Assessor messaging system.

5. **Crossed-Out Responses**
   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 may give candidates the benefit of the doubt and mark the crossed-out response where legible.

   Rubric Error Responses – Optional Questions
   Where candidates have a choice of question across a whole paper or a whole section and have provided more answers than required, then all responses are marked and the highest mark allowable within the rubric is given. Enter a mark for each question answered into RM Assessor, which will select the highest mark from those awarded. *(The underlying assumption is that the candidate has penalised themselves by attempting more questions than necessary in the time allowed.)*

Multiple-Choice Question Responses
When a multiple-choice question has only a single, correct response and a candidate provides two responses (even if one of these responses is correct), then no mark should be awarded (as it is not possible to determine which was the first response selected by the candidate).
When a question requires candidates to select more than one option/multiple options, then local marking arrangements need to ensure consistency of approach.

Contradictory Responses
When a candidate provides contradictory responses, then no mark should be awarded, even if one of the answers is correct.

Short Answer Questions (requiring only a list by way of a response, usually worth only one mark per response)
Where candidates are required to provide a set number of short answer responses then only the set number of responses should be marked. The response space should be marked from left to right on each line and then line by line until the required number of responses have been considered. The remaining responses should not then be marked. Examiners will have to apply judgement as to whether a 'second response' on a line is a development of the 'first response', rather than a separate, discrete response. *(The underlying assumption is that the candidate is attempting to hedge their bets and therefore getting undue benefit rather than engaging with the question and giving the most relevant/correct responses.)*

Short Answer Questions (requiring a more developed response, worth two or more marks)
If the candidates are required to provide a description of, say, three items or factors and four items or factors are provided, then mark on a similar basis – that is downwards (as it is unlikely in this situation that a candidate will provide more than one response in each section of the response space).

Longer Answer Questions (requiring a developed response)
Where candidates have provided two (or more) responses to a medium or high tariff question which only required a single (developed) response and not crossed out the first response, then only the first response should be marked. Examiners will need to apply professional judgement as to whether the second (or a subsequent) response is a 'new start' or simply a poorly expressed continuation of the first response.

6. Always check the pages (and additional objects if present) at the end of the response in case any answers have been continued there. If the candidate has continued an answer there, then add the annotation 'SEEN' to confirm that the work has been seen and mark any responses using the annotations in section 11.

7. 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.

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

8. The RM Assessor **comments box** is used by 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.**

9. Assistant Examiners will send a brief report on the performance of candidates to their Team Leader (Supervisor) via email by the end of the marking period. The report should contain notes on particular strengths displayed as well as common errors or weaknesses. Constructive criticism of the question paper/mark scheme is also appreciated.

10. For answers marked by levels of response: Not applicable in F501
To determine the level – start at the highest level and work down until you reach the level that matches the answer
To determine the mark within the level, consider the following

Descriptor	Award mark
On the borderline of this level and the one below	At bottom of level
Just enough achievement on balance for this level	Above bottom and either below middle or at middle of level (depending on number of marks available)
Meets the criteria but with some slight inconsistency	Above middle and either below top of level or at middle of level (depending on number of marks available)
Consistently meets the criteria for this level	At top of level

11. Annotations available in RM Assessor. These **must** be used whenever appropriate during your marking.

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
BP	Blank page
SEEN	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

i. **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.

ii. 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.
- **nfww** 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.

3. 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.

4. 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.

5. 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 × (*their* '37' + 16), or FT 300 – √(*their* '52 + 72'). Answers to part questions which are being followed through are indicated by e.g., FT 3 × *their* (a).

6. 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'.

7. 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.

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. 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.

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 marks for the poorer response unless the candidate has clearly indicated which response is to be marked.

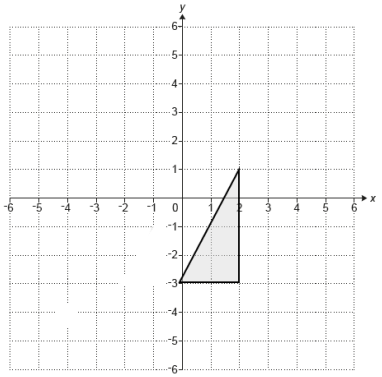
   When the data of a question is consistently misread in such a way as not to alter the nature or difficulty of the question, please follow the candidate's work and allow follow through for **A** and **B** marks. Deduct 1 mark from any **A** or **B** marks earned and record this by using the **MR** annotation. **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.

10. 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.

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

12. For methods not described in the mark scheme, such as visual representations like bar models, ratio tables, give equivalent marks for equivalent work. If in doubt, consult your Team Leader.

13. If in any case the mark scheme operates with considerable unfairness consult your Team Leader.

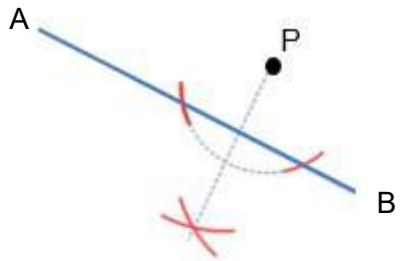
Question			Answer	Marks	Part Marks and Guidance	
1	(a)		<table><tr><th>×</th><th>3</th><th>4</th><th>5</th><th>6</th></tr><tr><td>3</td><td>9</td><td>12</td><td>15</td><td>18</td></tr><tr><td>4</td><td>12</td><td>16</td><td>20</td><td>24</td></tr><tr><td>5</td><td>15</td><td>20</td><td>25</td><td>30</td></tr><tr><td>6</td><td>18</td><td>24</td><td>30</td><td>36</td></tr></table>	1		
	(b)		$\frac{3}{16}$ oe	2FT	**Strict FT** *their* table for multiples of 8 **M1** for 16 and both 24s and any FT multiples of 8 identified with no extras or omissions or for $\frac{\textit{their } 3}{n}$ where $n \geq 13$	Do not accept ratio or words Accept 0.187[5], 0.188, 18.7[5]% or 18.8% If scoring fraction seen in body isw attempt to change form or cancel to final answer Note: If (a) is NR (b) $\frac{3}{16}$ scores **2** marks and $\frac{3}{n}$ where $n \geq 13$ scores **1** mark
2			Correct translation 	2	**B1** for a translation $\begin{pmatrix}3\\k\end{pmatrix}$ or $\begin{pmatrix}k\\-2\end{pmatrix}$ or three correct points not joined or three joined points one just out of tolerance	k can be 0 Mark intent (vertices within ±2 mm of correct position by eye) Ignore “counting” dots, intermediate position dots and dots on perimeter To be considered for the mark **one** point would need to be less than half way to the next gridline and the others in tolerance

