2015 Mathematics

Intermediate 2 Units 1, 2 and 3
Paper 1 (Non-Calculator)

Finalised Marking Instructions

Part One: General Marking Principles for Mathematics Intermediate 2 Units 1, 2 and 3 Paper 1 (Non-calculator)

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 (Non-calculator)

Question			Marking Scheme	Max Mark	Illustrations of evidence
1.			**Ans: $10x^2 + 33x - 18$** •[1] process: start to multiply out brackets •[2] process: complete the process of multiplying out brackets •[3] process: collect like terms, which must include a term in x^2.	**3**	•[1] evidence of any 2 correct terms, (eg $10x^2 - 6x$) •[2] $10x^2 - 6x + 30x - 18$ •[3] $10x^2 + 33x - 18$
Notes:					
2.			**Ans: 1884 cm^3** •[1] process: substitute correctly into the formula for volume of a cone •[2] process: correct calculation	**2**	•[1] $V = 1/3 \times 3{\cdot}14 \times 10^2 \times 18$ •[2] 1884
Notes: 1. Alternative correct answers: 1890 ($1{\cdot}05 \times 10^2 \times 18$) 1882·116 ($0{\cdot}333 \times 3{\cdot}14 \times 10^2 \times 18$) 2. The second mark is available for a calculation involving 4 values including a fraction and 3·14					

Question	Marking Scheme	Max Mark	Illustrations of
3.	**Ans: 39°**	**3**	
	$\bullet^1$ process: know that angle OBA is a right angle		$\bullet^1$ angle OBA = 90° or angle OBC = 90° or angle OBD = 13°
	$\bullet^2$ process: know that angle DFE is a right angle		$\bullet^2$ angle DFE = 90° or angle FDE = 26°
	$\bullet^3$ process: calculate the size of angle BDF		$\bullet^3$ 39°

Notes:

1. The first two marks may be awarded for information marked on a diagram.
2. An answer of 39^o must be stated outwith the diagram for the third mark to be awarded
3. For an answer of 39^o with no relevant working award 0/3

4.	**Ans: $k = 3$**	**2**	
	$\bullet^1$ process: substitute correctly into formula		$\bullet^1$ $48 = k \times 4^2$
	$\bullet^2$ process: find k		$\bullet^2$ $k = 3$

Notes:

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

Question			Marking Scheme	Max Mark	Illustrations of evidence
5.			**Ans: a = 8** $\bullet^1$ process: find $\bar{x}$ and $(x-\bar{x})^2$ $\bullet^2$ process: substitute into formula for a $\bullet^3$ process: calculate the value of a	**3**	$\bullet^1$ 3 and 4, 1, 1, 1, 25 $\bullet^2$ $\frac{32}{5-1}$ $\bullet^3$ 8

Notes:

1. Where a candidate has worked out the standard deviation, award marks as follows:

$\bullet^1$ process: find $\bar{x}$ and $(x-\bar{x})^2$	$\bullet^1$ 3 and 4, 1, 1, 1, 25
$\bullet^2$ process: substitute into formula	$\bullet^2$ $\sqrt{\frac{32}{5-1}}$
$\bullet^3$ process: calculate standard deviation	$\bullet^3$ $\sqrt{8}$

2. For use of alternative formula award marks as follows:

$\bullet^1$ process: find $\sum x$ and $\sum x^2$	$\bullet^1$ 15 and 77
$\bullet^2$ process: substitute into formula for a	$\bullet^2$ $\frac{77-\frac{15^2}{5}}{5-1}$
$\bullet^3$ process: calculate value of a	$\bullet^3$ 8

3. For a final answer of $a=\sqrt{8}$ award 2/3
4. Disregard any attempt to simplify $\sqrt{8}$
5. For a correct answer without working award 0/3

Question			Marking Scheme	Max Mark	Illustrations of evidence
6.			**Ans: $a = 4, b = 3$** $\bullet^1$ communication: state the value of a $\bullet^2$ communication: state the value of b	**2**	 $\bullet^1$ 4 $\bullet^2$ 3
Notes: 1. For an answer of $y = 4 \sin 3x$ award 2/2 2. For answer $a = 3$, $b = 4$ or $y = 3 \sin 4x$ award 1/2					
7.	**(a)**	 **(i)** **(ii)**	**Ans: $a = -2, b = -4$** $\bullet^1$ communication: state the value of a $\bullet^2$ communication: state the value of b	**2**	 $\bullet^1$ -2 $\bullet^2$ -4
7.	**(b)**		**Ans: $x = 2$** $\bullet^1$ communication: state equation of axis of symmetry	**1**	 $\bullet^1$ $x = 2$
Notes: 1. Where a candidate has answers of (i) -4 and (ii) -2, award 0/1 for (i) award 0/1 for (ii)					

Question	Marking Scheme	Max Mark	Illustrations of evidence
8.	**Ans: $x = -1, y = 3$**	**3**	
	$\bullet^1$ process: correctly draw the graph of one of the given equations		$\bullet^1$ evidence from graph
	$\bullet^2$ strategy: correctly draw on the same diagram the graph of the other equation		$\bullet^2$ evidence from graph
	$\bullet^3$ communication: state solution		$\bullet^3$ $x = -1, y = 3$

