Pearson Edexcel

Mark Scheme (Results)

November 2020

Pearson Edexcel International GCSE
Mathematics A (4MA1)
Paper 2H

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

November 2020
Publications Code 4MA1_2H_2011_MS

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
  - awrt – answer which rounds to
  - 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.
  If a candidate misreads a number from the question. Eg. Uses 252 instead of 255; method marks may be awarded provided the question has not been simplified. Examiners should send any instance of a suspected misread to review. If there is a choice of methods shown, mark the method that leads to the answer on the answer line; where no answer is given on the answer line, award the lowest mark from the methods shown.
  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 to another.

International GCSE Maths					
Apart from question 11c, 12, 13, 16, 19, 20 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.					
Q		**Working**	**Answer**	**Mark**	**Notes**
1	a		g^{10}	1	B1
	b		k^7	1	B1
	c		$9c^2d^8$	2	B2 B1 for 2 out of 3 terms correct in a product
	d	$4x > 2 - 7$ oe			M1 accept as an equation or with wrong inequality sign.
			$x > -1.25$	2	A1 oe allow $(-1.25, (+)\infty)$ Note: award M1A0 for an answer on the answer line of -1.25 with no sign or the incorrect sign eg $x = -1.25$, $x < -1.25$
					Total 6 marks

2	a		$50 < L \leq 60$	1	B1	oe eg 50 - 60
	b	$25 \times 6 + 35 \times 26 + 45 \times 31 + 55 \times 40 + 65 \times 17$ $(150 + 910 + 1395 + 2200 + 1105)(= 5760)$			M2	For correct products using midpoints (allow one error) with intention to add. M1 for products using frequency and a consistent value within the range (allow one error) with intention to add or correct products using midpoints (allow one error) without addition
		"5760" ÷ "120"			M1	dep on M1
			48	4	A1	
						Total 5 marks

3	*ADC* = 180 – 58 (= 122) **or** *EDF* = 122 **or** *CDE* = 58 **or** *ADF* = 58			M1 may be seen marked on the diagram
	e.g. *DEF* = 58 ÷ 2 **or** *DEF* = (180 – 122) ÷ 2			M1 complete method to find angle *DEF*
		29		A1
			5	B2 dep on M2 for fully correct reasons for their method (B1 dep on M1 for one correct reason stated and used) e.g. Allied angles, co-interior angles, Alternate angles, Corresponding angles, Vertically opposite angles are equal (or Vertically opposite angles are equal), Angles on a straight line add up to 180°(or angles on a straight line add to 180°), Sum of two angles in a triangle are equal to opposite exterior angle, Angles in a triangle add up to 180°(or Angles in a triangle add up to 180°), Base angles in an isosceles triangle Angles in a quadrilateral add up to 360. (accept "4-sided shape"or parallelogram) Opposite angles of a parallelogram are equal
				Total 5 marks

4	eg 76 ÷ (5 + 2 – 3) oe (= 19) or 5*x* + 2*x* – 3*x* = 76 **and** *x* = 76 ÷ (5 + 2 – 3) (=19) oe			M1 For a correct method to find the value of 1 share
	3 × "19" (= 57)			M1
	"57" – 48.5(0)			M1
		8.5(0)	4	A1
				Total 4 marks

5	a	1.04 × 3 130 000 oe				M2	complete method to increase salary by 4% M1 for 0.04 × 3 130 000 oe (= 125 200)	
				3 255 200	3	A1		
	b	for 0.15 × 750 000 oe (=112 500) **or** 0.85 × 750 000 oe (=637 500)	**OR** 750 000 × 0.85^3			M1	For method to find depreciation for 1 year or value after 1 year	**or** M2 for 750 000 × 0.85^3 (= 460 593.75) **or** 750 000 × 0.85^4 (= 391 504.69)
		0.85 × "637 500" oe (= 541 875) 0.85 × "541 875" oe(= 460 593.75)				M1	for completing method	(M1 for 750 000 × 0.85^2 (= 541 875)
				460 594	3	A1	accept 460 593 – 460 594	
							SC: if no other marks gained award M1 for 0.55 × 750 000 oe **(=** 412 500) **or** 0.45 × 750 000 oe **(=** 337 500) accept (1 – 0.15) as equivalent to 0.85 throughout	
								Total 6 marks