Question			Answer	Marks	Part Marks and Guidance	
3	(a)		15	3	**M2** for $(1 - \frac{382.5[0]}{450})$ [× 100] oe or $\frac{450 - 382.5[0]}{450}$ [× 100] oe or $\frac{382.5[0] - 450}{450}$ [× 100] oe or **M1** for $\frac{382.5[0]}{450}$ [× 100] oe	Condone ⁻15 for **3** marks **M2** may be implied by ±0.15 or $\pm\frac{67.5}{450}$ or $\pm\frac{3}{20}$ **M1** may be implied by 0.85 or 85 or $\frac{17}{20}$ Non-calculator methods score **3** for correct answer or **M2** when equivalent to main scheme e.g. (second M2 method) 100(%) = 450 10(%) = 45 1(%) = 4.5 **M2** (450 – 382.5[0]) ÷ 4.5
	(b)		Vertical axis doesn't start from 0 oe or Jan price looks [less than] half Dec price oe or the difference between 382[.50] and 450 looks much bigger than it really is oe	1		Ignore • any reference to the horizontal axis • any insufficient reason that does not contradict the correct reason (if two reasons given) BUT, if two reasons offered and one reason clearly incorrect, mark the worst See Appendix

Question			Answer	Marks	Part Marks and Guidance	
4			One rectangle 8 cm by 4 cm	2	**B1** for one rectangle 8 by *n* or *m* by 4	Accept in any orientation, good freehand, tolerance for length ±2 mm by eye Additional shapes/lines or a net score **0** Other shapes/lines must be clearly deleted to allow **1** or **2** marks
5			They have ignored the [negative] powers oe 10^{-2} or 0.01 or $\frac{1}{100}$	1 1		See Appendix
6	(a)		69.5 [≤ *w* <] 70.5	2	**B1** for each If **0** scored **SC1** for • correct but reversed or • 69.50 [≤ *w* <] 70.50	
	(b)		Accept any correctly matched pair of values in which space < fridge from these ranges 69.5 ≤ space < 69.55 e.g. s = 69.5 and 69.5 < fridge < 69.55 f = 69.54	2	**B1** for one value for space or fridge where 69.5 ≤ space < 69.55 e.g s = 69.5 or 69.5 < fridge < 69.55 e.g. f = 69.51	Error interval (e.g. ...≤ space < ...) alone scores **0** Only mark candidate's chosen value(s) Measurements used must be clearly associated with space and/or fridge Space < fridge does not need to be stated For **B1** if one or multiple values for fridge/space seen and no clear choice all must be in correct ranges

7			250 with correct working	**6**	**M2** for $\frac{100-16}{9+5}$ × 9 oe or $\frac{100-16}{9+5}$ × 5 oe or **M1** for $\frac{100-16}{9+5}$ oe may be implied by 6 AND **B1** for 54 and 30 AND **M2** for (54 and 30 and 16) × $\frac{95}{54-16}$ oe or for $\frac{95}{54-16}$ × 100 oe or **M1** for $\frac{95}{54-16}$ oe may be implied by 2.5, 135, 75 or 40 If **0** or **1** scored, instead award **SC2** for 250 with no or insufficient working If **0** scored, instead award **SC1** for 54 or 30 with no or insufficient working	Correct working requires evidence of at least **M1**or**B1** AND **M1** Where there is a choice of method, mark the one that is progressed furthest May be seen with + signs, as a ratio, or as three separate products <u>Alternative second stage by trials</u> (in addition to any marks received for the first stage) **M2** for 135 : 75 : 40 or **M1** for 108 : 60 : 32 and 162 : 90 : 48 **<u>Algebra in terms of juniors *j*</u>** **M1** for $a = \frac{5}{9}j$ oe **M1** for $s = j - 95$ oe AND **M1** for $j - 95 = \frac{16}{100}(j - 95 + j + \frac{5}{9}j)$ oe or better **A1** for $j = 135$ **M1** for $s = 135 - 95$ implied by 40 and $a = \frac{5}{9} \times 135$ implied by 75

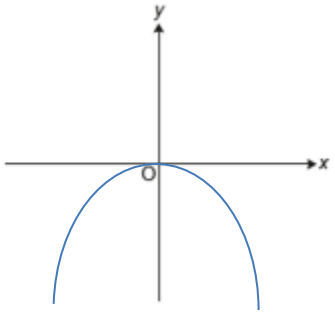
					Starting from ratio *j* : *a* is 9*x* : 5*x* **M2** for 9*x* – 95 = 0.16(9*x* + 5*x* + 9*x* – 95) oe or better **A1** for *x* = 15 or **M1** for *s* = 9*x* – 95 or *s* = 0.16(9*x* + 5*x* + 9*x* – 95) oe or better AND **M2** for 23 × 15 – 95 oe or **M1** for *a* = 5 × 15 implied by 75 or *j* = 9 × 15 implied by 135 or *s* = 9 × 15 – 95 implied by 40 If **0** or **1** scored, instead award **SC2** for 250 with no or insufficient working If **0** scored, instead award **SC1** for 15 with no or insufficient working **Algebra in terms of total *t*** **M1** for *s* = 0.16*t* **M1** for *j* = 0.16*t* + 95 **M1** for $a = \frac{5}{9}(0.16t + 95)$ AND **M2** for $t = 0.16t + 0.16t + 95 + \frac{5}{9}(0.16t + 95)$ oe or better	**Algebra in terms of adults *a*** **M1** for $j = \frac{9}{5}a$ oe **M1** for $s = \frac{9}{5}a - 95$ oe AND **M1** for $\frac{9}{5}a - 95 = \frac{16}{100}(a + \frac{9}{5}a + \frac{9}{5}a - 95)$ oe or better **A1** for *a* = 75 **M1** for $j = \frac{9}{5} \times 75$ implied by 135 and $s = \frac{9}{5} \times 75 - 95$ implied by 40 **Algebra in terms of seniors *s*** **M1** for *j* = *s* + 95 oe **M1** for $a = \frac{5}{9}(s + 95)$ oe AND **M1** for $s = \frac{16}{100}(s + s + 95 + \frac{5}{9}(s + 95))$ oe or better **A1** for *s* = 40 **M1** for *j* = 40 + 95 implied by 135 and $a = \frac{5}{9}(40 + 95)$ implied by 75

