2012 Mathematics

Intermediate 2 − Units 1, 2 and 3, Paper 1

Finalised Marking Instructions

General Marking Principles

These principles describe the approach to be taken when marking Intermediate 2 Mathematics papers. For more detailed guidance please refer to the notes which are included with the Marking Instructions.

1 Marks must be assigned in accordance with the Marking Instructions. The main principle in marking scripts is to give credit for the skills demonstrated and the criteria met. Failure to have the correct method may not preclude a candidate gaining credit for the calculations involved or for the communication of the answer.

2 The answer to one part of a question, even if incorrect, must be accepted as a basis for subsequent dependent parts of the question. Full marks in the dependent part(s) may be awarded provided the question is not simplified.

3 The following should not be penalised:

- working subsequent to a correct answer (unless it provides firm evidence that the requirements of the question have not been met)
- omission or misuse of units (unless marks have been specifically allocated for the purpose in the marking scheme)
- bad form, eg sin $x° = 0.5 = 30°$
- legitimate variation in numerical values / algebraic expressions.

4 Solutions which seem unlikely to include anything of relevance must nevertheless be followed through. Candidates still have the opportunity of gaining one mark or more provided the solution satisfies the criteria for the mark(s).

5 Full credit should only be given where the solution contains appropriate working. Where the correct answer may be obtained by inspection or mentally, credit may be given, but reference to this will be made in the Marking Instructions.

6 In general markers will only be able to give credit for answers if working is shown. A wrong answer without working receives no credit unless specifically mentioned in the Marking Instructions. The rubric on the outside of the question papers emphasises that working must be shown.

7 Sometimes the method to be used in a particular question is explicitly stated; no credit should be given where a candidate obtains the correct answer by an alternative method.

8 Where the method to be used in a particular question is not explicitly stated, full credit must be given for alternative methods which produce the correct answer.

9 Do not penalise the same error twice in the same question.

10 A transcription error is taken to be the case where the candidate transcribes incorrectly from the examination paper to the answer book. This is not normally penalised except where the question has been simplified as a result.

11 Do not penalise inadvertent use of radians in trigonometry questions, provided their use is consistent within the question.

12 When multiple solutions are presented by the candidate **and** it is not clear which is intended to be the final one, mark all attempts and award the lowest mark.

Practical Details

The Marking Instructions should be regarded as a working document and have been developed and expanded on the basis of candidates' responses to a particular paper. While the guiding principles of assessment remain constant, details can change depending on the content of a particular examination paper in a given year.

1 Each mark awarded in a question is referenced to one criterion in the marking scheme by means of a bullet point.

2 Where a candidate has scored zero marks for any question attempted, "0" should be shown against the answer in the place in the margin.

3 Where a marker wishes to indicate how the marks have been awarded, the following should be used:

(a) Correct working should be ticked, ✓.

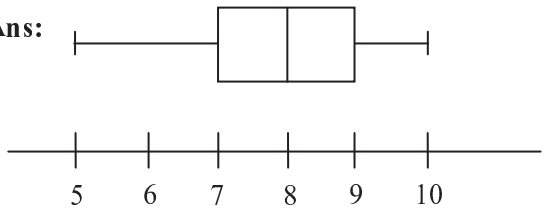
(b) Where working subsequent to an error is followed through and can be awarded marks, it should be marked with a crossed tick, ✗.

(c) Each error should be underlined at the point in the working where it first occurs.

4 **Do not write any comments, words or acronyms on the scripts.**

Mathematics Intermediate 2: Paper 1, Units 1, 2 and 3 (non-calc)

