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Mark Scheme (Results)

January 2012

International GCSE Mathematics
(4MB0) Paper 02

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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
- **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.

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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.

- **Follow through marks**

  Follow through marks which involve a single stage calculation can be awarded without working since you can check the answer yourself, but if ambiguous do not award.

  Follow through marks which involve more than one stage of calculation can only be awarded on sight of the relevant working, even if it appears obvious that there is only one way you could get the answer given.

- **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.

- **Probability**

  Probability answers must be given a fractions, percentages or decimals. If a candidate gives a decimal equivalent to a probability, this should be written to at least 2 decimal places (unless tenths).

  Incorrect notation should lose the accuracy marks, but be awarded any implied method marks.

  If a probability answer is given on the answer line using both incorrect and correct notation, award the marks.

  If a probability fraction is given then cancelled incorrectly, ignore the incorrectly cancelled answer.

- **Linear equations**

  Full marks can be gained if the solution alone is given on the answer line, or otherwise unambiguously indicated in working (without contradiction elsewhere). Where the correct solution only is shown substituted, but not identified as the solution, the accuracy mark is lost but any method marks can be awarded.

- **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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January 2012 International GCSE Mathematics (4MB0) Paper 02
Mark Scheme

Question Number	Working	Answer	Mark	Notes
1	$6 \le 3x$ $3x - 2x \le 6$ **NB:** Condone use of "<" for "$\le$"	$x \ge 2$ $x \le 6$	**4**	M1 A1 M1 A1

Question Number	Working	Answer	Mark	Notes
2(a)	$15000 \times \frac{75}{100}$ (o.e.) $15000 \times \frac{75}{100} \times \frac{80}{100}$	£9000	**3**	M1 M1 (DEP) A1

Question Number	Working	Answer	Mark	Notes
2(b)	$\frac{15000 - "9000"}{15000} \times 100$ **OR** 1 – 0.75 x 0.8 (o.e) M1	40%	**2**	M1 A1

Question Number	Working	Answer	Mark	Notes
3(a)	$\angle BCD = 110^o$ (Cyclic quad.) $\angle CBD = 35^o$ (ΔBCD Isos Δ) $\angle CDT = 35^o$ (Alt. Seg. Theorem) **NB: At least TWO reasons needed for full marks** **If** $\angle CDT = 35^o$ is stated then **:**deduct 1 mark if only 1 reason given **:** B1 only if no reasons given		**3**	B1 B1 B1

Question Number	Working	Answer	Mark	Notes
3(b)		$\angle ADS = 20^o$	**1**	B1

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Question Number	Working	Notes
4(a)	$\sum f \times x = 12.5\times 20 + 30\times 11 + 37.5\times 27 + 50\times 15 + 75\times 15 + 95\times 12$ (= 4607.5) (having at least two correct products in 6 summed products) $\frac{"4607.5"}{100}$ Answer: 46.1 Mark: **3**	M1 M1 (DEP) A1

Question Number	Working		Answer	Mark	Notes
4(b)	Interval	Frequency Density	Given height and width drawn.	**4**	B4 (-1eeoo)
	$0 \le t < 25$	**0.8**			
	$25 \le t < 35$	**1.1**			
	$35 \le t < 40$	**5.4**			
	$40 \le t < 60$	0.75 **(given)**			
	$60 \le t < 90$	**0.5**			
	$90 \le t < 100$	**1.2**			

Question Number	Working	Answer	Mark	Notes
5(a)		$\frac{1}{3}$, 33.3%, 0.333	**1**	B1

Question Number	Working	Answer	Mark	Notes
5(b)	$\frac{1}{3}\times\frac{1}{3}+\frac{1}{3}\times\frac{1}{2}$ (one correct pair of probabilities) (adding 2nd correct pair of probabilities) Conclusion with no wrong working seen		**3**	M1 M1 (DEP) A1

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Question Number	Working	Answer	Mark	Notes
5(c)	Any one correct term from the following: $\frac{1}{3}\times\frac{1}{3}$, $\frac{1}{3}\times\frac{1}{2}$, $\frac{1}{3}\times\frac{1}{3}\times\frac{1}{2}$ Three correct terms added together **OR** 1 – (one correct term) from "$\frac{1}{3}$", $\frac{5}{18}$, $\frac{1}{3}\times\frac{1}{3}\times\frac{1}{2}$ 1 – "(a)" – (b) - $\frac{1}{3}\times\frac{1}{3}\times\frac{1}{2}$ (all correct)	1/3, 33.3%, 0.333	**3**	M1 M1 (DEP) A1 M1 M1 (DEP)

Question Number	Answer	Mark	Notes
6(a)	ΔABC drawn and labelled	**1**	B1

Question Number	Working	Answer	Mark	Notes
6(b)(i)		A_1 = (-1.5, 4.5) B_1 = (-6, 6), C_1 = (-9, 3)	**2**	B2 (-1 eeoo)

Question Number	Answer	Mark	Notes
6(b)(ii)	$\Delta A_1B_1C_1$ drawn and labelled	**1**	B1 ft

