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Mark Scheme (Results)

January 2017

Pearson Edexcel International GCSE

Mathematics B (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.
  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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Mark Scheme

1 (a) $3x + 2y = 80$	B1	1	
(b) $8x + 5y = 204$	B1	1	
(c) Rearranging so that coefficient of x or y is the same in both equations			
OR isolating x or y	M1		
Subtracting or adding equations			
OR subst expression for x or y to obtain y or x	M1 (DEP)		
$x = 8$	A1		
$y = 28$	A1	4	**6**
			Total 6 marks

2 $(5x+3)(x+1)=(x-2)^2$	(removing denominators)	M1	
$5x^2+8x+3=x^2-4x+4$	(expanding, allow 1 error)	M1(DEP)	
$4x^2+12x-1(=0)$		A1	
$x=\frac{-12\pm\sqrt{12^2-4\times4\times(-1)}}{8}$	(no errors on cand's trinomial quadratic)	M1	
$\sqrt{160}$ (= 12.649…)	(cand. must have a +ve discriminant)	B1ft	
0.08114, –3.08114 → **0.0811, –3.08**		A1, A1	**7**
			Total 7 marks

3(a) $\frac{1}{xy}\begin{pmatrix} 2x & 0 \\ 0 & \frac{y}{2} \end{pmatrix}$, $\begin{pmatrix} 2/y & 0 \\ 0 & 1/2x \end{pmatrix}$ (oe) B2(-1 eeoo) 2

(b) $\begin{pmatrix} y-2 \\ 4 \end{pmatrix} = "\frac{1}{xy}\begin{pmatrix} 2x & 0 \\ 0 & \frac{y}{2} \end{pmatrix}"\begin{pmatrix} y \\ x^4 \end{pmatrix}$ M1

$\left(= \begin{pmatrix} 2 \\ \frac{x^3}{2} \end{pmatrix}\right)$

$y-2 = "2"$ A1

$4 = "\frac{x^3}{2}"$ A1

(Equating elements but after a correct evaluation of the RHS using their (a))

$\left(\text{OR } \begin{pmatrix} \frac{y}{2} & 0 \\ 0 & 2x \end{pmatrix}\begin{pmatrix} y-2 \\ 4 \end{pmatrix} = \begin{pmatrix} y \\ x^4 \end{pmatrix}\right.$

Multiplication of LHS for obtaining at least **one** correct equation (M1)

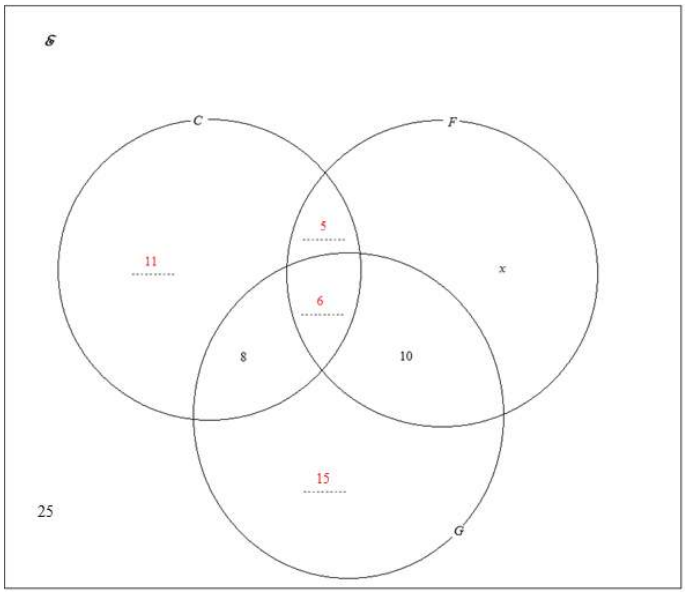
$\frac{y}{2}(y-2) = y$ (A1)

$8x = x^4$ (A1)$\Big)$

$\left.\begin{matrix} x = 2 \\ y = 4 \end{matrix}\right\}$ A1, A1 5 **7**

Total 7 marks

4 (a)



