edexcel

Mark Scheme (Results)

Summer 2014

Pearson Edexcel International GCSE in Mathematics B Paper 2R (4MB0/02R)

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications come from Pearson, the world's leading learning company. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information, please visit our website at www.edexcel.com.

Our website subject pages hold useful resources, support material and live feeds from our subject advisors giving you access to a portal of information. If you have any subject specific questions about this specification that require the help of a subject specialist, you may find our Ask The Expert email service helpful.

www.edexcel.com/contactus

Pearson: helping people progress, everywhere

Our aim is to help everyone progress in their lives through education. We believe in every kind of learning, for all kinds of people, wherever they are in the world. We've been involved in education for over 150 years, and by working across 70 countries, in 100 languages, we have built an international reputation for our commitment to high standards and raising achievement through innovation in education. Find out more about how we can help you and your students at: www.pearson.com/uk

Summer 2014
Publications Code UG039439

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.
- 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.

Question Number	Answer	Notes	Marks	Total
1	(a) $\sqrt{(5-(-3))^2+(-8-7)^2}$ (oe)	M1		
	17 (cao)	A1	2	
	(b) $\frac{-8-7}{5-(-3)}$ (oe)	M1		
	$-\frac{15}{8}$, $\frac{15}{-8}$, (oe) (awrt -1.88)	A1	2	**4**
2	$\mathbf{A}^2 = \begin{pmatrix} 11 & -14 \\ -7 & 18 \end{pmatrix}$			
	One term correct	M1		
	All correct	A1		
	$"\begin{pmatrix} 11 & -14 \\ -7 & 18 \end{pmatrix}"-\begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix}$	M1(DEP)		
	$2\mathbf{B} = \begin{pmatrix} 8 & -12 \\ -6 & 14 \end{pmatrix}$ (cao)	A1		
	$\mathbf{B} = \begin{pmatrix} 4 & -6 \\ -3 & 7 \end{pmatrix}$	B1 ft		
	NB: ft on their 2**B**			
	OR			
	$\begin{pmatrix} 3 & -2 \\ -1 & 4 \end{pmatrix}+2\begin{pmatrix} a & b \\ c & d \end{pmatrix}="\begin{pmatrix} 11 & -14 \\ -7 & 18 \end{pmatrix}"$	M1 (DEP)		
	4 eq^{n}s for *a, b, c* and *d* from above equation, Max. 2 slips allowed in their eq^{n}s	A1 (cao)		

	$2a=8$ $\quad a=4$ $2b=-12$ OR $b=-6$ $2c=-6$ $\quad c=-3$ $2d=14$ $\quad d=7$ $\mathbf{B} = \begin{pmatrix} 4 & -6 \\ -3 & 7 \end{pmatrix}$	B1 ft	5	**5**
3	$220\times 2.40+140\times 1.60+(400-220-140)\times 0.55$ (£) 774 (cao) $\frac{"774"-360}{360}\times 100$ **OR** $\frac{£360}{400}\ (=£0.9)$ and $220\times(2.40-0.9)+140\times(1.60-0.9)+$ $40\times(0.55-0.9)$ (can be embedded within working) £414 (cao) $\frac{£414}{£360}\times 100$ **115%** (cao)	M1 A1 M1 (DEP) M1 A1 M1 (DEP) A1	4	**4**
4	(a) $19-x$ $35-x$ (b) (i) $"(19-x)"+"(35-x)"+x+16=62$ (ii) $x=8$ (cwo) (c) $\frac{"8"}{19}$ $\frac{8}{19}$, 0.421 (or better), 42.1% (cao)	B1 B1 M1 A1 B1ft B1	2 2 2	**6**

