edexcel

Mark Scheme (Results)

January 2016

Pearson Edexcel International GCSE
Mathematics B (4MB0)
Paper 01

Edexcel and BTEC Qualifications

Edexcel and BTEC qualifications are awarded by Pearson, the UK's largest awarding body. We provide a wide range of qualifications including academic, vocational, occupational and specific programmes for employers. For further information visit our qualifications websites at www.edexcel.com or www.btec.co.uk. Alternatively, you can get in touch with us using the details on our contact us page at www.edexcel.com/contactus.

Pearson: helping people progress, everywhere

Pearson aspires to be the world's leading learning company. 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

January 2016
Publications Code UG043271

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.

Question	Working	Answer	Mark	Notes
1	$15+10x-21x-14x^2$		2	M1
		$15-11x-14x^2$		A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
2	$\frac{155}{600}\times 360$		2	M1
		93^o		A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
3	$6x+\frac{9}{x^4}$ OR $6x + 9x^{-4}$ (1 term correct)		2	M1
	Note: isw	Fully Correct		A1
	Note: Don't simply look at the answer and award (M0, A0). Previous working might imply (M1)			
				Total 2 marks

Question	Working	Answer	Mark	Notes
4	$b = \frac{8}{2} \times 5$		2	M1
		b = 20		A1
				Total 2 marks

Question		Working	Answer	Mark	Notes
5	(a)	$3y = 6x + 1$ $\quad y = 2x + 1$		1	B1
	(b)	$y = 1 - x$ $\quad y = 2x + 1$		1	B1
					Total 2 marks

Question		Working	Answer	Mark	Notes
6	(a)	Point *B* positioned and labelled correctly.		1	B1
	(b)	Point *C* positioned and labelled correctly.		1	B1
		Notes: 1. Centre of the X must be inside the overlay circle (not touching) 2. Penalise missing labels once – from first time it happens 3. Penalise a missing X once only (provided points can be identified exactly in another way (i.e. a dot for instance))			
					Total 2 marks

Question	Working	Answer	Mark	Notes
7	$0.3 \times \frac{100}{15}$		2	M1
		2 kg		A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
8	$3\times 2^3+2^2+a\times 2+4=0$		2	M1
		a = -16		A1
	Notes: 1. If a long division method is used we will accept for method: Quotient of $3x^2+7x-2$ or: $3x^2+7x+(14+a)$ or: $14+a+2=0$ 2. Do not accept $-\frac{32}{2}$ for A1			
				Total 2 marks

Question	Working	Answer	Mark	Notes
9	**Note:** Accept $\theta=-180$	θ = 180	2	B1
		a = 1 **OR** x = 1		B1
				Total 2 marks

Question	Working			Answer	Mark	Notes
10	$8^2 = 4 \times BD$	$8^2 = 4 \times (4 + CB)$	$8^2 = 4 \times (4 + x)$		3	M1
	Note: $8^2 = 4 \times x$ earns nothing until we can be sure that x is equivalent to BD. i.e. $4 \times x = 64$ leads to *BC* = 16 earns M0, A0					
	Radius = $\frac{"16" - 4}{2}$					M1dep
	OR					
	$(4 + r)^2 = 8^2 + r^2$					M1
	$16 + 8r + r^2 = 64 + r^2$					M1 dep
	Note: *BC* = 12 or diameter = 12 earns M2					
				Radius = 6 cm		A1
						Total 3 marks

Question	Working		Answer	Mark	Notes
11	$\frac{200}{1.54}$ (= £129.87) **Note:** Accept awrt £ 130	350×1.54 ($ 539)		3	M1
	350 – "129.87"	$\frac{"350 \times 1.54" - 200}{1.54}$ $\left(\frac{"539" - 200}{1.54}\right)$			M1dep
	Note: £ 220.13 loses the A mark here		£220		A1
					Total 3 marks

