AQA

GCSE
MATHEMATICS
8300/3H

Higher Tier Paper 3 Calculator

Mark scheme

Shadow paper based on November 2024

Version: 1.0 Final

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

Further copies of this mark scheme are available from aqa.org.uk

Glossary for Mark Schemes

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

M	Method marks are awarded for a correct method which could lead to a correct answer.
A	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
B	Marks awarded independent of method.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
M dep	A method mark dependent on a previous method mark being awarded.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
oe	Or equivalent. Accept answers that are equivalent. eg accept 0.5 as well as $\frac{1}{2}$
[a, b]	Accept values between a and b inclusive.
[a, b)	Accept values a $\leqslant$ value $<$ b
3.14 …	Accept answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles.

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Continental notation

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Q	Answer	Mark	Comments
1	0.2	B2	B1 $\dfrac{3}{15}$ or $\dfrac{1}{15/3}$ or $\left(\dfrac{15}{3}\right)^{-1}$ or $\dfrac{1}{5}$ or -0.2
	Additional Guidance		
	$-\dfrac{3}{15}$		B0

Q	Answer	Mark	Comments
	Plots at least 2 points correctly	M1	$\pm\frac{1}{2}$ square
	Fully correct with all points joined by single straight lines	A1	$\pm\frac{1}{2}$ square
	Additional Guidance		
2(a)	Mark intention		
	Ignore other points plotted and any lines of best fit		
	Points may be implied by the position of the line		
			M1A1

Q	Answer	Mark	Comments
	[340, 500]	B1	
2(b)	**Additional Guidance**		
	An interval given entirely in range eg 425 – 440		B1
	An interval given not entirely in range eg 320 – 430		B0

Q	Answer	Mark	Comments
3(a)	Circle with diameter 5 cm	B2	diameter $\pm$ 5 mm B1 for any circle or 50 ÷ 10 or 5 or (radius =) 2.5
	Additional Guidance		
	   Can be anywhere on the grid		B2
	Mark intention		
	Check stem and part (b) for evidence of 5 or 2.5		
	5 or 2.5 cannot be implied from a diagram for B1		

