SCOTTISH
QUALIFICATIONS
AUTHORITY

2003 Mathematics

Intermediate 2 – Units 1, 2 and 3

Finalised Marking Instructions

Special Instructions

1   The main principle in marking scripts is to give credit for the skills which have been demonstrated. Failure to have the correct method may not preclude a pupil gaining credit for the calculations involved or for the communication of the answer.

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

It is of great importance that the utmost care should be exercised in adding up the marks. Where appropriate, all summations for totals and grand totals must be carefully checked.

2   The answer to one part, correct or incorrect must be accepted as a basis for subsequent dependent parts of a question. Full marks in the dependent part is possible if it is of equivalent difficulty.

3   Working after a correct answer should only be taken into account if it provides **firm** evidence that the requirements of the question have not been met.

4   In certain cases an error will ease subsequent working. **Full** credit cannot be given for this subsequent work but **partial** credit may be given.

5   Accept answers arrived at by inspection or mentally, where it is possible for the answer to have been so obtained.

6   Do not penalise omission or misuse of units unless marks have been specifically allocated to units.

7   A wrong answer without working receives no credit unless specifically mentioned in the marking scheme.

The rubric on the outside of the papers emphasises that working must be shown. In general markers will only be able to give credit to partial answers if working is shown. However there may be a few questions where partially correct answers unsupported by working can still be given some credit. **Any such instances will be stated in the marking scheme.**

8   Acceptable alternative methods of solution can only be given the marks specified, ie a more sophisticated method cannot be given more marks.

Note that for some questions a method will be specified.

9   In general do not penalise the same error twice in the one question.

10   Accept legitimate variations in numerical/algebraic questions.

11   Do not penalise bad form eg $\sin x° = 0.5 = 30°$.

12   A transcription error is not normally penalised except where the question has been simplified as a result.

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

Paper 1, Units 1, 2, 3

Marking Instructions

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
1. (a)	**Ans: $6a^2 + ab - 2b^2$** •[1] process: starts to multiply out brackets •[2] process: completes the process of multiplying out brackets correctly and collects like terms	 •[1] evidence of any 2 correct terms from: $6a^2 + 4ab - 3ab - 2b^2$ •[2] $6a^2 + ab - 2b^2$ **2 marks**
NOTES:		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
2. (a)	**Ans**: |	**1**	**2**	**3**	**4**	**5**
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Red	R,1	R,2	R,3	R,4	R,5
Yellow	Y,1	Y,2	Y,3	Y,4	Y,5
Blue	B,1	B,2	B,3	B,4	B,5
Green	G,1	G,2	G,3	G,4	G,5 | •[1] process: complete table correctly	•[1] correct table **1 mark**
NOTES:		
(b)	**Ans:** $\dfrac{2}{20}$ **(or equivalent)** •[1] process: calculate probability	•[1] $\dfrac{2}{20}$ (or equivalent) **1 mark**
NOTES:		
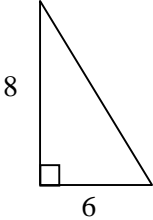
Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
3.	**Ans: 1256 cm³** •¹ process: substitute correctly into formula for the volume of cone •² process: calculates correct answer	$\bullet^1$ V $= \dfrac{1}{3} \times 3 \cdot 14 \times 10^2 \times 12$ $\bullet^2$ V $= 1256$ cm³ **2 marks**

NOTES:

Alternative correct answers: 1260 cm³ ($1 \cdot 05 \times 10^2 \times 12$) or
　　　　　　　　　　　　　　1254·744 cm³ ($0 \cdot 333 \times 3 \cdot 14 \times 10^2 \times 12$)

All other answers, the maximum award is 1/2, where the criteria for the first mark is clearly met.

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
4.	**Ans: (i) 27·5 (ii) 13 (iii) 35** •[1] communicate: state median •[2] communicate: state lower quartile •[3] communicate: state upper quartile	•[1] median $= 27\cdot5$ •[2] $Q_1 = 13$ •[3] $Q_3 = 35$ **3 marks**

NOTES:

(i)   An incorrect answer for the median must be followed through with the possibility of awarding 2/3

(b)	**Ans: 11** •[1] process: calculates semi-interquartile range	•[1] 11 **1 mark**

NOTES:

(i)   Incorrect answer(s) in (a) must be followed through to give the possibility of awarding 1/1