Question			Answer	Marks	Part Marks and Guidance	
8			Ruled line through P and perpendicular to AB constructed with correct arcs (one pair intersecting AB)	2	**B1** for correct arcs (one pair intersecting AB) only or for correct ruled line but no, or incomplete, construction arcs  	Condone dotted lines Set protractor to 90° and check 88° to 92° at AB Correct construction arcs as shown (may be two pairs of arcs used to draw line through P) Ignore other arcs if correct arcs clearly used to construct line Condone perpendicular extending beyond AB but must pass through P and reach AB (no daylight) **Alternative (eg constructing a kite)** Arc centred on A length AP and arc centred on B length BP meeting below AB (may also pass through P). Candidates may use points on AB other than A and B for this construction. In such cases check radii of arcs using on-line ruler to judge See appendix for exemplars
9	(a)		7	3	**M2** for $8x - 6x = 3 + 11$ oe OR **M1** for $2x - 11 = 3$ or for $2x = k$ or for $8x = 14 + 6x$ or for $kx = 14$ **M1** for $x = \frac{b}{a}$ FT *their* $ax = b$ seen	Embedded 7 scores **M2** e.g. $8 \times \mathbf{7} - 11 = 6 \times \mathbf{7} + 3$ [= 45] identified as final working or written on answer line eg $2x = -8$ and answer line -4 with no other working scores **M1** and **M1FT**

Question			Answer	Marks	Part Marks and Guidance	
	(b)		$(x + 16)(x – 1)$	**M2**		Condone final bracket missing Accept $x + 16 = 0$ and $x – 1 = 0$ for **M2**
					M1 for $(x + a)(x + b)$ where $ab = ^-16$ or $a + b = 15$ or $x(x + 16) – [1](x + 16)$ or $x(x – 1) + 16(x – 1)$	Allow correctly completed grid for **M1**
			$^-16$ and 1	**B1FT**	For correct solutions from their quadratic factors If **0** scored, instead award **SC1** for answers ±16 and ±1	$(x – 16)(x + 1)$ with answers $^-16$ and 1 scores **M1B0**

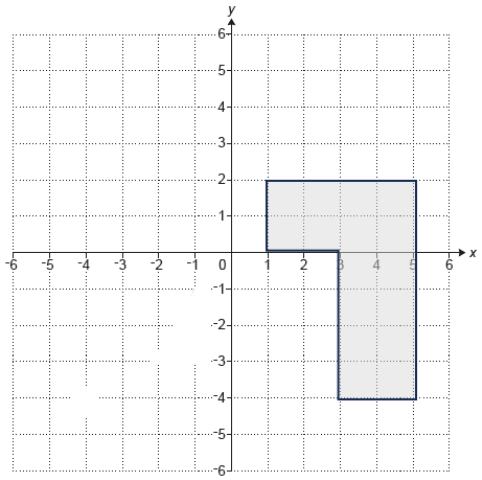
Question			Answer	Marks	Part Marks and Guidance	
10			$\sqrt{6\pi}$ or 4.34… with correct working	5	**B2** for 36π or 113 to 113.143 or **M1** for $4\pi 3^2$ oe AND **M2** for $\sqrt{\frac{their\ 4\pi 3^2}{6}}$ or **M1** for $6x^2$ may be implied by div by 6 <u>and</u> square root If **0**, **1** or **2** scored, instead award **SC3** for $\sqrt{6\pi}$ or 4.34… with no or insufficient working <u>Alternative method:</u> **M4** for $\sqrt{\frac{4\pi 3^2}{6}}$ or better or **M3** for $\sqrt{\frac{4\pi r^2}{6}}$ or better or **M2** for $\frac{4\pi r^2}{6}$ or better or **M1** for $6x^2$	Correct working requires evidence of at least **M1**or**B2** AND **M1** or alternative method **M2** *Their* value must come from correct substitution into sphere formula $\sqrt{\frac{\text{a positive value}}{6}}$ implies **M1** $\sqrt[3]{\frac{\text{a positive value}}{6}}$ implies **M0** After **B2** scored, correct final answer from trials scores full marks Note: $x^3 = 36\pi$ gives answer x = 4.84 (similar to correct answer 4.34)

Question			Answer	Marks	Part Marks and Guidance	
11			1250 nfww	4	**M3** for $\frac{1352}{1.04^2}$ oe or **M2** for $\frac{1352}{1.04}$ may be implied by 1300 or **B1** for 1.04 oe may be implied by 1.0816 or for 104[%] associated with 1352 or for 1352 = $P(1 + \frac{4}{100})^2$	May be performed in stages Continuing to find the interest (1352 – 1250 = 102) scores **M3** eg $\frac{104}{100}$ but not just $1 + \frac{4}{100}$ For **B1** allow fraction but not just 104% Note: 1352 ÷ 1.08 = 1251.85… corrected to 3 sf = 1250, scores **0**
12			39	4	**B2** for [*a* =] 1.5 oe or **M1** for 11 = 2 + 6*a* or better **M1** for 2 × 6 + $\frac{1}{2}$ × *their a* × 6^2 or better	 *their a* must come from use of *v = u + at*
13			20	3	**M2** for $\frac{8 \times 17.5}{5}$ oe may be implied by 28 or **M1** for $\frac{17.5}{5}$ oe or $\frac{8}{5}$ oe or for AC : 8 = 17.5 : 5	May be in stages Equivalents include 3.5, 1.6 etc
14			$2^6 \times 5^6 \times 7^5$	3	**B1** for 7^5 in answer **B1** for [7^5 ×] $2^k \times 5^k$ in answer, where *k* is a positive integer	Accept written in full without indices **B1B1** for $7^5 \times (2 \times 5)^6$