Q	Answer	Mark	Comments
	Rectangle with horizontal sides 5 cm and vertical sides 6.5 cm	B2	± 2 mm B1 for any rectangle or 50 ÷ 10 or 5 **and** 65 ÷ 10 or 6.5 SC2 for correct answers in (a) and (b) reversed (award 0 in (a) and 2 in (b))
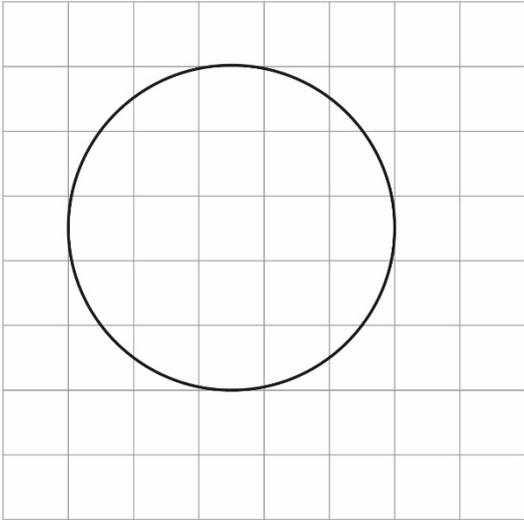
	Additional Guidance	
3(b)		B2
	Can be anywhere on the grid	
	Mark intention	
	Do not accept curved corners on any rectangle	
	Check stem and part (a) for evidence of 5 and 6.5	
	5 and 6.5 cannot be implied from a diagram for B1	
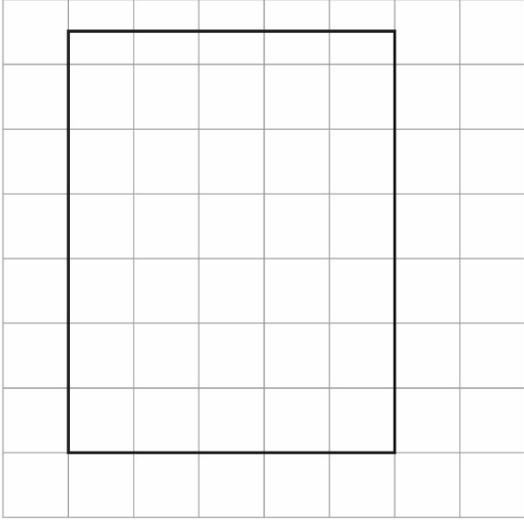
Q	Answer	Mark	Comments
	Alternative method 1: Compares lower bound with cost of 5 ice creams.		
	13 − 0.5(0) or 12.5(0)	M1	oe eg 1300 − 50 allow mixed units eg 13 − 50
	2.45 × 5 or 12.25	M1	oe eg 245 × 5
	12.5(0) and 12.25	A1	oe eg 1250 and 1225 units must be consistent
	Alternative method 2: Compares rounded cost of ice creams with 12		
	2.45 × 5 or 12.25	M1	oe eg 245 × 5
	12.25 rounds to 12	M1dep	oe eg 12.25 → 12
	12.25 rounds to 12 and 12 is less than 13	A1	oe units must be consistent
4	**Alternative method 3: Uses lower bound to work out cost or number of ice creams**		
	13 − 0.5(0) or 12.5(0)	M1	oe eg 1300 − 50 allow mixed units eg 13 − 50
	their 12.5(0) ÷ 5 or 2.5(0) or their 12.5(0) ÷ 2.45 or 5.1(…)	M1	oe eg 1250 ÷ 5 or 250 their 12.5(0) must be [12, 12.99]
	12.5(0) ÷ 5 and 2.5(0) or 12.5(0) ÷ 2.45 and 5.1(…)	A1	oe eg 1250 ÷ 5 and 250 units must be consistent
	Additional Guidance		
	Ignore any use of upper bound		
	Condone inconsistent notation eg 12.50 and £12.25p		M1M1A1
	12.25 rounds to 12 not 13 so she will have enough		M1M1A1
	12.25 rounds to 12 so she will have enough		M1M1A0

.Q	Answer	Mark	Comments
5	$17h + 20$ or $17 \times h + 20$	B2	oe B1 $17h$ or $h17$ or $1700h + 2000$ or $kh + 20$ with k an integer, k $\neq$ 0 or 17

Additional Guidance	
Ignore any attempt to substitute a value for h after $17h$ seen for B1	
Condone $h17 + 20$ (not testing simplification)	B2
Accept use of another letter for h other than c eg1 $17x + 20$ eg2 $17c + 20$	B2 B0
Condone inclusion of £ sign for B1 eg1 £$17h + 20$ eg2 £$17h$	B1 B1

Q	Answer	Mark	Comments
	Alternative method 1: Cost of six shirts		
	17.5(0) × 3 or 52.5(0)	M1	oe shop A
	12(.00) × 0.2 or 2.4(0) or 1 − 0.2 or 0.8	M1	oe shop B implied by 9.6(0)
	(12.(00) − their 2.4(0)) × 6 or 12(.00) × their 0.8 × 6 or 9.6(0) × 6 or 57.6(0)	M1dep	oe shop B dep on 2nd M
	36.8(0) × 1.5 or 55.2(0)	M1	oe shop C
	A and 52.5(0) and 57.6(0) and 55.2(0)	A1	
6	**Alternative method 2: Cost per shirt**		
	17.5(0) ÷ 2 or 8.75	M1	oe shop A
	12(.00) × 0.2 or 2.4(0) or 1 − 0.2 or 0.8	M1	oe shop B implied by 9.3(0)
	12(.00) − their 2.4(0) or 12(.00) × their 0.8 or 9.6(0)	M1dep	oe shop B dep on 2nd M
	36.8 (0) × 1.5 ÷ 6 or 9.2(0)	M1	oe shop C
	A and 8.75 and 9.6(0) and 9.2(0)	A1	