Notes:

1. For an answer of $(-1,3)$ with appropriate working — award 3/3
2. For a correct answer obtained from 2 tables of values or solving 2 equations algebraically or trial and improvement — award 0/3
3. For a correct answer without working — award 0/3

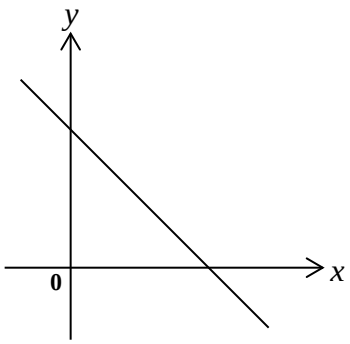
Question	Marking Scheme	Max Mark	Illustrations of evidence
9.	**Ans: cos 100°, cos 90°, cos 300°, with reason**	**2**	
	$\bullet^1$ communicate: state correct order		$\bullet^1$ cos 100°, cos 90°, cos 300°
	$\bullet^2$ communicate: state reason		$\bullet^2$ cos 100° is negative, cos 90° is zero and cos 300° is positive (or similar)

Notes:

1. Where 2 out of the 3 values are in the correct position relative to each other, with a valid reason — award 1/2

   eg, For "cos 90° is positive, cos 100° is negative, cos 300° is positive so cos 100°, cos 300°, cos 90°" — award 1/2

2. Accept positions of cos 90°, cos 100°, cos 300° indicated on a cos curve for award of mark 2

Question			Marking Scheme	Max Mark	Illustrations of evidence
10.			**Ans: $7\sqrt{5}$** •[1] process: simplify surd $\sqrt{45}$ •[2] process: simplify surd $\sqrt{20}$ •[3] process: state answer in simplest form	**3**	•[1] $3\sqrt{5}$ •[2] $2\sqrt{5}$ •[3] $7\sqrt{5}$
Notes:					
11.			**Ans: Straight line drawn sloping down from left to right, crossing the *y* axis above the origin.** •[1] interpret: realise $m < 0$ represents a downward sloping line •[2] interpret: realise $c > 0$ represents a *y*-intercept above the origin	**2**	 •[1] line with downward slope drawn on graph •[2] line drawn with *y*-intercept above origin
Notes: 1. Where a candidate has omitted *x*, *y*, 0 from perpendicular axes, full marks are still available					

Question			Marking Scheme	Max Mark	Illustrations of evidence
12.			**Ans: 34** •[1] strategy: start to solve problem •[2] process: find age of eighth member	**2**	 •[1] evidence (see note 1) •[2] 34

Notes:

1. Candidate may attempt to list the ages of the 7 original members
   eg 17, 20, ?, 24, ?, 32, 37
2. For a correct answer without working award 0/2

TOTAL MARKS FOR PAPER 1
30

[END OF MARKING INSTRUCTIONS]

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

Question			Marking Scheme	Max Mark	Illustrations of evidence
1.			**Ans: £253 628 (·16)** $\bullet^1$ strategy: know how to increase by 2·8% $\bullet^2$ strategy: know how to calculate expected value $\bullet^3$ process: carry out calculations correctly within a valid strategy	**3**	$\bullet^1$ × 1·028 $\bullet^2$ 240 000 × $1·028^2$ $\bullet^3$ 253 628 (·16)

Notes:

1. For an answer of 253 628 without working — award 3/3 ✓✓✓
2. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 2/3
   eg for an answer of 393 216 (240 000 × $1·28^2$), with working — award 2/3 ×✓✓
3. For an answer of 246 720 (240000 x 1·028), no working necessary — award 1/3 ✓××
4. For an answer of 493 440 (240 000 × 1·028 × 2), with working — award 1/3 ✓××
5. For an answer of 253 440 (240 000 + 240 000 × 0·028 × 2), with working — award 1/3 ✓××
6. For an answer of 13 440 (240 000 × 0·028 × 2) — award 0/3 ×××

Question			Marking Scheme	Max Mark	Illustrations of evidence
2.	**(a)**		**Ans: 4/21** •[1] process: find probability	**1**	•[1] 4/21 (or equivalent)
2.	**(b)**		**Ans: (i) $Q_2 = 58$ (ii) $Q_1 = 46{\cdot}5$ (iii) $Q_3 = 69$**	**3**	
		(i)	•[1] process: calculate the median		•[1] $Q_2 = 58$
		(ii)	•[1] process: calculate the lower quartile		•[1] $Q_1 = 46{\cdot}5$
		(iii)	•[1] process: calculate the upper quartile		•[1] $Q_3 = 69$
2.	**(c)**		**Ans: The SIQR for the museum was 11·25 so the number of visitors to the museum was more varied.** •[1] strategy: calculate SIQR for the museum •[2] communication: valid comment about spread of number of visitors	**2**	•[1] SIQR = 11·25 •[2] comment

Notes:

