2013 Mathematics

Intermediate 2 Units 1, 2 & 3 Paper 1

Finalised Marking Instructions

Part One: General Marking Principles for: Mathematics Intermediate 2 Units 1, 2 & 3 Paper 1

This information is provided to help you understand the general principles you must apply when marking candidate responses to questions in this Paper. These principles must be read in conjunction with the specific Marking Instructions for each question.

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 $\sin x^\circ = 0{\cdot}5 = 30^\circ$
- 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.

Part Two: Mathematics Intermediate 2: Paper 1, Units 1, 2 and 3

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
1	**Ans:** $b(6a - 7c)$ •[1] process: factorise correctly	**1**	•[1] $b(6a - 7c)$
2	**Ans:** $y = -\frac{4}{3}x + 4$ •[1] process: state y-intercept or c in $y = mx + c$ •[2] process: find gradient •[3] process: state correct equation of line	**3**	•[1] c = 4 •[2] $m = -\frac{4}{3}$ •[3] $y = -\frac{4}{3}x + 4$

Notes:

1. For a correct answer without working — award 3/3
2. For $y = -\frac{4}{3}x$ — award 1/3
3. Where m and/or c is calculated incorrectly the working must be followed through with a possibility of awarding 1/3 or 2/3
4. If the equation is stated incorrectly and there is no working, 1/3 can be awarded for correct gradient or correct y-intercept
5. For an incorrect equation (ie both m and c are incorrect) without working eg $y = 4x - \frac{4}{3}$ — award 0/3

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
3	**Ans: 6·28 cm**	**3**	
	•[1] strategy: know to express arc as fraction of a circle		•[1] $\frac{72}{360}$
	•[2] strategy: know how to find length of arc		•[2] $\frac{72}{360}\times 3\cdot 14\times 2\times 5$
	•[3] process: correctly calculate length of arc		•[3] 6·28

Notes:

1. For $\frac{72}{360}\times 3\cdot 14\times 5^2$ leading to 15·7 award 2/3

2. For the award of the final mark, calculations must involve 3·14 and be of equivalent difficulty

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
4	**Ans: $x = 4, y = -2$**	**3**	
	•[1] process: scale system of equations		•[1] $10x - 5y = 50$ $4x + 5y = 6$
	•[2] process: solve for one variable		•[2] $x = 4$
	•[3] process: solve for other variable		•[3] $y = -2$

Notes:

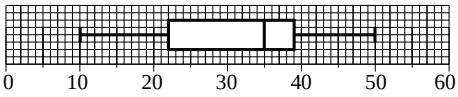
1. For a correct answer obtained from 2 tables of values or solving 2 equations graphically or trial and improvement award 0/3

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			Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
5			**Ans: 121°** •[1] process: know that angle QTV is a right angle •[2] process: know that angle in a semi-circle is a right angle •[3] process: calculate the size of angle PQR	**3**	•[1] angle QTV = 90° **or** angle RTQ = 22° •[2] angle TPQ = 90° **or** angle TRQ = 90° •[3] 121°
Notes: 1. For correct answer without working award 3/3 2. Angle QTV, angle RTQ, angle TPQ and angle TRQ may not be explicitly stated: they may be marked in a diagram and can be awarded the first and second marks, as appropriate 3. For the final mark to be awarded the size of the angle PQR must be stated explicitly					
6	**a**	**i**	**Ans: $Q_2 = 35$** •[1] communicate: state median	**1**	•[1] 35
6	**a**	**ii**	**Ans: $Q_1 = 22$** •[1] communicate: state lower quartile	**1**	•[1] 22
6	**a**	**iii**	**Ans: $Q_3 = 39$** •[1] communicate: state upper quartile	**1**	•[1] 39

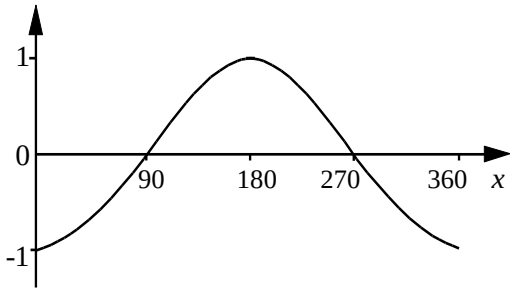
Question			Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
6	**b**		**Ans:**  •[1] communicate: correct endpoints •[2] communicate: correct box	**2**	•[1] endpoints at 10 and 50 •[1] box showing Q_1, Q_2, Q_3
Notes: 1. Incorrect answers in part (a) must be followed through to give the possibility of awarding 2/2 2. The boxplot must be drawn to a reasonable scale					
6	**c**		**Ans: In general, the fourth year pupils spend more time on homework.** **There is less variation in the times spent on homework in fourth year than in first year.** •[1] communicate: valid comment about the average time •[2] communicate: valid comment about the spread of times	**2**	•[1] comment •[2] comment
Notes: 1. Do not accept: "The fourth years had a higher median than the first years" "There was a longer period of time spent on homework in the second boxplot"					