Question			Answer	Marks	Part Marks and Guidance	
15	(a)		$\frac{3}{5}$ and $\frac{2}{5}$ oe correct on top branch $\frac{4}{5}$ and $\frac{1}{5}$ oe correct on second branch	1 1		
	(b)		$\frac{7}{15}$ oe or 0.466 to 0.467	3	**M2FT** for $\left(\frac{4}{6}\times\frac{3}{5}\right)+\left(\frac{2}{6}\times\frac{1}{5}\right)$ oe or better or **M1FT** for $\left(\frac{4}{6}\times\frac{3}{5}\right)$ oe or $\left(\frac{2}{6}\times\frac{1}{5}\right)$ oe may be implied by $\frac{12}{30}$ oe or by $\frac{2}{30}$ oe	**FT** their probabilities from **(a)** Working may be seen next to diagram If answers to products seen, then + may be implied by final answer
16	(a)		Correct shape and orientation, reasonable symmetry in y-axis, intent to pass through origin  	2	**M1** attempt at correct curve shape and orientation not necessarily through the origin	See Appendix Should be a single smooth curve that appears symmetrical by eye For **M1** condone translation in any direction, minor feathering and curvature errors Plots should be curved and not straight-line segments

Question			Answer	Marks	Part Marks and Guidance	
	(b)		[y =] [k] tan x where $k > 0$	**1**		Condone [y =][k] tan x°, tan θ etc Do not accept [y =][k] tan, tan y, tan $\frac{o}{a}$, tan(a number) etc Ignore attempts at domain
17	**(a)**		75	**1**		
	(b)		11K and medians 15 and 15.5	**2**	**B1** for 11K with decision clearly supported by an attempted use of medians or for both medians correct	See Appendix For **2** marks, accept "average" and condone "mean" for median For **1** mark, use of "average/mean" must also have one correct median value Credit median values written on diagram only if referenced in their reason For **2** marks and **B1**, ignore mention of min/max/quartiles/IQR/range with correct or no values, as long as not an incorrect interpretation. If the interpretation is incorrect, or incorrect values are given, award **0** marks.

Question			Answer	Marks	Part Marks and Guidance	
18			2520	**4**	**M3** for (10 × 9 × 8 × 7) ÷ 2 oe or **M2** for 10 × 9 × 8 × 7 oe may be implied by 5040 or **M1** for $\frac{a}{10} \times \frac{b}{9} \times \frac{c}{8} \times \frac{d}{7}$ may be implied by $\frac{k}{5040}$ or $\frac{10}{a} \times \frac{9}{b} \times \frac{8}{c} \times \frac{7}{d}$ may be implied by $\frac{5040}{k}$ where *a*, *b*, *c*, *d* and $k \neq 1$ If **0** scored, instead award **SC1** for (10 × 10 × 10 × 10) ÷ 2 oe or for 9 × 8 × 7 × 6 [÷ 2] oe or for 9 × 9 × 8 × 7 [÷ 2] oe or for 10 × 9 × 8 × 5 or for 10 × 9 × 8 × 4	e.g. 5040 ÷ 2 or 5 × 9 × 8 × 7 For **M2** they must be working in whole numbers not fractions apart from probabilities as below 5040 in body via whole numbers subsequently spoilt: **M2** for 5040/*n*, otherwise **M1** Condone answers and working in probabilities to a max of **M3**: e.g. **M3** for answer $\frac{1}{2520}$ e.g. **M2** for $\frac{1}{10} \times \frac{1}{9} \times \frac{1}{8} \times \frac{1}{7}$ or $\frac{1}{5040}$ e.g. **SC1** for $\frac{1}{9} \times \frac{1}{8} \times \frac{1}{7} \times \frac{1}{6}$ [× 2]

Question			Answer	Marks	Part Marks and Guidance	
19				3	**B2** for shape of correct size and orientation in wrong position or **B1** for wrong size, correct orientation or for at least 3 correct vertices	See overlay; mark intent (±2 mm by eye), condone good freehand
20	(a)		18 × (7.5 – 0.5) or 18 × 7	1		126/18 = 7 only scores if 7 is related to the context 126/7 = 18 only scores if 18 is related to the context
	(b)		16.87[5] or 16.88 or 16.9 oe	4	**M3** for $\frac{126+2\times\frac{1}{2}\times0.5\ \times18}{8}$ oe or **M2** for $126+2\ \times\frac{1}{2}\times0.5\ \times18$ oe may be implied by 135 or **M1** for $[2\ \times]\ \frac{1}{2}\times0.5\ \times18$ oe may be implied by 4.5 for one triangle or 9 for two triangles If **0** scored, **SC1** for $\frac{126+2\times9}{8}$ or $\frac{126+18}{8}$	e.g. $\frac{\frac{1}{2}\times(7+8)\times18}{8}$ e.g. $\frac{1}{2}$ × (7 + 8) × 18 or $18\times8-2\ \times\frac{1}{2}\times0.5\ \times18$

Question			Answer	Marks	Part Marks and Guidance	
21			$(-\sqrt{7}, 3\sqrt{7})$ and $(\sqrt{7}, -3\sqrt{7})$ exact form only with correct working	5	**M3** for $x^2 = 7$ or **M2** for $x^2 + 9x^2 = 70$ or $10x^2 = 70$ or $10x^2 - 70 = 0$ or **M1** for $x^2 + (-3x)^2 = 70$ **A1** for $x = -\sqrt{7}$ and $\sqrt{7}$ or for one correct point If **0** or **1** scored, instead award **SC2** for $(-\sqrt{7}, 3\sqrt{7})$ and $(\sqrt{7}, -3\sqrt{7})$ with no or insufficient working If **0** scored, instead award **SC1** for both *x* values or for one correct point with no or insufficient working	Correct working requires evidence of at least **M2** For *y* values accept $\pm\sqrt{63}$ and for *x* values accept $\frac{\pm\sqrt{63}}{3}$ If $x = -\sqrt{7}$ and $\sqrt{7}$ seen after **M2**, award **M3A1** Condone omission of brackets if recovered For **A1** and **SC1**, condone -2.65 to -2.64, 2.64 to 2.65, -7.94 to -7.93, 7.93 to 7.94 Apply similar scheme for working in terms of *y*.