(c)	**Ans: FASTCABS with valid reason** •[1] communicate: FASTCABS with reason	•[1] **1 mark**

NOTES:

Examples For 1 Mark:

(i)   Fastcabs because their semi-interquartile range is much smaller

(ii)   Fastcabs because their waiting times are less spread out

Examples For no Marks:

(i)   Fastcabs because they are faster

(ii)   Fastcabs is better as the SIQR is lower and they do not take as long

(iii)   Fastcabs are more consistent as the waiting time is a lot shorter for them

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5.	**Ans: a = 3, b = 2** •[1] communicate: state value of a •[2] communicate: state value of b	•[1] $a = 3$ •[2] $b = 2$ **2 marks**

NOTES:

For a = 2 **and** b = 3   award 1/2

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6 (a)	**Ans: $2\sqrt{5}$** •[1] process: start to simplify $\sqrt{40}/\sqrt{2}$ •[2] process: completes simplification correctly	•[1] $\sqrt{20}$ or $\dfrac{\sqrt{80}}{2}$ or $\dfrac{2\sqrt{10}}{\sqrt{2}}$ (minimum requirement) •[2] $2\sqrt{5}$ **2 marks**

NOTES:

(i)   For a correct answer without working, award 2/2

(b)	**Ans: $\dfrac{2}{x+1}$** •[1] process: factorises numerator •[2] process: simplifies expression correctly	•[1] $2(x+1)$ •[2] $\dfrac{2}{x+1}$ **2 marks**

NOTES:

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
7.	**Ans: 10 cm** •^{1} strategy: marshal facts and recognise right-angled triangle •^{2} strategy: correct use of Pythagoras Theorem •^{3} process: calculate radius correctly	•^{1} 8 6 •^{2} $r^2 = 8^2 + 6^2$ •^{3} $r = 10$ **3 marks**

NOTES:

(i)   A correct answer, without working,   award 0/3

(ii)   Where there is a wrong assumption that angle BCA = 90º, the last 2 marks are available.

An answer of $\sqrt{128}$ or $\dfrac{16}{\sqrt{2}}$, with working, could gain these 2 marks.

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
8. (a)	**Ans: $(7 - x)(1 + x)$** $\bullet^1$ process: factorise trinomial expression $\bullet^2$ process: completes factorisation	$\bullet^1$ one correct factor $\bullet^2$ second correct factor **2 marks**

NOTES:

(i)   For an answer of $(7 + x)(1 - x)$, award 1/2

(b)	**Ans: 7, -1** $\bullet^1$ communicate: state roots of the equation	$\bullet^1$ 7, -1 **1 mark**

NOTES:

(c)	**Ans: (3, 16)** $\bullet^1$ strategy: finds x-coordinate of turning point $\bullet^2$ process: replaces $x = 3$ into $y = 7 + 6x - x^2$ $\bullet^3$ process: completes coordinates of turning point	$\bullet^1$ $x = 3$ $\bullet^2$ $y = 7 + 6 \times 3 - 3^2$ $\bullet^3$ (3, 16) **3 marks**

NOTES:

(i)   Incorrect roots in part (b) must be followed through to give the possibility of awarding full credit in part (c)

(ii)   Where the x-coordinate of the turning point has been calculated incorrectly, the second and third marks are still available only where the working shows that the criteria for the second and third marks are met.

TOTAL MARKS FOR PAPER 1
26

Paper 2, Units 1, 2 & 3

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
1.	**Ans: 102º** •¹ process:　calculates the size of ∠PLJ •² process:　calculates the size of ∠PLK •³ process:　calculates the size of ∠KLJ	 •¹ 43º •² 59º •³ 102º **3 marks**
NOTES: (i)　Angle PLJ and angle PLK may not be explicitly stated, they may be marked in a diagram and can be awarded the first and second marks. (ii)　A correct answer, without working,　　award 3/3		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
2. (a)	**Ans: Pie Chart** •[1] process: knows how to calculate angles in a pie chart •[2] process: calculates angles in pie chart correctly •[3] process: constructs pie chart with all sections labelled	•[1] $\dfrac{250}{1000} \times 360, \dfrac{375}{1000} \times 360,$ $\dfrac{125}{1000} \times 360$ •[2] 90º, 135º, 45º •[3] diagram (angles correct $\pm$ 2º) **3 marks**

NOTES:

(i) For a correctly constructed pie chart with all sections labelled, award 3/3, with or without working

(ii) Where percentages or fractions have been calculated, <u>and</u> an incorrect pie chart is drawn, the second mark is available for 25%, 37·5% and 12·5% <u>or</u> $\dfrac{1}{4}, \dfrac{3}{8}$ and $\dfrac{1}{8}$.

