General Certificate of Secondary Education
June 2012

Mathematics (Linear) B **4365**
Paper 2
Higher Tier

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 meeting attended by all examiners and is the scheme which was used by them in this examination. The standardisation meeting 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 the standardisation meeting each examiner analyses a number of students' scripts: alternative answers not already covered by the mark scheme are discussed at the meeting and legislated for. If, after this meeting, examiners encounter unusual answers which have not been discussed at the meeting 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 which is 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	This mark is for quality of written communication. Further details of how to apply it will be in the mark scheme.
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 $\frac{1}{2}$
[*a, b*]	Accept values between *a* and *b* inclusive.

Q	Answer	Mark	Comments
1	(7.2) + 6 or 13.2	M1	$4x - 6 = 7.2$
	(their 13.2) ÷ 4	M1dep	$4x = 7.2 + 6$ or $x - \dfrac{6}{4} = \dfrac{7.2}{4}$
	3.3	A1	SC2 52.8 or 0.3 or 8.7 SC1 4.8

Q	Answer	Mark	Comments
2	169 ÷ 65	M1	65 × 2.5 or 65 × their 2.5 or 169 ÷ 2.5
	2.6 or 2 hours 36 (minutes)	A1	162.5 or 6.5 miles to go or 67.6 (mph)
	2h 30 or 2.5 h or 150 (minutes) or 9.06 or 9.1 (not 9.10) or 6.24 or 6.4	B1	2.5 h
	No	A1	

Q	Answer	Mark	Comments
3(a)	147	B1	May be seen on diagram
	Corresponding	Q1	oe eg (y is) alternate and x is opposite Check part (b) Strand (i)

Q	Answer	Mark	Comments
3(b)	147	B1ft	May be seen on diagram ft their (a)
	Alternate or (vertically) opposite	Q1	oe eg x is corresponding and y is opposite Strand (i)

Q	Answer	Mark	Comments	
4	10 × 78 or 780 or 10 × 36 or 360 or 78 ÷ 3 (x 2) or 26 or 52	M1		78 ÷ 3 (x 2) or 26 or 52
	10 × 78 ÷ 3 (× 2) or 260 or 520	M1		600 ÷ 10 or 60
	0.15 × 600 or 90 or 15 × 600 (÷ 100) 0.18 × 600 or 18 x 600 (÷ 100)	M1	oe	0.15 × their 60 or 9
	450 or 108	A1		45
	their 450 × 1.2 or 540	M1	10 × 36 × 1.2 or 360 × 1.2 or 432 or 0.15 × 1.2 or 0.18 or 15 × 1.2 or 18	their 45 × 1.2
	520 and 540 and Hire Deal	A1		52 and 54 and Hire Deal

Q	Answer	Mark	Comments
5	15 ($\times$) (3 $\times$ 13 + 8) or 15 $\times$ 47	M1	15 $\times$ 3 $\times$ 13 + 15 $\times$ 8 or 15 $\times$ 39 + 15 $\times$ 8 45 $\times$ 13 + 15 $\times$ 8 or 585 + 120 oe
	(£) 705	A1	

Q	Answer	Mark	Comments
6(a)	$x + x + 16 + 118 + 134 = 360$ or $2x + 268 = 360$	M1	oe 360 – 252 (=108) and their 108 – 16 (=92)
	$x + x = 360 - 118 - 134 - 16$ or $2x = 92$	M1dep	their 92 $\div$ 2
	(x =) 46	A1	Answer may be on diagram

Q	Answer	Mark	Comments
6(b)	Yes and 46 + 134 = 180 or 118 + 62 = 180	B1ft	ft reason from their x oe

Q	Answer	Mark	Comments
7	$\frac{1}{2} \times 9.5 \times 7.3$ or $\frac{1}{2} \times 69.35$	M1	oe
	34.67(5)	A1	
	34.7	B1ft	ft their answer if 2 or more dp seen SC2 for 34.7 coming from premature rounding or approximation seen