5, 6, 15		B2 (-1eeoo)
11		B1 ft

NB: ft on "5" and "6"

(b) $10 + x +$ "15" $= 45$		M1
$x = 20$	(cao)	A1 2
(c) No of club members = "11" + "5" + "6" + 8 + 10 + 15 + "20" + 25		
(adding 8 subsets) (= 100)		M1
(i) $\frac{"11"}{"100"}$		A1ft
(ii) $\frac{8+"5"+10}{"100"}$		M1 (DEP)
$\frac{23}{100}$, 0.23, 23%	(cao)	A1 4 **9**

Total 9 marks

5 Selling price of 200 items = $\left(\frac{\$570}{300}\right)\times 200\times\frac{120}{100}$ (=\$456) (oe) M1

Selling price of remaining 100 items = $100\times\frac{75}{100}\times\frac{"\$456"}{200}$ (=\$171.00) (oe)

M1 (DEP)

$"\left(\left(\frac{\$570}{300}\right)\times 200\times\frac{120}{100}\right)"+"\left(100\times\frac{75}{100}\times\frac{"\$456"}{200}\right)"-\$570$ M1 (DEP)

[**OR** 200 items selling price = $\left(\frac{\$570}{300}\right)\times\frac{120}{100}$ each (= \$2.28 each) (M1)

100 items selling price = $("\$2.28")\times\frac{75}{100}$ each (=\$1.71 each) (M1(DEP))

Profit = "\$2.28" x 200 + "\$1.71" x 100 - \$570 (M1(DEP))

OR

Profit per item on 1st 200 sold = $\frac{20}{100}\times\frac{\$570}{300}$ (= \$0.38)

((M1))

Remaining 100 sold at $\frac{\$570}{300}\times\frac{120}{100}\times\frac{75}{100}$ (= \$1.71 each)

$\therefore$ loss on each of remaining 100 = $\frac{\$570}{300}-"\$1.71"$ (=\$0.19) ((M1(DEP)))

$\therefore$ Total profit = "\$0.38"×200 – "\$0.19"×100 ((M1(DEP)))]

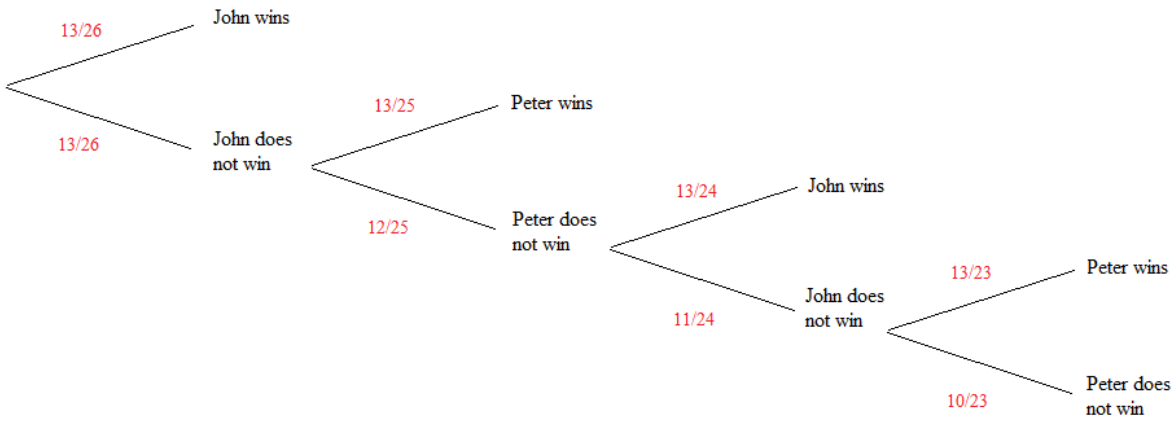
\$57.00 (cao) A1 **4**

Total 4 marks

6 (a) 13/ 26, 0.5, 50% B1 1

NB: Award if on diagram

(b)