Question Number	Answer	Notes	Marks	Total
5	$\frac{3}{10}$	B1		
	(a) $\frac{6}{9}, \frac{3}{9}$ (o.e)	B1		
	$\frac{7}{9}, \frac{2}{9}$	B1	3	
	(b) $\frac{7}{10}\times"\frac{3}{9}"$ or $"\frac{3}{10}"\times"\frac{7}{9}"$	M1		
	$\frac{7}{10}\times\frac{3}{9} + \frac{3}{10}\times\frac{7}{9}$ (o.e.)	A1		
	OR			
	$\frac{7}{10}\times"\frac{6}{9}"$ or $"\frac{3}{10}"\times"\frac{2}{9}"$	M1		
	$1-\frac{7}{10}\times\frac{6}{9} - \frac{3}{10}\times\frac{2}{9}$ (o.e)	A1		
	$\frac{42}{90}, \frac{14}{30}, \frac{7}{15}$ (awrt 0.467, 46.7%)	A1	3	**6**
6	(a) (i) $\frac{7}{3}$, awrt 2.33 (ii) 9	B1, B1	2	
	(b) $y+2x=1$ OR $2x=1-y$ OR $2y = 1- x$ OR $x = 1 - 2y$ (No slips)	M1		
	$\frac{1-x}{2}, -\frac{x-1}{2}, \frac{1}{2}-\frac{x}{2}$ (cao)	A1	2	
	(c) $2(1-2x)^2-5$	M1		
	$2(4x^2-4x+1)-5$			
	$8x^2-8x-3$ (cwo)	A1	2	
	NB: Answer given (ag)			
	(d) $"8x^2-8x-3"=45$ (oe)	B1 ft		
	Attempt to solve a trinomial quadratic	M1 (INDEP)		

	$x = 3$ (cwo) $x = -2$ (cwo)	A1 A1	4	**10**

Question Number	Answer	Notes	Marks	Total
7	(a) $\frac{400}{x}$ (o.e.)	B1	1	
	(b) $\frac{400}{x-60}$ (o.e)	B1	1	
	(c) $\frac{1}{3}$ (oe)	B1	1	
	(d) $"\frac{400}{x-60}"-"\frac{400}{x}"="\frac{1}{3}"$ (o.e)	B1 ft	1	
	(e) " $3\times x\times 400-3\times 400\times(x-60)=x(x-60)$ " (removal of denominator(s), but denominators must involve x, 1 slip allowed when expanding brackets)	M1		
	$x^2-60x-72000=0$ (cwo)	A1		
	Attempt to factorise a trinomial quadratic	M1 (INDEP)		
	$x = 300$ (cao)	A1	4	
	(f) $\frac{28300}{92.35}$ (oe)	M1		
	306.4….	A1		
	$306 (to their 'correct' nearest dollar)	B1 ft	3	**11**

Question Number	Answer	Notes	Marks	Total
8	(a) (i) $4\mathbf{b}$ (ii) $\mathbf{a}-\mathbf{b}$	B1, B1		
	(iii) $\overrightarrow{BE}=\overrightarrow{BA}+\overrightarrow{AE}="(\mathbf{a}-\mathbf{b})"+\frac{1}{2}("4\mathbf{b}"-\mathbf{a})$	M1		
	OR $\overrightarrow{BE}=\overrightarrow{BC}-\overrightarrow{EC}=3\mathbf{b}+\frac{1}{2}(\mathbf{a}-"4\mathbf{b}")$			
	$\frac{\mathbf{a}}{2}+\mathbf{b}$ (cao, oe)	A1		
	(iv) $\overrightarrow{CD}=\overrightarrow{CB}+\overrightarrow{BD}=-3\mathbf{b}+\frac{1}{2}("\mathbf{a}-\mathbf{b}")$			
	OR			
	$\overrightarrow{CD}=\overrightarrow{CA}+\overrightarrow{AD}=-("4\mathbf{b}"-\mathbf{a})+\left(-\frac{1}{2}"(\mathbf{b}-\mathbf{a})"\right)$	M1		
	$\frac{1}{2}\mathbf{a}-\frac{7}{2}\mathbf{b}$ (cao, oe)	A1	6	
	(b) $\mu("\frac{\mathbf{a}}{2}+\mathbf{b}")$	B1 ft	1	
	(c) $\overrightarrow{BX}=\overrightarrow{BC}+\overrightarrow{CX}=$ $3\mathbf{b}+\lambda("\frac{1}{2}\mathbf{a}-\frac{7}{2}\mathbf{b}")$	M1		
	$\frac{1}{2}\lambda\mathbf{a}+(3-\frac{7}{2}\lambda)\mathbf{b}$ OR $\frac{1}{2}\lambda\mathbf{a}+3\mathbf{b}-\frac{7}{2}\lambda\mathbf{b}$	A1	2	
	(d) $\mu=3-\frac{7}{2}\lambda$ or $\frac{1}{2}\mu=\frac{1}{2}\lambda$ (from equating *their* components of **a** AND equating *their* components of **b** of 2 **vector** versions of their $\overrightarrow{BX}$)	M1		
	$\lambda=\frac{2}{3}$	A1		
	$\mu=\frac{2}{3}$ (cwo)	A1	3	**12**

