



Mark Scheme (Results)

January 2019

Pearson Edexcel International GCSE
In Mathematics A (4MA1) Higher Tier
Paper 1H

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 2019

Publications Code 4MA1_1H_1901_MS

All the material in this publication is copyright

© Pearson Education Ltd 2019

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.

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 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

Apart from Questions 1(c), 5, 6(c), 20 and 21 (where the mark scheme states otherwise), the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method.

Question	Working	Answer	Mark	Notes
1 (a)		$2p(2+3q)$	2	B2 If not B2 then award B1 for $2(2p+3pq)$ or $p(4+6q)$ or $2p$ (a two term expression) or $x(2+3q)$ where $x \neq 2p$
(b)	$e^2 + 3e - 5e - 15$			M1 for 3 correct terms or for 4 correct terms ignoring signs or $e^2 - 2e + k$ for non-zero k or $\dots - 2e - 15$
(c)	$5y = 2y + 1$ or $y = \frac{2y}{5} + \frac{1}{5}$ E.g. $5y - 2y = 1$ or $3y = 1$ or $3y - 1 = 0$ or $\frac{3y}{5} = \frac{1}{5}$	$e^2 - 2e - 15$	2	A1 M1 for a correct first step M1 for collecting terms in y in a correct equation
		$\frac{1}{3}$ oe	3	A1 dep on at least M1 for $\frac{1}{3}$ oe e.g. $0.\dot{3}$, $0.3333\dots$

Question	Working	Answer	Mark	Notes
2 (a)		Rotation, 90° clockwise, centre (-2, 3)	3	B1 for rotation B1 90° clockwise or -90° (or 270° anticlockwise) B1 (centre) (-2, 3) Note: Do not accept $\begin{pmatrix} -2 \\ 3 \end{pmatrix}$ for centre Award no marks is more than one transformation explicitly stated (the sight of a vector is not a second transformation) eg. moved and then rotated; rotation and translation
(b)		Triangle at (-2, 2), (-2, 4), (-1, 4)	1	B1 cao
(c)		Triangle at (-2, 1), (-2, 3), (-1, 3)	2	B2 If not B2 then award B1 for a triangle of the correct size and orientation or the wrong size but enlarged correctly from (-4, 2) with a sf other than 0.5 e.g. a triangle at (4, -2), (4, 6), (8, 6)

Question	Working	Answer	Mark	Notes
3	$1 - (0.15 + 0.26 + 0.33)$ or $1 - 0.74$ $(=0.26)$ $(P(\text{yellow}) =) \frac{0.26 - 0.06}{2}$ or 0.1 150×0.1	15	4	M1 can be implied by two values where $P(\text{brown}) + P(\text{yellow}) = 0.26$ (may be seen in table) M1 for a complete method to find $P(\text{yellow})$ M1 independent mark Award for $150 \times p$ where $0 < p < 1$ A1 NB: An answer of $\frac{15}{150}$ scores M3 A0

Question	Working	Answer	Mark	Notes
4 (a)	$1236.5 - 1126.5$ or 110 or $\frac{1236.5}{1126.5}$ or $1.09(7647\dots)$ or $\frac{1236.5}{1126.5} \times 100$ or $109(.7647\dots)$ $\frac{1236.5 - 1126.5}{1126.5}$ or $\frac{"110"}{1126.5}$ or $\left(\frac{1236.5}{1126.5} - 1\right)$ or $(1.09(764\dots) - 1)$ or $\frac{1236.5}{1126.5} \times 100 - 100$ or $0.0976(475\dots)$	9.76	3	M1 M1 for method that would result in 9.76... or 0.0976... A1 for 9.76 - 9.765
(b)	1126.5×1.19 oe	1341	3	M2 if not M2 then award M1 for $\frac{19}{100} \times 1126.5$ oe or $214(.035)$ A1 for 1340 – 1342

Question	Working	Answer	Mark	Notes
5	<p>E.g. $4x + 15 + 30x - 5 = 180$ OR $20x + 45 + 4x + 15 = 180$ OR $4x + 15 + 20x + 45 = 180$ OR $30x - 5 = 20x + 45$ $x = 5$</p> <p>E.g. $20 \times "5" + 45 (=145)$ or $4 \times "5" + 15 (=35)$ or $30 \times "5" - 5 (=145)$</p> <p>OR E.g. $4x + 15 + 30x - 5 = 180$ AND $30x - 5 = 20x + 45$</p> <p>E.g. $AFC = 145$ and $FCD = 145$ OR $AFC = 145$ and $BCF = 35$</p> <p>OR $x = 5$ from the solution of two equations</p>	Shown correctly with reasons	5	<p>M1 for forming an appropriate equation</p> <p>A1 dep on previous M1</p> <p>M1 for substituting their value for x into the expression NOT used to form the equation solved</p> <p>OR forms a second equation in x</p> <p>A1 dep on previous M1 NB : It must be clear which angles are being found</p> <p>B1 For full reasons: <u>Alternate angles</u> are equal and <u>angles</u> in a straight <u>line</u> add to <u>180°</u> OR <u>Allied angles</u> (or co-interior) add to <u>180°</u> and <u>angles</u> in a straight <u>line</u> add to <u>180°</u></p>