Q	Answer	Mark	Comments
8	$12x - 28$ (= 20)	M1	$3x - 7 = 20 \div 4$
	$12x = 20 + 28$	M1	$3x = 5 + 7$ $3x = \frac{20}{4} + 7$ This mark is for separating terms in their equation
	4	A1ft	ft if M1M0 or M0M1

Q	Answer	Mark	Comments
9	Lists at least 3 correct combinations $\frac{1}{3}$ or $\frac{1}{2}$ seen	M1	(1)A3, (1)A4, (1)B3, (1)B4, (1)C3, (1)C4
	Lists or chooses all 6 correct combinations or 3 $\times$ 2 or 6 seen or $\frac{1}{3} \times \frac{1}{2}$	M1	Seen or implied eg 6 lines drawn from letters to numbers on diagram A$\rightarrow$3, A$\rightarrow$4,B$\rightarrow$3 etc
	$\frac{1}{6}$	A1	

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Q	Answer	Mark	Comments
10	Correct trial such that root < trial $\leqslant$ 5	M1	eg $4^3 - 3 \times 4 = 52$ (too big) Obtains $3 < x \leqslant 5$ or better (need not be stated)
	Improved correct trial	M1	3 < trial < 1st trial or 3 < trial < root eg $3.5^3 - 3 \times 3.5 = 32.(3…)$ or 32.4 (too small)
	Obtains $3.8 \leqslant x \leqslant 3.9$ or better	A1	3.6 → 35.(8…) or 35.9 3.7 → 39.(5…) or 39.6 3.8 → 43.(4…) or 43.5 3.9 → 47.(6…)
	Tests 3.85 (or 3.84) and concludes 3.8	Q1	3.85 → 45.5(16625) 3.84 → 45.1(03104) Using 2 dp to ensure 1 dp Strand (ii)

Q	Answer	Mark	Comments
11	$(AC^2 =) 23^2 + 31^2$ (=1490)	M1	$A = \tan^{-1}(\frac{23}{31})$ or $C = \tan^{-1}(\frac{31}{23})$
	$\sqrt{23^2 + 31^2}$ or $\sqrt{\text{their } 1490}$	M1 dep	eg $\frac{23}{\sin 36.57}$ or $\frac{31}{\cos 36.57}$ or $\frac{23}{\cos 53.43}$ or $\frac{31}{\sin 53.43}$
	38.6(...) or 39	A1	

Q	Answer	Mark	Comments
12	Suitable question with time frame	B1	
	Suitable response section	B1	No gaps, no overlap and final category open-ended

Q	Answer	Mark	Comments
13(a)	$3x \geqslant 16 + 5$ or $3x \geqslant 21$	M1	oe $x \geqslant \frac{21}{3}$
	or $x \geqslant 7$	A1	oe

Q	Answer	Mark	Comments
13(b)	$-2 \leqslant 2y \leqslant 6$	B1	

Q	Answer	Mark	Comments
14	Correct heights plotted or shown	B1	
	Fully correct frequency polygon	B1	Midpoints used and straight lines intended to join them Allow midpoints to be at [24.5, 26] [34.5, 36] etc SC1 for one height plotted incorrectly but midpoints used in an otherwise correct frequency polygon

Q	Answer	Mark	Comments	
15	Equates two sides $5w = 3w + 3$	M1	$3w + 3 = w + 6$	$5w = w + 6$
	Collects like terms $5w - 3w = 3$	M1dep	$3w - w = 6 - 3$	$5w - w = 6$
	$(w =)$ 1.5	A1		
	Works out that all sides are 7.5 or solves another pair to get $(w =)$ 1.5	A1	Must have 3rd side = 7.5 and one side using their equation = 7.5 as a minimum	