1. Any comment must be based on a calculation of SIQR for museum

Question			Marking Scheme	Max Mark	Illustrations of
3.			**Ans: 0·78 km** •[1] process: substitute correctly into cosine rule •[2] process: calculate AB^2 •[3] process: calculate length of AB	**3**	•[1] $c^2 = 1{\cdot}35^2 + 1{\cdot}2^2 - 2 \times 1{\cdot}35 \times 1{\cdot}2 \times \cos 35^o$ •[2] 0·608… •[3] 0·78
Notes: 1. For 0·8 with valid working, award 3/3 2. Disregard errors due to premature rounding provided there is evidence. eg $1{\cdot}35^2 + 1{\cdot}2^2 - 2 \times 1{\cdot}35 \times 1{\cdot}2 \times 0{\cdot}8 = 0{\cdot}6705 \Rightarrow$ final answer = 0·82, award 3/3 3. For 2·49 (uses RAD) or 0·71 (uses GRAD), with working award 3/3 4. Correct answer without working, award 0/3					
4.	**(a)**		**Ans: $y = 0{\cdot}75x + 10$** •[1] process: find gradient •[2] process: state y-intercept or c in $y = mx + c$ •[3] communicate: state equation of line	**3**	•[1] $0 \cdot 75$ or equivalent •[2] 10 •[3] $y = 0{\cdot}75x + 10$
4.	**(b)**		**Ans: 70%** •[1] process: calculate Unit 2% **using equation**	**1**	•[1] $y = 0 \cdot 75 \times 80 + 10 = 70$
Notes: **(a)** 1. For a correct answer without working award 3/3 2. Where m and/or c are incorrect, the working must be followed through to give the possibility of awarding 1/3 or 2/3 3. For $y = 0{\cdot}75x$ award 1/3 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 incorrect), without working eg $y = 10x + 0{\cdot}75$ award 0/3					

Question			Marking Scheme	Max Mark	Illustrations of evidence
5.			**Ans: 10*s***	**3**	
			$\bullet^1$ strategy: know how to start division calculation		$\bullet^1$ $\frac{5t}{s}\times\frac{2s^2}{t}$ or equivalent
			$\bullet^2$ process: continue process		$\bullet^2$ evidence of correctly cancelling either variable **OR** $\frac{10ts^2}{st}$
			$\bullet^3$ process: express in simplest form		$\bullet^3$ $10s$

Notes:

1. Correct answer without working — award 3/3
2. For $\frac{10s}{1}$ — award 2/3 (✓✓×)

Question			Marking Scheme	Max Mark	Illustrations of evidence
6.			**Ans:** $\boldsymbol{b = \frac{2A}{d} - c}$ $\bullet^1$ process: start to re-arrange formula $\bullet^2$ process: continue process $\bullet^3$ process: make *b* the subject ALTERNATIVE MARKING SCHEME FOR SECOND AND THIRD MARKS $\bullet^2$ process: continue process $\bullet^3$ process: make *b* the subject	**3**	$\bullet^1$ $2A = (b + c)d$ $\bullet^2$ $\frac{2A}{d} = b + c$ $\bullet^3$ $b = \frac{2A}{d} - c$ $\bullet^2$ $2A - cd = bd$ $\bullet^3$ $b = \frac{2A - cd}{d}$

Notes:

1. For a correct answer without working — award 3/3

2. For $b + c = \frac{A}{\frac{1}{2}d}$

$$b = \frac{A}{\frac{1}{2}d} - c$$ — award 3/3

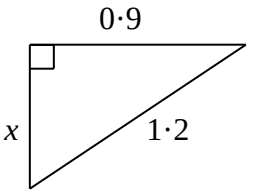
3. For $\frac{1}{2}b + \frac{1}{2}c = \frac{A}{d}$

$$\frac{1}{2}b = \frac{A}{d} - \frac{1}{2}c$$

$$b = \frac{\frac{A}{d} - \frac{1}{2}c}{\frac{1}{2}}$$ — award 2/3

Question	Marking Scheme	Max Mark	Illustrations of evidence
7.	**Ans: $10p^4$** •[1] process: simplify powers in numerator •[2] process: simplify constants •[3] process: simplify powers in fraction	**3**	•[1] $\frac{5\times 4p^5}{2p}$ •[2] $\frac{10p^5}{p}$ •[3] $10p^4$
Notes: 1. For a correct answer without working, award 3/3			
8.	**Ans: 120°** •[1] communicate: state the period	**1**	•[1] 120
Notes:			
9.	**Ans: $x = 63{\cdot}4$ and $x = 243{\cdot}4$** •[1] process: solve equation for tan x^o •[2] process: find one value for x •[3] process: find second value for x	**3**	•[1] tan $x^o = 2$ or equivalent •[2] $x = 63(\cdot 4)$ •[3] $x = 243(\cdot 4)$
Notes: 1. Where a graphical solution has been used, the first mark is available for indicating what graph is drawn and where the values occur. 2. For a correct answer, without working award 0/3			

