2010 Mathematics

Intermediate 2 – Units 1, 2 and 3 Paper 2

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 a 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 s/he has awarded marks, the following should be used:

(a) Correct working should be ticked, ✓ .

(b) Where working subsequent to an error is followed through, if otherwise correct 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 2, Units 1, 2 and 3

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
1.	**Ans: £155 000**	
	•[1] strategy: know how to decrease by 4·25%	•[1] $\times 0{\cdot}9575$
	•[2] strategy: know how to calculate expected value	•[2] $176\,500 \times 0{\cdot}9575^3$
	•[3] process: carry out all calculations correctly within a valid strategy	•[3] 154 939·1102
	•[4] process: round answer to 3 significant figures	•[4] 155 000 **4 marks**

NOTES:

1.	For an answer of £155 000, with or without working	award 4/4	✓✓✓✓
2.	For an answer of £154 939·11, with or without working	award 3/4	✓✓✓✗
3.	Where an incorrect percentage has been used, the working must be followed through to give the possibility of awarding 3/4 eg for an answer of £200 000 ($176\,500 \times 1{\cdot}0425^3$), with working	award 3/4	✗✓✓✓
4.	For an answer of £507 000 ($176\,500 \times 0{\cdot}9575 \times 3$), with working	award 2/4	✓✗✗✓
5.	For an answer of £154 000 ($176\,500 - 3 \times 0{\cdot}0425 \times 176\,500$), with working	award 2/4	✓✗✗✓
6.	For an answer of £22 500 ($176\,500 \times 0{\cdot}0425 \times 3$), with working	award 1/4	✗✗✗✓
7.	For an answer of 155 000·00 the final mark is not available		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
2.	**Ans: 150º, 200º, 10º** •[1] strategy: know how to calculate angles in a pie chart •[2] process: calculate angles in a pie chart correctly	•[1] any 2 of $\frac{30}{72}\times 360$, $\frac{40}{72}\times 360$ $\frac{2}{72}\times 360$ •[2] 150, 200, 10 **2 marks**

NOTES:

1. For a correct answer without working award 2/2
2. COMMON ANSWERS

   For 41·7 $\left(\frac{30}{72}\times 100\right)$, 55·6 $\left(\frac{40}{72}\times 100\right)$, 2·8 $\left(\frac{2}{72}\times 100\right)$, with working, award 1/2

   For 6 $\left(\frac{72}{360}\times 30\right)$, 8 $\left(\frac{72}{360}\times 40\right)$, 0·4 $\left(\frac{72}{360}\times 2\right)$, with working, award 1/2

   For 108 (30% of 360), 144 (40% of 360), 7·2 (2% of 360), with working, award 1/2

3.	**Ans: £11** •[1] process: calculate fare using equation	•[1] 11 **1 mark**

NOTES:

1. For a correct answer, without working award 1/1

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
4. (a)	**Ans: (i) 7 (ii) 3·958** **(i)** •[1] process: calculate the mean	•[1] 7 **1 mark**
	(ii) •[1] process: calculate $\left(x-\bar{x}\right)^2$ •[2] process: substitute into formula •[3] process: calculate standard deviation	•[1] 36, 0, 49, 4, 0, 1, 4 •[2] $\sqrt{\frac{94}{6}}$ •[3] 3·958 (disregard rounding) **3 marks**

NOTES:

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

•[1] process: calculate $\sum x$ and $\sum x^2$	•[1] 49 and 437
•[2] process: substitute into formula	•[2] $\sqrt{\frac{437-49^2/7}{6}}$
•[3] process: calculate standard deviation	•[3] 3·958

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 •
4. (b)	**Ans: The team scores more points under the new coach.** **The team is more consistent.** •[1] communicate: make valid comment comparing means •[2] communicate: make valid comment comparing standard deviations	 •[1] valid comment •[2] valid comment **2 marks**

NOTES:

1. SOME ACCEPTABLE ANSWERS (Comparing means):
   The average score is higher.
   The average number of points scored is higher.
   The mean is higher so the team has improved.
   The team is playing better.

   SOME UNACCEPTABLE ANSWERS (Comparing means):
   The average is higher.
   The new coach got a higher mean than before.
   The mean score is higher.

