



**General Certificate of Secondary Education
June 2011**

Mathematics (Linear)

43061H

(Specification 4306)

Paper 1: Higher Tier

Mark Scheme

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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.

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.
Q	Marks awarded for quality of written communication. (QWC)
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.
ft	Follow through marks. Marks awarded following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
oe	Or equivalent. Accept answers that are equivalent. eg, accept 0.5 as well as $\frac{1}{2}$

Higher Tier: Paper 1

Q	Answer	Mark	Comments
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1	$\frac{1}{2} \times (10 + 8) \times 7$	M1	$10 \times 7 - \frac{1}{2} \times 2 \times 7$ or $8 \times 7 + \frac{1}{2} \times 2 \times 7$ or $\frac{1}{2} \times 8 \times 7 + \frac{1}{2} \times 10 \times 7$
	63	A1	

2 (a)	$c^2 - 3c$	B2	B1 for c^2 and B1 for $-3c$ Do not ignore further working
2 (b)	$3(d + 4)$	B1	Allow $3(4 + d)$, $3(1d + 4)$, $3(4 + 1d)$

3 (a)	$+7 \quad \times 5$	B1	Correct order
3 (b)	$\times 5 \quad + 7$ $\times 5 \quad - 7$ $+ 7 \quad \times -5$ $+ 7 \quad - 7$ $- 7 \quad + 7$ $- 7 \quad \times 5$	B1	Ignore output
3 (c)	$\times 5 \quad \times -5 \quad (= 75)$ $\times -5 \quad \times 5 \quad (= 75)$	B2	B1 for $-7 \quad \times -5 \quad (= 50)$ Ignore output SC1 for output 75 and other boxes blank

Q	Answer	Mark	Comments
4 (a)	Correct and ordered $\begin{array}{c c} 17 & 7\ 9 \\ 18 & 1\ 4\ 6\ 6\ 7\ 8 \\ 19 & 0\ 4 \end{array}$	B2	One or two errors or omissions B1 or Correct but not ordered B1
	Correct key eg $17 \mid 9 = 179\text{ cm}$	B1	Stem must be 17, 18 or 19
4 (b)	186	B1	
4 (c)	Two 186s in 5 th and 6 th places 186 is now the 6 th out of 11	B1	oe Any reference to two 186s

5	Any two of 10, 6 or 4 (or 2 ²)	M1	
	$60 \div 4$ or 2.5×6 or 10×1.5	M1	
	15	A1	Accept $\frac{15}{1}$

6 (a)	Sight of 1200	B1	oe eg $800 + 400$
	24×350	M1	
	8400	A1	oe eg $7000 + 1400$ or $7200 + 1200$
6 (b)	$\frac{1600}{8000} \times 100$	M1	oe
	20	A1	

Q	Answer	Mark	Comments
7 (a)	$x + 4 = 14 - x$ or $x + 4 = 2x - 1$ or $14 - x = 2x - 1$	M1	
	$x + x = 14 - 4$ or $4 + 1 = 2x - x$ or $14 + 1 = 2x + x$	M1	
	$(x =) 5$	A1	
7 (b)	27	B1ft	

8 (a)	Triangle at (0, 2), (0, 5), (-2, 5)	B3	<p>B2 for 90° clockwise rotation about (0,1)</p> <p>B2 for 90° anti-clockwise about any centre other than (0,1)</p> <p>B1 for 90° clockwise about any centre other than (0,1)</p> <p>B1 for 180° rotation about (0,1)</p> <p>Deduct 1 mark if triangle not drawn</p> <p>B1 for 2 vertices correct with or without triangle</p>
8 (b)	Reflection	B1	
	$y = -x$	B1	oe eg $x + y = 0$