22			19.3[4…] to 19.3[7…] or 19.4 with correct working	**6**	**M2** for $[\frac{1}{2}\times]\sqrt{10.7^2 + 10.7^2}$ or for $\sqrt{5.35^2 + 5.35^2}$ or for $[\frac{1}{2}\times]\frac{10.7}{\cos 45}$ or $[\frac{1}{2}\times]\frac{10.7}{\sin 45}$ or for $\frac{5.35}{\cos 45}$ or $\frac{5.35}{\sin 45}$ or **M1** for $10.7^2 + 10.7^2$ or $5.35^2 + 5.35^2$ or for $\cos 45 = \frac{10.7}{AC}$ oe or $\sin 45 = \frac{10.7}{AC}$ oe or for $\cos 45 = \frac{5.35}{AO}$ oe or $\sin 45 = \frac{5.35}{AO}$ oe **A1** for 7.56 to 7.57 or 7.6 AND **M2** for $\frac{their\ 7.566...}{\cos 67}$ or $\frac{their\ 7.566...}{\sin 23}$ or $\frac{AE}{\sin 90} = \frac{their\ 7.566...}{\sin 23}$ or **M1** for $\cos 67 = \frac{their\ 7.566...}{AE}$ oe or $\sin 23 = \frac{their\ 7.566...}{AE}$ oe or $\frac{\sin 90}{AE} = \frac{\sin 23}{their\ 7.566}$ oe If **0**, **1** or **2** scored, instead award **SC3** for answer 19.3 to 19.4 with no or insufficient working If **0** or **M1** scored, instead award **SC2** for 7.56 to 7.57 or 7.6 with no or insufficient working If **0** scored instead award **SC1** for 15.1[3…] or 57.2… with no or insufficient working	Correct working requires evidence of at least **M1** AND **M1** Accept intermediate values rot to at least 3sf. If **M1A1** seen then award **M2A1** AO / AE 7.5 19.19478 7.56 19.34834 7.566 19.3637 7.566043 19.36381 7.57 19.37394 7.6 19.45072 *their* 7.566…must follow from the award of the first **M2** Mark less efficient methods by considering how many steps remain to reach the correct answer and match against the most comparable stage: eg Assuming AO has been found, then using trig to find EO is unnecessary and inefficient, so no further marks are awarded for just finding EO and stopping. However, if EO is then used in a correct Pythagoras expression with AO or a correct trig expression with 67˚ that lead directly or indirectly to finding AE, then **M2** or **M1** may be awarded.

Question			Answer	Marks	Part Marks and Guidance	
23			[a =] 98 [b =] 0.949[9…] or 0.95[0]	3	**B1** for [a =] 98 AND **B2** for [b =] 0.949[9…] or 0.95[0] or **M1** for $84 = 98b^3$ or better or $84 = ab^3$	**SC2** if correct answers transposed unless correctly identified in body

Question			Answer	Marks	Part Marks and Guidance	
24	(a)		$1^4 + 3(1)^2 - 2(1) - 5 = -3$ $2^4 + 3(2)^2 - 2(2) - 5 = 19$ Sign change so solution between $x = 1$ and $x = 2$	3	**M2** for $1^4 + 3(1)^2 - 2(1) - 5 = -3$ and $2^4 + 3(2)^2 - 2(2) - 5 = 19$ or **M1** for $1^4 + 3(1)^2 - 2(1) - 5$ or $2^4 + 3(2)^2 - 2(2) - 5$ soi by -3 or 19 <u>Alternative Method 1</u> After $x^4 + 3x^2 - 2x = 5$ seen **M2** for $1^4 + 3(1)^2 - 2(1) = 2$ and $2^4 + 3(2)^2 - 2(2) = 24$ **A1** for $24 > 5$ and $2 < 5$ so solution between $x = 1$ and $x = 2$ OR **M1** for $1^4 + 3(1)^2 - 2(1)$ or $2^4 + 3(2)^2 - 2(2)$ soi by 2 or 24 <u>Alternative Method 2</u> **SC3** for using an iterative equation that converges to a value in the range 1.25 to 1.35 **and** concluding statement that $1 < 1.25$ to $1.35 < 2$ oe or **SC2** for using an iterative equation that converges to a value in the range 1.25 to 1.35	Accept a minimum of $1 + 3 - 2 - 5 = -3$ and $16 + 12 - 4 - 5 = 19$ Accept other values of x used between 1 and 2 (see table in part (b)). For full marks, we need to see correct substitutions and evaluations that produce a sign change and a correct statement. For **M2**, we can see correct substitutions and evaluations, or two correct answers producing a sign change with a correct statement. Examples just sufficient for third mark include: • Sign change • $-3 < 0 < 19$ • $x = 1$ gives an answer < 0 and $x = 2$ gives an answer > 0 Examples insufficient for third mark: • so x lies between 1 and 2 If within part **(a)** a candidate refers to their iterative equation work in part **(b)** then award marks for Alternative Method 2.

<table>
<tr><th colspan="3">Question</th><th>Answer</th><th>Marks</th><th>Part Marks and Guidance</th></tr>
<tr><td></td><td>(b)</td><td></td><td>Two correct evaluations for
$1.25 \le x \le 1.35$, one of which gives a positive answer and the other giving a negative answer

1.3</td><td>M3

A1</td><td>M2 for two correct evaluations for $1 < x < 2$, one which gives a positive answer and the other giving a negative answer
or
M1 for one correct evaluation for $1 < x < 2$