Question			Marking Scheme	Max Mark	Illustrations of evidence
10.			**Ans: 8·8 centimetres** •[1] strategy: know how to find expression for volume of mug •[2] process: equate volume to 400 •[3] communicate: state value for height correct to one decimal place	**3**	 •[1] $3{\cdot}14 \times 3{\cdot}8^2 \times h$ •[2] $3{\cdot}14 \times 3{\cdot}8^2 \times h = 400$ •[3] 8·8 (cm)
Notes: **1.** Accept variations in the value of the height due to variations in the value of π. **2.** Where a candidate uses $3{\cdot}14 \times 3{\cdot}8 \times h$, marks 2 and 3 are still available					
11.	**(a)**		**Ans: – 1·5 (or equivalent)** •[1] strategy: know how to find gradient •[2] communicate: state gradient	**2**	 •[1] from diagram or $y = \frac{-3}{2}x + 6$ •[2] – 1·5 (or equivalent)
	(b)		**Ans: 6** •[1] communication: state *y*-intercept	**1**	 •[1] 6
Notes: **(a)** 1. For a correct answer without working award 2/2 **(b)** 1. For an answer of (0, 6) award 1/1					

Question			Marking Scheme	Max Mark	Illustrations of evidence
12.			**Ans: 1·99 metres**	**4**	
			$\bullet^1$ strategy: marshal facts and recognise right-angle		$\bullet^1$ 
			$\bullet^2$ strategy: know how to use Pythagoras		$\bullet^2$ $x^2 = 1\cdot 2^2 - 0\cdot 9^2$
			$\bullet^3$ process: correct calculation of x		$\bullet^3$ 0·79
			$\bullet^4$ process: find depth of milk		$\bullet^4$ 1·99

Notes:

1. $x = 0\cdot 8$ and depth = 2 are acceptable in awarding the third and fourth marks
2. The final mark is for adding 1·2 to a value which has been calculated
3. In the absence of a diagram accept $x^2 = 1\cdot 2^2 - 0\cdot 9^2$ as evidence for the award of the first 2 marks
4. For $x^2 = 1\cdot 2^2 + 0\cdot 9^2 \rightarrow$ depth = 2·7
   (a) with correct diagram — award 3/4 (✓×✓✓)
   (b) without correct diagram — award 2/4 (××✓✓)
5. Where a candidate assumes angle MLO = angle OML = 45°, only the 1st and 4th marks are available
6. For an answer of 1·99 without working — award 0/4

Question	Marking Scheme	Max Mark	Illustrations of evidence
13.	**Ans: 23·8 kilometres**	**4**	
	•[1] process: calculate the size of angle PQR		•[1] 52^o
	•[2] process: correct substitution into sine rule		•[2] $\frac{q}{\sin 52^o} = \frac{25}{\sin 56^o}$
	•[3] strategy: know how to solve equation		•[3] $q = \frac{25\sin 52^o}{\sin 56^o}$
	•[4] process: calculate PR correctly		•[4] 23·8

Notes:

1. Disregard errors due to premature rounding provided there is evidence
2. Where incorrect sizes are used for angles, marks 3 and 4 are still available for rearranging and processing a sine rule calculation
   eg $\frac{25}{\sin 160} = \frac{q}{\sin 128} \rightarrow q = 57\cdot 6$ award 2/4 (××✓✓)
3. $\frac{q}{52} = \frac{25}{56} \rightarrow q = 23\cdot 2$ …. award 1/4 (×××✓)
4. For a correct answer without working award 0/4
5. Use of RAD or GRAD (working must be shown)
   (a) For 23·7 (uses GRAD) award 4/4
   (b) For $-47\cdot 3$ or $47\cdot 3$ (uses RAD) award 3/4

Question			Marking Scheme	Max Mark	Illustrations of evidence
14.			**Ans: $x = -5, x = 0{\cdot}5$**	**3**	
			$\bullet^1$ strategy: know to factorise $2x^2 + 9x - 5$		$\bullet^1$ evidence
			$\bullet^2$ process: factorise correctly		$\bullet^2$ $(2x-1)(x+5)$
			$\bullet^3$ process: find roots		$\bullet^3$ $-5,\ 0{\cdot}5$
			<u>ALTERNATIVE STRATEGY</u>		
			$\bullet^1$ strategy: know to use quadratic formula		$\bullet^1$ evidence
			$\bullet^2$ process: substitute correctly in formula		$\bullet^2$ $x = \dfrac{-9 \pm \sqrt{9^2 - 4 \times 2 \times (-5)}}{2 \times 2}$
			$\bullet^3$ process: find roots		$\bullet^3$ $-5,\ 0{\cdot}5$

Notes:

1. For $(2x+5)(x-1)$ leading to $x = -\dfrac{5}{2}, x = 1$

   or $(2x-5)(x+1)$ leading to $x = \dfrac{5}{2}, x = -1$

   or $(2x+1)(x-5)$ leading to $x = -\dfrac{1}{2}, x = 5$ award 2/3 (✓×✓)

Question			Marking Scheme	Max Mark	Illustrations of evidence
15.			**Ans: 310º** $\bullet^1$ strategy: marshall facts and recognise link with circumference $\bullet^2$ process: express arc as ratio of circumference $\bullet^3$ strategy: know how to find angle $\bullet^4$ process: calculate angle	**4**	$\bullet^1$ $\frac{arc}{circumference} = \frac{angle}{360}$ or equivalent $\bullet^2$ $\frac{34 \cdot 6}{\pi \times 12 \cdot 8}$ or equivalent $\bullet^3$ $\frac{34 \cdot 6 \times 360}{\pi \times 12 \cdot 8}$ $\bullet^4$ 310

Notes:

1. Accept variations in π; disregard premature or incorrect rounding of $\frac{34 \cdot 6}{\pi \times 12 \cdot 8}$
2. For $\frac{34 \cdot 6 \times 360}{\pi \times 6 \cdot 4}$**,** leading to an answer of 620**,** award 3/4 provided the criteria for the other marks are met.
3. Where the candidate has correctly calculated the acute angle AOB, with working award 3/4
4. For the use of πr^2, the third and fourth marks are available.