3. (a)	**Ans:** $x + y = 130$ •[1] interpret: interpret the text	•[1] $x + y = 130$ **1 mark**

NOTES:

(b)	**Ans:** $30x + 50y = 6000$ •[1] interpret: interpret the text	•[1] $30x + 50y = 6000$ **1 mark**

NOTES:

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
(c)	**Ans: 25 seats sold at £30, 105 seats sold at £50** •[1] strategy: know to solve system of equations •[2] process: follow a valid strategy through to produce a value for x and y •[3] process: correct value for x and y •[4] communicate: state result	•[1] evidence •[2] a value for x and y •[3] $x = 25$, y =105 •[4] 25 seats at £30 105 seats at £50 **4 marks**

NOTES:

(i) Incorrect answers in (a) and (b) must be followed through to give the possibility of awarding 4/4

(ii) Any valid strategy must involve the use of two equations

(iii) For an answer of $x = 25$ and y = 105, award 3/4 (loses the communication mark)

(iv) <u>Where a trial and improvement method is used</u>:

    (a) The minimum acceptable working for the first two marks is:
$$50 \times 105 + 30 \times 25 = 6000$$
or $\left.\begin{array}{l} 50 \times 105 = 5250 \\ 25 \times 30 = 750 \end{array}\right\}$ Where 6000 is <u>clearly</u> implied

    The final two marks can then be awarded for 25 seats at £30 and 105 seats at £50 (x and y values implied) clearly stated.

    (b) For an answer of $x = 25$ and y = 105 with working, award 3/4 (loses the commuication mark as in note (iii))

(v) For a wrong answer, without working or based on an invalid strategy, the final mark cannot be awarded.

(vi) 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 •

4.	**Ans: V = −30t + 150**
	
	•[1] process: find gradient
	
	•[2] process: state y – intercept or c in
	                 y = mx + c
	
	•[3] communicate: state equation connecting
	                 V and t
		•[1] m = −30
		
		•[2] c = 150
		
		•[3] V = −30t + 150
		
		3 marks

NOTES:

(i)   For a correct answer without working, award 3/3

(ii)   For V = −30t, with or without working, award 1/3

(iii) For V = 150t – 30 without working, award 0/3

(iv)   Where m and/or c are incorrect, the working must be followed through to give the possibility of awarding 1/3 or 2/3

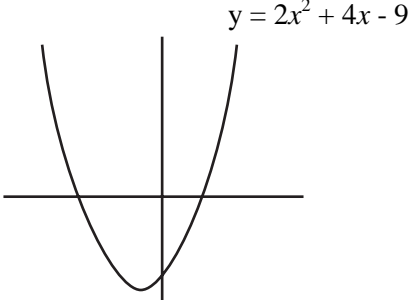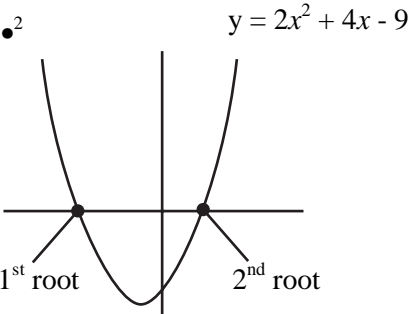(v)   For y = -30x + 150, with or without working, award 3/3

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
5. (a)	**Ans: (i) $\bar{x} = 19$ (ii) s = 3·65**	
	(i) •^{1} process: calculate the mean	•^{1} $\bar{x} = 19$
	(ii) •^{1} process: calculate $(x - \bar{x})^2$	•^{1} 4, 9, 36, 4, 9, 9, 9
	•^{2} process: substitute into formula	•^{2} $\sqrt{\dfrac{80}{6}}$
	•^{3} process: calculate standard deviation	•^{3} 3·65
		4 marks

NOTES:

(i)   <u>Use of alternative formula in part (ii)</u>: the first mark can be awarded for the correct calculation of $\sum x^2$ leading to 2607

