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General Certificate of Secondary Education
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Linear Mathematics 4365H

(Specification 4365)

Paper 2 Higher Tier 43652H

Final

Mark Scheme

Mark schemes are prepared by the Principal Examiner 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 examiners 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 examiner understands and applies it in the same correct way. As preparation for standardisation each examiner 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, examiners encounter unusual answers which have not been raised they are required to refer these to the Principal 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.

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.
M dep	A method mark dependent on a previous method mark being awarded.
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.
B dep	A mark that can only be awarded if a previous independent mark has been awarded.
Q	Marks awarded for quality of written communication.
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.
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 between *a* and *b* with *a* included but *b* not included.
25.3 …	Allow answers which begin 25.3 e.g. 25.3, 25.31, 25.378.
Use of brackets	It is not necessary to see the bracketed work to award the marks.
Nms	No method shown.

Paper 2 Higher Tier

Q	Answer	Mark	Comments
1(a)	3 × 18 (+) 1.2 × 110 or 54 (+) 132	M1	oe
	186	A1	186.00
1(b)	235 – 1.2 × 150 (= 55) or 235 – 180	M1	oe $235 = 22n + 1.2 \times 150$
	$\frac{\text{their } 55}{22}$	M1dep	$235 - 1.2 \times 150 = 22n$ $235 = 2.5 \times 22 + 1.2 \times 150$
	2.5	A1	Accept 2 hour 30 minutes, 2.30, 2:30 Ignore incorrect units
2(a)	2	B1	
2(b)	Four points plotted correctly	B2	$\frac{1}{2}$ square tolerance B1 for 2 or 3 points plotted correctly
2(c)	Straight ruled line of best fit correctly drawn within tolerance	B1	
2(d)	Correct reading off for their line of best fit	B1ft	$\frac{1}{2}$ square tolerance ft their line of best fit Accept [32, 42] if no line of best fit seen

Q	Answer	Mark	Comments
3(a)	Needs time frame	B1	oe e.g. No time period (zone) Vague as needs weekly or monthly
3(b)	No box for never	B1	oe If (a) incorrect allow needs time frame Answers may be seen in (a)
	No box for 4	B1	oe If (a) incorrect allow needs a time frame Answers may be seen in (a)
4	360 – 52 – 144 – 144 or 180 – 80 – 80 or 2 × (180 – 26 – 144)	M1	oe y + 52 + 144 + 144 = 360
	20	A1	

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Q	Answer	Mark	Comments
5	48	B1	
	their 48 × 0.11 (= 5.28)	M1	oe their 48 × 11 (= 528)
	their 5.28 – 2.43 (= 2.85)	M1dep	oe their 528 – 243 (= 285)
	their 2.85 ÷ 3 (× 2) = (0.95 (× 2))	M1dep	oe their 285 ÷ 3 (× 2) = (95 (× 2))
	1.90	Q1	Strand (i) Correct money notation SC3 for £3.52 SC2 for 352 (p)
Alt 5	48	B1	
	2.43 ÷ their 48 (= 0.050 625)	M1	243 ÷ their 48 (= 5.062 5)
	(0.11 – their 0.050 625) × their 48 (= 2.85) or (0.11 – their 0.050 625) ÷ 3 (× 2) (= 0.01979…(× 2))	M1dep	(11 – their 5.062 5) × their 48 (= 285) or (11 – their 5.062 5) ÷ 3 (× 2) (= 1.979…(× 2))
	their 2.85 ÷ 3 (× 2) = (0.95 (× 2)) or their 0.01979…(× 2) × their 48	M1dep	their 285 ÷ 3 (× 2) = (95 (× 2)) or their 1.979… (× 2) × their 48
	1.90	Q1	Strand (i) Correct money notation SC3 for £3.52 SC2 for 352 (p)