9 (a)	m^{10}	B1	
9 (b)	h^8	B1	

Q	Answer	Mark	Comments
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10	$120 \div 3 \times 4$ or 160	M1	or $120 \div 3 \times 7$ or 280
	$500 - 120 - \text{their } 160 (= 220)$	M1	or $500 - 280 (= 220)$
	220 and 160 seen	A1	
	11 : 8	A1ft	Ratio the correct way round and in its simplest form (two integers) ft their ratio only if it can be simplified

11	$\pi \times 20 \div 2$ or $3.14 \times 20 \div 2$ or 31.4	M1	oe
	their $31.4 + 20$ or 51.4 or 21.4	M1	May be in terms of π $10\pi + 20$
	their $(51.4 - 30) \div 2$	M1	oe May be in terms of π $\frac{10\pi - 10}{2}$
	10.7	A1	

12	Reference to number of trials	B1	Must indicate 'lots' or state a number ≥ 30
	Table of results	B1	or other valid method of displaying outcomes
	Calculating the theoretical probabilities	B1	oe approx the same frequency for each number
	Comparing the experimental probabilities with the theoretical	B1	oe comparing actual totals with theoretical totals

Q	Answer	Mark	Comments
13 (a)	$\frac{w}{6} = 2 - 5$ or $\frac{w}{6} = -3$ or $30 + w = 12$	M1	
	- 18	A1	SC1 for ($w =$) 18
13 (b)	$y - 7 = 3x$	M1	oe eg $-3x = 7 - y$ $\frac{y}{3} = x + \frac{7}{3}$
	$\frac{y - 7}{3} = x$	A1	Must see $x = \dots$ otherwise M1 max. oe eg $x = \frac{7 - y}{-3}$ $\frac{y}{3} - \frac{7}{3} = x$
13 (c)	- 3, - 2, - 1, 0, 1, 2, 3	B2	B1 for one extra or one omission B1 for $-4 < n \leq 3$ B1 for -3 to 3 or 3 to -3

14 (a)	Median 33.5 to 34.5 inclusive	B1	
	LQ from 22.5 to 23.5 inclusive and UQ from 41.5 to 42.5 inclusive	B1	
	Whiskers at 7 and 58	B1	
14 (b)	7	B1	
14 (c)	cf diagram because you can find 45 on the horizontal axis and read off the corresponding number of people on the vertical axis	B1	Any reference to the fact that the cf graph enables you to count the people or The box plot gives no detail apart from information about the median, quartiles and max and min values (mention of one of these is sufficient)

Q	Answer	Mark	Comments
15	Substitution method		Elimination method
	$3(y + 3) - 2y = 5$ or $3x - 2(x - 3) = 5$	M1	$3x - 2y = 5$ and, either $3x - 3y = 9$ or $2x - 2y = 6$ or equivalent equations suitable for elimination Allow one error at this stage
	$3y - 2y = 5 - 9$ or $3x - 2x = 5 - 6$ Allow one error in the simplification ... must collect variables on one side and numbers on the other	M1	$-2y - (-3y) = 5 - 9$ or $3x - 2x = 5 - 6$ For correct elimination from their equations if 1 st M1 earned
	$y = -4$ and $x = -1$	A1	SC1 for both answers correct with no working shown or from trial and improvement
16	Scale Factor 1.5 or $\frac{2}{3}$ or $\frac{3}{4}$ or $\frac{4}{3}$ seen or $\frac{x}{8} = \frac{9}{12}$ or $\frac{x}{9} = \frac{8}{12}$	M1	oe Accept equivalent ratios (need not be simplified)
	6 (cm)	A1	May be on diagram Use of 3 cm for shortest side of 'L' shape
	9×12 – their 6×8	M1	oe their $3 \times 8 + 4 \times 9$ or their $3 \times 12 + 4 \times 6$
	60	A1	
	cm ²	B1	units mark