Additional Guidance is on the next page

	Additional Guidance	
6 cont	Use the scheme which favours the student	
	Comparable costs for different quantities of shirts	

Shop	Cost of 1	Cost of 2	Cost of 3	Cost of 6
A	8.75	17.5(0)	26.25	52.5(0)
B	9.6(0)	19.2(0)	28.8(0)	57.6(0)
C	9.2(0)	18.4(0)	27.6(0)	55.2(0)

Q	Answer	Mark	Comments
7(a)	124 ÷ 6.2 or 20	M1	oe implied by 18
	124 ÷ (their 20 − 2) or 124 ÷ 18 or [6.8, 6.9]	M1dep	oe
	[6.8, 6.9] : 1 or 7 : 1 with M2 awarded	A1	oe eg $\dfrac{62}{9}$: 1
	Additional Guidance		
	M1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Do not allow misreads for 6.2		

Q	Answer	Mark	Comments
7(b)	Valid explanation	B1	eg he needs to round up

Additional Guidance	
He rounded down	B1
Needs 6 (adults)	B1
Need (one) more	B1
Only 20 children could go	B1
1 child does not have an adult	B1
There are children without an adult	B1
Have groups of 5 with 5 adults	B0
6	B0
Cannot have 0.25 of a teacher	B0

Q	Answer	Mark	Comments
8	(2, −2) and (2, 5) and (−5, 5)	B4	B3 for 2 correct coordinates or the 3 correct lines drawn B2 for 1 correct coordinate or 2 correct lines drawn B1 for 1 correct line drawn

Additional Guidance	
Mark coordinates first	
Ignore incorrect lines	

Q	Answer	Mark	Comments
9	Two numbers which are 2 more than a multiple of 12 eg 14, 26, 38, 50, 62 …	B2	B1 at least one number which is 2 more than a multiple of 12 with at most one other number or lists (2, 4, 6, 8 …and) 5, 8, 11, 14 … and 6, 10, 14, 18 …

	Additional Guidance	
If the answer line is blank: award B2 if two or more correct numbers and no incorrect numbers are clearly chosen award B1 if one or more correct number(s) and one incorrect number are clearly chosen		

Q	Answer	Mark	Comments
10	At least one of 22, 16.5 and 11	M1	may be seen in table or implied by correct point or curve passing through the correct point
	Points plotted at (1, 66), (2, 33), (3, their 22), (4, their 16.5), (5, 13.2) and (6, their 11)	M1	$\pm\dfrac{1}{2}$ square implied by curve through these six points
	Single smooth curve through the correct points	A1	

	Additional Guidance	
Ignore curve before $x = 1$ and after $x = 6$ if it is decreasing and does not touch either axis		
Curve touches at least one axis		A0

Q	Answer	Mark	Comments
11	$2y(5 + y^2)$	B2	B1 $2(5y + y^3)$ or $y(10 + 2y^2)$

<table>
<tr><td colspan="3" align="center">Additional Guidance</td></tr>
<tr><td colspan="2">Ignore any "solutions" seen</td><td></td></tr>
<tr><td colspan="2">Ignore any attempts to complete the square with the final answer</td><td></td></tr>
<tr><td colspan="2">Condone $2y \times (5 + y^2)$</td><td>B2</td></tr>
<tr><td colspan="2">Condone $2y(5 + 1y^2)$</td><td>B2</td></tr>
<tr><td colspan="2">Condone $2 \times (5y + y^3)$</td><td>B1</td></tr>
<tr><td colspan="2">$(2y + 0)(5 + y^2)$</td><td>B1</td></tr>
<tr><td colspan="2">Do not ignore further incorrect algebraic simplification for B2</td><td></td></tr>
</table>