Question Number	Working	Answer	Mark	Notes
6(c)(i)		A_2 = $\left(\frac{3}{4}, -2\frac{1}{4}\right)$ or rounded , B_2 = (3, -3), C_2 = (4.5, -1.5)	**2**	B2 ft (-1eeoo)

Question Number	Answer	Mark	Notes
6(c)(ii)	$\Delta A_2B_2C_2$ drawn and labelled	**1**	B1 ft

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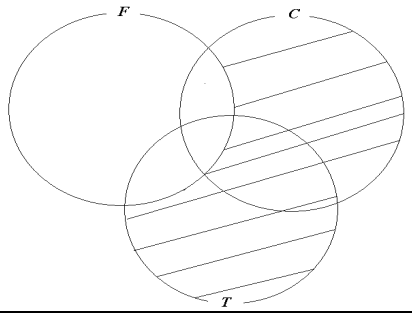
Question Number	Answer	Mark	Notes
6(d)	Reflection in the *x*-axis, Enlargement scale factor 0.8 (or better, 0.75), centre *O* **OR** Reflection in y-axis, Enlargement scale factor -0.8 (or better, -0.75), centre *O* **NB:** ***In ePEN,*** *enter these marks in the order given above*	**3**	B1 B1 B1 B1 B1 B1

Question Number	Working	Answer	Mark	Notes
7(a)	$2 + 3 + 1 + x = 9$	$x = 3$	**2**	M1 A1

Question Number	Working	Answer	Mark	Notes
7(b)	n(F) + 1 + "3" + 8 = 25	n(F) = 13	**2**	M1 A1 ft

Question Number	Working	Answer	Mark	Notes
7(c)	Uses n($(F \cap T) \cap C'$) = 3 "13" – (3+3+2) $\left[= \text{n}\left(F \cap C' \cap T'\right) = n\left(F \cap \left(C \cup T\right)'\right)\right]$	Football only = 5	**2**	M1 A1 ft

Question Number	Working	Answer	Mark	Notes
7(d)(i)		Correctly shaded	**1**	B1

Question Number	Answer	Mark	Notes
7(d)(ii)	$F' \cap (T \cup C)$ represents those pupils who **play cricket (tennis) ,** **and/or tennis (cricket).** **NB:** allow just "and"	**2**	B1 ft B1 ft

Question Number	Working	Answer	Mark	Notes
7(d)(iii)		**Football**	**1**	**B1**

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Question Number	Working	Answer	Mark	Notes
8(a)	$60 = 2h + 2\times 2\pi r$ **(o.e.)** **cc**		**2**	**M1** **A1**

Question Number	Working	Answer	Mark	Notes
8(b)	$V = \pi r^2 h = \pi r^2 (30 - 2\pi r)$ **(o.e.)** **cc**		**2**	**M1** **A1**

Question Number	Working	Mark	Notes
8(c)	$\frac{dV}{dr} = 60\pi r - 6\pi^2 r^2$ (one term correct) $60\pi r - 6\pi^2 r^2$ $60\pi r - 6\pi^2 r^2 = 0$ (o.e) $\therefore 6\pi r(10 - \pi\ r\ ) = 0$ (factorising or cancelling r) (o.e) $r = \frac{10}{\pi}$ and cc (eg $r = 0 \Rightarrow V = 0$ so unacceptable)	**5**	M1 A1 M1 (DEP on "$\frac{dV}{dr}$" $= 0$) M1 (DEP) A1

Question Number	Working	Answer	Mark	Notes
9(a)(i)		$\overrightarrow{OR}$ = **a**	**1**	B1

Question Number	Working	Answer	Mark	Notes
9(a)(ii)		$\overrightarrow{RB}$ = **b** - **"a"**	**1**	B1 ft

Question Number	Working	Answer	Mark	Notes
9(a)(iii)		$\overrightarrow{AB}$ = **b** – 4**a**	**1**	B1

Question Number	Working	Answer	Mark	Notes
9(b)(i)		$\overrightarrow{PB} = \frac{2}{3}$"(**b** – 4**a**)" (o.e)	**1**	B1 ft

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Question Number	Working	Answer	Mark	Notes
9(b)(ii)	$\overrightarrow{OP} = \mathbf{b} - "\frac{2}{3}(\mathbf{b} - 4\mathbf{a})"$ **OR** $\overrightarrow{OP} = 4\mathbf{a} + \frac{1}{3}"(\mathbf{b} - 4\mathbf{a})"$	$\overrightarrow{OP} = \frac{8}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}$	**2**	M1 A1

Question Number	Working	Answer	Mark	Notes
9(c)(i)	$\overrightarrow{MP}$ = k"(**b** – **a**)" - "$\overrightarrow{PB}$" coef of **a** in above = 0 $k = \frac{8}{3}$ cc		**3**	M1 M1(DEP) A1

Question Number	Working	Answer	Mark	Notes
9(c)(ii)		$\overrightarrow{MP}$ = 2**b**	**1**	B1