Question			Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
7			**Ans:** $\frac{(x+4)}{(x-5)}$ •[1] process: start to factorise denominator •[2] process: factorise denominator completely •[3] process: correctly simplify fraction	**3**	 •[1] one correct factor •[2] $(x + 4)(x – 5)$ •[3] $\frac{(x+4)}{(x-5)}$
Notes: 1. Where the denominator has been factorised as: $(x + 1)(x – 20)$ $(x – 1)(x + 20)$ $(x + 2)(x – 10)$ $(x – 2)(x + 10)$ $(x – 4)(x + 5)$ award 1/3					
8			**Ans: 180°** •[1] communicate: state period	**1**	 •[1] 180°
9	**a**		**Ans: (4, 20)** •[1] communicate: state clearly one coordinate •[2] communicate: state clearly coordinates of maximum turning point	**2**	 •[1] $(4, y)$ or $(x, 20)$ •[2] (4, 20)
Notes: 1. For an answer of $x = 4$, $y = 20$ award 1/2 2. For an answer of 4, 20 award 1/2 3. For an answer of (20, 4) award 0/2					

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
9 b	**Ans: $x = 4$** •[1] communicate: state equation	**1**	•[1] $x = 4$

Notes:

1. For an answer of (a) $x = 4$ and (b) (4, 20) — award 2/2 for (a), award 0/1 for (b)
2. An incorrect answer in part (a) must be followed through
3. For an answer of 4 — award 0/1

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
10	**Ans: The graph of $y = \sin(x - 90)°$ from 0° to 360°**  	**3**	
	•[1] process: know the max = 1 and the min = –1		•[1] evidence from graph
	•[2] process: move graph of sin $x°$ to the right by 90°		•[2] evidence from graph eg sine graph from (0, –1) to (90, 0) or sine graph starting at (90, 0)
	•[3] process: draw curve correctly		•[3] evidence

Notes:

1. Disregard poor draughtsmanship
2. The 3rd mark can be awarded for one cycle of any sine or cosine curve being drawn from 0° to 360°

TOTAL MARKS FOR PAPER 1
30

[END OF MARKING INSTRUCTIONS]

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Part Two: Mathematics Intermediate 2: Paper 2, Units 1, 2 and 3

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
1	**Ans: $x^2 - 12x - 10$**	**3**	
	•[1] process: start to multiply out brackets		•[1] evidence of any two correct terms eg $x^2 - 5x$
	•[2] process: complete the process by multiplying out brackets correctly		•[2] $x^2 - 5x + 2x - 10$
	•[3] process: collect like terms which must include x^2 term		•[3] $x^2 - 12x - 10$
Notes: 1. Where candidates have attempted to "simplify" beyond the correct answer, the 3rd mark is not available			
2	**Ans: 4 years because 307 200 < 375 000**	**4**	
	•[1] strategy: know how to decrease 750 000 by 20%		•[1] × 0·8
	•[2] strategy: continue strategy until value is below half		•[2] $750\,000 \times 0{\cdot}8^4$
	•[3] process: carry out the calculations correctly, continuing for at least 4 years or until the value is less than half		•[3] 307 200
	•[4] process/ communication: state response which must compare above answer with 375 000		•[4] 4 years because 307 200 < 375 000
Notes: 1. Where an incorrect percentage has been used, the working must be followed through to give the possibility of awarding 3/4 2. Where a candidate has an answer of 4 years and has calculated 307 200 and 375 000, the 4th mark is available 3. For a correct answer without working award 0/4			

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
3	**Ans: Pie chart**	**3**	
	•[1] process: know how to calculate angles in a pie chart		•[1] $\frac{35}{100}\times 360$ $\frac{10}{100}\times 360$ $\frac{30}{100}\times 360$ $\frac{15}{100}\times 360$
	•[2] process: calculate angles in a pie chart correctly		•[2] 126°, 36°, 108°, 54°
	•[3] process: construct pie chart with all sections labelled		•[3] diagram (angles ± 2°)