2. ACCEPTABLE ANSWERS (Comparing standard deviations):
   There is a smaller range of scores.
   The scores are less spread out.

   UNACCEPTABLE ANSWERS (Comparing standard deviations):
   The standard deviation is lower.

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5.	**Ans: $x = 7, y = -2$** •[1] process: scale system of equations •[2] process: solve for one variable •[3] process: solve for other variable	•[1] $16x - 40y = 192$ $35x + 40y = 165$ •[2] $x = 7$ •[3] $y = -2$ **3 marks**

NOTES:

1. For a correct answer obtained from two tables of values or solving two equations graphically or trial and improvement — award 0/3
2. For a correct answer without working — award 0/3
3. Where an error occurs in scaling the system of equations, working must be followed through with the possibility of awarding 2/3
4. An incorrect answer for the first variable must be followed through with the possibility of awarding 2/3

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6.	**Ans: $\frac{3s}{2}$** •[1] process: know how to multiply •[2] process: simplify answer	•[1] $\frac{s^2 \times 3t}{t \times 2s}$ •[2] $\frac{3s}{2}$ **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 •
7.	**Ans:** $\boldsymbol{L = \frac{P}{2} - B}$ **or** $\boldsymbol{L = \frac{P - 2B}{2}}$ •[1] process: divide both sides by 2 •[2] process: subtract B from both sides	•[1] $\frac{P}{2} = L + B$ •[2] $L = \frac{P}{2} - B$
	ALTERNATIVE METHOD: •[1] process: remove brackets and subtract $2B$ from both sides •[2] process: divide both sides by 2	•[1] $2L = P - 2B$ •[2] $L = \frac{P - 2B}{2}$ **2 marks**
NOTES: 1. For a correct answer without working award 2/2 2. For incorrect working subsequent to a correct answer, the second mark is not available		
8.	**Ans: $4\sqrt{7}$** •[1] process: simplify surd $\sqrt{63}$ •[2] process: simplify surd $\sqrt{28}$ •[3] process: state answer in simplest form	•[1] $3\sqrt{7}$ •[2] $2\sqrt{7}$ •[3] $4\sqrt{7}$ **3 marks**
NOTES: 1. 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: 1342·35 square centimetres**	
	•[1] strategy: express sector as a fraction of a circle	•[1] $\frac{65}{360}$
	•[2] strategy: know how to find area of a sector	•[2] $\frac{65}{360}\times\pi\times14^2$
	•[3] process: calculate the area of a sector	•[3] 111·177
	•[4] process: calculate the area of material required	•[4] 1342·35 **4 marks**

NOTES:

1. Accept variations in π. Disregard premature or incorrect rounding of $\frac{65}{360}$.
2. The third mark is for a calculation involving a fraction and π.
3. COMMON ANSWERS (with working)

For $\frac{65}{360}\times\pi\times28$ leading to 15·88 and a final answer of 1151·76 award 3/4

For $\frac{65}{360}\times\pi\times14$ leading to 7·94 and a final answer of 1135·88 award 3/4

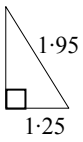
For $\frac{65}{360}\times\pi\times7^2$ leading to 27·79 and a final answer of 1175·59 award 3/4

For $\frac{360}{65}\times\pi\times14^2$ leading to 3410·32 and a final answer of 7940·64 award 3/4

For $\frac{65}{100}\times\pi\times14^2$ leading to 400·24 and a final answer of 1920·48 award 3/4