Question Number	Working	Answer	Mark	Notes
9(d)		$\overrightarrow{OP}$ = "**a**" + m**a** + l **b**	**1**	B1 ft (on (a(i))

Question Number	Working	Answer	Mark	Notes
9(e)	$"\frac{8}{3}\mathbf{a} + \frac{1}{3}\mathbf{b}"$ = "**a** + m**a** + l **b**" Equate **a** coefs: $\frac{8}{3} = 1 + m$	$m = \frac{5}{3}$	**3**	M1 M1 (DEP) A1

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Question Number	Working	Notes
10(a)	$3^2 = 3^2 + 5^2 - 2\times 3\times 5\times \cos \angle ABF$ $\cos \angle ABF = \dfrac{3^2+5^2-3^2}{2\times 3\times 5}$ (o.e.) **OR** *BY*=2.5 cm (*Y* on *AB* st *FY* perpen to *AB* and $\because$ ΔABF is isosceles) cos $\angle ABF$ = $\dfrac{2.5}{3}$ Answer: 33.6° Mark:**3**	M1 M1 (DEP) M1 M1(DEP) A1

Question Number	Working	Mark	Notes
10(b)	*BX* = 1 cm (*X* is a pt on *BC* st *FX* is perpend to *BC)* $\cos \angle FBC = \dfrac{1}{3}$ Answer: 70.5 °	**3**	B1 M1 A1

Question Number	Working	Answer	Mark	Notes
10(c)	(*Y* is the mid-pt of *AB*) *YZ* = 1 **OR** *BX* = 1 (**if** using Δ***FZX*** below) Δ***FZY:*** $FY^2 = 3^2 - 2.5^2$ (*FY*=1.658 = $\sqrt{2.75}$) FZ^2 = 2.75 - 1^2 **OR** Δ***FBZ:*** $BZ^2 = 2.5^2 + 1^2$ (= 7.25) $FZ^2 = 3^2$ – "7.25" **OR** Δ***FZX:*** $FX^2 = 3^2 - 1^2$ (FX^2= 8= $\sqrt{2.828}$) FZ^2 = "8" - 2.5^2	1.32 , 1.33 cm	**4**	M1 M1 M1(DEP) M1 M1 (DEP) M1 M1 (DEP) A1

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Question Number	Working	Mark	Notes
10(d)	$\Delta AFB = \Delta CDE = \frac{1}{2}\times 5\times 3\times \sin"33.6"$ $(= 4.15)$ OR $\frac{1}{2}\times 5\times "1.658"$ *ABCD* = 10x5 $FX = \sqrt{3^2 - 1^2}$ $(= 2.828)$ OR 3 × sin70.5° $AFED = BCEF = \frac{1}{2}\times "2.828"\times (8+10)$ $(= 25.45)$ Total SA = ”50” + 2 x”4.15” + 2 x”25.45” (adding **FOUR** correct areas) Adding **ALL** correct areas Answer: 109 cm^2	**6**	M1 (area) M1 (Rect. area) M1 (Trap. area) M1 (DEP on all Ms above) M1 (DEP) A1

Question Number	Working	Answer	Mark	Notes
11(a)		2.12 1.85 2.59	**3**	B1 B1 B1

Question Number	Answer	Mark	Notes
11(b)	Curve -1 mark for straight line segments each point missed $\left(\pm\frac{1}{2}\text{ small square}\right)$ each missed segment each point not plotted each point incorrectly plotted $\left(\pm\frac{1}{2}\text{ small square}\right)$ tramlines very poor curve	**3**	B3 (-1eeoo)

Question Number	Answer	Mark	Notes
11(c)	Drawn line going through (1, 2.2) and (4, 2.8)	**1**	B1

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Question Number	Working	Answer	Mark	Notes
11(d)	(Identifying pts of intersection of "line" and "curve") 1.4 ft and 3.6 ft **NB: (1)** awrt to 1.4 ft and 3.6 ft **(2)** Condone "<" for "≤"	 $1.4 \leq x \leq 3.6$	 **2**	 B1 ft B1 ft

Question Number	Working	Mark	Notes
11(e)	$x^2 - x - 15 + \frac{20}{x} = 0$ (ie divide by x) $\frac{x^2}{5} - \frac{x}{5} - 3 + \frac{4}{x} = 0$ (ie divide by 5) (allow 1 slip in above 2 Ms) $\therefore \frac{x^2}{5} + \frac{4}{x} - 1 = \frac{x}{5} + 2$ **OR** $\frac{x^2}{5} + \frac{4}{x} - 1 = \frac{x}{5} + 2$ $x^3 + 20 - 5x = x^2 + 10x$ (mult by x) $x^2 + \frac{20}{x} - 5 =$ x+10 (mult. by 5) (allow 1 slip in above 2 Ms) $\therefore \; x^3 - x^2 - 15x + 20 = 0$ "thus the **2 sol^{n}s** are the **2 intersections** of **x/5+2** and **x^2/5+4/x-1** " **(o.e) and** **1.4** **3.6** **(ft on (d))**	

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