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Mark Scheme (Results)

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Pearson Edexcel International GCSE
Mathematics A (4MA0)
Paper 4HR

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General Marking Guidance

- All candidates must receive the same treatment. Examiners must mark the first candidate in exactly the same way as they mark the last.
- Mark schemes should be applied positively. Candidates must be rewarded for what they have shown they can do rather than penalised for omissions.
- Examiners should mark according to the mark scheme not according to their perception of where the grade boundaries may lie.
- There is no ceiling on achievement. All marks on the mark scheme should be used appropriately.
- All the marks on the mark scheme are designed to be awarded. Examiners should always award full marks if deserved, i.e. if the answer matches the mark scheme. Examiners should also be prepared to award zero marks if the candidate's response is not worthy of credit according to the mark scheme.
- Where some judgement is required, mark schemes will provide the principles by which marks will be awarded and exemplification may be limited.
- When examiners are in doubt regarding the application of the mark scheme to a candidate's response, the team leader must be consulted.
- Crossed out work should be marked UNLESS the candidate has replaced it with an alternative response.
- **Types of mark**
  - M marks: method marks
  - A marks: accuracy marks
  - B marks: unconditional accuracy marks (independent of M marks)
- **Abbreviations**
  - cao – correct answer only
  - ft – follow through
  - isw – ignore subsequent working
  - SC - special case
  - oe – or equivalent (and appropriate)
  - dep – dependent
  - indep – independent
  - eeoo – each error or omission
  - awrt –answer which rounds to

- **No working**

  If no working is shown then correct answers normally score full marks

  If no working is shown then incorrect (even though nearly correct) answers score no marks.

- **With working**

  If there is a wrong answer indicated on the answer line always check the working in the body of the script (and on any diagrams), and award any marks appropriate from the mark scheme.

  If it is clear from the working that the "correct" answer has been obtained from incorrect working, award 0 marks.

  Any case of suspected misread loses A (and B) marks on that part, but can gain the M marks.

  If working is crossed out and still legible, then it should be given any appropriate marks, as long as it has not been replaced by alternative work.

  If there is a choice of methods shown, then no marks should be awarded, unless the answer on the answer line makes clear the method that has been used.

  If there is no answer on the answer line then check the working for an obvious answer.

- **Ignoring subsequent work**

  It is appropriate to ignore subsequent work when the additional work does not change the answer in a way that is inappropriate for the question: eg. Incorrect cancelling of a fraction that would otherwise be correct.

  It is not appropriate to ignore subsequent work when the additional work essentially makes the answer incorrect eg algebra.

  Transcription errors occur when candidates present a correct answer in working, and write it incorrectly on the answer line; mark the correct answer.

- **Parts of questions**

  Unless allowed by the mark scheme, the marks allocated to one part of the question CANNOT be awarded in another

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Apart from Questions 4, 8, 15, 17 and 20b where the mark scheme states otherwise, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Ques	Working	Answer	Mark	Notes
1	600 × 67.1 (= 40260) **or** 67.1 ÷ 82.5 (=0.813…)		3	M1
	"40260" ÷ 82.5 **or** "0.813.." × 600			M1 dep
		488		A1 SC: B2 for 712
				Total 3 marks

Ques	Working	Answer	Mark	Notes
2a	$\pi \times 150$ oe		2	M1
		471		A1 awrt 471
b	30 × 60 (=1800) **or** "471" ÷ 30 (=15.7)		3	M1
	"471" ÷ "1800" **or** "15.7" ÷ 60			M1 dep
		0.262		A1 for 0.26 – 0.262 or ft from (a)
c	Radius = $x - h$ **or** $\dfrac{D}{2} = x - h$ oe		2	M1
		$h = x - \dfrac{D}{2}$ oe		A1 or $h = \dfrac{2x - D}{2}$
				Total 7 marks

Ques	Working	Answer	Mark	Notes
3	Angle $DAB = 110$		4	B1 can be implied by angle DAX = angle $BAX = 55^{o}$
	Angle $BAX = 110 \div 2 \ (= 55)$ **or** Angle $DAX = 110 \div 2 \ (= 55)$ **or** Angle $AXD = 55$			M1
	Angle $AXD = 55$ **or** Angle $CBA = 180 - 110 \ (=70)$ **or** Angle $ADC = 180 - 110 \ (=70)$			M1
		125		A1
				Total 4 marks