Question	Working	Answer	Mark	Notes
6	(a)	(6),2,(0),(0),(2),6	1	B1 For both entries correct
	(b)	(0,6), (1,2), (2,0), (3,0), (4,2), (5,6)		M1 for at least 5 points plotted correctly (ft their table)
		Correct curve	2	A1 for a correct curve
	(c)	$x^2 - 5x + 6 = x - 1$		M1 or for $y = x - 1$
		1.6 and 4.4	3	M1 for $y = x - 1$ drawn A1 dep on M2 ft from their graph in (b) if at least 1 mark scored in (b)
7	(a)	71 800 000	1	B1
	(b)	Eg $1.88 \times 10^7 + 3.10 \times 10^8 + 2.64 \times 10^8 + 7.18 \times 10^7$ or $18\,800\,000 + 310\,000\,000 + 264\,000\,000 + 71\,800\,000$ with at least 3 numbers correct		M1 for a complete method or for digits 6646
		6.646×10^8 oe	2	A1 for 6.646×10^8 oe eg 664 600 000
	(c)	9.88×10^6	1	B1

Question	Working	Answer	Mark	Notes
8	$\frac{1}{2} \times 5 \times h = 12$ oe or $\frac{1}{2} \times 2.5 \times h = 6$ oe or $h = 4.8$ $(x =) \sqrt{2.5^2 + 4.8^2}$ or $(x =) \sqrt{29.29}$ or 5.41(202...) $2 \times 5.41 + 5$	15.8	4	M1 NB: 4.8 may be seen on the diagram M1 ft the candidate's value for height for this mark (award of this mark does not depend on award of previous mark) M1 dep on previous M1 A1 for 15.8 – 15.83

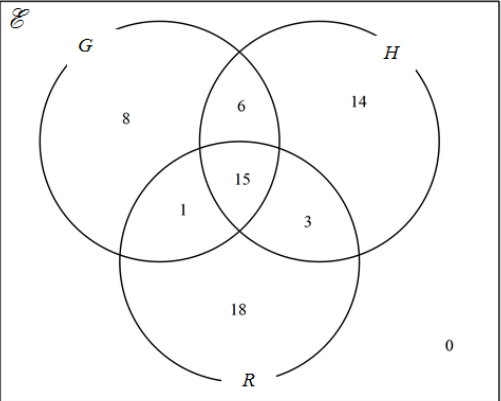
Question	Working	Answer	Mark	Notes
<p>9 (a)</p> <p>(b)</p> <p>(c)</p>	<p>15 and 45 indicated on the cumulative frequency axis and readings taken from speed axis</p>	<p>3, 19, 43, 53, 58, 60</p> <p>correct cf graph</p> <p>13 – 15</p>	<p>1</p> <p>2</p> <p>2</p>	<p>B1</p> <p>M1 ft from (a) if only one addition error for at least 4 points plotted correctly at end of interval or for all 6 points plotted consistently within each interval in the frequency table at the correct height (Eg. using values of 5, 15, 25 etc on x axis)</p> <p>A1 accept curve or line segments accept curve which is not joined to (0,0)</p> <p>M1 ft from a cf graph for a correct method to find LQ and UQ and intention to subtract Eg for a correct reading from 45/45.75 and 15/15.25 from vertical axis to find LQ and UQ and an intention to subtract</p> <p>A1 accept 13 – 15 ft from a cf graph</p>