TOTAL MARKS FOR PAPER 2
50

TOTAL MARKS FOR PAPER 1 & 2
80

[END OF MARKING INSTRUCTIONS]

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- bad form, eg $\sin x^\circ = 0{\cdot}5 = 30^\circ$
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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).

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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.

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Part Two: Mathematics Intermediate 2: Paper 1, Units 1, 2 and Applications Paper 1 (Non-calculator)

Question			Marking Scheme	Max Mark	Illustrations of evidence
1.			**Ans: $10x^2 + 33x - 18$** •1 process: start to multiply out brackets •2 process: complete the process of multiplying out brackets •3 process: collect like terms, which must include a term in x^2.	**3**	 •1 evidence of any 2 correct terms, (eg $10x^2 - 6x$) •2 $10x^2 - 6x + 30x - 18$ •3 $10x^2 + 33x - 18$
Notes:					
2.			**Ans: 1884 cm^3** •1 process: substitute correctly into the formula for volume of a cone •2 process: correct calculation	**2**	 •1 $V = 1/3 \times 3{\cdot}14 \times 10^2 \times 18$ •2 1884
Notes: 1. Alternative correct answers: 1890 ($1{\cdot}05 \times 10^2 \times 18$) 1882·116 ($0{\cdot}333 \times 3{\cdot}14 \times 10^2 \times 18$) 2. The second mark is available for a calculation involving 4 values including a fraction and 3·14					

Question			Marking Scheme	Max Mark	Illustrations of
3.			**Ans: 39°** •[1] process: know that angle OBA is a right angle •[2] process: know that angle DFE is a right angle •[3] process: calculate the size of angle BDF	**3**	•[1] angle OBA = 90° or angle OBC = 90° or angle OBD = 13° •[2] angle DFE = 90° or angle FDE = 26° •[3] 39°

Notes:

1. The first two marks may be awarded for information marked on a diagram.
2. An answer of 39^o must be stated outwith the diagram for the third mark to be awarded
3. For an answer of 39^o with no relevant working award 0/3

Question			Marking Scheme	Max Mark	Illustrations of
4.			**Ans: £245·38** •[1] strategy: know how to calculate Gross Pay •[2] strategy: know how to calculate Net Pay •[3] process: carry out all calculations correctly	**3**	•[1] 291·25 + 0·025 × 1800 •[2] Gross Pay – Deductions •[3] 245·38

Notes:

1. The third mark is available for a calculation involving addition, subtraction and percentage.

Question	Marking Scheme	Max Mark	Illustrations of evidence
5.	**Ans: a = 8**	**3**	
	$\bullet^1$ process: find $\bar{x}$ and $(x-\bar{x})^2$		$\bullet^1$ 3 and 4, 1, 1, 1, 25
	$\bullet^2$ process: substitute into formula for a		$\bullet^2$ $\frac{32}{5-1}$
	$\bullet^3$ process: calculate the value of a		$\bullet^3$ 8

Notes:

1. Where a candidate has worked out the standard deviation, award marks as follows:

$\bullet^1$ process: find $\bar{x}$ and $\left(x-\bar{x}\right)^2$	$\bullet^1$ 3 and 4, 1, 1, 1, 25
$\bullet^2$ process: substitute into formula	$\bullet^2$ $\sqrt{\frac{32}{5-1}}$
$\bullet^3$ process: calculate standard deviation	$\bullet^3$ $\sqrt{8}$

2. For use of alternative formula award marks as follows:

$\bullet^1$ process: find $\sum x$ and $\sum x^2$	$\bullet^1$ 15 and 77
$\bullet^2$ process: substitute into formula for a	$\bullet^2$ $\frac{77-\frac{15^2}{5}}{5-1}$
$\bullet^3$ process: calculate value of a	$\bullet^3$ 8

3. For a final answer of $a=\sqrt{8}$ award 2/3
4. Disregard any attempt to simplify $\sqrt{8}$
5. For a correct answer without working award 0/3

Question			Marking Scheme	Max Mark	Illustrations of evidence
6.			**Ans: 72** •[1] strategy: substitute correctly into formula •[2] process: carry out all calculations correctly	**2**	•[1] $A = \frac{1}{2} \times 8 \times (6+12)$ •[2] $A = 72$
Notes:					
7.	**(a)**		**Ans: 78** •[1] process: calculate value in cell C4	**2**	•[1] 78
7.	**(b)**		**Ans: Formula contains circular reference** •[1] communication: explain problem		•[1] eg Formula should be B2:B5 or formula should say B5 not B7 or formula contains circular reference
Notes:					

Question	Marking Scheme	Max Mark	Illustrations of evidence
8.	**Ans: $x = -1, y = 3$**	**3**	
	•[1] process: correctly draw the graph of one of the given equations		•[1] evidence from graph
	•[2] strategy: correctly draw on the same diagram the graph of the other equation		•[2] evidence from graph
	•[3] communication: state solution		•[3] $x = -1, y = 3$