Ques	Working	Answer	Mark	Notes
4	$2y - - y = 3 - 6$ **or** $x + 2x = 3 + 12$		3	M1 for a complete method to eliminate one variable (condone one arithmetic error)
				A1 $x = 5$
		$x = 5, y = -1$		A1 $y = -1$ NB: Candidates showing no working score 0 marks
				Total 3 marks

Ques	Working	Answer	Mark	Notes
5a		25	1	B1 cao
bi		$n(n + 2) + 1$	2	B1 for $n(n + 2) + 1$ on answer line or in table
ii		$(n + 1)^2$		B1 for $(n + 1)^2$ on answer line or in table SC : If no marks scored in (i) or (ii) award B1 for $n^2 + 2n + 1$ in (b)
				Total 3 marks

Ques	Working	Answer	Mark	Notes
6a		16 to 20	1	B1 Accept any unambiguous notation e.g. 16-20
b	3×8 + 8×10 + 13×18 +18×20 + 23×10 + 28×4 **or** 24 + 80 + 234 + 360 + 230 + 112 **or** 1040		4	M1 finds products $f \times x$ consistently within intervals (inc end points) allow 1 error NB. products do not have to be evaluated
				M1 (dep on first M1) –uses midpoints
	$\dfrac{3\times8+8\times10+13\times18+18\times20+23\times10+28\times4}{8+10+18+20+10+4}$ **or** "1040" ÷ (8+10+18+20+10+4)			M1 (dep on first M1) $\Sigma fx \div \Sigma f$
		14.9		A1 $14.8 - 14.9$ or $14\dfrac{6}{7}$ Accept 15 if full working shown
				Total 5 marks

Ques	Working	Answer	Mark	Notes
7a	$\dfrac{1}{2}(14+20)\times8$ **or** $8\times14+\dfrac{1}{2}\times6\times8$		2	M1 for a complete method
		136		A1
b	$20 - 14 \,(= 6)$		4	M1
	$'6'^2 + 8^2$ **or** 36 + 64 **or** 100			M1 dep on previous M1
	$\sqrt{('6'^2+8^2)}$			M1 dep on previous M1
		10		A1
				Total 6 marks

Ques	Working	Answer	Mark	Notes
8a	224 = 2 × 112 = 2×2×56 = 2×2×2×28 = 2×2×2×2×14 2×2×2×2×2×7		3	M1 for at least 2 correct steps in repeated factorisation (may be seen in a tree diagram)
				A1 2, 2, 2, 2, 2, 7 (condone inclusion of 1)
		$2^5 \times 7$		A1 $2^5 \times 7$ NB: Candidates showing no working score 0 marks
b	56 + 32 + 16 56 + 32 + 14 56 + 28 + 16		2	M1 for any 3 correct distinct factors (excluding 1 and 224)
		eg. 56, 32, 16 or 56, 32, 14 or 56, 28, 16		A1 correct and have a sum between 99 and 110
				Total 5 marks

Ques	Working	Answer	Mark	Notes
9a		3, 6, 9	1	B1 condone {3, 6, 9}
b		{2,3,4,6,8,9,10}	1	B1 condone omission of brackets
c		{6}	1	B1 condone omission of brackets
d		3, 9	2	B2 cao (B1 for one of 3, 9 with no incorrect numbers)
				Total 5 marks

Ques	Working	Answer	Mark	Notes
10a	$\dfrac{CE}{17} = \dfrac{22.5}{9}$ oe **or** 22.5÷9 (=2.5) **or** 9 ÷ 22.5 (=0.4)		2	M1 for correct scale factor
		42.5		A1 for 42.5 or $42\dfrac{1}{2}$
b	$\dfrac{AE}{10} = \dfrac{22.5}{9}$ $DE = 10 \times 2.5 - 10$ **or** $10 \times \dfrac{13.5}{9}$ **or** 10×1.5oe		2	M1 for a complete method
		15		A1cao
c	$2.5^2 \times 36$ (=225)		3	M1 or for a fully correct method to find area of triangle *ACE* (height of triangle *ABD* = 4.2(3…) height of triangle *ACE* = 10.5(8…))
	"225" − 36			M1 (dep)
		189		A1 cao
				Total 7 marks