Correct probabilities added on 1st branch (13/26, 13/26) B1

Correct probabilities added on 2nd branch (13/25, 12/25) B1

Correct probabilities added on 3rd branch (13/24, 11/24) B1

Correct probabilities added on 4th branch (13/23, 10/23) B1 4

(c) $"\frac{13}{26}"\times"\frac{13}{25}"$ M1

$\frac{169}{650}$, $\frac{13}{50}$, 0.26, 26% A1 2

(OR 1 – P(John wins with 1st card)-P(draw)

$=1-\frac{13}{26}-\frac{13}{26}\times\frac{12}{25}$)

(d) $"\frac{13}{26}"\times"\frac{13}{25}"+"\frac{13}{26}"\times"\frac{12}{25}"\times"\frac{11}{24}"\times"\frac{13}{23}"$

One probability product M1

Both probability products added M1(DEP)

$\left(\text{OR } 1 - \text{P(John wins)} - \text{P(draw)}\right.$

$=1-\left(\frac{13}{26}+\frac{13}{26}\times\frac{12}{25}\times\frac{13}{24}\right)-\left(\frac{13}{26}\times\frac{12}{25}\times\frac{11}{24}\times\frac{10}{23}\right)$

1 - One correct bracketed term (M1)

Above expression fully correct $\left.\text{(M1(DEP))}\right)$

$\frac{741}{2300}$, awrt 0.322, 32.2% A1 3 **10**

Total 10 marks

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7 (a) $\frac{BC}{\sin 30}=\frac{20}{\sin 100}$ M1

$BC=\frac{20\times\sin 30}{\sin 100}$ M1 (DEP)

BC = 10.154→**awrt 10.2** A1 3

(b) $\cos 40=\frac{"10.2"}{CD}$ M1

CD = 13.255→**awrt 13.3** A1 2

(c) $20^2="12^2+"13.26"^2-2\times12\times"13.26"\times\cos\angle ADC$ M1

$\angle ADC=\cos^{-1}\left(\frac{12^2+"13.26"^2-20^2}{2\times12\times"13.26"}\right)$ M1 (DEP)

$\angle ADC=104.59$ (104.35 from 13.3) →**awrt 104, 105** A1 3

(d) $\Delta ADC=\frac{1}{2}\times12\times"13.26"\times\sin"104.6"$ (oe) M1

= **77** A1 2 **10**

Total 10 marks

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8 (a) Triangle *A* drawn and labelled. B1 1

(b) $\begin{pmatrix} 1 & 1 \\ 2 & 1 \end{pmatrix}\begin{pmatrix} -3 & -2 & -1 \\ -2 & 0 & -1 \end{pmatrix}$ M1

Triangle *B* is (–5, –8), (–2, –4), (–2, –3).

Triangle *B* drawn and labelled. A2 (-1eeoo) 3

(c) Triangle *C* is (–1, –6), (2, –2), (2, –1).

Triangle *C* drawn and labelled. B2ft (-1eeoo) 2

(d) $\begin{pmatrix} -1 & 1 \\ 2 & -1 \end{pmatrix}$"$\begin{pmatrix} -1 & 2 & 2 \\ -6 & -2 & -1 \end{pmatrix}$" M1

Triangle *D* is (–5, 4), (–4, 6) and (-3, 5).

Triangle *D* drawn and labelled. A2ft (-1eeoo) 3

(e) Translation B1

$\begin{pmatrix} -2 \\ 6 \end{pmatrix}$ B1, B1 3 **12**

(ie B1 (for –2) and B1 (for 6))

SC: -2 and 6 seen or 6 and -2 seen but not in vector form scores B1 B0

Total 12 marks

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9 (a) $\overrightarrow{CB} = 12\mathbf{c} - 2\mathbf{a}$ B1 1

(b) One of:

$AD \,//\, OB \Rightarrow \Delta\dfrac{CAD}{COB}$ are **similar** (given) $\therefore \dfrac{AC}{OC} = \dfrac{DC}{BC} = \dfrac{AD}{OB}$