Q	Answer	Mark	Comments
6	$x + 9 + 2x + 3x$	M1	oe 48 – 9
	$x + 9 + 2x + 3x = 48$	M1dep	oe 48 – 9 and 6 seen
	$6x = 48 – 9$ or $6x = 39$	M1dep	oe their 39 ÷ 6
	6.5 or $\frac{13}{2}$ or $6\frac{1}{2}$	A1	SC3 for 13, 19.5 and 15.5
7	12 000 – 10 000 or 2000	M1	
	$\frac{\text{their } 2000}{12}$ or 166.(6 …) or 166.7	M1	
	0.85 × 195 (= 165.75) or 0.15 × 195 (= 29.25)	M1	oe
	165.75 and 166.(6 …) or 166.7	A1	
	Rent it	Q1ft	strand (iii) correct conclusion from their answers Comparing their 165.75 (85%) with their 166
7 **Alt**	12 000 – 10 000 or 2000	M1	
	0.85 × 195 (= 165.75) or 0.15 × 195 (= 29.25)	M1	12 × 195 (= 2340) oe
	their 165.75 × 12 or (195 – their 29.25) × 12 or 2000 ÷ their 165.75	M1	0.85 × their 2340 or 0.15 × their 2340 (= 351) oe
	1989 and 2000 or 12.06 or 12.07 or 12.1 and 12	A1	oe £11 cheaper
	Rent it	Q1ft	strand (iii) correct conclusion from their answers Comparing their 1989 (85%) with their 2000 or comparing their 12.06 with 12

Q	Answer	Mark	Comments
8(a)	their 9 × 0.6 or their 9 ÷ 0.5 or 0.6 ÷ 0.5 (= 1.2)	M1	oe
	$\frac{\text{their } 9 \times 0.6}{0.5}$	M1dep	oe
	10.8	A1	
8(b)	13.6 × 3600 or 13.6 ÷ 1000 or 3600 ÷ 1000	M1	oe 50 × 1000 or 50 ÷ 3600 or 1000 ÷ 3600
	$\frac{13.6 \times 3600}{1000}$	M1	$\frac{50 \times 1000}{3600}$
	48(…) or 49	A1	13.8(…) or 13.9
Alt 8(b)	13.6 × 3600	M1	13.6 ÷ 1000
	50 × 1000	M1	50 ÷ 3600
	48 960 or 49 000 and 50 000	A1	0.0136 and 0.0138(...) or 0.0139
9	0.6 × 100 × 100 × 100 (= 600 000)	M1	oe 1250 ÷ 100 ÷ 100 ÷ 100 (= 0.00125)
	÷ 1250	M1	oe ÷ their 0.00125
	480	A1	480
10(a)	0.05	B1	
10(b)	150 × 0.92	M1	
	138	A1	SC1 for 12

Q	Answer	Mark	Comments
11(a)	47°	B1	
11(b)	10 cm	B1	
12	12 seen or 6 seen for radius	B1	
	$\pi \times$ their 12 (÷ 2)	M1	oe
	$2 \times \frac{\pi \times \text{their } 12}{2}$ + their 12 + their 12	M1dep	oe
	61.6(…) or 61.7 or 62	A1	Accept $12\pi + 24$
13	n + 18 or 18 ÷ 2 or 9 or 45 × 2	M1	Tries two numbers with a difference of 18 or tries two numbers with a sum of 90
	n + n + 18 or n + 9 or 45 – 9 or 45 + 9 or their 90 – 18 (= 72) or their 90 + 18 (= 108)	M1	oe Different trial
	n + n + 18 = 90 or n + 9 = 45 or 45 – 9 and 45 + 9 or their 72 ÷ 2 or their 108 ÷ 2	M1	oe 3rd trial
	Amy 36	A1	36 and 54 in any order
	Chris 54	A1	

Q	Answer	Mark	Comments
14(a)	1612.5	M1	oe 1.6×10^3 or 1.61×10^3 or 1.612×10^3 or 1.613×10^3
	1.6125×10^3	A1	
14(b)	$5.05 \times 10^3 \times 20 + 1000$	M1	oe or 101 000 seen
	102 000	A1	oe SC1 for 100 000 or 1252.5
	1.02×10^5	B1 ft	SC2 for 1×10^5 or 1.2525×10^3
15(a)	-3.625 or $-3\frac{5}{8}$ or $-\frac{29}{8}$	B1	
15(b)	$2x(2x + 3y)$	B2	B1 for partial factorisation i.e. $2(2x^2 + 3xy)$ $x(4x + 6y)$ $4x(x + 1.5y)$ Do not ignore fw
16	90% = 80.1	M1	oe 29 – 2.9 (= 26.1)
	$\frac{80.1}{90} \times 100$ (= 89) or 80.1 ÷ 0.9 (= 89)	M1	oe 80.1 – their 26.1 (= 54)
	their 89 – 29	M1dep	their 54 ÷ 90 × 100
	60	A1	
	All steps clearly shown with logical reverse percentage argument	Q1	strand (iii)