Question	Working	Answer	Mark	Notes
12	$-1-8<3n-n$ (o.e.) (isolate n) **Notes:** 1. Allow one sign slip (+/-) for method 2. Allow '=' sign for method here $-2n<9$ | $-9<2n$		3	M1
	Notes: 1. The inequality sign must be correct for this mark 2. Accept $n>\frac{9}{-2}$	$n>-\frac{9}{2}$		M1
	Notes: 1. A correct answer can only be awarded **FULL** marks if no incorrect working seen. 2. Final A mark is dependent on the previous M mark. 3. If T & E method seen : (a) Final answer of -4 seen, with no incorrect working seen $\Rightarrow$ full marks (b) If the final answer of -4 **NOT** seen then only award M1, M1 **IF** $-4-1<8+(-12)$ (o.e.) **AND** $-5-1>8-15$ seen	n = -4		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
13	Any two of $\frac{10}{3}$, $\frac{3}{2}$, $\frac{20}{9}$		3	B1
	$\frac{10}{3}\times\frac{2}{3}$			M1
		$\frac{20}{9}$ and cc		A1
	Notes: 1. The final A1 can only be awarded if $2\frac{2}{9}$ is linked to $\frac{20}{9}$ in the candidates working. LHS = $\frac{20}{9}$ and RHS = $\frac{20}{9}$ is not sufficient. 2. Use of a calculator earns **no** marks			
				Total 3 marks

Question		Working	Answer	Mark	Notes
14	(a)	0, 11, 12 (oe)		1	B1
	(b)	0, 1, 2, 3, 4, 5, 6, 7, 8, 9 **OR** $0 \le x \le 9$		1	B1
	(c)	4, 5, 6, 7, 8, 9 **OR** $4 \le x \le 9$		1	B1
					Total 3 marks

Question	Working	Answer	Mark	Notes
15	$\sin 30 = \frac{BD}{5}$ ($BD = 2.5$) (o.e.) **Note:** Accept equivalent trig statement such as the sine rule		3	M1
	$\therefore \sin 20 = \frac{"2.5"}{BC}$ **Note:** This is an **independent** M mark but must involve their answer for *BD*.			M1
		7.31 cm		A1
	Note: Penalise n.c. answer			
				Total 3 marks

Question	Working	Answer	Mark	Notes
16 (b)	$(2n-4)\times 90 = 900$ (o.e.)		2	M1
		n = no. of sides = 7		A1
				Total 3 marks

Question	Working	Answer	Mark	Notes
17	$\left(\frac{dy}{dx} =\right) 10x-6$ **Note:** Beware of $x(5x-6)+15$ leading to $5x-6=0$ or $5x-6=-2$		4	M1 1 term correct
		correct		A1
	$"10x-6"=-2$ **Note:** Allow a misread of $"10x-6"=2$			M1dep
	Note: isw	$x=\frac{4}{10},\ \frac{2}{5},\ 0.4$		A1
				Total 4 marks

Question		Working	Answer	Mark	Notes
18	(a)	**Note:** Take the first penalty from the second B mark	$\begin{pmatrix} 8 & -5 \\ -7 & -13 \end{pmatrix}$	2	B2 -1ee
	(b)	**Note:** Take the first penalty from the second B mark	$\begin{pmatrix} 0 & 13 \\ 5 & -1 \end{pmatrix}$	2	B2 -1ee
					Total 4 marks

Question	Working	Answer	Mark	Notes
19 (a)	4 or x^2 **Note:** Accept these expressions embedded in the candidate's working i.e. $(4x)^2 \Rightarrow$ B1, B0		2	B1
	Note: $(64x)^2$ is a popular incorrect answer earning B1, B0	$(2x)^2$		B1
(b)	$\sqrt{\frac{1}{"(2x)^2"}}$ **OR** $2^{-1}x^{-1}$ **Notes:** 1. Accept $64^{-1/6}x^{-1}$ or $\frac{1}{\sqrt[6]{64}}x^{-1}$ or $4^{-1/2}x^{-1}$ 2. The candidate may start again in part (b) 3. The popular incorrect answer in part (a), leading to $\frac{1}{64x}$ scores M1, A0		2	M1
	Note: Accept $\frac{1}{2\lvert x\rvert}$	$\frac{1}{2x}$		A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
20	$3x^2 - 4x - 7\ (= 0)$		4	B1
	$(3x - 7)(x + 1) = 0$ (solving trinomial quad.) **Notes;** 1. For method, the candidates quadratic **must** be a trinomial. The resultant factorised form must, when multiplied out give at least two of their quadratic terms. So $(3x+7)(x-1)$ earns M1 but $(x-7)(3x-1)$ earns M0. 2. If the quadratic formula is used, M1 is earned for a correct substitution into a correctly quoted formula.			M1
	Notes: 1. On ePen, first A1 for 7/3 (2.33 or better), second A1 for -1 2. No working seen, but completely correct answers scores full marks. If $x = 2.3$, $x = -1$ seen with no working score B1, M1, A0, A1	$x = \frac{7}{3}$, $x = -1$		A1, A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
21	base side = 230 m **Note:** 1. 230 seen is enough for B1 2. Accept 920/4		4	B1
	Volume = $\frac{1}{3}\times"230"\times"230"\times129$ **Note:** Do not accept 920 for "230" here			M1
		Volume = 2 274 700 m^3		A1 for awrt (2 270 000)
	Note: This A1 ft is for their SF form from a numerical value seen. (i.e. not directly from their quoted formula).	2.27×10^6 m^3		B1 ft
				Total 4 marks