Q	Answer	Mark	Comments
16 Alt	Scale Factor	M1	oe Accept equivalent ratios (need not be simplified)
	1.5 or $\frac{2}{3}$ seen		
	$\frac{5}{9}$ or $(1.5)^2$ or $(\frac{2}{3})^2$ seen	A1	oe Accept equivalent ratios (need not be simplified)
	$9 \times 12 - 9 \times 12 \times (\frac{2}{3})^2$ or $9 \times 12 \times \frac{5}{9}$ or 108 – their 48	M1	oe
	60	A1	
	cm ²	B1	units mark
17 (a)	0.5×10^3 or 500 or $\frac{30\,000\,000}{60\,000}$	M1	oe eg $\frac{3 \times 10\,000\,000}{6 \times 10\,000}$
	5×10^2	A1	
17 (b)	16×10^6 or 16 000 000	M1	oe eg $16 \times 1\,000\,000$
	1.6×10^7	A1	
18 (a)	1	B1	
18 (b)	$\frac{1}{16}$	B1	oe eg 0.0625
19	(AC =) 4×0.6 or 2.4	M1	May be on diagram
	$\frac{\text{their } 2.4}{AD} = \frac{1}{3}$	M1dep	oe
	7.2	A1	

Q	Answer	Mark	Comments
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20 (a)	$(2n + 3)(2n + 1)$	B2	B1 for $(4n + 3)(n + 1)$ or $(4n + 1)(n + 3)$ SC1 for $(4n + 6)(n + 0.5)$ or $(4n + 2)(n + 1.5)$
20 (b)	When $n = 10$ LHS = 483, RHS = 23×21	M1	$483 = 3 \times 161$ or 7×69 or 23×21 oe or seen on factor tree
	$23 \times 3 \times 7$	A1	SC1 for two of the three factors

21 (a)	24	B1	
	4 th bar drawn at f.d. = 1.5	B1	
21 (b)	7×15 or 14×7.5 60 (one third of 3 rd bar) or 45 (half of 4 th bar) Must be from correct reasoning	M1	Values given in freq table, so must be correct figures eg $\frac{1}{3} \times 180$ or $\frac{1}{2} \times 90$ or 30×2 (not 60 from $180 - 120$)
	105	A1	

Q	Answer	Mark	Comments
22 (a)	136	B3	<p>B2 for 124 at angle AOB and 100 at angle COB</p> <p>B2 for 28 at angle OBA and 40 at angle OBC</p> <p>B1 for 124 at angle AOB or 28 at angle OAB or 100 at angle COB</p> <p>Award B2 for correct working but with just one arithmetical slip</p> <p>eg. angle $OAB = 90 - 62 = 28$, which, with no further errors, leads to an answer of 116</p>

Q	Answer	Mark	Comments
22 (a) Alt1	<i>BO</i> extended to meet the circle at <i>X</i> (creating a diameter)		
	136	B3	<p>B2 for 56 at angle <i>XOA</i> and 80 at angle <i>XOC</i></p> <p>B2 for 224 at reflex angle <i>AOC</i></p> <p>B2 for 124 at angle <i>AOB</i> and 100 at angle <i>COB</i> (as in first scheme)</p> <p>B2 for 68 at angle <i>ABC</i></p> <p>B2 for 28 at angle <i>OBA</i> and 40 at angle <i>OBC</i> (as in first scheme)</p> <p>B1 for 62 at angle <i>OXA</i> or 62 at angle <i>OAX</i> or 50 at angle <i>OXC</i> or 50 at angle <i>OCX</i></p> <p>Award B2 for correct working but with just one arithmetical slip</p>
22 (a) Alt2	Join <i>AC</i>		
	136	B3	<p>B2 for 22 at angle <i>OCA</i> and 22 at angle <i>OAC</i></p> <p>B1 for 62 at angle <i>ACB</i> or 22 at angle <i>OCA</i></p> <p>Award B2 for correct working but with just one arithmetical slip</p>