Question	Working	Answer	Mark	Notes
<p>10</p>	<p>Working with CD and then triangle ABD</p> <p>E.g. $\tan 20 = \frac{CD}{13}$</p> <p>E.g. ($CD =$) $13 \tan 20$ or $4.7(316\dots)$</p> <p>E.g. $\tan(BAD) = \frac{8 + "4.73"}{13}$ or $\tan(BAD) = 0.97(93\dots)$</p> <p>E.g. ($BAD =$) $\tan^{-1}("0.979")$ or $44.4(024\dots)$</p>	<p>24.4</p>	<p>5</p>	<p>M1 for a correct statement or equation including CD as the only variable</p> <p>E.g. $CD^2 = \left(\frac{13}{\cos 20}\right)^2 - 13^2$</p> <p>M1 for a correct method to find CD</p> <p>E.g. $\sqrt{\left(\frac{13}{\cos 20}\right)^2 - 13^2}$</p> <p>M1 for a correct statement or equation including angle BAD as the only variable</p> <p>M1 for a correct method to find angle BAD</p> <p>A1 for 24.3 - 24.41</p> <p>Award M1A1M1M1A0 for an answer in the range 44.3 – 44.41</p>

Question	Working	Answer	Mark	Notes
10	<p>Alternative mark scheme – working with AC and then triangle ABC</p> <p>E.g. $\cos 20 = \frac{13}{AC}$</p> <p>E.g. $(AC =) \frac{13}{\cos 20}$ or 13.8(3...)</p> <p>E.g. $(AB =) \sqrt{13.8^2 + 8^2 - 2 \times 13.8 \times 8 \times \cos(110)}$ (=18.1(9..) or 18.2</p> <p>E.g. $\frac{\sin BAC}{8} = \frac{\sin 110}{18.1}$ or $8^2 = 13.8^2 + 18.1^2 - 2 \times 13.8 \times 18.1 \times \cos BAC$</p>	24.4	5	<p>M1 for a correct statement or equation including AC as the only variable E.g. $AC^2 = 13^2 + (13 \tan 20)^2$</p> <p>M1 for a correct method to find AC E.g. $\sqrt{13^2 + (13 \tan 20)^2}$</p> <p>M1 for a correct method to find AB</p> <p>M1 for a correct statement or equation including angle BAC as the only variable</p> <p>A1 for ans in range 24.3 - 24.41</p> <p>Award M4A0 for an answer in the range 44.3 – 44.41</p>

Question	Working	Answer	Mark	Notes
11	E.g. $\frac{10x}{6x} - \frac{3(x+2)}{6x}$ or $\frac{10x-3(x+2)}{6x}$ $\frac{10x-3x-6}{6x}$ or $\frac{7}{6x} - \frac{1}{x}$	$\frac{7x-6}{6x}$	3	M1 for two correct fractions with common denominator or a single correct fraction M1 for a correct single fraction with brackets expanded A1 for $\frac{7x-6}{6x}$ as the final answer SC: If no marks awarded then award B1 for an answer of $\frac{7x+6}{6x}$

Question	Working	Answer	Mark	Notes
<p>12 (a)</p>	$3 \times \frac{1}{3}x^2 - 9$	$x^2 - 9 \text{ oe}$	2	<p>M1 for $3 \times \frac{1}{3}x^2$ oe or -9 oe</p>
<p>(b)</p>		$-3 < x < 3 \text{ oe}$	3	<p>B3 may be seen as two separate inequalities</p> <p>if not B3 then award B2 for $x < 3$ or $x > -3$ or $-3 \leq x \leq 3$</p> <p>if not B2 then award B1 for $x^2 - 9 < 0$ or $x^2 < 9$ oe or for $(x-3)(x+3)$ or for $(x =) \pm 3$ (values maybe seen in incorrect inequalities)</p> <p>SC: If no marks awarded and M1 awarded in (a) then award B1 for “quadratic” < 0</p>

Question	Working	Answer	Mark	Notes
<p>13 (a)</p> <p>(b)</p>		<p>Correct Venn diagram</p> <p>$\frac{3}{18}$ oe</p>	<p>3</p> <p>2</p>	<p>M2 for at least 4 correct entries If not M2 then M1 for 2 or 3 correct entries</p> <p>NB: For the award of the method marks do not accept a blank outside the circles as 0</p> <p>A1 Accept omission of 0 for the award of full marks</p> <p>M1 ft from Venn diagram for $\frac{a}{"18"}$ where a is an integer and $1 \leq a < "18"$ or for $\frac{"3"}{b}$ where b is an integer and $b > "3"$</p> <p>A1 ft from Venn diagram</p>

Question	Working	Answer	Mark	Notes
<p>14 (a)</p> <p>(b)</p>	$T = kr^3$ $21.76 = k \times 4^3$ oe or $k = 0.34$	$T = 0.34r^3$ oe 73.44	 3 1	M1 Allow $r^3 = mT$ Do not allow $T = r^3$ M1 for correct substitution into a correct equation; implies first M1 Award M2 if $k = 0.34$ stated unambiguously ($m = 2.94$) Condone use of proportional sign in place of equals sign A1 Only award if T is the subject Award M2A1 if $T = kr^3$ on answer line and k given as 0.34oe in working space. B1ft for their value of k if $T = kr^3$