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
10. (a)	**Ans: Proof** •[1] strategy: know how to find area •[2] process: complete proof	•[1] $(x+7)(x+3)$ •[2] evidence of four correct terms $x^2+7x+3x+21$ leading to $x^2+10x+21$ **2 marks**
NOTES: 1. Where a candidate starts from $x^2+10x+21$ and factorises, the two marks are available as above.		
(b)	**Ans: $x = 2$** •[1] strategy: equate area formula to 45 •[2] process: use factorisation to solve equation or equivalent •[3] process: solve for x •[4] process: choose positive value for x	•[1] $x^2+10x+21=45$ •[2] $(x-2)(x+12)=0$ •[3] $2, -12$ •[4] 2 **4 marks**
NOTES: 1. Where a candidate states that $x=2$ and checks by substitution — award 2/4 2. For the case in NOTE 1, if $x=2$ is not stated explicitly — award 1/4 3. For an answer of $x=2$, without working, — award 0/4		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
11.	**Ans: 25·3 centimetres**	
	•[1] strategy: know how to find expression for volume of cylinder	•[1] $\pi \times 6 \cdot 4^2 \times h$
	•[2] process: equate volume with 3260	•[2] $\pi \times 6 \cdot 4^2 \times h = 3260$
	•[3] communicate: state value for h	•[3] 25·3 **3 marks**
NOTES: 1. Accept variations in π. Disregard premature or incorrect rounding		
12.	**Ans: 126·5 metres**	
	•[1] strategy: know to find QR or PR	•[1] evidence of use of sine rule in triangle PQR
	•[2] process: correct application of sine rule in triangle PQR	•[2] $\frac{350}{\sin 111^\circ} = \frac{QR}{\sin 27^\circ}$ or $\frac{PR}{\sin 42^\circ} = \frac{350}{\sin 111^\circ}$
	•[3] process: calculate QR or PR correctly	•[3] QR = 170·2 m or PR = 250·9m
	•[4] strategy: know to use right-angled trig to calculate QS or PS	•[4] $\cos 42^\circ = \frac{QS}{170 \cdot 2}$ or $\cos 27^\circ = \frac{PS}{250 \cdot 9}$
	•[5] process: calculate QS	•[5] 126·5 (metres) **5 marks**
NOTES: 1. Disregard errors due to premature rounding provided there is evidence. 2. Variations in answers for a value of QR or PR, or a wrong value for QR or PR must be accepted as a basis for calculating the length of QS. 3. Where a candidate assumes that angle PRQ = 90º, the first three marks are not available. 4. 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: 3·45 metres**	
	•[1] strategy: marshall facts and recognise right-angle	•[1] 
	•[2] strategy: use Pythagoras Theorem or equivalent	•[2] $x^2 = 1{\cdot}95^2 - 1{\cdot}25^2$
	•[3] process: calculate third side correctly	•[3] 1·496
	•[4] process: state height	•[4] 3·45 m
		4 marks

NOTES:

1. The final mark is for adding 1·95 to a value which has been calculated.
2. SOME COMMON ANSWERS (with working):

   $\sqrt{1{\cdot}95^2 + 1{\cdot}25^2} + 1{\cdot}95 = 4{\cdot}27$ award 3/4

   $\sqrt{1{\cdot}95^2 + 2{\cdot}5^2} + 1{\cdot}95 = 5{\cdot}12$ award 2/4

   $\sqrt{2{\cdot}5^2 - 1{\cdot}95^2} + 1{\cdot}95 = 3{\cdot}51$ award 2/4

   $\sqrt{3{\cdot}9^2 - 2{\cdot}5^2} = 2{\cdot}99$ award 1/4
3. Where a candidate assumes an angle of 45º in the right-angled triangle, only the first and fourth marks are available.

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
14. (a)	**Ans: 8·69 metres** •[1] process: substitute into formula •[2] process: calculate height correctly	•[1] $h = 15 \tan 25^\circ + 1{\cdot}7$ •[2] $h = 8{\cdot}69$ **2 marks**

NOTES:

1. For a correct answer, without working — award 2/2
2. For an answer of –0·303 (Rads) or 7·91 (Grads) — award 2/2
3. Where a candidate correctly uses the sine rule (or SOHCAHTOA) but forgets to add 1·7. — award 1/2

14. (b)	**Ans: 48°** •[1] process: substitute correctly •[2] process: rearrange correctly •[3] process: calculate angle	•[1] $15 \tan x^\circ + 1{\cdot}7 = 18{\cdot}4$ •[2] $\tan x^\circ = 16{\cdot}7/15$ •[3] $x = 48$ **3 marks**

NOTES:

1. For a correct answer, arrived at by trial and improvement, only the first and third marks are available, eg for $15 \tan 48 + 1{\cdot}7 = 18{\cdot}4$ — award 2/3
2. Where a candidate works out two values for x, the third mark is not available.

TOTAL MARKS FOR PAPER 2
50

[END OF MARKING INSTRUCTIONS]