Q	Answer	Mark	Comments
12	Multiplication by 0.986 or multiplication by 1.01	M1	oe eg multiplication by 0.014 followed by subtraction implied by 67 442 400 or multiplication by 0.01 followed by addition implied by 69 084 000
	$68\,400\,000 \times 0.986^5$ or 63 744 200(.21) or $68\,400\,000 \times 1.01^3$ or 70 472 588(.4) or $68\,400\,000 \times 0.986^5 \times 1.01^3$	M1dep	oe
	65 675 713(.22)	A1	
	65 700 000 or 65.7 million or 6.57×10^7 or 65.7×10^6	B1ft	ft any answer with >3sf correctly rounded to 3sf
	Additional Guidance		
	$68\,400\,000 \times 0.986 \times 5 \times 1.01 \times 3 = 1\,021\,752\,360$ Answer 1 020 000 000	M1M0A0 B1ft	

Q	Answer	Mark	Comments
	Alternative method 1		
	$4 \times 3 \ (\div 2)$ or $12 \ (\div 2)$ or 6 or correct list of all possible combinations or all possible qualifying combinations 5,10 5,20 (5,50) 10,5 (10,20) (10,50) 20,5 (20,10) (20,50) (50,5) (50,10) (50,20) or 5,10 5,20 (5,50) (10,20) (10,50) (20,50)	M1	number of possible combinations may be implied by the correct total for each combination
	$\dfrac{2}{6}$ or $\dfrac{4}{12}$	A1	oe fraction, decimal or percentage with M1 awarded
	Alternative method 2		
13	$\dfrac{1}{4} \times \dfrac{1}{3}$ or $\dfrac{1}{12}$ and $\dfrac{1}{4} \times \dfrac{2}{3} \ (\times 2)$ or $\dfrac{2}{12} \ (\times 2)$ or $\dfrac{4}{12}$ and $\dfrac{1}{4} \ (\times 1)$ or $\dfrac{3}{12}$	M1	picking £5 first picking £10 first or £20 first picking £50 first oe probabilities
	$\dfrac{2}{6}$ or $\dfrac{4}{12}$	A1	oe fraction, decimal or percentage with M1 awarded
	Additional Guidance		
	Decimals or percentages should be rounded or truncated to 2dp or better		
	In Alt 1, combinations may be seen in a grid, table or other diagram		
	In Alt 1, do not accept repeat combinations or incorrect combinations for M1		

Q	Answer	Mark	Comments
14(a)	0.6(0) (Pass) and 0.4(0) (Fail) for Section A	B1	oe fractions, decimals or percentages
	0.22 (Fail) on top branch for Section B and 0.65 (Pass) and 0.35(Fail) on bottom branches for Section B	B1	oe fractions, decimals or percentages

Q	Answer	Mark	Comments
	Alternative method 1		
14(b)	their 0.6 × 0.78 or 0.468 or their 0.6 × their 0.22 or 0.132 or their 0.4 × their 0.65 or 0.26 or their 0.4 × their 0.35 or 0.14	M1	oe ft their tree diagram provided all probabilities are > 0 and < 1
	1 − their 0.468 or their 0.132 + their 0.26 + their 0.14 or their 0.132 + 0.4 or 0.532	M1dep	oe their 0.468 their 0.132, their 0.26 and their 0.14 must be from correct methods
	their 0.532 × 0.7 or 0.3724 or their 0.532 × 5000 or 2660	M1dep	oe fraction, decimal or percentage dep on M2
	1862	A1ft	ft their tree diagram provided all probabilities are > 0 and < 1