Question	Working	Answer	Mark	Notes
22 (a)	(3, 4) **Notes:** 1. First B1 for 3, 2nd B1 4. 2. Accept $x=3,\quad y-4$		2	B1, B1
(b)	$\left\|\overrightarrow{OM}\right\| = \sqrt{"3^2"+"4"^2}$		2	M1
	Note: Final A1 dependent on completely correct working	5		A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
23 (a)	Arcs drawn from *B* and *E* intersecting at two points **OR** an indication that the line drawn is perpendicular to *BE* and that it is a bisector of *BE*		2	M1
	Note: For A mark, their line must fit under overlay	Line, equidistant from B and E, correctly drawn		A1 Accept straight line joining the midpoints of *AF* and *DC* for (M1)(A1)
(b)	Arc, radius 6 cm, centre *A*, drawn **Note:** Again, must fit under overlay. It does not have to be complete – only the part which intersects part (a) has to be seen.		1	M1
(c)	*P* correctly labelled **Note:** This A1 ft is dependent on the first M1 and a reasonable attempt at part (b). i.e if lines are out of tolerance, we can award A1 ft here.		2	A1 ft
	PD = 24 ($\pm$1) mm **Notes:** 1. Accept 2.4 ($\pm$1) cm – cm **must** be seen 2. Although you are unlikely to see it, answers which round to an answer in the given range are acceptable.			B1
				Total 5 marks

Question	Working	Answer	Mark	Notes
24 (a)	$216 = k \times 2^3$		3	M1
	Note: Accept 216/8	$k = 27$		A1
	Notes: 1. Accept $(C =)"\frac{216}{8}"x^3$ 2. $k = 27$ followed by $y = kx^3$ earns A1 here	$(y =)"27"x^3$		A1
(b)	$x^3 = \left(\frac{-343}{"27"}\right)$ **Notes:** 1. Accept $x^3 = -12.7$ or better. 2. Allow a consistent MR here from part (a) i.e. a candidate who uses $y = \frac{k}{x^3}$ in part (a) can pick up method here for $x^3 = \left(\frac{"216 \times 2^3"}{-343}\right)$ 3. No retrospective marking for $k = 27$ here 4. An answer of -2.3 only seen implies M1		2	M1
		$x = -\frac{7}{3}$		A1 awrt –2.33
				Total 5 marks

Question	Working		Mark	Notes
25 (a)	$\angle AEC = 60^o$ or $\angle ADC = 60^o$	$\angle ABE = 30^o$	4	M1
	Notes: 1. This is crucial to the solution to this problem. 2. Award if seen, BUT not if it follows from incorrect working. So $\angle AEC = 60^o$ because $\angle AEC = \frac{1}{2} \times \angle ABC$ earns M0			
	Cyclic quad(rilateral) **Notes:** 1. Accept quadrilateral in a circle 2. Do not accept **opposite sides** of a cyclic quadrilateral	Angles in the same segment		A1
	$\angle EAC = 90^o$ + reason **Notes:** 1. Angle sum of triangle ($\angle s$ of Δ) 2. Sufficient to say that $\angle EAC + 60 + 30 = 180$ **OR** using $\angle ABE = 30^o$ $\angle EBC = 90^o = \angle EAC$ (angles in the same segment)	$\angle CDE = 90^o$ + **one** reason **Note:** Either $\angle ADC = \angle AEC = 60^o$ ($\angle$ in same seg) or $\angle ADE = \angle ACE = 30^o$ ($\angle$ in same seg) **OR** using $\angle ABE = 30^o$ $\angle EBC = 90^o = \angle CDE$ (opposite angles of a cyclic quad)		M1