Notes:

1. For a correctly constructed pie chart with all sections labelled with or without working — award 3/3
2. The 3rd mark is available only when there are exactly 5 sectors in the pie chart
3. If 4 sectors are drawn within tolerance then the 3rd mark can be awarded

4	**Ans: 30·6°**	**3**	
	•[1] strategy: know to apply the cosine rule to find angle QPR		•[1] evidence of cosine rule
	•[2] process: correct substitution into cosine rule		•[2] $\cos P = \frac{9\cdot 3^2 + 14\cdot 2^2 - 7\cdot 8^2}{2\times 9\cdot 3\times 14\cdot 2}$
	•[3] process: correctly calculate the size of angle QPR		•[3] 30·6°

Notes:

1. Where an angle other than QPR has been calculated (angle Q = 112°, angle R = 37·4°), a maximum of 2/3 can be awarded provided that the value of the angle calculated is consistent with the application of the cos rule.

2. 0·53 (RAD), 34 (GRAD), with working — award 3/3

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
5	**Ans:** $x = -0{\cdot}4$, $x = 5{\cdot}4$	**4**	
	•[1] strategy: know to use quadratic formula		•[1] evidence
	•[2] process: substitute correctly into quadratic formula		•[2] $\frac{5 \pm \sqrt{(-5)^2 - 4 \times 1 \times -2}}{2 \times 1}$
	•[3] process: calculate $b^2 - 4ac$		•[3] 33
	•[4] process: state both values of x correct to one decimal place		•[4] –0·4, 5·4

Notes:

1. Where $b^2 - 4ac$ is calculated incorrectly, the final mark is only available if $b^2 - 4ac > 0$

2. For a correct answer without working award 0/4

Question			Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
6	**a**	**i**	**Ans: $\overline{x}$ = 82** •[1] process: calculate mean	**1**	•[1] $\overline{x}$ = 82
6	**a**	**ii**	**Ans: s = 3·54** •[1] process: $(x-\overline{x})^2$ •[2] process: substitute into formula •[3] process: calculate standard deviation	**3**	•[1] 4, 16, 25, 4, 1 •[2] $\sqrt{\frac{50}{4}}$ •[3] 3·54

Notes:

1. For use of alternative formula in part (a) (ii), award marks as follows:
   - •[1] process: calculate Σx and Σx^2 — •[1] 410 and 33 670
   - •[2] process: substitute into formula — •[2] $\sqrt{\frac{33670 - \frac{410^2}{5}}{4}}$
   - •[3] process: calculate standard deviation — •[3] 3·54
2. For a correct answer without working in part (a) (ii) — award 0/3

6	**b**		**Ans: mean = 102** **standard deviation = 3·54** •[1] process: state mean •[2] process: state standard deviation	**2**	•[1] 102 •[2] 3·54

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
7	**Ans: 14 cm**	**5**	
	•[1] strategy: know how to calculate volume of remaining metal		•[1] $0{\cdot}92 \times 10^3$
	•[2] strategy: know how to find expression for volume of cone		•[2] $\frac{1}{3} \times \pi \times 8^2 \times h$
	•[3] process: equate above volumes		•[3] $\frac{1}{3} \times \pi \times 8^2 \times h = 0{\cdot}92 \times 10^3$
	•[4] process: calculate height		•[4] $13{\cdot}72711384$
	•[5] process: round answer to 2 significant figures		•[5] 14

Notes:

1. Accept variations in π
2. The fifth mark is available for rounding an answer correct to two significant figures
3. Where the answer requires no rounding, the fifth mark cannot be awarded

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
8	**Ans:** $\boldsymbol{b = \sqrt{\frac{a-c}{3}}}$ •[1] process: start to re-arrange formula •[2] process: continue process •[3] process: make *b* the subject	**3**	 •[1] $3b^2 = a - c$ •[2] $b^2 = \frac{a-c}{3}$ •[3] $b = \sqrt{\frac{a-c}{3}}$
Notes: 1. For a correct answer without working award 0/3 2. The second mark is available for division by 3 3. The third mark is available for taking the square root of an expression for b^2			
9	**Ans:** x^3y •[1] process: start to simplify •[2] process: fully simplify	**2**	 •[1] x^3 **or** y^1 •[2] x^3y
Notes: 1. For the following answers $\frac{x^3}{y^{-1}}$ $\frac{x^3y}{1}$ $x^3 \times y$ award 1/2			