Question Number	Answer	Notes	Marks	Total
9	**<u>Penalise LABELLING ONCE only</u>**			
	(a) Triangle P drawn and labelled	B1	1	
	(b) $y = -1$ drawn and labelled (ie y = -1 Or "line of reflection")	B1	1	
	(c) Triangle Q drawn and labelled (*coords:* $(-5,2),(-5,4),(-2,2)$)	B1	1	
	(d) $\begin{pmatrix} -1 & -1 \\ 1 & 3 \end{pmatrix}\times$ c's coords in (c)	M1 (seen or implied)		
	Triangle R drawn and labelled *(coords:* $(3,1),(1,7),(0,4)$ *)*	A2 ft (-1 ee)	3	
	(e) Triangle S drawn and labelled *(coords:* $(7,-11),(5,-5),(4,-8)$ *)*	B2 ft (-1 ee)	2	
	(f) $\begin{pmatrix} -\frac{3}{2} & -\frac{1}{2} \\ \frac{1}{2} & \frac{1}{2} \end{pmatrix}\times$ c's coords in (e)	M1 (seen or implied)		
	Triangle T drawn and labelled *(coords:* $(-5,-2),(-5,0),(-2,-2)$ *)* (cao)	A2 (-1ee)	3	
	(g) Reflection $y = -3$	B1 B1	2	**13**

Question Number	Answer	Notes	Marks	Total
10	**NB: Penalise not corrected ONCE only in the question.**			
	(a) $AC^2 = 18^2 + 24^2 - 2\times18\times24\times\cos 65$	M1		
	$AC = \sqrt{\left(18^2 + 24^2 - 2\times18\times24\times\cos 65\right)}$	M1 (DEP)		
	OR			
	$AC^2 = \left(18\times\sin 65\right)^2 + (24 - 18\times\cos 65)^2$	M1		
	$AC = \sqrt{\left(18\times\sin 65\right)^2 + (24 - 18\times\cos 65)^2}$	M1 (DEP)		
	$AC =$ **23.1 m**	A1	3	
	(b) $\dfrac{18}{\sin ACD} = \dfrac{"23.1"}{\sin 65}$	M1		
	$\angle ACD = \sin^{-1}\left(\dfrac{18\times\sin 65}{"23.1"}\right)$	M1 (DEP)		
	OR			
	$\tan\angle ACD = \dfrac{18\times\sin 65}{24 - 18\times\cos 65}$	M1		
	$\angle ACD = \tan^{-1}\left(\dfrac{18\times\sin 65}{24 - 18\times\cos 65}\right)$	M1 (DEP)		
	NB: Other right-angled trig. solutions possible.			
	OR			
	$18^2 = 24^2 + "23.1"^2 - 2\times24\times"23.1"\times\cos\angle ACD$	M1		
	$\angle ACD = \cos^{-1}\left(\dfrac{24^2 + "23.1"^2 - 18^2}{2\times24\times"23.1"}\right)$	M1 (DEP)		
	$\angle ACD =$ **44.9°**	A1	3	
	NB: Watch for the **incorrect** assumption that AC bisects $\angle BCD$ so that $\angle ACD = 45^o$. This scores M0 M0 A0			
	(c) $\angle BCA = 90 - "44.9"$	B1 ft		