Notes:

1. For an answer of $(-1, 3)$ with appropriate working — award 3/3
2. For a correct answer obtained from 2 tables of values or solving 2 equations algebraically or trial and improvement — award 0/3
3. For a correct answer without working — award 0/3

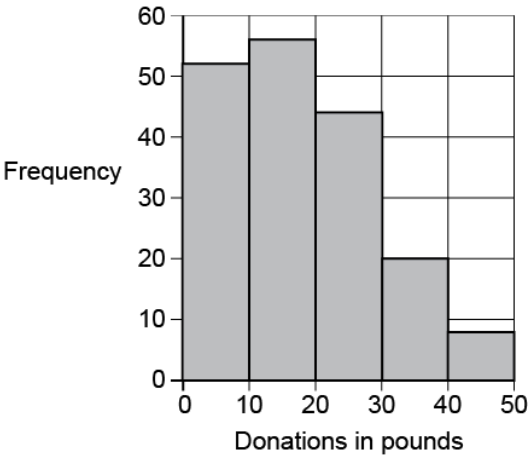
Question	Marking Scheme	Max Mark	Illustrations of evidence
9.	**Ans: cos 100°, cos 90°, cos 360°, with reason**	**2**	
	•[1] communicate: state correct order		•[1] cos 100°, cos 90°, cos 360°
	•[2] communicate: state reason		•[2] cos 100° is negative, cos 90° is zero and cos 360° is positive (or similar)

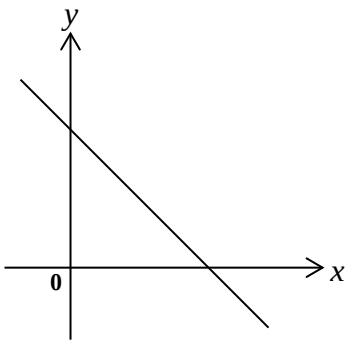
Notes:

1. Where 2 out of the 3 values are in the correct position relative to each other, with a valid reason — award 1/2

   eg, For "cos 90° is positive, cos 100° is negative, cos 360° is positive so cos 100°, cos 360°, cos 90°" — award 1/2

2. Accept positions of cos 90°, cos 100°, cos 360° indicated on a cos curve for award of mark 2

Question			Marking Scheme	Max Mark	Illustrations of evidence
10.	**(a)**		**Ans: histogram**  •[1] process: choose suitable scales and label **both** axes •[2] process: correctly draw histogram	**2**	•[1] evidence •[2] evidence
Notes:					
10.	**(b)**		**Ans: £12·50** $(\pm 0 \cdot 50)$ •[1] communication: estimate the modal amount	**1**	•[1] 12·5
Notes: 1. Where an invalid method has been used leading to an answer of 12·5 award 0/1					

Question	Marking Scheme	Max Mark	Illustrations of evidence
11.	**Ans: Straight line drawn sloping down from left to right, crossing the *y* axis above the origin.** •[1] interpret: realise $m < 0$ represents a downward sloping line •[2] interpret: realise $c > 0$ represents a *y*-intercept above the origin	**2**	 •[1] line with downward slope drawn on graph •[2] line drawn with *y*-intercept above origin
Notes: Where a candidate has omitted *x*, *y*, 0 from perpendicular axes, full marks are still available			
12.	**Ans: 34** •[1] strategy: start to solve problem •[2] process: find age of eighth member	**2**	•[1] evidence (see note 1) •[2] 34
Notes: 1. Candidate may attempt to list the ages of the 7 original members eg 17, 20, ?, 24, ?, 32, 37 2. For a correct answer without working award 0/2			

TOTAL MARKS FOR PAPER 1
30

[END OF MARKING INSTRUCTIONS]

2015 Mathematics

Intermediate 2 Units 1, 2 and Applications
Paper 2

Finalised Marking Instructions

Part One: General Marking Principles for: Mathematics Intermediate 2 Units 1, 2 and Applications Paper 2

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

Question			Marking Scheme	Max Mark	Illustrations of evidence
1.			**Ans: £253 628 (·16)**	**3**	
			$\bullet^1$ strategy: know how to increase by 2·8%		$\bullet^1$ $\times 1{\cdot}028$
			$\bullet^2$ strategy: know how to calculate expected value		$\bullet^2$ $240\,000 \times 1{\cdot}028^2$
			$\bullet^3$ process: carry out calculations correctly within a valid strategy		$\bullet^3$ 253 628 (·16)

Notes:

1. For an answer of 253 628 without working — award 3/3 ✓✓✓
2. Where an incorrect percentage is used, the working must be followed through to give the possibility of awarding 2/3
   eg for an answer of 393 216 ($240\,000 \times 1{\cdot}28^2$), with working — award 2/3 ×✓✓
3. For an answer of 246 720 (240000 × 1·028), no working necessary — award 1/3 ✓××
4. For an answer of 493 440 (240 000 × 1·028 × 2), with working — award 1/3 ✓××
5. For an answer of 253 440 (240 000 + 240 000 × 0·028 × 2), with working — award 1/3 ✓××
6. For an answer of 13 440 (240 000 × 0·028 × 2) — award 0/3 ×××