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
1	**Ans: £1 158 000 000 000** •[1] process: round correctly	 •[1] 1 158 000 000 000 **1 mark**
NOTES:		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
2 (a)	**Ans:** **mark** **frequency** **cumulative frequency** **5 2 2** **6 5 7** **7 6 13** **8 11 24** **9 9 33** **10 2 35** •[1] communicate: table with cumulative frequency column	•[1] 2,7,13,24,33,35 **1 mark**
NOTES:		
(b)	**Ans:** **(i) 8 (ii) 7 (iii) 9** •[1] process: state median •[2] process: state lower quartile •[3] process: state upper quartile	•[1] 8 •[2] 7 •[3] 9 **3 marks**
NOTES: 1. Where the quartiles have been obtained from: (i) *Marks* leading to $Q_2 = 7{\cdot}5$, $Q_1 = 6$, $Q_3 = 9$ award 0/3 (ii) *Frequency* (unordered) leading to $Q_2 = 8{\cdot}5$, $Q_1 = 5$, $Q_3 = 9$ award 0/3 (iii) *Frequency* (ordered) leading to $Q_2 = 5{\cdot}5$, $Q_1 = 2$, $Q_3 = 9$ award 0/3 (iv) *Cumulative frequency* leading to $Q_2 = 18{\cdot}5$, $Q_1 = 7$, $Q_3 = 33$ award 0/3		
(c)	**Ans:**  •[1] communicate: correct end points •[2] communicate: correct box	•[1] end points at 5 and 10 •[2] box showing Q_1, Q_2, Q_3 **2 marks**
NOTES: 1. The boxplot must be drawn to a reasonable scale		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
3 (a)	**Ans: A(0, 12)** •[1] communicate: state coordinates of A	•[1] (0, 12) **1 mark**
NOTES:		
(b)	**Ans: C(3, 8)** •[1] strategy: know to substitute in expression •[2] communicate: state coordinates of C	•[1] $4x + 3(8) = 36$ •[2] (3, 8) **2 marks**
NOTES: 1. For a correct answer without working		award 2/2

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
4	**Ans: 34°** •[1] process: calculate size of angle OSR •[2] process: calculate size of angle PSR •[3] process: calculate size of angle QRS	•[1] 90° •[2] 118° •[3] 34° **3 marks**

NOTES:

1 Alternative methods

METHOD TWO (USING TRIANGLE ORS)

•[1]	process: calculate size of angle OSR	•[1] 90°
•[2]	process: calculate size of angle SOR	•[2] 56°
•[3]	process: calculate size of angle QRS	•[3] 34°

METHOD THREE (USING TRIANGLE QRS)

•[1]	process: calculate size of angle OSR	•[1] 90°
•[2]	process: calculate size of angle QSR and SQR	•[2] 28° AND 118°
•[3]	process: calculate size of angle QRS	•[3] 34°

2. For a correct answer without working award 3/3
3. For marks 1 and 2, angles need not be explicitly stated. They may be marked on a diagram
4. For the final mark to be awarded, the size of angle QRS must be stated explicitly

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5 (a)	**Ans: 20 160** •[1] process: calculate the mean	•[1] 20 160 **1 mark**
NOTES:		
(b)	**Ans: The median, with reason** •[1] communicate: state median with reason	•[1] median with reason **1 mark**

NOTES:

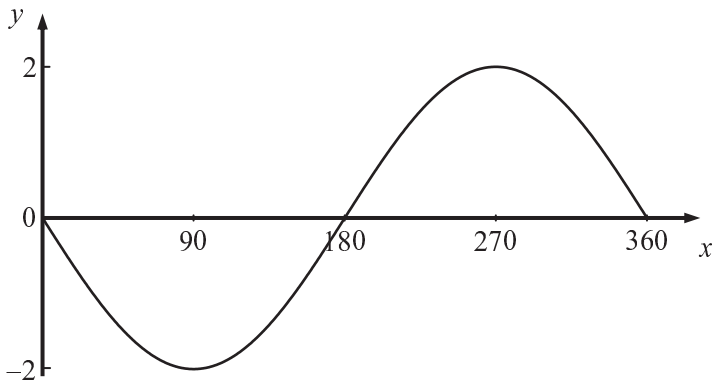
1. The reason must refer to the fact that the mean is affected by one very high attendance or that the median is closer to the majority of the attendances

2. SOME COMMON ANSWERS

   "The median because it is close(r) to all except one of the attendances" award 1/1
   "The median because it is close(r) to most of the numbers" award 1/1
   "The median because it is close(r) to the numbers" award 0/1