	$\therefore \Delta ABC = \frac{1}{2}\times 20\times "23.1"\times \sin(90-"44.9")$	M1		
	164 m^2	A1	3	
	NB: Assumption that *ABCD* is a cyclic quadrilateral scores B0 M0 A0			
	(d) $\Delta ADB = \Delta ADC + \Delta ABC - \Delta BCD$ **route:**			
	Area of $\Delta\, ADC = \frac{1}{2}\times 18\times 24\times \sin 65$	M1		
	awrt 196 m^2	A1		
	Area of $\Delta\, ADB = "196"+"164"-\frac{1}{2}\times 24\times 20$	M1 (DEP)		
	OR			
	$\Delta ADB = \frac{1}{2}\times AD\times \boldsymbol{AB}\times \sin\angle DAB$ **route:**			
	$AB^2 = 20^2 + "23.1"^2 - 2\times 20\times "23.1"\times \cos"45.1"$	M1		
	$AB = \sqrt{\left(20^2 + "23.1"^2 - 2\times 20\times "23.1"\times \cos"45.1"\right)}$ (AB=16.802)			
	AB = awrt 16.8	A1		
	then			

	$\angle DAC = 180-(65+"44.861") = 70.139$			
	$\frac{20}{\sin\angle CAB} = \frac{"16.802"}{\sin"45.1"}$			
	$\left(\angle CAB = 57.536\right)$			
	$\therefore \angle DAB = "70.139"+"57.536" = 127.68$			
	OR			
	$BD = \sqrt{\left(20^2+24^2\right)} = 31.24,\ 4\sqrt{61}$			
	$\therefore \angle DAB = \cos^{-1}\left(\frac{"16.802"^2+18^2-"31.24"^2}{2\times "16.802"\times 18}\right)$			
	$= 127.67$			

	Finally ($\Delta ADB = \frac{1}{2} \times AD \times \boldsymbol{AB} \times \sin \angle DAB$ **route:**) Area of $\Delta ADB = \frac{1}{2} \times 18 \times "16.802" \times \sin "127.68"$	M1 (DEP on correct method for $\angle DAB$ and AB)		
	OR $\Delta ADB = \frac{1}{2} \times AD \times \boldsymbol{BD} \times \sin \angle ADB$ **route:** $BD = \sqrt{\left(20^2 + 24^2\right)} = 31.24$ BD = awrt 31.2, $4\sqrt{61}$ $\angle BDC = \tan^{-1}\left(\frac{20}{24}\right) \quad (= 39.8056)$ $\therefore \angle BDA = 65 - "39.8056" \quad (= 25.19)$ Finally ($\Delta ADB = \frac{1}{2} \times AD \times \boldsymbol{BD} \times \sin \angle ADB$ **route:**) Area of $\Delta ADB = \frac{1}{2} \times 18 \times "31.24" \times \sin "25.19"$	M1 A1 M1 (DEP on method for $\angle ADB$ and BD)		
	$\Delta ADB =$ **120 m²**	A1	4	**13**

Question Number	Answer	Notes	Marks	Total
11	(a) $4y + x$	B1	1	
	(b) $x("4y + x")$	B1 ft	1	
	(c) $y = \frac{40}{x^2}$	M1		
	$S = x^2 + 4x\left(\frac{40}{x^2}\right)$ (cwo) (ag)	A1	2	
	(d) One term correctly differentiated	M1		
	$2x - \frac{160}{x^2}$	A1		
	$"2x - \frac{160}{x^2}" = 0$	M1 (DEP)		
	4.3 (cao)	A1	4	
	(e) 84 62.3 57	B1 B1 B1	3	
	(f) graph penalties (-1) straight line segment(s) each point missed (± ½ small sq.) each missed segment each point not plotted each point incorrectly plotted (± ½ small sq.) tramlines very poor curve i.e. line too thick	B3 ft (-1 eeoo)	3	
	(g) line drawn at $S = 75$	M1	2	**16**
	accept any $x \in [2.2, 2.4]$ **NB: "**Drawing $S = 75$" may be implied by answer $x \in [2.2, 2.4]$	A1		

Pearson Education Limited. Registered company number 872828
with its registered office at Edinburgh Gate, Harlow, Essex CM20 2JE