OR

If 0 scored instead award
SC1 for 1.3 with no worthwhile working

<u>Alternative Method by Iteration</u>
M1 rearranges to a correct iterative formula (converging or diverging, condone missing subscripts)
M1 attempts first iteration (either a substitution seen or evaluated to at least 2dp rot)
M1 continues further iteration(s) to reach x in the interval $1.25 \le x < 1.35$
A1 for 1.3</td><td>Likely values: accept rot to 1+sf
<table><tr><th>x</th><th>$x^4 + 3x^2 - 2x - 5$</th></tr><tr><td>1.1</td><td>-2.1059</td></tr><tr><td>1.2</td><td>-1.0064</td></tr><tr><td>1.25</td><td>-0.3710…</td></tr><tr><td>1.26</td><td>-0.2367…</td></tr><tr><td>1.27</td><td>-0.0998…</td></tr><tr><td>1.275</td><td>-0.0304…</td></tr><tr><td>1.28</td><td>0.0395…</td></tr><tr><td>1.285</td><td>0.1102…</td></tr><tr><td>1.3</td><td>0.3261</td></tr><tr><td>1.31</td><td>0.4732…</td></tr><tr><td>1.32</td><td>0.6231…</td></tr><tr><td>1.33</td><td>0.7757…</td></tr><tr><td>1.34</td><td>0.9309…</td></tr><tr><td>1.35</td><td>1.0890…</td></tr><tr><td>1.4</td><td>1.9216</td></tr><tr><td>1.5</td><td>3.8125</td></tr><tr><td>1.6</td><td>6.0336</td></tr><tr><td>1.7</td><td>8.6221</td></tr><tr><td>1.75</td><td>10.0664…</td></tr><tr><td>1.8</td><td>11.6176</td></tr><tr><td>1.9</td><td>15.0621</td></tr></table>
If a candidate refers to relevant working in part (a) then award up to full marks for part (b).</td></tr>
</table>

<table>
<tr>
<td>25</td>
<td></td>
<td></td>
<td>Proportion of black given round found as 0.6 oe
and
Proportion of black given square found as 0.64 oe

0.6 < 0.64 oe with both in comparable form</td>
<td>B5

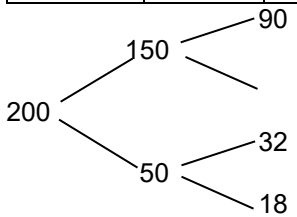
B1dep</td>
<td>B4 Proportion of black given round found as 0.6 oe
or
Proportion of black given square found as 0.64 oe

or

B3 Number or proportion of square black tiles found

or

M1 Round to square ratio of 3 : 1 used productively
M1 Number or proportion of round black and square white found (or, in the percentage method only 25 – 9 oe)

Eg working in decimals or probability
<table>
<tr><th>%</th><th>Black</th><th>White</th><th>Total</th></tr>
<tr><td>Round</td><td>0.45</td><td></td><td>0.75</td></tr>
<tr><td>Square</td><td>0.16</td><td>0.09</td><td>0.25</td></tr>
<tr><td>Total</td><td></td><td></td><td>1</td></tr>
</table>
B5 for 0.45/0.75 oe and 0.16/0.25 oe
or
B4 for 0.45/0.75 oe or 0.16/0.25 oe
or
B3 for 0.16 square black
or
M1 for 0.75 and 0.25
M1 0.45 and 0.09</td>
<td>All values may be seen in working or in diagrams/tables
Eg assuming number of tiles
<table>
<tr><th>Freq.</th><th>Black</th><th>White</th><th>Total</th></tr>
<tr><td>Round</td><td>90</td><td></td><td>150</td></tr>
<tr><td>Square</td><td>32</td><td>18</td><td>50</td></tr>
<tr><td>Total</td><td></td><td></td><td>200</td></tr>
</table>


B5 for 90/150 oe and 32/50 oe
or
B4 for 90/150 oe or 32/50 oe
or
B3 for 32 square black
or
M1 for150 and 50
M1 for 90 and 18
Eg working in percentages
<table>
<tr><th>%</th><th>Black</th><th>White</th><th>Total</th></tr>
<tr><td>Round</td><td>45</td><td></td><td>75</td></tr>
<tr><td>Square</td><td>16</td><td>9</td><td>25</td></tr>
<tr><td>Total</td><td></td><td></td><td>100</td></tr>
</table>
B5 for 45/75 oe and 16/25 oe
or
B4 for 45/75 oe or 16/25 oe
or
B3 for 16 square black
or
M1 for 75 and 25
M1 for 25 – 9</td>
</tr>
</table>