6				M1 for $y = 3x + c$ oe **or** $y = mx - 2$ oe **or** $3x - 2$ **or** eg $L = 3x - 2$ **or** $y = 3(x \pm a)$
		$y = 3x - 2$	2	A1 oe eg $y - 4 = 3(x - 2)$ $y - 1 = 3(x - 1)$ $y - a = 3(x - b)$ where (a, b) is any coordinate on the line
				Total 2 marks

7	$\tan x = \frac{3.4}{4.7}$ oe eg $\cos x = \frac{4.7}{\sqrt{3.4^2 + 4.7^2}}$ oe			M1 or $\sin x = \frac{3.4 \sin 90}{\sqrt{3.4^2 + 4.7^2}}$ oe
	$(x =) \tan^{-1}\left(\frac{3.4}{4.7}\right)$ oe eg $(x =) \cos^{-1}\left(\frac{4.7}{\sqrt{3.4^2 + 4.7^2}}\right)$			M1 or $(x =) \sin^{-1}\left(\frac{3.4 \sin 90}{\sqrt{3.4^2 + 4.7^2}}\right)$ oe
		35.9	3	A1 accept 35.7 - 36.1
				Total 3 marks

8	$8.5^2 - (8 \div 2)^2$ (= 56.25) **or** $\cos x = \frac{4}{8.5}$ oe			M1 **or** eg $\cos A = \frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}$
	$\sqrt{"56.25"}$ (= 7.5) **or** $x = \cos^{-1}\left(\frac{4}{8.5}\right)$ (= 61.927...) oe			M1 **or** eg $(A =) \cos^{-1}\left(\frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}\right)$ (61.927...) (other angle = 56.144...)
	8 × "7.5" ÷ 2 oe **or** 0.5 × 8 × 8.5 × sin "61.927..."			M1 **or** eg 0.5 × 8.5 × 8 × sin"61.927..." oe
		30	4	A1
				Total 4 marks

9	$\pi \times 3^2 \times h = 72\pi$ oe			M1	Allow use of 3.14... or $\frac{22}{7}$ for π and use of 226... for 72π
	$h = 72\pi \div (\pi \times 3^2)$ oe **or** $h = 8$			M1	method to isolate h (may be seen in several stages)
	$2 \times \pi \times 3^2$ (= 18π or 56.54...) **or** $2 \times \pi \times 3 \times$ "8" oe (= 48π or 150 - 151)			M1	method to find the area of the two circles **or** curved surface area – use of their h, dep on 1st M1 (NB may get this mark for total area of 2 circles with no previous marks awarded)
	$2 \times \pi \times 3^2 + 2 \times \pi \times 3 \times$ "8" oe (= 66π)			M1	method to find total surface area ft their h dep on 1st M1, including intention to add, to find the total surface area
		207	5	A1	accept 207-208
					Total 5 marks

10	a		10, 26, 70, 99, 114, 120	1	B1	
	b		correct cumulative frequency graph	2	B2	fully correct cf graph – points at ends of intervals and joined with curve or line segments If not B2 then B1 for 5 or 6 (ft from a table with only one arithmetic error) of their points at ends of intervals and joined with curve or line segments **OR** for 5 or 6 points plotted correctly at ends of intervals not joined **OR** for 5 or 6 of their points from table plotted consistently within each interval (not at upper ends of intervals) at their correct heights and joined with smooth curve or line segments
	c				M1	For use of 30 and 90, or 30.25 and 90.75 (eg reading of 21 and 37 stated or indicated by marks on horizontal axis that correspond to 30 (or 30.25) and 90 (or 90.75) on the vertical axis or correct readings ft their cf graph provided method to show readings is shown)
			16	2	A1	accept 14 – 18, ft from their cf graph (ft provided method to show readings is shown)
	d				M1	For use of cf from number of minutes late being 48 (eg an indication by a mark on the vertical axis corresponding to 48 mins late or a correct reading ft their cf graph)
			9	2	A1	accept 7 – 10, ft from their cf graph
						Total 7 marks