	$\therefore \angle EAC = \angle CDE = 90^o$ + **one** reason **Notes:** 1. Sufficient to say cyclic quad(rilateral) again 2. Not sufficient to say opposite angles of a diameter.		A1
(b)	$\angle$ in a semi-circle $(=90^o)$ **or** $\angle$ in a half-circle $(=90^o)$ Notes: 1. This mark is **dependent** on the 2nd M1 in part (a) earned. 2. If neither of these expressions are seen, you will have to look further… Accept: (i) (*EC* is a diameter because) the angle "subtended by" a diameter is 90 degrees. Accept "formed from/by" for "subtended by" (ii) Triangle in a semi-circle with an angle of 90^o (iii) *EC* is the hypotenuse of (two) right angled triangle(s) in the circle… (iv) Because $\angle EAC = 90^o$ (and $\angle ECD = 90^o$) This is not an exhaustive list but you can see that in all of these cases, 90^o **(or right angle) is mentioned** which is crucial to the argument (if $\angle$ in a semi-circle not seen)		A1
			Total 5 marks

Question	Working	Answer	Mark	Notes
	Notes: 1. Do not award marks for simply seeing values on the Venn diagram 2. Accept answers of the form n(18) etc... 3. If either answer in parts (b) and/or (c) is negative, the method mark is lost.			
26 (a)	n(B)= n(E) – n(B')	18	1	B1
(b)	n($A \cap B$) = "18" – 8 or $n(E) - n(A' \cap B) - n(B') = 40 - 22 - 8$ **Note:** M1 can be implied by their answer = "18" – 8		2	M1
		10		A1
(c)	$n\left((A \cup B)'\right) = 40 - (6 + 8 + "10")$ or $n(B') - n(A \cap B') = 22 - 6$ or $n(E) - n(B) - n(A \cap B') = 40 - "18" - 6$		2	M1
		16		A1
				Total 5 marks

Question	Working	Answer	Mark	Notes
27 (a)	Height = 4 Height = 3 Height = 2 **Note:** Widths must be correct as well.		2	B2 -1 eeoo
(b)	3 correct midpoints (22.5, 35, 52.5, 70)		4	M1
	At least 3 correct products added			M1dep
	$\frac{80\times"22.5"+160\times"35"+90\times"52.5"+80\times"70"}{(80+160+90+80)}$ (=17725/410)			M1dep
	Note: The unrounded answer is 43.23 years. This answer loses the last mark.	43 years		A1
				Total 6 marks

Question	Working	Answer	Mark	Notes
28 (a)	One line correct **Note:** If first line is incorrect, award first B1 if the second (or third) line would be correct ft from their first line		2	B1
	All 3 lines correct			B1
(b)	$\frac{1}{2}\times 30s\times 30m/s + 300s\times 30m/s + \frac{1}{2}\times 60s\times 30m/s$ $(450 + 9000 + 900)$ **OR** $\frac{1}{2}\times(300+390)\times 30$ **Note:** For method, their area must be a trapezium		2	M1
		10 350m		A1
(c)	$\left(\frac{"10350"}{"390"}\right)$ **Notes:** 1. For the ft, accept an answer consistent with the candidate using compatible but incorrect units – i.e. $"172.5"\div"6.5"$. Note that $172.5\div 390$ earns B0 2. For the B1 ft, their answer must not be left as a fraction.	awrt 27 m/s	1	B1ft
(d)	$\frac{1}{2}\text{m/s}^2$ **Note:** Accept $-\frac{1}{2}$		1	B1
				Total 6 marks

Question	Working	Answer	Mark	Notes
29 (a)	$x+x+3x+2x=1$		2	M1
		$x=\frac{1}{7}$, 0.143(or better)		A1
(b)	P(12) = P(6&6) + P(4&8) + P(8&4) $\left(3\times"\frac{1}{7}"\right)\times\left(3\times"\frac{1}{7}"\right)+\left(1\times"\frac{1}{7}"\right)\times\left(2\times"\frac{1}{7}"\right)+\left(2\times"\frac{1}{7}"\right)\times\left(1\times"\frac{1}{7}"\right)$ **Notes:** 1. At least two 'correct' double products seen and added. Ignore any other added probabilities for this M mark). 2. If either of these two 'correct' products results in a probability of a score >1 then this mark is lost. (You may ignore any probability scores for any extra double products seen at this stage)		3	M1
	All 3 double products 'correct' and added Note: If any of these three 'correct' products results in a probability of a score >1 then this mark is lost.			M1dep
		$\frac{13}{49}$, 0.265, 0.266 (using 0.143)		A1
				Total 5 marks

Pearson Education Limited. Registered company number 872828
with its registered office at 80 Strand, London WC2R 0RL