APPENDIX

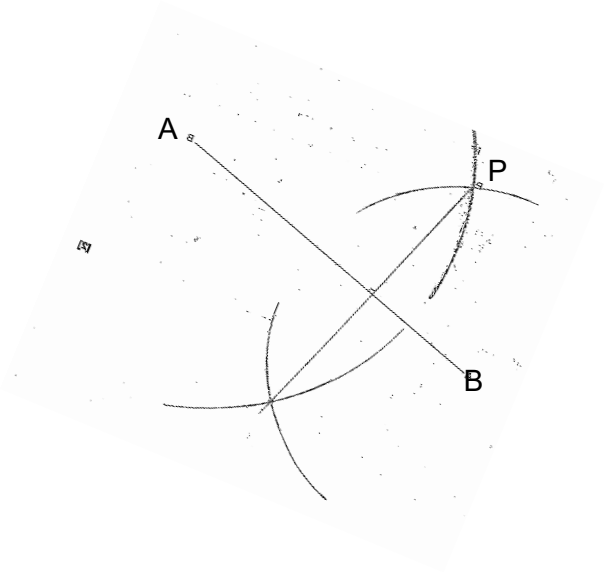
Question 3b

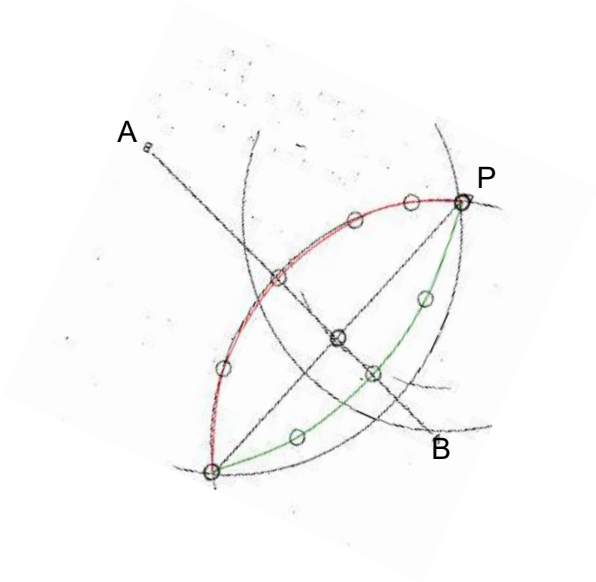
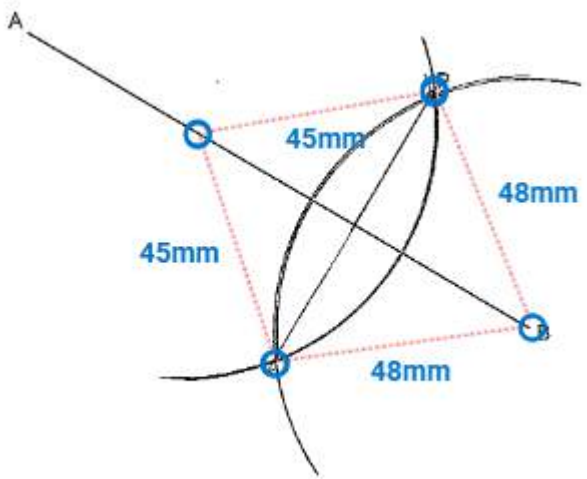
Assumption	Mark	Reason
The *y*-axis does not start at zero	**1**	Condone use of *y*-axis
The price axis does not start at zero	**1**	
The months are in the wrong order and the *y*-axis doesn't start from 0	**1**	Ignore reference to horizontal. Second is correct
Because it shows the drop in price is very bad but in reality, it's not that much	**1**	BOD third reason
The graph does not start at zero	**0**	Ambiguous, implies the line starting at bottom left corner
It does not start at zero	**0**	"It" is not enough to identify vertical axis
There are no numbers between 382.5 and 450	**0**	Does not say "Not starting at zero"
The *y*-axis isn't going up in equal amounts	**0**	Does not say "Not starting at zero"
The *y*-axis is not set out properly	**0**	Does not say "Not starting at zero"
It doesn't start at the bottom of the graph/y-axis	**0**	Does not say "Not starting at zero"
y-axis scale uneven, not equal, not going up by the same value	**0**	They are assuming a start from zero (but don't say it) and you can't tell from two values
The gap on the *y*-axis is too large	**0**	For what?
No numbers for the interval between the two prices	**0**	Does not say "Not starting at zero"
There aren't enough values on the *y*-axis	**0**	Does not say "Not starting at zero"
Does not have regular intervals	**0**	Does not say "Not starting at zero"
No clear scale for the *y*-axis	**0**	Does not say "Not starting at zero"
The scale is not complete	**0**	Does not say "Not starting at zero"
Because the price of the laptop axis starts from £382.50	**0**	Does not say "Not starting at zero"
It does not have all of the months from the start of the year	**0**	Ignore reference to horizontal
It should be January to December	**0**	Ignore reference to horizontal

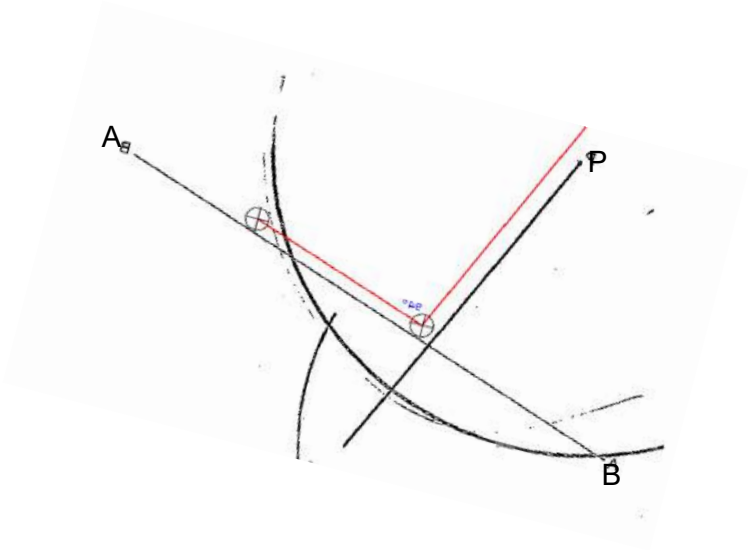
Question 5

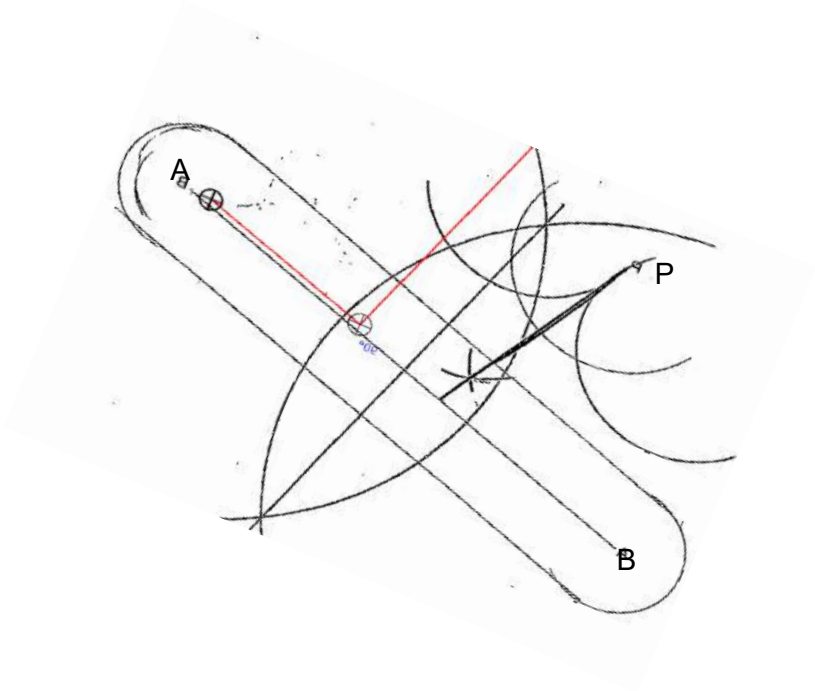
	Response	Mark
	They have ignored the negative powers	1
	That he ignored the small numbers next to the number	1 implies ignore indices
	They have ignored the negative powers, it is actually the largest number as it is a fraction	1bod, not contradicted
	They have only compared the whole numbers	1bod
	They thought the smallest base number would give the smallest answer	1bod
	They have treated the powers as positive / They have done $2^1, 4^3, 10^2$	0 not a comment on the student's reasoning
	The larger the number, the lower the reciprocal	0 true but not a comment on the student's reasoning
	The power -1 is bigger than the power -2	0 not always true
	10^{-2} is the smallest as it is closer to 0	0
	They haven't simplified the indices / They haven't calculated them	0
	You need to pick the one with the highest negative power	0
	Assumed all the powers were the same	0 not if powers are negative
	They didn't take the other numbers into account	0
	They have ignored the negative powers, the number with the largest negative power will be smallest	0 Second part is incorrect
	The student didn't calculate the actual value of each number (the three answers given as decimals)	0