11	a		$4e^{10}$	2	B2	(B1 for $4e^{k}$ **or** ke^{10})
	b	A correct first step eg $\frac{y^{-4}}{2^{-4}}$ **or** $\left(\frac{y^4}{16}\right)^{-1}$ **or** $\frac{y^{-4}}{0.0625}$ **or** $\left(\frac{2}{y}\right)^4$ **or** $\frac{16}{y^4}$ **or** $\left(\frac{1}{y/2}\right)^4$ **or** $\frac{1}{\left(y/2\right)^4}$			M1	or for $16y^{p}$ where $p \neq -4$
			$16y^{-4}$	2	A1	
	c	eg $12\times\frac{4x-2}{3}-12\times\frac{5-3x}{4}=12\times6$ **or** eg $4(4x-2)-3(5-3x)=12\times6$ **or** eg $\frac{4(4x-2)}{12}-\frac{3(5-3x)}{12}(=6)$ **or** eg $\frac{4(4x-2)-3(5-3x)}{12}(=6)$ oe			M1	for clear intention to multiply **all** terms by 12 or a multiple of 12 **or** to express LHS as two fractions over 12 or a multiple of 12 or as a single fraction with a denominator of 12 or a multiple of 12 (if expanded numerator, allow one sign error)
		eg $16x-8-15+9x=6\times12$			M1	expanding brackets and multiplying both sides by denominator with no more than one sign error
		eg $16x + 9x = 72 + 8 + 15$			M1	for correct rearrangement of a correct equation with terms in x isolated
			3.8	4	A1	oe, award full marks for a correct answer if at least M1 scored
						Total 8 marks

12	$3^4 = \frac{3^x}{9^{3x}}$ **or** $81 = \frac{3^x}{(3^2)^{3x}}$	$9^2 = \frac{3^x}{9^{3x}}$ **or** $81 = \frac{(9^{0.5})^x}{9^{3x}}$			M1 replacing 81 with 3^4 **or** 9^{3x} with $(3^2)^{3x}$ (or 3^{6x}) **or** replacing 81 with 9^2 **or** 3^x with $(9^{0.5})^x$ (in an equation)
	eg $4 + 6x = x$ or $4 = x - 2(3x)$ oe	eg $2 = 0.5x - 3x$ oe			M1 a correct equation using powers
			−0.8	3	A1 oe, dep on at least M1
					Total 3 marks

13	e.g. $x = 0.6\dot{8}\dot{1}$ and $100x = 68.\dot{1}\dot{8}$ **or** $10x = 6.\dot{8}\dot{1}$ and $1000x = 681.\dot{8}\dot{1}$			M1 e.g. two decimals that when subtracted give a finite decimal (must show understanding of recurring figures by 'dot' or at least 2 lots of 18 or 81 after the decimal point). Algebra required, use of any letter.
	$99x = 67.5$, $x = \frac{67.5}{99} = \frac{15}{22}$ **or** $990x = 675$, $x = \frac{675}{990} = \frac{15}{22}$ oe	show	2	A1 dep for completing the 'show that' arriving at given answer from correct working.
				Total 2 marks

14	a		8	1	B1	
	b	$A = \{10, 11, 12, 13, 14\ 15, 16, 17\}$ $B = \{13, 14, 15, 16, 17, 18, 19, 20, 21\}$ **or** $A \cup B = \{10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21\}$			M1	may be seen in a Venn diagram (allow for example 10 – 17 for A and 13 – 21 for B or 10 – 21 for $A \cup B$) **or** for an answer with one missing element or one extra element
			22, 23, 24, 25	2	A1	
	c	$A' = \{18, 19, 20, 21, 22, 23, 24, 25\}$ $B = \{13, 14, 15, 16, 17, 18, 19, 20, 21\}$			M1	may be seen in a Venn diagram (allow 18 – 25 for A' and 13 – 21 for B) **or** for an answer with one missing element or one extra element
			18, 19, 20, 21	2	A1	
	d		13, 14, 15, 16, 17	1	B1	
						Total 6 marks