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6 (a)	**Ans: 2 and 4** •[1] process: write down roots	•[1] $x = 2$ AND $x = 4$ **1 mark**
NOTES:		
(b)	**Ans: A(0,8), B(2,0), C(4,0)** •[1] process: state coordinates of A •[2] process: state coordinates of B •[3] process: state coordinates of C	•[1] A(0, 8) •[2] B(2, 0) •[3] C(4, 0) **3 marks**
NOTES: 1. Incorrect roots in part (a) must be followed through to give the possibility of awarding 2/3 in part (b)		
(c)	**Ans: $x = 3$** •[1] process: state equation of axis of symmetry	•[1] $x = 3$ **1 mark**
NOTES: 1. Incorrect co-ordinates for B and C in part (b) must be followed through to give the possibility of awarding full credit in part (c)		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
7	**Ans: 10 centimetres** •[1] strategy: substitute into correct formula •[2] process: correctly calculate BC	•[1] $20 = \frac{1}{2} \times a \times 16 \times \frac{1}{4}$ •[2] BC = 10 (cm) **2 marks**
NOTES: 1. For ($20 = \frac{1}{2} \times a \times 16 \times \sin \frac{1}{4}$) leading to an answer of 10 (cm) award 1/2 2. For a correct answer without working award 0/2		
8 (a)	**Ans: $(a + b)^2$** •[1] process: factorise $a^2 + 2ab + b^2$	•[1] $(a + b)^2$ **1 mark**
NOTES:		
(b)	**Ans: 10 000** •[1] strategy: know to substitute in expression •[2] process: evaluate expression	•[1] $(94 + 6)^2$ •[2] 10 000 **2 marks**
NOTES: 1. <u>Alternative method for 1st mark</u> •[1] strategy: know correct order of operations •[1] evidence 2. For a correct answer without working award 0/2		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
9	**Ans:**  •[1] process: know max/min values •[2] process: show that there is one cycle of sine graph in 360° •[3] process: negative trig graph correctly drawn	•[1] graph lies between +2 and –2 •[2] evidence from graph •[3] evidence from graph **3 marks**

NOTES:

1. Disregard poor draughtsmanship

2. SOME COMMON ANSWERS

$y = -2 \sin x^o$	award 3/3	✓✓✓
$y = -2 \cos x^o$	award 2/3	✓×✓
$y = 2 \sin x^o$	award 2/3	✓✓×
$y = -\sin 2x^o$	award 2/3	×✓✓
$y = 2 \cos x^o$	award 1/3	✓××
$y = -\cos 2x^o$	award 1/3	××✓
$y = \sin 2x^o$	award 1/3	×✓×
$y = \cos 2x^o$	award 0/3	×××

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
10	**Ans: 2** •[1] Process: start to simplify •[2] Process: simplify	 •[1] $\sqrt{6}+\sqrt{4}-\sqrt{6}$ or $\sqrt{2}\sqrt{3}+\sqrt{2}\sqrt{2}-\sqrt{2}\sqrt{3}$ •[2] 2 **2 marks**

NOTES:

1. For a correct answer without working — award 0/2

2. CAUTION: The correct answer may be arrived at by an incorrect method, eg
$\sqrt{2}\left(\sqrt{3}+\sqrt{2}\right)-\sqrt{6}$
$=\sqrt{2}\left(\sqrt{5}\right)-\sqrt{6}$
$=\sqrt{10}-\sqrt{6}$
$=\sqrt{4}$
$=2$
award 0/2

TOTAL MARKS FOR PAPER 1
30

[END OF MARKING INSTRUCTIONS]

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Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
1.	**Ans: 12·5 centimetres**	
	•[1] strategy: express arc as fraction of a circle	•[1] 110/360
	•[2] process: correctly calculate length of arc	•[2] 12·5 (cm)
		2 marks
NOTES: 1. Accept 12·5 (12·46 rounded) or 12·4 (12·46 truncated) 2. For a correct answer without working award 0/2		
2.	**Ans: $3x^3 + x^2 - 28x + 30$**	
	•[1] process: start to multiply out brackets	•[1] evidence of 3 correct terms (eg $3x^3 + 6x^2 - 18x$)
	•[2] process: complete process of multiplying out brackets	•[2] $3x^3 + 6x^2 - 18x - 5x^2 - 10x + 30$
	•[3] process: collect like terms which must include x^3	•[3] $3x^3 + x^2 - 28x + 30$
		3 marks
NOTES: 1. Where a candidate has attempted to 'simplify' beyond the correct answer, the 3rd mark is not available		
3.	**Ans: 1022 mm³**	
	•[1] strategy: know to add volumes of cylinder and sphere	•[1] evidence
	•[2] process: substitute correctly into formula	•[2] $V = \pi \times 4^2 \times 15$ (= 753·98)
	•[3] process: substitute correctly into formula	•[3] $V = \frac{4}{3} \times \pi \times 4^3$ (= 268·08)
	•[4] process: calculate volume correctly	•[4] 1022·(06481)
		4 marks
NOTES: 1. A common answer: $5160\left(\pi \times 8^2 \times 15 + \frac{4}{3} \times \pi \times 8^3\right)$ award 2/4		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
4.	**Ans: –2·9, 0·6**	
	•[1] strategy: know to use quadratic formula	•[1] $x = \frac{-b \pm \sqrt{(b^2 - 4ac)}}{2a}$
	•[2] process: substitute correctly	•[2] $x = \frac{-7 \pm \sqrt{7^2 - 4 \times 3 \times -5}}{2 \times 3}$
	•[3] process: evaluate discriminant	•[3] 109
	•[4] process: calculate roots, correct to one d.p.	•[4] –2·9, 0·6 **4 marks**