Ques	Working	Answer	Mark	Notes
11a		-3	1	B1 cao
b		$2y^3$	2	B2 cao (B1 for one correct simplification)
c	$3x^2 - 2yx + 6xy - 4y^2$		2	M1 for 4 correct terms, ignoring signs or for 3 out of 4 correct terms with correct signs **or** ….$+4xy - 4y^2$ **or** $3x^2 + 4xy$ ……
		$3x^2 + 4xy - 4y^2$		A1 cao
d			2	M1 for $(4x \pm 1)(x \pm 2)$
		$(4x+1)(x-2)$		A1 cao
				Total 7 marks

Ques	Working	Answer	Mark	Notes
12a	$5.67 \times 10^{-8} \times 5800^4$		2	M1 for digits $641(6…)$ **or** 642
		6.42×10^7		A1 for $6.4 \times 10^7 - 6.42 \times 10^7$
b	$T^4 = \dfrac{I}{k}$		2	M1 $T^4 = \dfrac{I}{k}$
		$T = \sqrt[4]{\dfrac{I}{k}}$ oe		A1 Allow $\pm$
				Total 4 marks

Ques	Working	Answer	Mark	Notes
13a		p and $1-p$ on the branches	2	B1 $1-p$ on LH branch B1 for p and $1-p$ in correct places on RH branches
b		p^2	1	B1 accept $p \times p$
c	$p \times (1-p)$ oe **or** $p \times$ "$(1-p)$" **or** 0.2×0.8 (=0.16)		3	M1 ft from tree diagram
	$p \times (1-p) + (1-p) \times p$ **or** $p \times$ "$(1-p)$" + "$(1-p)$" $\times p$ **or** $0.8 \times 0.2 + 0.2 \times 0.8$ **or** $2 \times$ "0.16"			M1 ft from tree diagram
		0.32 oe		A1 cao
				Total 6 marks

Ques	Working	Answer	Mark	Notes
14a	$x = \dfrac{--4 \pm \sqrt{(-4)^2 - 4 \times 1 \times (-1)}}{2}$		3	M1 for correct substitution – condone one sign error in substitution; condone missing brackets ; allow 4^2; NB. Terms may be simplified
	$x = \dfrac{4 \pm \sqrt{20}}{2}$			M1 (indep) for $\sqrt{20}$ or $2\sqrt{5}$ or $\sqrt{16+4}$
		4.24, −0.236		A1 4.235 to 4.24 and −0.236 to −0.24 dep on M1
	Alternative scheme $(x-2)^2 - 4 - 1 (= 0)$			M1
	$x = 2 \pm \sqrt{5}$			M1
		4.24, −0.236		A1 4.235 to 4.24 and −0.236 to −0.24 dep on M1
b		1.24, −3.24	1	B1 ft (accept more than 3 sig figs)
				Total 4 marks

Ques	Working	Answer	Mark	Notes
15a	$\sqrt{1^2 + 2^2}$ **or** $\sqrt{5}$		2	M1
		2.24		A1 awrt 2.24
b	$\overrightarrow{AC} = \begin{pmatrix} 1 \\ 2 \end{pmatrix} + \begin{pmatrix} 5 \\ 3 \end{pmatrix} \left(= \begin{pmatrix} 6 \\ 5 \end{pmatrix} \right)$ **or** B (4+5, 3+2) or (9, 5)		3	M1
	$\overrightarrow{OC} = "\begin{pmatrix} 6 \\ 5 \end{pmatrix}" + \begin{pmatrix} 4 \\ 2 \end{pmatrix} \left(= \begin{pmatrix} 10 \\ 7 \end{pmatrix} \right)$ **or** C (4+5+1, 3+2+2)			M1 dep
		(10, 7)		A1 cao SC: B1 for (10, y) or (x, 7)
c	$\overrightarrow{AE} = \dfrac{1}{2} "\begin{pmatrix} 6 \\ 5 \end{pmatrix}" \left(= \begin{pmatrix} 3 \\ 2.5 \end{pmatrix} \right)$ **or** $\overrightarrow{AE} = \dfrac{1}{2} \overrightarrow{AC}$ **or** $E\left(\dfrac{4 + "10"}{2}, \dfrac{2 + "7"}{2} \right)$		3	M1
	$\overrightarrow{OE} = \begin{pmatrix} 4 \\ 2 \end{pmatrix} + \dfrac{1}{2} "\begin{pmatrix} 6 \\ 5 \end{pmatrix}"$ **or** $\overrightarrow{OE} = \overrightarrow{OA} + \overrightarrow{AE}$ **or** E ("7", "4.5")			M1
		$\begin{pmatrix} 7 \\ 4.5 \end{pmatrix}$		A1 cao
				Total 8 marks