Q	Answer	Mark	Comments
17	$\frac{x+3x}{2}=-4$ or $4x = 2 \times -4$ or $4x = -8$ or $2x = -4$	M1	oe
	$x = -2$	A1	oe
	$\frac{2y+4y}{2}=15$ or $6y = 2 \times 15$ or $6y = 30$ or $3y = 15$	M1	oe
	$y = 5$	A1	oe
18(a)	tan chosen	M1	$\tan(y) = \frac{12}{7}$
	$\tan x = \frac{7}{12}$	M1	oe $\sin x = \frac{7}{\sqrt{193}}$ $\cos x = \frac{12}{\sqrt{193}}$ $(y =)$ 59.7… or 60
	[30, 30.3]	A1	
18(b)	$\frac{BC}{\sin 40}=\frac{18}{\sin 110}$ (= 19.15…)	M1	oe Perpendicular height = 6.1563…
	$\sin 40 \times \frac{18}{\sin 110}$	M1	oe 6.1563… ÷ sin 30
	12.3(…)	A1	SC2 9.57... or 9.6

Q	Answer	Mark	Comments
19(a)	Correct box plot	B2	B1 for three or four correct points Tolerance $\pm\frac{1}{2}$ square
19(b)	Attempt at one frequency density	M1	May be on diagram 17 ÷ 10 (= 1.7) or 12 ÷ 5 (= 2.4) or 3 ÷ 15 (= 0.2) or 9 ÷ 30 (=0.3) Tolerance $\pm\frac{1}{2}$ square
	Three or four correct frequency densities	A1	At least three from 1.7, 2.4, 0.2 and 0.3
	Fully correct histogram	A1	
20	$\frac{-8 \pm \sqrt{8^2 - 4 \times 2 \times 5}}{2 \times 2}$	M1	Allow one error oe
	$\frac{-8 \pm \sqrt{8^2 - 4 \times 2 \times 5}}{2 \times 2}$ or $\frac{-8 \pm \sqrt{24}}{4}$	A1	Fully correct oe
	– 0.78 and – 3.22	A1	SC2 for – 0.78 or – 3.22 SC1 for – 0.775... or – 3.224... – 0.775... and – 3.224... implies M1A1
21	$(x – 3)(x + 3)$	M1	Substitutes any value for x into both expressions but not $x = 0$
	$(x – 3)(x + 5)$	M1dep	Sets up a correct equation in b
	$(b =)$ 2 or $x^2 + 2x – 15$	A1	
22	$\frac{12}{10}$ (= 1.2) or $\frac{10}{12}$	M1	oe May be implied from answer of 600
	500 × their 1.2^3	M1dep	oe
	864	A1	Accept [863, 864]

Q	Answer	Mark	Comments
23	$\frac{5}{12} \times \frac{7}{11}$ or $\frac{35}{132}$ or $\frac{7}{12} \times \frac{5}{11}$ or $\frac{35}{132}$	M1	oe Tree diagram showing the 6 probabilities $\frac{5}{12} \times \frac{4}{11}$ or $\frac{20}{132}$ or $\frac{7}{12} \times \frac{6}{11}$ or $\frac{21}{66}$
	$\frac{5}{12} \times \frac{7}{11} + \frac{7}{12} \times \frac{5}{11}$	M1dep	oe $1 - (\frac{5}{12} \times \frac{4}{11} + \frac{7}{12} \times \frac{6}{11})$
	$\frac{70}{132}$ or $\frac{35}{66}$	A1	oe Decimals must be accurate to at least 2 d.p. SC1 for $\frac{70}{144}$ or $\frac{35}{72}$