Q	Answer	Mark	Comments
22 (b)	180 – their 136 or 360 – their 136 – (2 × 90) or 2 × (180 – 90 – their 68)	M1	90° at <i>TAO</i> and <i>TCO</i> can be implied
	44	A1ft	ft their angle <i>AOC</i> ... must be acute
23	$\sqrt{12} = 2\sqrt{3}$ and $\sqrt{48} = 4\sqrt{3}$ and $\sqrt{75} = 5\sqrt{3}$	M2	$12 = 2\sqrt{3}$ or $\sqrt{48} = 4\sqrt{3}$ or $\sqrt{75} = 5\sqrt{3}$ score M1
	$(\sqrt{3} + 2\sqrt{3} + 4\sqrt{3} + 5\sqrt{3}) \div 4$ or $12\sqrt{3} \div 4$	M1dep	Dependent on at least M1 already earned
	Mean = $3\sqrt{3}$	A1	
	Median = $(2\sqrt{3} + 4\sqrt{3}) \div 2 = (3\sqrt{3})$	B1	Or by listing the values in order and clearly indicating the middle as being between $2\sqrt{3}$ and $4\sqrt{3}$
24	$a = -10$	B1	
	$b = 25 + a$	M1	$x^2 - 5x - 5x + 25 (+a)$ or $x^2 - 10x + 25 (+a)$ both earn M1 Also, award M1 for substitution of a value of x in both sides of the identity eg $x = 1$ allows b to be found first. Another value of x would then give a . Alternatively, if b is found first, ft using $a = \text{their } b - 25$
	$b = 15$	A1ft	ft 25 + their a

Q	Answer	Mark	Comments
25 (a)	Angle $EBC = \text{angle } FDA$ $BC = DA$ $BE = DF$	B2	All three facts for B2 B1 for one or two facts
	Opposite angles of parallelogram Opposite sides of parallelogram	B1	Must have both of these reasons
	SAS	B1dep	Dep on first B2 being awarded Note: Any mention of alternate angles or corresponding angles is invalid and will lead to a wrong reason for congruency Any reference to $AF = CE$ is invalid
25 (a) Alt	The parallelogram has rotational symmetry of order 2 (or 180° rotational symmetry) about the centre of the parallelogram	B1	
	B maps onto D and C maps onto A	B1	
	Since $BE = DF$, E maps onto F	B1	
	So triangle BCE maps directly onto triangle DAF and hence they are congruent	B1	

Q	Answer	Mark	Comments
25 (b)	<p>Angle $BEC = \text{angle } DFA$ and angle $BEC = \text{angle } FCE$</p> <p>So angle $DFA = \text{angle } FCE$ (ie EC is parallel to AF)</p> <p>or</p> <p>Angle $DFA = \text{angle } BAF$ and angle $DFA = \text{angle } BEC$</p> <p>So angle $BAF = \text{angle } BEC$ (ie EC is parallel to AF)</p>	B2	<p>B2 for $ABCD$ is a parallelogram, so $AB = DC$ $BE = DF$ (given), so $AE = FC$ But, AE is also parallel to FC (B1 earned so far) So $AECF$ is a parallelogram So AF is parallel to EC (B2 now earned)</p> <p>B2 for $AE = AB - EB$, $FC = DC - DF$ So $AE = FC$ Also, $AF = EC$ (from part (a)) So quadrilateral $AEFC$ has two pairs of opposite equal sides (B1 earned so far) So $AEFC$ is a parallelogram So AF is parallel to EC (B2 now earned)</p> <p>B1 for any of these facts $\text{Angle } BEC = \text{angle } DFA$ or $\text{angle } BEC = \text{angle } FCE$ or $\text{angle } BAF = \text{angle } DFA$... reasons not necessary</p>

Q	Answer	Mark	Comments
25 (b) Alt	Triangles BCE and DAF are congruent so when CE is rotated through 180° it maps directly onto AF	B1	
	Any line when rotated through 180° is still parallel to its original position, hence CE is parallel to AF	B1	