Mark scheme continues on the next page

Q	Answer	Mark	Comments
14(b) cont	**Alternative method 2**		
	their 0.6(0) × 0.78 × 5000 or 2340 or their 0.6(0) × their 0.22 × 5000 or 660 or their 0.4(0) × their 0.65 × 5000 or 1300 or their 0.4(0) × their 0.35 × 5000 or 700 or their 0.4(0) × 5000 or 2000	M2	M1 their 0.6 × 5000 or 3000 implied by 462 implied by 910 implied by 490 ft their tree diagram provided all probabilities are > 0 and < 1
	5000 − their 2340 or their 660 + their 1300 + their 700 or their 660 + their 2000 or 2660 or 462 and 910 and 490	M1dep	dep on M2
	1862	A1ft	ft their tree diagram provided all probabilities are > 0 and < 1
	Additional Guidance		
	Working for part (b) may be seen in part (a)		

Q	Answer	Mark	Comments
15	All 3 correct matches	B3	B1 for each correct match
	Additional Guidance		
			B3
	Equation matched to more than one statement is choice for that equation		

Q	Answer	Mark	Comments
16	$\sqrt{y} = \dfrac{x}{2} + 3$	M1	
	$\sqrt{y} - 3 = \dfrac{x}{2}$ or $3 - \sqrt{y} = -\dfrac{x}{2}$ or $2\sqrt{y} = x + 6$ or $2\sqrt{y} - 6$ or $2(\sqrt{y} - 3)$	M1dep	
	$x = 2\sqrt{y} - 6$ or $x = 2(\sqrt{y} - 3)$	A1	

Additional Guidance	
$x = 2\sqrt{y} - 6$ in working with $2\sqrt{y} - 6$ on answer line	M1M1A1

Q	Answer	Mark	Comments
17	**Alternative method 1**		
	$d \propto t^2$ or $d = kt^2$ or $25 = k \times 2^2$ or $k = 25 \div 4$	M1	oe equation
	$d = 6.25t^2$ or $k = 6.25$	M1dep	oe equation
	$(t =)\sqrt{325 \div \text{their } 6.25}$ or $(t =)\sqrt{52}$	M1dep	oe eg $(t =)2\sqrt{13}$ dep on M2
	$7.2(\ldots)$	A1	
	Alternative method 2		
	$d \propto t^2$ or $kd = t^2$ or $k \times 25 = 2^2$ or $k = 4 \div 25$	M1	oe equation
	$0.16d = t^2$ or $k = 0.16$	M1dep	oe equation
	$(t =)\sqrt{\text{their } 0.16 \times 325}$ or $(t =)\sqrt{52}$	M1dep	oe eg $(t =)2\sqrt{13}$ dep on M2
	$7.2(\ldots)$	A1	
	Additional Guidance		
	Allow consistent use of other letters		
	$d \propto kt^2$ is M0 unless recovered		

Q	Answer	Mark	Comments
18	$10 \div 5$ or 2 or $18 \div 15$ or 1.2 or $8 \div 10$ or 0.8 or $14 \div 20$ or 0.7	M1	one correct frequency density implied by a correct bar
	At least 3 of 2 and 1.2 and 0.8 and 0.7	M1dep	
	At least 3 correct bars with correct linear scale on the vertical axis	M1dep	dep on M2
	Fully correct histogram with linear scale on the vertical axis	A1	

Q	Answer	Mark	Comments
19	$\dfrac{x}{\sin 117} = \dfrac{44}{\sin 35}$	M1	oe equation accept [0.57, 0.574] for sin 35 accept [0.89, 0.8911] for sin 117
	$(x =) \dfrac{44\sin 117}{\sin 35}$	M1dep	oe accept [0.57, 0.574] for sin 35 accept [0.89, 0.8911] for sin 117
	[68.3, 68.4] and correct sine rule equation seen	A1	accept 68 with M2 awarded

Q	Answer	Mark	Comments
20	$(2x + 5)(x + 3)$	B2	B1 $(2x + a)(x + b)$ where $a + 2b = 11$ or $ab = 15$
	Additional Guidance		
	B1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	Condone missing final bracket for B2 or B1		
	Ignore any attempt to 'solve' eg $(2x + 5)(x + 3)$ in working lines with $-\dfrac{5}{2}$ and –3 on answer line		B2
	Allow use of fractions or decimals for B1 eg $(2x + 2.5)(x + 6)$		B1