NOTES:

1. Where $b^2 - 4ac$ is calculated incorrectly, the fourth mark is available only if $b^2 - 4ac > 0$
2. For a correct answer without working award 0/4

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5. (a)	**Ans: (i) 116 (ii) 16·33**	
	•[1] process: calculate the mean	•[1] 116
	•[2] process: calculate $(x - \overline{x})^2$	•[2] 324, 196, 121, 324, 144, 225
	•[3] process: substitute into formula	•[3] $\sqrt{\frac{1334}{5}}$
	•[4] process: calculate standard deviation	•[4] s = 16·33(disregard rounding) **4 marks**

NOTES:

1. For use of alternative formula in part (a) (ii), award marks as follows

•[2] process: calculate $\sum x$ and $\sum x^2$	•[2] 696 and 82 070
•[3] process: substitute into formula	•[3] $\sqrt{\frac{82070 - \frac{696^2}{6}}{5}}$
•[4] process: calculate standard deviation	•[4] 16·33

2. For a correct answer without working in part (a) (ii) award 0/3

(b)	**Ans: 1 and 4 (The total score is the same in both matches and in the first match the scores are more spread out.)**	
	•[1] interpret: select one correct statement	•[1] 1
	•[2] interpret: select second correct statement	•[2] 4 **2 marks**

NOTES:

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6. (a)	**Ans: $6x + 2y = 3148$** •[1] interpret: interpret the text	•[1] $6x + 2y = 3148$ **1 mark**
NOTES:		
(b)	**Ans: $5x + 3y = 3022$** •[1] interpret: interpret the text	•[1] $5x + 3y = 3022$ **1 mark**
NOTES:		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
(c)	**Ans: Yes. The group has been overcharged by £10.** •[1] strategy: know to solve system of equations •[2] process: follow a valid strategy through to provide a value for x and y •[3] process: correct value for x and y •[4] communication: conclusion with evidence	•[1] evidence of scaling •[2] a value for x and y •[3] $x = 425,\ y = 299$ •[4] (Yes), the third group has been charged £10 too much **4 marks**

NOTES:

1. Incorrect equations in parts (a) and (b) must be followed through to give the possibility of awarding 4/4

2. Any valid strategy must involve the use of two equations

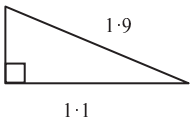
3. Minimum evidence for fourth mark is £2046 followed by "Yes"

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
7.	**Ans:** $\frac{a^2 + b^2}{ab}$ •[1] process: state common denominator •[2] process: state answer as single fraction **with no subsequent errors**	 •[1] ab •[2] $\frac{a^2 + b^2}{ab}$ **2 marks**
NOTES:		
8.	**Ans: 36·9, 323·1** •[1] process: solve equation for cos x^o •[2] process: find one value for x •[3] process: find second value for x	 •[1] cos $x^o = 4/5$ •[2] 36·9 •[3] 323·1 **3 marks**
NOTES: 1. Where cos x^o is calculated incorrectly, the working must be followed through with the possibility of awarding 2/3 2. For a correct answer without working award 0/3		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
9.	**Ans:** $\boldsymbol{D = \sqrt{\frac{I}{E}}}$ •[1] process: start to rearrange •[2] process: continue •[3] process: complete	•[1] $ED^2 = I$ •[2] $D^2 = \frac{I}{E}$ •[3] $D = \sqrt{\frac{I}{E}}$ **3 marks**