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
10	**Ans: 7·6 metres**	**5**	
	•[1] strategy: know to apply the sine rule in **ΔTSC**		•[1] evidence of sine rule
	•[2] process: correct application of the sine rule or other valid strategy		•[2] $\frac{SC}{\sin 40^\circ} = \frac{4}{\sin 12^\circ}$ OR $\frac{ST}{\sin 128^\circ} = \frac{4}{\sin 12^\circ}$
	•[3] process: calculate SC or ST		•[3] SC = 12·4 OR ST = 15·2
	•[4] strategy: know to use right angled trig to find height of tree		•[4] $\sin 38^o = \frac{CB}{12 \cdot 4}$ OR $\sin 50^o = \frac{TB}{15 \cdot 2}$
	•[5] process: correct calculation of CB		•[5] 7·6 (m)

Notes:

1. Disregard any errors due to premature rounding provided there is evidence
2. Variations in answers for SC (or ST) or a wrong value for SC (or ST) must be accepted as a basis for calculating the new height
3. Where an incorrect trig ratio is used to find the new height, the fifth mark is still available
4. For a correct answer without working award 0/5

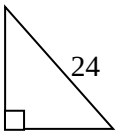
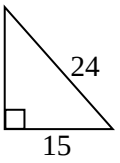
Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
11	**Ans:** $\dfrac{\mathbf{8x+7}}{\mathbf{(x+2)(x-1)}}$	**3**	
	$\bullet^1$ process: state a valid denominator		$\bullet^1$ any valid denominator
	$\bullet^2$ process: find correct numerator of equivalent fraction		$\bullet^2$ both numerators correct
	$\bullet^3$ process: state answer in simplest form		$\bullet^3$ $\dfrac{8x+7}{(x+2)(x-1)}$

Notes:

1. In this question, working subsequent to a correct answer should be ignored

2. For $\dfrac{3(x-1)+5(x+2)}{(x+2)(x-1)}=\dfrac{8x+7}{x^2+x-2}$ award 3/3 ✓✓✓

   $\dfrac{3(x-1)+5(x+2)}{x^2-2}=\dfrac{8x+7}{x^2-2}$ award 2/3 ×✓✓

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
12	**Ans: 85·4 cm**	**5**	
	•[1] strategy: marshall facts and recognise right angle		•[1] 
	•[2] strategy: know that PQ bisects AB		•[2] 
	•[3] strategy: know how to use Pythagoras'		•[3] $x^2 = 24^2 - 15^2$
	•[4] process: calculate length of 3rd side		•[4] $x = 18{\cdot}7$
	•[5] process: calculate height		•[5] 85·4 (cm)

Notes:

1. Disregard any errors due to premature rounding
2. The final mark is for doubling a calculated value and adding 48
3. Where a candidate assumes an angle of 45° in the right-angled triangle, only the first, second and fifth marks are available
4. For an answer of 104·6 coming from $\sqrt{(15^2+24^2)} \times 2 + 48$
   award 4/5 where a correct diagram is shown (✓✓×✓✓)
   Award 3/5 where a correct diagram is not shown (×✓×✓✓)

Question	Marking Scheme Give 1 mark for each •	Max Mark	Illustrations of evidence for awarding a mark at each •
13	**Ans: 49s, 131s**	**4**	
	•[1] process: substitute correctly		•[1] $7 + 5 \sin t^\circ = 10{\cdot}8$
	•[2] process: rearrange correctly		•[2] $\sin t^\circ = 3{\cdot}8/5$
	•[3] process: calculate one angle		•[3] $t = 49$
	•[4] process: calculate second angle		•[4] $t = 131$

Notes:

1. For a correct answer arrived at by trial and improvement, only the first, third and fourth marks are available
2. For the third mark to be awarded in a trial and improvement method, the candidate must
   - substitute into the expression a minimum of two values in the range 49-50, where one gives a height <10·8 and the other a height >10·8
     and
   - select the value giving a height closer to 10·8
3. For a correct answer without working award 1/4 (××××✓)
4. Where a graphical solution is used, the second mark is available for indicating what graph(s) is (are) drawn and where the values occur

TOTAL MARKS FOR PAPER 2
50

[END OF MARKING INSTRUCTIONS]