Question			Marking Scheme	Max Mark	Illustrations of evidence
2.	**(a)**		**Ans: 4/21** •[1] process: find probability	**1**	 •[1] 4/21 (or equivalent)
2.	**(b)**		**Ans: (i) $Q_2 = 58$ (ii) $Q_1 = 46{\cdot}5$ (iii) $Q_3 = 69$**	**3**	
		(i)	•[1] process: calculate the median		•[1] $Q_2 = 58$
		(ii)	•[1] process: calculate the lower quartile		•[1] $Q_1 = 46{\cdot}5$
		(iii)	•[1] process: calculate the upper quartile		•[1] $Q_3 = 69$
2.	**(c)**		**Ans: The SIQR for the museum was 11·25 so the number of visitors to the museum was more varied.** •[1] strategy: calculate SIQR for the museum •[2] communication: valid comment about spread of number of visitors	**2**	 •[1] SIQR = 11·25 •[2] comment

Notes:

1. Any comment must be based on a calculation of SIQR for museum

Question			Marking Scheme	Max Mark	Illustrations of
3.			**Ans: 0·78 km** •[1] process: substitute correctly into cosine rule •[2] process: calculate AB^2 •[3] process: calculate length of AB	**3**	•[1] $c^2 = 1{\cdot}35^2 + 1{\cdot}2^2 - 2 \times 1{\cdot}35 \times 1{\cdot}2 \times \cos 35^o$ •[2] 0·608… •[3] 0·78
Notes: 1. For 0·8 with valid working, award 3/3 2. Disregard errors due to premature rounding provided there is evidence. eg $1{\cdot}35^2 + 1{\cdot}2^2 - 2 \times 1{\cdot}35 \times 1{\cdot}2 \times 0{\cdot}8 = 0{\cdot}6705 \Rightarrow$ final answer = 0·82, award 3/3 3. For 2·49 (uses RAD) or 0·71 (uses GRAD), with working award 3/3 4. Correct answer without working, award 0/3					
4.	**(a)**		**Ans: $y = 0{\cdot}75x + 10$** •[1] process: find gradient •[2] process: state y-intercept or c in $y = mx + c$ •[3] communicate: state equation of line	**3**	•[1] $0 \cdot 75$ or equivalent •[2] 10 •[3] $y = 0{\cdot}75x + 10$
4.	**(b)**		**Ans: 70%** •[1] process: calculate Unit 2% **using equation**	**1**	•[1] $y = 0{\cdot}75 \times 80 + 10 = 70$
Notes: **(a)** 1. For a correct answer without working award 3/3 2. Where m and/or c are incorrect, the working must be followed through to give the possibility of awarding 1/3 or 2/3 3. For $y = 0{\cdot}75x$ 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 incorrect), without working eg $y = 10x + 0{\cdot}75$ award 0/3					

Question			Marking Scheme	Max Mark	Illustrations of evidence
5.			**Ans: £3428** •[1] strategy: know how to calculate taxable income •[2] strategy: know how to calculate tax •[3] process: calculate tax correctly	**3**	 •[1] 27 080 − 9940 (= £17 140) •[2] 0·2 × taxable income •[3] £3428

Notes:

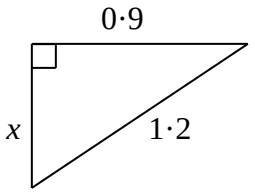
1. The final mark is for a calculation involving addition/subtraction followed by percentage
2. SOME COMMON ANSWERS (working must be shown):

£8406 from (27080 + 9940) then calculating tax in appropriate bands	award 2/3 (×✓✓)
£7404 from (27080 + 9940) × 0·2	award 1/3 (××✓)
£14808 from (27080 + 9940) × 0·4	award 1/3 (××✓)
£15356 from (27080 × 0·2 + 9940)	award 1/3 (×✓×)

Question			Marking Scheme	Max Mark	Illustrations of evidence
6.			**Ans: £5165** •[1] interpret: choose correct path •[2] strategy: know how to calculate cost of day event •[3] interpret: choose correct path •[4] process: correctly calculate total price	**4**	 •[1] NO followed by NO (£65 for Menu C) •[2] (65 + 4·5 × 3) × 50 •[3] YES and Total = Day + (12 × 70) +400 •[4] 5165

Notes:

Question			Marking Scheme	Max Mark	Illustrations of evidence
7.			**Ans: 8·8 centimetres** •[1] strategy: know how to find expression for volume of mug •[2] process: equate volume to 400 •3 communicate: state value for height correct to one decimal place	**3**	 •[1] $3{\cdot}14 \times 3{\cdot}8^2 \times h$ •[2] $3{\cdot}14 \times 3{\cdot}8^2 \times h = 400$ •[3] 8·8 (cm)
Notes: 1. Accept variations in the value of the height due to variations in the value of π. 2. Where a candidate uses $3{\cdot}14 \times 3{\cdot}8 \times h$, marks 2 and 3 are still available					
8.	**(a)**		**Ans: – 1·5 (or equivalent)** •[1] strategy: know how to find gradient •[2] communicate: state gradient	**2**	 •[1] from diagram or $y = \frac{-3}{2}x + 6$ •[2] – 1·5 (or equivalent)
	(b)		**Ans: 6** •[1] communication: state *y*-intercept	**1**	 •[1] 6
Notes: **(a)** 1. For a correct answer without working award 2/2 **(b)** 1. For an answer of (0, 6) award 1/1					