OR Since A is midpoint of OC means $\dfrac{AC}{OC} = \dfrac{1}{2}$ B1

(**NB:** So B1 for one of the above statements)

Then:

Having **both** statements means that $\dfrac{AC}{OC} = \dfrac{DC}{BC} = \dfrac{AD}{OB} = \dfrac{1}{2}$ (cc) B1 2

(c)(i) $\overrightarrow{AD} = 6\mathbf{c}$ B1

(ii) $\overrightarrow{OD} = \mathbf{a} + 6\mathbf{c}$ B1 2

(d) $\overrightarrow{FO} = \dfrac{1}{m+1}\left(2\times"\overrightarrow{DA}"\right)$ M1

$\overrightarrow{FD} = \overrightarrow{FO} + \overrightarrow{OD} = "-\dfrac{12}{m+1}\mathbf{c}" + "\mathbf{a} + 6\mathbf{c}"$ (oe) M1(DEP)

OR $\overrightarrow{FB} = \dfrac{m}{m+1}12\mathbf{c}$ (M1)

$\overrightarrow{FD} = \overrightarrow{FB} + \overrightarrow{BD} = \dfrac{m}{m+1}12\mathbf{c} - \dfrac{1}{2}"\left(12\mathbf{c} - 2\mathbf{a}\right)"$ (oe) (M1(DEP))

(cso) A1 3

NB: This must be a correct conclusion (watch for possible algebraic errors in the alternative method ie *a correct answer cannot be obtained from incorrect working*).

(e) $3 = 6 - \dfrac{12}{m+1}$ M1

$\therefore m = 3$ A1 2

(f) $\Delta COB = 2^2 \times \Delta ACD \;\; (= 40)$ (by part (b)) M1

$\therefore \Delta FCB = \dfrac{"3"}{"3"+1}\Delta COB$ M1 (DEP)

$\therefore \Delta FCB = 30\,(\text{cm}^2)$ A1 3 **13**

Total 13 marks

10 (a) 3.3, 3.2, –2.5 B1, B1, B1 3

(b) –1 mark for

straight line segments			
each point missed			
each missed segment			
each point not plotted			
each point incorrectly plotted			
tramlines			
very poor curve	B3	3	

(c) 3.296638→3.3 (+0.05) B1ft 1

(d) One of 0.8 ($\pm$0.05) < x OR x < 4.4, 4.5 ($\pm$0.05) B1ft

0.8 ($\pm$0.05) < x < 4.4, 4.5 ($\pm$0.05) B1ft 2 **9**

(ie a range for the 2nd B1)

Total 9 marks

11 (a) $S = \frac{1}{2} \times 4\pi r^2 + \left(\pi r^2 + 2\pi rh\right)$ M1

$S = \pi r\left(3r + 2h\right)$ (cso) A1 2

(b) $50 = \pi r\left(3r + 2h\right)$ M1

$h = \frac{25}{\pi r} - \frac{3r}{2}$ (cso) A1 2

(c) $V = \pi r^2 h + \frac{1}{2} \times \frac{4}{3}\pi r^3$ M1

$\therefore V = \pi r^2\left(\frac{25}{\pi r} - \frac{3r}{2}\right) + \frac{1}{2} \times \frac{4}{3}\pi r^3$ (subst. h) M1 (DEP)

$\therefore V = \left(25r - \frac{3\pi r^3}{2}\right) + \frac{2}{3}\pi r^3$ (eliminating r denominators) M1 (DEP)

$V = 25r - \frac{5\pi r^3}{6}$ (cso) A1 4

(d) $\frac{\mathrm{d}V}{\mathrm{d}r} = 25 - \frac{15\pi r^2}{6}$ (one term) M1

(fully correct) A1

$\frac{\mathrm{d}V}{\mathrm{d}r} = "25 - \frac{15\pi r^2}{6}" = 0$ M1 (INDEP)

Solving 2 term quadratic with no r term M1 (DEP)

$r = +\sqrt{\frac{10}{\pi}}$, +1.78(or better)) A1 5 **13**

Total 13 marks

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