15	$xy + 3y = 5 - 2x$ oe			M1	multiplying both sides by $(x + 3)$ and expanding the brackets correctly
	e.g. $xy + 2x = 5 - 3y$			M1	ft dep on 2 terms on left and $(5 - 2x)$ on right, for collecting all x terms on one side and non-x terms on the other side
	eg $x(y + 2) = 5 - 3y$			M1	ft, dep on 2 terms in x, for factorising for x
		$x = \frac{5-3y}{2+y}$	4	A1	oe allow $\frac{5-3y}{2+y}$ as answer so long as previously seen $x = \frac{5-3y}{2+y}$
					Total 4 marks

16	$3y(2y+1)-y^2=8$ **or** $x=\frac{8+y^2}{3y}\rightarrow\frac{8+y^2}{3y}-2y=1$ **or** $3xy-y^2=8$ $3xy-3y\times2y=3y\times1$ oe	$3x\left(\frac{x-1}{2}\right)-\left(\frac{x-1}{2}\right)^2=8$ oe			M1	correct first step eg substitution by eg $x=1+2y$ or $y=\frac{x-1}{2}$ to get an equation in a single variable **or** writing 2nd equation with x the subject and substituting into 1st **or** multiplying 2nd equation by $3y$ and subtracting from 1st oe
	eg $5y^2+3y-8\ (=0)$	eg $5x^2-4x-33\ (=0)$			A1	for a correct simplified quadratic
	$(5y+8)(y-1)\ (=0)$ or $\frac{-3\pm\sqrt{3^2-4\times5\times(-8)}}{2\times5}$	$(5x+11)(x-3)\ (=0)$ or $\frac{4\pm\sqrt{(-4)^2-4\times5\times(-33)}}{2\times5}$			M1ft	dep on M1 for solving their 3 term quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-3\pm\sqrt{9+160}}{10}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$y=-\frac{8}{5}$ and $y=1$ (both)	$x=-\frac{11}{5}$ and $x=3$ (both)			A1	dep on first M1
			$x=-\frac{11}{5}, y=-\frac{8}{5}$ $x=3, y=1$	5	A1	oe dep on first M1 Must be paired correctly
						Total 5 marks

17	$(3x + 2)(2x – 4) < 3x + 27$oe eg $6x^2 – 8x – 8 < 3x + 27$			M1	condone incorrect symbol
	eg $6x^2 – 11x – 35 < 0$			M1	expanding and rearranging to get a correct 3 term quadratic, condone incorrect symbol
	$(2x – 7)(3x + 5)$ $(= 0)$ or $\frac{11 \pm \sqrt{(-11)^2 - 4 \times 6 \times (-35)}}{2 \times 6}$			M1	first step to find the critical values dep on M1 for solving their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as the equivalent of $\frac{11 \pm \sqrt{121 + 840}}{12}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$-\frac{5}{3}, \frac{7}{2}$			A1	oe the positive critical value only or both critical values (if both they must be correct)
		$2 < x < \frac{7}{2}$	5	A1	accept $2 \leq x < \frac{7}{2}$ may be seen as two separate inequalities $x > 2$ $(x \leq 2)$ **and** $x < \frac{7}{2}$
					Total 5 marks

18	eg $\frac{4}{AC} = \tan 35$ oe **or** $\frac{AC}{4} = \tan 55$ oe **or** $\frac{AC}{\sin 55} = \frac{4}{\sin 35}$ oe **or** $CH = \frac{4}{\sin 35}$ oe (= 6.97...) **and** $\frac{AC}{"6.97"} = \cos 35$ oe **or** $CH = \frac{4}{\sin 35}$ oe (=6.97...) **and** $AC^2 = 6.97^2 - 4^2$ oe			M1 A correct trig statement involving *AC* **or** trig and then Pythagoras involving *AC*
	$(AC =) \frac{4}{\tan 35}$ oe eg $(AC =)$ 4tan55 (= 5.71...) **or** $(AC =) \frac{4\sin 55}{\sin 35}$ **or** "6.97" × cos35 oe **or** $(AC =) \sqrt{"6.97"^2 - 4^2}$			M1 complete method to find *AC*
	$(BC =) \sqrt{"5.71"^2 - 5^2}$ (= 2.76...)			M1 complete method to find *BC*
	4 × 5 × "2.76..."			M1 method to find volume
		55.3	5	A1 accept 55.1 – 55.5
				Total 5 marks

