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Level 2 Certificate in Further Mathematics

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Paper 1 8360/1

Final

Mark Scheme

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Glossary for Mark Schemes

These examinations are marked in such a way as to award positive achievement wherever possible. Thus, for these papers, marks are awarded under various categories.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
M Dep	A method mark dependent on a previous method mark being awarded.
B Dep	A mark that can only be awarded if a previous independent mark has been awarded.
ft	Follow through marks. Marks awarded following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a candidate has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the candidate. In cases where there is no doubt that the answer has come from incorrect working then the candidate should be penalised.

Questions which ask candidates to show working

Instructions on marking will be given but usually marks are not awarded to candidates who show no working.

Questions which do not ask candidates to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Candidates often copy values from a question incorrectly. If the examiner thinks that the candidate has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1	$m = 5$	B1	
	$3 = 5 \times 4 + c$ or $3 = 20 + c$	M1	$y - 3 = 5\,(x - 4)$ or $y - 3 = 5x - 20$ oe
	$c = -17$	A1	SC1 for $y = -0.2\,x + 3.8$ (using the perpendicular gradient)
2	$5a + 2b = 28$	M1	or $5a + 2b$ and $4a - 2$ seen but with no (or incorrect) equations
	$4a - 2 = 18$	M1	
	$a = 5$	A1	
	$b = 1.5$	A1 ft	ft their a $b = \frac{28 - 5(\text{their } a)}{2}$
3(a)	$\frac{x}{16}$	B1	
3(b)	$\frac{9}{x} = \frac{x}{16}$	M1	
	$x = 12$	A1	
	Alternative method		
	$16^2 - x^2 = x^2 - 9^2 + 7^2$	M1	oe
	$x = 12$	A1	

Q	Answer	Mark	Comments
4(a)	$5 \times 2^2 - 8 \times 2 + 4^2 - 2 \times 4$	M1	oe Allow one error
	12	A1	
4(b)	$5x^2 - 8x + (3)^2 - 2(3)$ (= 0)	M1	Allow one error
	$5x^2 - 8x + 3$ (= 0)	A1	
	$(5x + a)(x + b)$ (= 0)	M1	$ab = 3$ or $a + 5b = -8$ or $x = \frac{8 \pm \sqrt{(8^2 - 4 \times 5 \times 3)}}{2 \times 5}$ Allow one error
	$\frac{3}{5}$ and 1	A1 ft	oe ft their quadratic

5(a)	$2n + 1$ or $1 + 2n$	B1	
5(b)	$(2n - 1)(2n + 1)$	M1	oe eg $(2n + 1)(2n + 3)$ or $(2n - 3)(2n - 1)$
	$4n^2 - 2n + 2n - 1$ or $4n^2 - 1$	A1	oe eg $4n^2 + 2n + 6n + 3$ or $4n^2 - 6n - 2n + 3$
	$4n^2$ is a multiple of 4 so $4n^2 - 1$ is one less	A1	oe clear explanation from their (correct) expression

6(a)	Correct line with $-1\frac{1}{2}$ labelled	B2	B1 For line through (3, 0) without $-1\frac{1}{2}$ labelled or for line with positive gradient through $(0, -1^1/_2)$ (labelled), but not passing through (3, 0)
6(b)	$x(x - 3) = \frac{(x - 3)}{2}$	M1	oe eg $2x^2 - 6x = x - 3$ or $2x^2 - 7x + 3 = 0$ or $(2x - 1)(x - 3) = 0$ or $x^2 - 3.5x + 1.5 = 0$
	$x = \frac{1}{2}$	A1	

Q	Answer	Mark	Comments
7	$y = \frac{6x^5 - 14x^3}{x}$	M1	or other sensible first step eg $y = 2x(3x^3 - 7x)$ or $y = 2x^2(3x^2 - 7)$ Allow one error
	$y = 6x^4 - 14x^2$	A1	
	$\frac{dy}{dx} = 24x^3 - 28x$	B2 ft	B1 ft for each term ft their $y = \ldots$ if there are two terms

8	$b - 4a = 7$ and $b - 8a = 5$	B1	B0 for use of $b - 4a = 5$ and $b - 8a = 7$ but follow scheme for max 2 out of 4 B0 M1 A0 A1ft
	Subtract $4a = 2$	M1	eg $4a = -2$
	$a = \frac{1}{2}$	A1	$a = -\frac{1}{2}$
	$b = 9$	A1 ft	$b = 3$

9a	$2x + 5$ or $5 + 2x$	B1	
9b	$\frac{7x - 5}{2x + 5} = \frac{8}{3}$ or $3(7x - 5) = 8(2x + 5)$	M1	oe eg $(5x - 10) \equiv 5$ parts and $\frac{2x + 5}{5x - 10} = \frac{3}{5}$
	$21x - 15 = 16x + 40$	M1	oe eg $10x + 25 = 15x - 30$ Allow one error
	$x = 11$	M1	
	99	A1	oe eg 77 in A and 22 in B SC1 for correct answer with no algebra