Question	Working	Answer	Mark	Notes
15	<p>Eg $\frac{4\pi r^2}{2} (+\pi r^2) = 2\pi(2r)h$ oe</p> <p>$h = \frac{3}{4}r$ or $r = \frac{4}{3}h$</p> <p>Eg $\frac{1}{2} \times \frac{4}{3} \times \pi \times r^3$ and $\pi \times (2r)^2 \times \frac{3}{4}r$"</p> <p>OR</p> <p>$\frac{1}{2} \times \frac{4}{3} \times \pi \times \left(\frac{4}{3}h\right)^3$ and $\pi \times \left(2 \times \frac{4}{3}h\right)^2 \times h$</p>	4.5 oe	4	<p>M1 for use of, for example, r and $2r$ in an equation condone omission of flat surface area</p> <p>A1 for a correct expression for either r or h</p> <p>M1 dep on award of first M1 ft for candidate's expression for r or h for correct expressions for volume of hemisphere and volume of cylinder ; both in terms of either r or h</p> <p>A1</p>

Question	Working	Answer	Mark	Notes
<p>16 (a)</p> <p>(b)</p>	<p>Eg $\frac{a + \sqrt{4b}}{a - \sqrt{4b}} \times \frac{a + \sqrt{4b}}{a + \sqrt{4b}}$ or $\frac{a + 2\sqrt{b}}{a - 2\sqrt{b}} \times \frac{a + 2\sqrt{b}}{a + 2\sqrt{b}}$ or</p> $\frac{(a + 2\sqrt{b})^2}{(a + 2\sqrt{b})(a - 2\sqrt{b})}$ <p>Eg $\frac{(a + \sqrt{4b})(a + \sqrt{4b})}{a^2 - 4b}$</p>	$\frac{a^2 + 4a\sqrt{b} + 4b}{a^2 - 4b}$ <p>2.5 oe</p>	<p>3</p> <p>1</p>	<p>M1 For multiplying the numerator and denominator by $a + \sqrt{4b}$ or $a + 2\sqrt{b}$</p> <p>M1 dep on M1 for correctly simplified denominator</p> <p>A1 for $\frac{a^2 + 4a\sqrt{b} + 4b}{a^2 - 4b}$ or $\frac{(a + 2\sqrt{b})^2}{a^2 - 4b}$</p> <p>B1</p>

Question	Working	Answer	Mark	Notes
17	$(AC^2 =) 4.1^2 + 5.3^2 - 2 \times 4.1 \times 5.3 \times \cos(110)$ $(AC =) \sqrt{16.81 + 28.09 + 14.8(641\dots)}$ or $\sqrt{59.7(641\dots)}$ or 7.7(3073) or $AC^2 = 59.7\dots$ Eg $\frac{\sin x}{5.3} = \frac{\sin 110}{"7.7"}$ or $\frac{5.3}{\sin x} = \frac{"7.7"}{\sin 110}$ or $5.3^2 = 4.1^2 + "7.7"{}^2 - 2 \times 4.1 \times "7.7" \times \cos x$ oe Eg $\sin x = \frac{\sin 110}{"7.7"} \times 5.3 (= 0.644(2\dots))$ or $\cos x = \frac{4.1^2 + "7.7"{}^2 - 5.3^2}{2 \times 4.1 \times "7.7"} (= 0.764(83\dots))$	40.1	5	M1 for the correct use of Cosine rule to find AC M1 NB: there must be evidence of correct order of operations for this mark to be awarded M1 dep on first M1 for correct use of sine rule or cosine rule ft for their value of AC or AC^2 M1 for isolating $\sin x$ or $\cos x$ A1 for 40.1 – 40.11

Question	Working	Answer	Mark	Notes
18 (a)		Parabola through $(-4, 5), (-2, 0), (0, -3), (2, -4), (4, -3), (6, 0), (8, 5)$		B2 For a parabola with minimum $(2, -4)$ through at least 5 of $(-4, 5), (-2, 0), (0, -3), (4, -3), (6, 0), (8, 5)$ If not B2 then B1 For u-shaped parabola with minimum $(2, -4)$ or For u-shaped parabola through $(-2, 0), (6, 0)$ or For u-shaped parabola through $(-4, 5), (8, 5)$
(b)		3	2 1	B1