19	$\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{BA} = \mathbf{a} - \mathbf{b}$			M1	Correct diagram (condone missing vector labels or arrows – with C on line segment OA and D on line segment OB) **OR** for finding $\overrightarrow{AB}$ or $\overrightarrow{BA}$ - may be seen as part of later working
	$\overrightarrow{CD} = \frac{1}{3}(-\mathbf{a} + \mathbf{b})$ or $\overrightarrow{DC} = \frac{1}{3}(\mathbf{a} - \mathbf{b})$oe			M1	Method to find $\overrightarrow{CD}$ or $\overrightarrow{DC}$
		Correct vectors and conclusion including <u>parallel</u> and <u>trapezium</u>	3	A1	eg $\overrightarrow{AB}$ (AB) and $\overrightarrow{CD}$ (CD) are parallel therefore $ABDC$ is a trapezium
					Total 3 marks

20	$\frac{\left(\frac{X+4}{2}\right)}{X}\left(=\frac{X+4}{2X}\right)$ **or** $\frac{\left(\frac{X+4}{2}\right)-1}{X-1}\left(=\frac{X+2}{2X-2}\right)$	eg, where b = number of blue counters $\frac{b}{2b-4}$ **or** $\frac{b-1}{2b-5}$	eg, where r = number of red counters $\frac{r+4}{2r+4}$ **or** $\frac{r+3}{2r+3}$			M1	for making a correct start by finding the probability of the first counter being blue for their method
	eg $\frac{X+4}{2X}\times\frac{X+2}{2X-2}$	eg $\frac{b}{2b-4}\times\frac{b-1}{2b-5}$	eg $\frac{r+4}{2r+4}\times\frac{r+3}{2r+3}$			M1	oe correct calculation for 2 blue (using one variable)
	eg $8(X^2 + 6X + 8) = 3(4X^2 - 4X)$	eg $8b(b - 1) = 3(2b - 4)(2b - 5)$	eg $8(r + 4)(r + 3) = 3(2r + 4)(2r + 3)$			M1	dep for a correct equation with no algebraic fractions eg could have $X^2+6X+8=\frac{3}{8}(4X^2-4X)$
	Eg $4X^2 - 60X - 64 (= 0)$ **or** $X^2 - 15X - 16 (= 0)$ oe	eg $4b^2 - 46b + 60 (= 0)$ **or** $2b^2 - 23b + 30 (= 0)$ oe	eg $4r^2 - 14r - 60 (= 0)$ **or** $2r^2 - 7r - 30 (= 0)$ oe			M1	for rearranging their equation to a correct 3 term quadratic
				16	5	A1	cao dep on M4
							Total 5 marks

21	a	$5 - (x \pm q)^2 + 9$ oe **or** $p - (x - 3)^2$ oe **or** $p - q^2 + 2qx - x^2$ and one of $2q = 6$ **or** $p - q^2 = 5$			M1	may be seen in working eg $-[(x - 3)^2 - 9 - 5]$ **or** expanding $p - (x - q)^2$ correctly and equating one of the coefficient of x or the constant term
			$14 - (x - 3)^2$	2	A1	fully correct SCB1 for $(x - 3)^2 - 14$
	b	e.g. $(x - 3)^2 = 14 - y$ [or $(y - 3)^2 = 14 - x$]			M1	correct steps to isolate their bracket ft from (a) dep on expression in form $\pm p \pm (x - q)^2$
		$x = 3 \pm \sqrt{14 - y}$ [or $y = 3 \pm \sqrt{14 - x}$]			M1	complete method to find y in terms of x or x in terms of y. Condone + for ± ft from (a) dep on expression in form $\pm p \pm (x - q)^2$
		$(f^{-1}(x) =) 3 - \sqrt{14 - x}$			M1	for the correct inverse
					M1	method to solve $0 < 3 - \sqrt{14 - x}$ or a lower bound of 5 clearly shown, eg $x > 5$ as part of the answer
			$5 < x \leq 14$	5	A1	cao
						Total 7 marks

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