NOTES:

1. For a correct answer without working — award 3/3
2. The third mark is available for taking the square root of an expression for D^2
3. For an answer of $D = \frac{\sqrt{I}}{E}$ with or without working — award 2/3

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
10.	**Ans: 0·4 m** •[1] strategy: marshall facts and recognise right-angled triangle •[2] strategy: correct use of Pythagoras' Theorem •[3] process: correct calculation •[4] process: calculate depth of oil	•[1]  •[2] $x^2 = 1\cdot9^2 - 1\cdot1^2$ •[3] $x = 1\cdot55$ •[4] 0·35 **4 marks**

NOTES:

1. For a correct answer without working — award 0/4
2. The final mark is for subtracting a calculated value from the radius
3. Where a candidate assumes an angle of 45° in the right-angled triangle, only the first and fourth marks are available
4. SOME COMMON ANSWERS (with working):
   $\sqrt{1\cdot9^2 + 1\cdot1^2} = 2\cdot2$ — award 2/4
   $1\cdot9 - \sqrt{2\cdot2^2 - 1\cdot9^2} = 0\cdot8$ — award 2/4

11.	**Ans:** $\frac{x^5}{y^2}$ •[1] process: simplify x terms or y terms •[2] process: correctly simplify and express with positive indices.	•[1] x^5 or y^{-2} •[2] $\frac{x^5}{y^2}$ **2 marks**

NOTES:

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
12.	**Ans: 75·3 metres**	
	•[1] strategy: know to apply sine rule to find CP or other valid strategy	•[1] evidence
	•[2] process: correct application of sine rule or other valid strategy	•[2] $\frac{CP}{\sin 27^\circ} = \frac{89}{\sin 25^\circ}$ or $\frac{YP}{\sin 128^\circ} = \frac{89}{\sin 25^\circ}$
	•[3] process: calculate CP or YP	•[3] CP = 95·6 or YP = 165·9
	•[4] strategy: know to apply trigonometry to find height of cliff	•[4] $\sin 52^\circ = \frac{h}{95\cdot 6}$ or $\sin 27^\circ = \frac{h}{165\cdot 9}$
	•[5] process: calculate height	•[5] h = 75·3 (metres)
		5 marks

NOTES:

1. Disregard any errors due to premature rounding provided there is evidence
2. Variations in CP (or YP) or a wrong value for CP (or YP) must be accepted as a basis for calculating the height
3. Where a candidate assumes that C is the midpoint of YF, the last two marks are available for a correct trig calculation
4. Where an incorrect trig ratio is used to find the height, the fifth mark is still available
5. For a correct answer without working award 0/5

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
13.	**Ans: No, 0·522 > 0·5**	
	•[1] strategy: know how to decrease by 15%	•[1] $0 \cdot 85$
	•[2] strategy: know how to find reduction	•[2] $0 \cdot 85^4$
	•[3] process: carry out all calculations correctly	•[3] 0·52200625
	•[4] communication: state conclusion with reason	•[4] No, 0·522 > 0·5 **4 marks**

NOTES:

1. For an answer of No, 0·522 > 0·5, with or without working, award 4/4
2. Where an incorrect percentage has been used, the working must be followed through to give the possibility of awarding 3/4
3. For a correct calculation of any number × $0 \cdot 85^4$, the first 3 marks should be awarded
4. The reason must refer to the candidate's answer and 50%, or the difference between them
5. Where a candidate calculates 4 × 15% = 60%, for an answer of
   "yes, 60% is greater than 50%" award 1/4
   "yes, it is reduced by 60%" award 0/4

14.	**Ans: 1**	
	•[1] strategy: start to simplify	•[1] $\dfrac{\cos x^\circ \dfrac{\sin x^\circ}{\cos x^\circ}}{\sin x^\circ}$ **or** $\dfrac{\sin x^\circ}{\sin x^\circ}$ **or** $\dfrac{\cos x^\circ \tan x^\circ}{\cos x^\circ \tan x^\circ}$
	•[2] process: simplify fully	•[2] 1 **2 marks**

NOTES:

1. For a correct answer without working award 0/2

TOTAL MARKS FOR PAPER 2
50

[END OF MARKING INSTRUCTIONS]