Question	Working	Answer	Mark	Notes	
19 (a) (b)	$(x+3)^2 - 3^2$ or $(x+3)^2 - 9$ or $(y+3)^2 - 3^2$ or $(y+3)^2 - 9$ $y+9 = (x+3)^2$ or $x+9 = (y+3)^2$ $\sqrt{y+9} = x+3$ or $\sqrt{x+9} = y+3$	$y \geq -3$ $-3 + \sqrt{x+9}$	1 4	B1 M1 M1 M1 A1	Accept $g^{-1}(x) \geq -3$ for completing the square oe M3A0 for $-3 + \sqrt{y+9}$ and for $-3 \pm \sqrt{x+9}$

Question	Working	Answer	Mark	Notes
20	$\frac{n-4}{n} \text{ or } \frac{n-5}{n-1}$ $\frac{n-4}{n} \times \frac{n-5}{n-1} = \frac{1}{3}$ <p>Eg $3(n^2 - 9n + 20) = n(n-1)$ or $3n^2 - 27n + 60 = n^2 - n$</p> <p>Eg $2n^2 - 26n + 60 = 0$ or $n^2 - 13n + 30 = 0$</p> <p>Eg $(n-10)(n-3) = 0$ or $\frac{- -13 \pm \sqrt{(-13)^2 - 4 \times 1 \times 30}}{2 \times 1}$</p>	10	6	<p>M1 $\frac{n-4}{n}$ or $\frac{n-5}{n-1}$</p> <p>M1 for the correct equation</p> <p>M1 for a correct quadratic equation with fractions removed</p> <p>M1 for a correct quadratic equation equal to 0</p> <p>M1 dep on M2 ft for method to solve 3 term quadratic</p> <p>A1 for correct answer from correct working</p> <p>NB. Award M5A1 for an answer of 10 with justification e.g. $\frac{6}{10} \times \frac{5}{9} = \frac{1}{3}$</p> <p>Award M0A0 for an answer of 10 with no working and no justification</p>

Question	Working	Answer	Mark	Notes
	Mark scheme 1 (see next page for alternative mark scheme)			
21	$(8x + 2) - (2x + 23) (= 6x - 21)$ or $(2x + 23) - (8x + 2) (= -6x + 21)$ or $(20x - 52) - (8x + 2) (= 12x - 54)$ or $(8x + 2) - (20x - 52) (= -12x + 54)$ $(8x + 2) - (2x + 23) = (20x - 52) - (8x + 2)$ oe or $(2x + 23) - (8x + 2) = (8x + 2) - (20x - 52)$ oe $x = 5.5$ Eg $2 \times 5.5 + 23 (=34)$ and $8 \times 5.5 + 2 (=46)$ OR $8 \times 5.5 + 2 (=46)$ and $20 \times 5.5 - 52 (=58)$	shown	4	M1 for a correct expression for the common difference in terms of x brackets must be present or removed correctly M1 for a correct equation A1 A1 for 12 from correct working

Question	Working	Answer	Mark	Notes
21	<p>Alternative method – starts by assuming $d = 12$ E.g. $(2x + 23) + 12 = (8x + 2)$ or $(8x + 2) + 12 = (20x - 52)$ or $(2x + 23) - 12 = (8x + 2)$ or $(8x + 2) - 12 = (20x - 52)$ or $(2x + 23) + (8x + 2) + (20x - 52) = \frac{3}{2}(2(2x + 23) + 2 \times 12)$</p> <p>$x = 5.5$ or $x = 1.5$ from $(2x + 23) - 12 = (8x + 2)$ or $x = 3.5$ from $(8x + 2) - 12 = (20x - 52)$ $2 \times 5.5 + 23 (=34)$ and $8 \times 5.5 + 2 (=46)$ and $20 \times 5.5 - 52 (=58)$</p> <p>OR $2x + 23 + 12 = (8x + 2)$ and $(8x + 2) + 12 = (20x - 52)$ and gets $x = 5.5$ both times</p>	shown	4	<p>M2 for a correct equation If not M2 then award M1 for a correct expression for the common difference in terms of x brackets must be present or removed correctly e.g $(8x + 2) - (2x + 23) (= 6x - 21)$ or $(20x - 52) - (8x + 2) (= 12x - 54)$</p> <p>A1</p> <p>A1 for explicitly showing both common differences are 12</p> <p>OR solves both $(2x + 23) + 12 = (8x + 2)$ and $(8x + 2) + 12 = (20x - 52)$ and gets $x = 5.5$ both times</p>