Q	Answer	Mark	Comments
10	$x - 1 = 3(y - 2)$ or $x + 6 = 4(y - 1)$	M1	oe Rearranging one of the two equations $x - 1 = 3y - 6$ or $x + 6 = 4y - 4$
	$x - 3y = -5$ oe	M1	ft from their equations (no further errors) oe eg attempts substitution and rearranges to a suitable form (earns M2)
	$x - 4y = -10$ oe	M1	
	$x = 10$ or $y = 5$	A1 ft	Correct elimination from their equations if at least M1 earned
	$x = 10$ and $y = 5$	A1	SC1 for $x = 10$ and $y = 5$ from no (or incorrect) working
11	$\sqrt{500} = 10\sqrt{5}$ or $\sqrt{45} = 3\sqrt{5}$	M1	or for $5\sqrt{4}\sqrt{5}$ and $2\sqrt{9}\sqrt{5}$
	$4\sqrt{5}$	A1	
12	$(ax + b)(cx + d)$	M1	Where $ac = 4$ and $bd = \pm 5$ or $ad + bc = \pm 19$
	$(4x - 1)(x + 5)$	A1	
	$(3x - 4)(3x + 4)$	B1	
	their $\frac{(4x-1)(x+5)}{(3x-4)(3x+4)} \times \frac{(3x-4)}{(x+5)}$	M1	Inverting the 2nd fraction and multiplying Must have attempted to factorise both expressions (allow max one error in each)
	$\frac{4x-1}{3x+4}$	A1	

Q	Answer	Mark	Comments
13(a)	$\frac{dy}{dx} = 6x^2 - 24x + 24$	M1	Allow one error
	$6(x^2 - 4x + 4)$	M1	oe eg $(6x - 12)(x - 2)$ or $(3x - 6)(2x - 4)$
	$6(x - 2)^2$	A1	
13(b)	$\frac{dy}{dx} = 0$ when $x = 2$	M1	ft their answer to part (a) if in the form $a(x - b)^2$
	(2, 5)	A1 ft	ft their answer to part (a)
13(c)	The gradient is positive except when $x = 2$ Or choose a value either side of $x = 2$ and show $\frac{dy}{dx}$ is positive for both eg $x = 1$ $\frac{dy}{dx} = 6 \times (-1^2) = 6$ $x = 3$ $\frac{dy}{dx} = 6 \times 1^2 = 6$	B1	Oe

14	$(x - 1)^2 (-1)$ **or** $(y - 3)^2 (-3^2)$	M1	
	$(x - 1)^2 (-1)$ **and** $(y - 3)^2 (-3^2)$	M1	
	$(x - 1)^2 + (y - 3)^2 = 10$	A1	
	Centre = (1, 3)	A1 ft	ft from their equation if at least M1 earned
	Radius = $\sqrt{10}$	A1 ft	ft from their equation

Q	Answer	Mark	Comments
15	(tan x =) $\frac{12 - 5\sqrt{3}}{4\sqrt{3} - 5}$	M1	
	$\frac{(12 - 5\sqrt{3})(4\sqrt{3} + 5)}{(4\sqrt{3} - 5)(4\sqrt{3} + 5)}$	M1	oe
	Numerator = $48\sqrt{3} - 60 + 60 - 25\sqrt{3}$ or denominator = $48 - 25$	A1	oe
	Numerator = $48\sqrt{3} - 60 + 60 - 25\sqrt{3}$ **and** denominator = $48 - 25$ **and** tan $x = \sqrt{3}$	A1	
	Alternative method		
	(tan x =) $\frac{12 - 5\sqrt{3}}{4\sqrt{3} - 5}$	M1	
	taking a factor of $\sqrt{3}$ out of the numerator or multiplying numerator and denominator by $\sqrt{3}$	M1	
	$\frac{\sqrt{3}(4\sqrt{3} - 5)}{4\sqrt{3} - 5}$ or $\frac{\sqrt{3}(12 - 5\sqrt{3})}{12 - 5\sqrt{3}}$	A1	oe
	tan $x = \sqrt{3}$	A1	

Q	Answer	Mark	Comments
16	$A = (4, 0)$	B1	
	$B = (0, 8)$	B1	
	$C = (-2, 12)$	B1	
	$D = (0, 36)$ or $E = (-3, 0)$	B1	
	Correct area for one of their triangles	M1	Using their coordinates of Δ *AEC* or Δ *BCD*
	3 : 2	A1	Accept 2 : 3
	Alternative method		
	$AB = 2$, $BC = 1$, $EC = 1$, $CD = 2$	B1	oe
	$\frac{1}{2} \times EC \times AC \times \sin ECA$ or $\frac{1}{2} \times BC \times DC \times \sin BCD$	M1	$\frac{1}{2}ab\sin C$ statement for either triangle
	$\frac{1}{2} \times 1 \times 3 \times \sin ECA$	A1	
	$\frac{1}{2} \times 1 \times 2 \times \sin BCD$	A1	
	$\sin ECA = \sin BCD$ since these angles are supplementary	B1	oe must be clearly explained
	3 : 2	A1	Accept 2 : 3