Alt 23	0.416... × 0.636... or 0.583... × 0.454…	M1	oe Tree diagram showing the 6 probabilities 0.416... × 0.363... or 0.583... × 0.545...
	0.416... × 0.636...+ 0.583... × 0.454...	M1dep	oe 1 – (0.416... × 0.363... + 0.583... × 0.545...)
	0.53(...)	A1	oe Decimals must be accurate to at least 2 d.p. SC1 for 0.486... or 0.49

Q	Answer	Mark	Comments
24(a)	$-\mathbf{p}$ (+) $2\mathbf{q} - \mathbf{p}$ (+) $5\mathbf{p}$	B1	oe
24(b)	$\mathbf{q} - \frac{1}{2}\mathbf{p}$ or $-\mathbf{q} + \frac{1}{2}\mathbf{p}$ or $2\mathbf{p}$ or $-2\mathbf{p}$ or $3\mathbf{p}$ or $-3\mathbf{p}$	M1	oe $\frac{1}{2}(2\mathbf{q} - \text{p})$ or $\frac{1}{2}(\mathbf{p} - 2\mathbf{q})$
	$(\overrightarrow{MN} =)\ \mathbf{q} - \frac{1}{2}\mathbf{p} + 2\mathbf{p}$ or $(MN(\overrightarrow{NM} =) - 2\mathbf{p} - \mathbf{q} + \frac{1}{2}\mathbf{p}$	M1dep	oe $(\overrightarrow{MN} =) -\mathbf{q} + \frac{1}{2}\mathbf{p} + \mathbf{p} + 3\mathbf{p} + 2\mathbf{q} - 3\mathbf{p}$ or $(\overrightarrow{NM} =) 3\mathbf{p} - 3\mathbf{p} - 2\mathbf{q} - \mathbf{p} + \mathbf{q} - \frac{1}{2}\mathbf{p}$
	$(\overrightarrow{MN} =)\ \mathbf{q} + \frac{3}{2}\mathbf{p}$ or $(\overrightarrow{NM} =) -(\mathbf{q} + \frac{3}{2}\mathbf{p})$	A1	oe Must be fully simplified
	$\overrightarrow{MN} = \frac{1}{2}(2\mathbf{q} + 3\mathbf{p})$ or MN is a multiple/fraction of CB (therefore parallel)	A1	oe $\overrightarrow{CB} = 2(\mathbf{q} + \frac{3}{2}\mathbf{p})$ or $\frac{1}{2}\overrightarrow{CB} = \mathbf{q} + \frac{3}{2}\mathbf{p}$ or $2(\mathbf{q} + \frac{3}{2}\mathbf{p}) = 2\mathbf{q} + 3\mathbf{p}$ or $\mathbf{q} + \frac{3}{2}\mathbf{p} = \frac{1}{2}(2\mathbf{q} + 3\mathbf{p})$ $MN = \frac{1}{2}CB$ or $CB = 2MN$ or $CB : MN = 2 : 1$

Q	Answer	Mark	Comments
25(a)	Correct graph passing through (0, 1), (90, 2), (180, 1), (270, 0) and (360, 1)	B1	
25(b)	Correct graph passing through (0, 0), (90, 2), (180, 0), (270, –2) and (360, 0)	B1	
26	$5(x + 1)$ or $4(x + 2)$ or $(x + 2)(x + 1)$ or $2(x + 2)(x + 1)$	M1	oe
	$5x + 5 + 4x + 8$ or $x^2 + 2x + x + 2$ or $x^2 + 3x + 2$ or $2x^2 + 4x + 2x + 4$ or $2x^2 + 6x + 4$	M1dep	Allow 1 error
	their $5x + 5 + 4x + 8 = 2(x + 2)(x + 1)$	M1dep	oe
	$2x^2 - 3x - 9 = 0$ or $2x^2 - 3x = 9$ or $2x^2 = 3x + 9$	A1	Correctly simplified to three terms
	$(2x + 3)(x - 3)$	M1	Attempt to factorise their quadratic or uses quadratic formula with at most one error i.e. $(mx + a)(nx + b)$ where $mn =$ their 2 and ab = ± their 9
	$x = -\frac{3}{2}$ and $x = 3$	A1	