Question			Marking Scheme	Max Mark	Illustrations of evidence
9.			**Ans: 1·99 metres**	**4**	
			$\bullet^1$ strategy: marshal facts and recognise right-angle		$\bullet^1$ 
			$\bullet^2$ strategy: know how to use Pythagoras		$\bullet^2$ $x^2 = 1\cdot 2^2 - 0\cdot 9^2$
			$\bullet^3$ process: correct calculation of x		$\bullet^3$ 0·79
			$\bullet^4$ process: find depth of milk		$\bullet^4$ 1·99

Notes:

1. x = 0·8 and depth = 2 are acceptable in awarding the third and fourth marks
2. The final mark is for adding 1·2 to a value which has been calculated
3. In the absence of a diagram accept $x^2 = 1\cdot 2^2 - 0\cdot 9^2$ as evidence for the award of the first 2 marks
4. For $x^2 = 1\cdot 2^2 + 0\cdot 9^2 \rightarrow$ depth = 2·7
   (a) with correct diagram — award 3/4 (✓×✓✓)
   (b) without correct diagram — award 2/4 (××✓✓)
5. Where a candidate assumes angle MLO = angle OML = 45°, only the 1st and 4th marks are available
6. For an answer of 1·99 without working — award 0/4

Question			Marking Scheme	Max Mark	Illustrations of evidence
10.			**Ans: 23·8 kilometres** •[1] process: calculate the size of angle PQR •[2] process: correct substitution into sine rule •[3] strategy: know how to solve equation •[4] process: calculate PR correctly	**4**	•[1] 52^o •[2] $\frac{q}{\sin 52^o} = \frac{25}{\sin 56^o}$ •[3] $q = \frac{25 \sin 52^o}{\sin 56^o}$ •[4] 23·8

Notes:

1. Disregard errors due to premature rounding provided there is evidence
2. Where incorrect sizes are used for angles, marks 3 and 4 are still available for rearranging and processing a sine rule calculation
   eg $\frac{25}{\sin 160} = \frac{q}{\sin 128} \rightarrow q = 57 \cdot 6$ award 2/4 (××✓✓)
3. $\frac{q}{52} = \frac{25}{56} \rightarrow q = 23 \cdot 2$ …. award 1/4 (×××✓)
4. For a correct answer without working award 0/4
5. Use of RAD or GRAD (working must be shown)
   (a) For 23·7 (uses GRAD) award 4/4
   (b) For $-47 \cdot 3$ or $47 \cdot 3$ (uses RAD) award 3/4

Question	Marking Scheme	Max Mark	Illustrations of evidence
11.	**Ans: £144·32** $\bullet^1$ process: calculate total repayments $\bullet^2$ strategy: know how to use table to find the amount of the loan $\bullet^3$ process: correctly calculate amount of loan $\bullet^4$ process: correctly calculate cost of loan	**4**	$\bullet^1$ 2344·32 $\bullet^2$ 195·36 − 177·60 and compare with table $\bullet^3$ 2200 $\bullet^4$ 144·32
Notes:			
12.	**Ans: 310º** $\bullet^1$ strategy: marshall facts and recognise link with circumference $\bullet^2$ process: express arc as ratio of circumference $\bullet^3$ strategy: know how to find angle $\bullet^4$ process: calculate angle	**4**	$\bullet^1$ $\frac{arc}{circumference} = \frac{angle}{360}$ or equivalent $\bullet^2$ $\frac{34\cdot6}{\pi\times12\cdot8}$ or equivalent $\bullet^3$ $\frac{34\cdot6\times360}{\pi\times12\cdot8}$ $\bullet^4$ 310

Notes:

1. Accept variations in π; disregard premature or incorrect rounding of $\frac{34\cdot6}{\pi\times12\cdot8}$

2. For $\frac{34\cdot6\times360}{\pi\times6\cdot4}$**,** leading to an answer of 620**,** award 3/4 provided the criteria for the other marks are met.

3. Where the candidate has correctly calculated the acute angle AOB, with working award 3/4

4. For the use of πr^2, the third and fourth marks are available.

Question			Marking Scheme	Max Mark	Illustrations of evidence
13.			**Ans: 10·4 minutes** $\bullet^1$ process: know to calculate mid-points $\bullet^2$ process: know to calculate mid-points *x* frequency $\bullet^3$ process: know to calculate Σf and Σfx $\bullet^4$ strategy: know how to calculate mean $\bullet^5$ process: calculate mean	**5**	$\bullet^1$ 2, 7, 12, 17, 22, 27, 32, 37 $\bullet^2$ 84, 126, 276, 272, 176, 135, 96, 37 $\bullet^3$ 116, 1202 $\bullet^4$ $\frac{\sum fx}{\sum f}$ $\bullet^5$ 10·4 (minutes)
Notes:					

TOTAL MARKS FOR PAPER 2
50

TOTAL MARKS FOR PAPER 1 & 2
80

[END OF MARKING INSTRUCTIONS]