Ques	Working	Answer	Mark	Notes
16a	$\angle ADB = 90^o$		2	M1
	$180 - 90 - 70$	20		A1
b	Position of T shown on diagram		3	M1
	$\angle TDC \, (= \angle DBC) = 50^o$			M1
	$180 - 70 - 50$ **or** $180 - 50 - (180 - 110)$	60		A1
				Total 5 marks

Ques	Working	Answer	Mark	Notes
17a	$12 - 3\sqrt{2} + 8\sqrt{2} - 2\sqrt{2} \times \sqrt{2}$ **or** $12 - 3\sqrt{2} + 8\sqrt{2} - 2 \times 2$ **or** $12 - 3\sqrt{2} + 8\sqrt{2} - 4$		2	M1 for any 3 terms correct of a 4 term expansion
		$8 + 5\sqrt{2}$		A1 dep on M1 with all necessary steps shown
b	$\dfrac{10 + 3\sqrt{2}}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}}$ **or** $\dfrac{10}{\sqrt{2}} + 3 = \dfrac{10}{\sqrt{2}} \times \dfrac{\sqrt{2}}{\sqrt{2}} + 3$		2	M1 for a correct method to rationalise denominator
		$5\sqrt{2} + 3$		A1 dep on M1 with all necessary steps shown
				Total 4 marks

Ques	Working	Answer	Mark	Notes
18	$360 \div 9 = 40$ (per cm sq) **or** $360 \div (9 \times 25) = 1.6$		3	M1
	"40" $\times$ 19 oe **or** 7$\times$"40" + 6 $\times$ "40" + 6$\times$"40" **or** 280 + 240 + 240 **or** 19 $\times$ 25 $\times$ "1.6"			M1 dep
		760		A1
	Alternative method $2a \times 12 + 6a \times 8 = 360$			M1
	$a = \dfrac{360}{72} = 5$ **and** 14$\times$'5'$\times$4 + 12$\times$'5'$\times$4 + 4$\times$'5'$\times$12			M1 dep
		760		A1
				Total 3 marks

Ques	Working	Answer	Mark	Notes
19a	$kx = \dfrac{N}{x}$ oe **or** $kp = \dfrac{N}{p}$ oe		3	M1
		$p = \sqrt{\dfrac{N}{k}}$ oe		A1 $p = \sqrt{\dfrac{N}{k}}$ or $p = \pm\sqrt{\dfrac{N}{k}}$
		$q = \sqrt{Nk}$ oe		A1 $q = \sqrt{Nk}$ or $q = \pm\sqrt{Nk}$ oe eg. $q = k\sqrt{\dfrac{N}{k}}$
b	$\sqrt{\dfrac{N}{k}} = 2\sqrt{Nk}$ **or** $q = k \times 2q$ **or** $\dfrac{1}{2}p = kp$		2	M1 ft from (a)
		$\dfrac{1}{2}$		A1 $k = \dfrac{1}{2}$, 0.5
				Total 5 marks

Ques	Working	Answer	Mark	Notes
20a			2	M1 $(2x\pm1)(2x\pm1)$
		$(2x-1)(2x+1)$		A1 cao
b	$\dfrac{4(2x-1)}{(2x-1)(2x+1)}+\dfrac{1}{4x^2-1}[=3]$ **or** $\dfrac{4(4x^2-1)}{(2x+1)(4x^2-1)}+\dfrac{(2x+1)}{(2x+1)(4x^2-1)}[=3]$ **or** $\dfrac{4(4x^2-1)}{2x+1}+\dfrac{1(4x^2-1)}{4x^2-1}=3(4x^2-1)$ **or** $4(4x^2-1)+(2x+1)=3(2x+1)(4x^2-1)$		4	M1 multiply all terms by $(4x^2-1)$ **or** correct equation with fractions with a common denominator NB $(4x^2-1)$ may be factorised throughout
	$4(2x-1)+1=3(4x^2-1)$ oe **or** $4(4x^2-1)+2x+1=3(2x+1)(4x^2-1)$ oe			M1 correct equation with no fractions
	$12x^2-8x=0$ **or** $8x-12x^2=0$ **or** $24x^3-4x^2-8x=0$ **or** $8x+4x^2-24x^3=0$			M1 correct simplified equation with all terms on one side
		$0,\dfrac{2}{3}$		A1 dep on M2
				Total 6 marks