Question 8

Response		Mark
A		**Scores 2** This is a correct alternative method for arcs centred on A and B Use overlay to see arcs lie within circles (We can also check using on-line ruler) Candidates may use points on AB other than A and B for this construction. In such cases check radii of arcs using on-line ruler to judge.

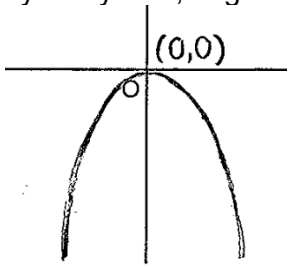
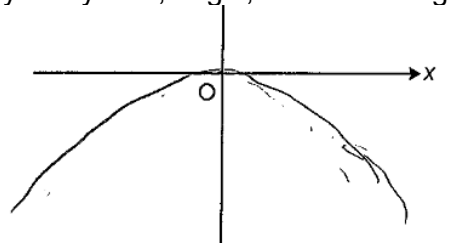
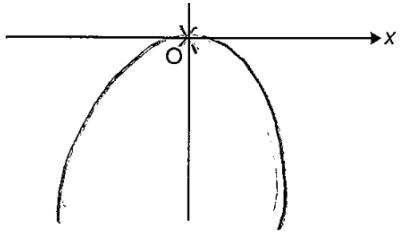
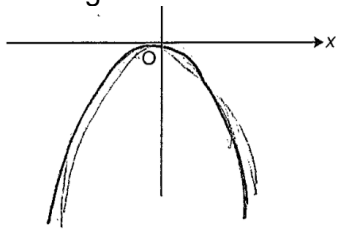
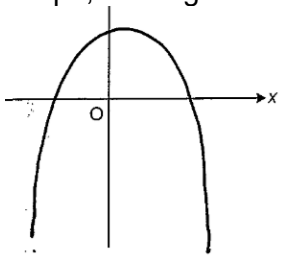
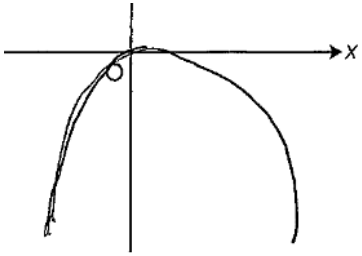
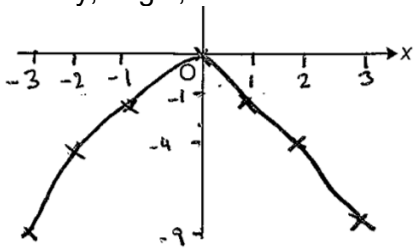
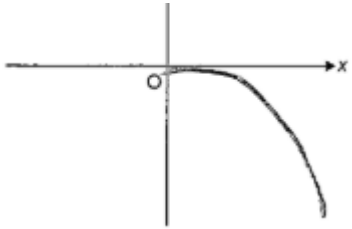
B		**Scores 2** This is the main method not the alternative. Arc from P intersects AB at B and another point. Red arc from B intersects the arc from that other point.
C		**Scores 2** There is an arc from B through P. Another arc passes through P but its centre on AB is not identified - perhaps a small compass hole on the hard copy? This arc should have symmetry in line AB. This may need to be confirmed using the ruler tool.

D		**0 marks** Only one correct (pair of) arcs (One arc centred on P and cutting AB twice) and inaccurate line.

E		**0 marks** No valid sets of arcs nor a correct line

Question 16a **2 marks:** Correct shape and orientation, reasonable symmetry in y-axis, intent to pass through origin
1 mark: Attempt at correct curve shape and orientation not necessarily through the origin; condone translation in any direction, minor feathering and curvature errors

Plots should be curved and not straight-line segments

2 marks sym in y-axis, origin 	2 marks sym in y-axis, origin, min feathering 	2 marks reasonable.sym in y-axis, origin, min curvature 	2 marks sym y-axis, origin, borderline feathering and min curvature 
1 mark shape, not origin 	1 mark Shape, not origin, minor curvature error 	1 mark (best fit), shape, poor symmetry, origin, curvature issues 	0 marks 

Question 17b

	Response	Mark
	11K the midpoint of the time they finished the race is 15 secs whereas for the other it is 15.5 seconds	2 condone midpoint for median
	11K 50% of the class were faster than 15 seconds whereas in 11G 50% were faster than 15.5 seconds	2 implies use of median
	11K the median is lower AND only 15 and 15.5 written on diagram	2
	11K because their median was 0.5 less than 11G	1 median values need to be seen for 2
	11K because the median time of 15 was quicker	1 one correct median
	11K medians are 14.9 and 15.5	1 one correct median
	11K averages are 14.9 and 15.5	1 one correct median value so intent that “average” is median
	11K the median is lower	1 intent to use median
	11K the median is lower (with lots of values written on diagram)	1 intent to use median, choice of values
	11G the median is higher AND 15 and 15.5 written on diagram	1 wrong conclusion, intent to use median and correct values
	11G averages are 15 and 15.5	1 wrong conclusion, condone “average” for median, both correct values
	11K has a bigger IQR and a lower median	1bod IQR not relevant but true
	11K (15 and 15.5 stated but not called median/average/mean)	1 both medians correct
	11K (no reason, 15 and 15.5 written on diagram)	0 need a statement
	11K averages are 1.9 and 1.5	0 not median values
	11K has a lower average	0 “average” requires one correct median value

	11K	0 not supported by attempt to use medians
	11G medians are 14.9 and 15.5	0 wrong conclusion and an incorrect median

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