Q	Answer	Mark	Comments
21	$\dfrac{13}{32}$ or $\dfrac{7}{32}$	M1	oe eg 0.406(…) or [0.218, 0.219] may be seen on a diagram or embedded in a calculation
	$\dfrac{13}{32} \times \dfrac{7}{31}$ (× 2) or $\dfrac{7}{32} \times \dfrac{13}{31}$ (× 2) or $\dfrac{91}{992}$ (× 2)	M1dep	oe eg 0.09(17…) (× 2)
	$\dfrac{91}{496}$ or $\dfrac{15}{92}$ or 0.183(…)	A1	oe fraction, decimal or percentage accept 0.18 with M2 awarded
	Additional Guidance		
	Ignore incorrect conversion if correct answer seen		
	A correct embedded value seen eg $\dfrac{12}{32} \times \dfrac{13}{31} \times \dfrac{7}{30}$ or $\dfrac{12}{32} \times \dfrac{7}{31} \times \dfrac{13}{30}$		M1M0A0
	$\dfrac{13}{32} \times \dfrac{7}{31} \times \dfrac{7}{32} \times \dfrac{13}{31}$		M1M0A0

Q	Answer	Mark	Comments
22	5265 ÷ 4.05 or 1300 or 17.2 × 4.05 or 69.66	M1	oe cost per cubic centimetre
	their 1300 ÷ 17.2 or 5265 ÷ their 69.66 or 75.58(….)	M1dep	mass ÷ density total cost ÷ cost per cubic centimetre
	$(r^3 =)$ their 75.58(…) $\times \dfrac{3}{4} \div \pi$ or [18.04, 18.06]	M1dep	oe dep on M2
	[2.6, 2.63]	A1	

Q	Answer	Mark	Comments
23	Constructs any equation using coordinates	M1	eg $4 = a \times b^0$ or $4 = a \times 1$ $8 = a \times b^1$ $16 = a \times b^2$ $32 = a \times b^3$
	$a = 4$ and $b = 2$	A2	A1 $a = 4$
	Additional Guidance		
	M1 may be awarded for correct work, with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$a = 4$ with no working		M1A1
	$b = 2$ with no working and $a \neq 4$		M0A0

Q	Answer	Mark	Comments
	Alternative method 1		
	$x^2 + 5x - 6 = 3x + 2$	M1	
	$x^2 + 2x - 8 \ (= 0)$	A1	
	$(x + 4)(x - 2) \ (= 0)$ or $(x =) \dfrac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -8}}{2 \times 1}$ or $(x + 1)^2 - 9 \ (= 0)$	M1	oe correct for their 3-term quadratic in the form $ax^2 + bx + c \ (= 0)$ if the quadratic formula is used with $+$ and $-$ separately, both must be seen correctly for this mark
24	$(x =) -4$ and $(x =) \ 2$	A1	
	$(-4, -10)$ and $(2, 8)$	A1	SC1 for 1 correct coordinate
	Alternative method 2		
	$y = \left(\dfrac{y - 2}{3}\right)^2 + 5\left(\dfrac{y - 2}{3}\right) - 6$	M1	
	$y^2 + 2y - 80 \ (= 0)$	A1	
	$(y + 10)(y - 8) \ (= 0)$ or $(y =) \dfrac{-2 \pm \sqrt{2^2 - 4 \times 1 \times -80}}{2 \times 1}$ or $(y + 1)^2 - 81 \ (= 0)$	M1	oe correct for their 3-term quadratic in the form $ay^2 + by + c \ (= 0)$ if the quadratic formula is used with $+$ and $-$ separately, both must be seen correctly for this mark
	$(y =) -10$ and $(y =) \ 8$	A1	
	$(-4, -10)$ and $(2, 8)$	A1	SC1 for 1 correct coordinate
	Additional Guidance		
	Trial and improvement may be awarded SC1 for one correct coordinate or full marks if both coordinates are correct		