(b)	**Ans: Yes, with reasons covering both conditions**	
	•^{1} communicate: s = 3·65 which is less than 5	•^{1} evidence
	•^{2} communicate: $\bar{x} = 19$ which is between 15 and 25	•^{2} evidence
		2 marks

NOTES:

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
6. (a)	**Ans: 52 000 cm³** •¹ strategy: know how to calculate volume of trough •² process: substitute correctly into formulae for volume •³ process: calculate total volume •⁴ process: rounds answer to 2 significant figures	•¹ volume of cuboid + volume of cylinder •² $46 \times 30 \times 25 + \pi \times 15^2 \times 25$ •³ 52 171 cm³ •⁴ 52 000 cm³ **4 marks**

NOTES:

(i)   Accept variations in the volume due to variations in the value of π.

(ii) The fourth mark is available for rounding an answer correct to two significant figures. Where the answer requires no rounding, the fourth mark cannot be awarded.

(b)	**Ans: 43·7 cm** •¹ strategy: know how to find expression for volume of trough •² process: equate volume with 30 000 •³ communicate: state value for r	•¹ $\frac{1}{4} \times \pi \times r^2 \times 20$ •² $\frac{1}{4} \times \pi \times r^2 \times 20 = 30\,000$ •³ $r = 43\cdot7$ **3 marks**

NOTES:

(i)   Accept variations in the radius due to variations in the value of π or premature rounding

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
7.	**Ans:** $x = \sqrt{\dfrac{y-c}{a}}$ •^{1} process: start to re-arrange formula •^{2} process: continue process •^{3} process: make x the subject	•^{1} $ax^2 = y - c$ •^{2} $x^2 = \dfrac{y-c}{a}$ •^{3} $x = \sqrt{\dfrac{y-c}{a}}$ **3 marks**

NOTES:

(i) For a correct answer without working award 3/3

(ii) The second mark is available for division by a

(iii) The third mark is available for taking the square root of an expression for x^2

(iv) For an answer of $\dfrac{\sqrt{y-c}}{a}$ 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 •
8.	**Ans: 24·7 m**	
	•[1] Strategy: knows to find circumference	•[1] $C = 2 \times \pi \times 9$
	•[2] process: express arc as fraction of circle	•[2] $\dfrac{7}{16}$
	•[3] strategy: knows how to find arc length	•[3] $\dfrac{7}{16} \times 2 \times \pi \times 9$
	•[4] process: calculates arc length within valid strategy	•[4] 24·7 m
		4 marks

NOTES:

(i) Accept variations in π; disregard premature or incorrect rounding of $\dfrac{7}{16}$

(ii) For 157·5º, award the second mark (implies $\dfrac{7}{16}$ of 360º)

(iii) For $\dfrac{7}{16} \times \pi \times 9$, $\dfrac{7}{16} \times \pi \times 9^2$, award 3/4 provided the criteria for the other marks are met

(iv) 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 •
9.	**Ans: $x = -3\cdot3, x = 1\cdot3$** METHOD 1 •[1] strategy: know to use quadratic formula •[2] process: substitutes correctly into quadratic formula •[3] process: calculate $b^2 - 4ac$ •[4] process: states both values of x correctly to 1 decimal place METHOD 2 – possible graphical solution •[1] strategy: know to graph $y = 2x^2 + 4x - 9$ or equivalent •[2] communicate: indicate position of roots •[3] communicate: state first root correct to one decimal place •[4] communicate: state second root correct to one decimal place	•[1] evidence •[2] $\dfrac{-4 \pm \sqrt{4^2 - 4 \times 2 \times -9}}{4}$ •[3] 88 •[4] -3·3, 1·3 **4 marks** •[1] $y = 2x^2 + 4x - 9$ •[2] $y = 2x^2 + 4x - 9$ 1st root 2nd root •[3] - 3·3 •[4] 1·3

NOTES:

(i)   The third and fourth marks: where $b^2 - 4ac$ is calculated incorrectly, the fourth mark is available only when $b^2 - 4ac > 0$
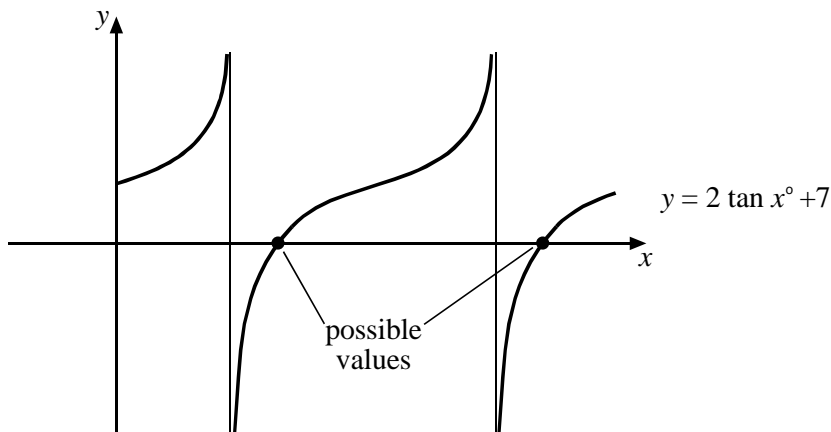
(ii) For a correct answer without working, award 0/4

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
10 (a)	**Ans: PQR = 78·6º** •^{1} strategy: know to apply cosine rule to find PQR •^{2} process: correct application of cosine rule •^{3} calculates PQR	•^{1} cosine rule •^{2} $\cos Q = \dfrac{11\cdot2^2 + 8\cdot4^2 - 12\cdot6^2}{2 \times 11\cdot2 \times 8\cdot4}$ •^{3} PQR = 78·6º **3 marks**

NOTES:

(i)   Disregard errors due to rounding provided there is evidence

(ii)   Where an angle other than PQR has been calculated, a maximum of 2/3 can be awarded provided the value of the angle is consistent with the application of the cosine rule

(iii)   For a correct answer without working, award 0/3

(b)	**Ans: 92·2 cm^2** •^{1} strategy: knows how to find area of PQRS •^{2} process: substitutes correctly into formula •^{3} process: calculates area correctly	•^{1} evidence •^{2} $2 \times \dfrac{1}{2} \times 11\cdot2 \times 8\cdot4 \times \sin 78\cdot6º$ •^{3} 92·2 cm^2 **3 marks**

NOTES:

(i)   An incorrect answer for angle PQR must be followed through with the possibility of awarded 3/3

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
11. (a)	**Ans: $a^{4/3} - 1$** $\bullet^1$ process: correctly starts to remove brackets $\bullet^2$ process: completes removal of brackets and gives in simplest form	$\bullet^1$ $a^{4/3}$ $\bullet^2$ $a^{4/3} - 1$ **2 marks**
NOTES:		
11. (b)	**Ans: $\dfrac{ay - bx}{xy}$** $\bullet^1$ process: state valid denominator $\bullet^2$ process: state answer in simplest form	$\bullet^1$ xy, or equivalent $\bullet^2$ $\dfrac{ay - bx}{xy}$ **2 marks**
NOTES:		

Question No	Marking Scheme Give 1 mark for each •	Illustrations of evidence for awarding a mark at each •
12. (a)	**Ans: $x = 105 \cdot 9$ and $285 \cdot 9$** •^{1} process: solve equation for $\tan x^o$ •^{2} process: find one value for x •^{3} process: find second value for x	 •^{1} $\tan x^o = -\dfrac{7}{2}$ or equivalent •^{2} $x = 105 \cdot 9$ •^{3} $x = 285 \cdot 9$ **3 marks**

NOTES:

(i)   The second and third marks: where $\tan x^o$ is calculated incorrectly, these marks are only available when $\tan x^o < 0$. Where $\tan x^o > 0$, 1/3 can be awarded when 2 values for x are calculated consistent with the incorrect value for $\tan x^o$ (working eased)

(ii) Where a graphical solution is used, the first mark is available for indicating what graph(s) was (were) drawn and where the values occur eg

$x = 105.9$
$x = 285.9$

(iii) 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 •
(b)	**Ans: Proof** $\bullet^1$ strategy: know to factorise $\sin^3 x^\circ + \sin x^\circ \cos^2 x^\circ$ $\bullet^2$ strategy: know to substitute $\sin^2 x^\circ + \cos^2 x^\circ = 1$ to complete proof	$\bullet^1 \sin x^\circ (\sin^2 x^\circ + \cos^2 x^\circ)$ $\bullet^2 \sin x^\circ \times 1 = \sin x^\circ$ **2 marks**

NOTES:

TOTAL MARKS FOR PAPER 2
54

TOTAL MARKS FOR PAPER 1 AND PAPER 2
80

[END OF MARKING INSTRUCTIONS]