Q	Answer	Mark	Comments
16	Correct cubing of any integer [25, 30]	M1	Note: $25^3 = 15\,625$ $26^3 = 17\,576$ $27^3 = 19\,683$ $28^3 = 21\,952$ $29^3 = 24\,389$ $30^3 = 27\,000$
	26 or 27	A1	SC1 for 18 or 18^3 (= 5832)

Q	Answer	Mark	Comments
17	3000 – 2500 or 500	M1	$\frac{2500}{3000} \times 100(\%)$
	$\frac{\text{their } 500}{3000} \times 100(\%)$ oe	M1dep	$100 - \frac{2500}{3000} \times 100(\%)$
	16.6(6..) or 16.7 or 17	A1	

Q	Answer	Mark	Comments
18(a)	$\pi r + 2r$	B1	

Q	Answer	Mark	Comments
18(b)	their $(\pi r + 2r) = 11.6$	B1ft	ft their formula from (a) or for an incorrect formula that is given in (a) Allow $\pi = 3.14$ or better throughout
	$r(\pi + 2) = 11.6$ or $(r =)$ 11.6 ÷ $(\pi + 2)$	M1	
	2.256… or 2.2559…	A1	
	2.26 or 2.3	B1ft	Accept 1.8 or 1.85 if $2\pi r$ used 2.7 or 2.72 if $\frac{1}{2}\pi r^2$ used 3.7 or 3.69 if πr used

Q	Answer	Mark	Comments
19(a)	Fully correct box plot	B2	B1 for three or four or five correct plots 210, 250, 310, 390, 470

19(b)	No change	B1	
	Increase	B1	
	Increase	B1	

20(a)	–1, –3, 5	B2	B1 for 1 or 2 correct

20(b)	Axes drawn and labelled	B2	B1 for x-axis from –2 to 2 (minimum) B1 for y-axis from –3 to 5 (minimum) Condone one missing x or y label
	Points plotted	B1ft	ft 5 points
	Smooth curve through their 5 points	B1ft	Must be a U shape

21	Possible weight given for **one** of Amy's fish [6.75, 6.8) or [4.25, 4.3) or [5.15, 5.2)	M1	Any Amy weight could go down (or Kate up) by 0.05
	Possible weight given for **one** of Kate's fish (8.2, 8.25] or (3.4, 3.45] or (4.5, 4.55]	M1	Any 3 Amy weights could go down (or Kate up) by 0.15
	5 or 6 of these allowed values	M1	16.3 – 0.15 = 16.15 or 16.1 + 0.15 = 16.25
	Totals showing possible Must have total for Kate > total for Amy	A1	Amy = [16.15, 16.3) Kate = (16.1, 16.25]

22	1.5 or $\frac{2}{3}$ seen or $\frac{1}{2}$ seen as a scale factor		M1	oe 12 : 8 8 : 12 $\tan C = \frac{8}{11}$ or 36° $\frac{12}{EC} = \frac{8}{11}$ or $\frac{EC}{12} = \frac{11}{8}$ or $\frac{11 \times 12}{8}$
	11×1.5 or $11 \times \frac{1}{2}$	$\frac{1}{2} \times 11 \times 8 \times 1.5^2$	M1dep	oe $CE = \dfrac{12}{\tan(\text{their } 36)}$
	16.5 or 5.5	99	A1	16.5(...) or 5.5(...)
	$\frac{1}{2}(8 + 12) \times$ their 5.5 or $\frac{1}{2}(8 + 12) \times$ their ED	their $99 - \frac{1}{2} \times 11 \times 8$	M1	$\frac{1}{2} \times$ their $16.5 \times 12 - \frac{1}{2} \times 11 \times 8$ their $ED \times 8 + \frac{1}{2} \times$ their $ED \times 4$

	55	A1	

Q	Answer	Mark	Comments
23	Lists outcomes 1, 4 4, 1 1, 5 5, 1 1, 6 and/or 6, 1 2, 4 4, 2 2, 5 5, 2 2, 6 6, 2	M1	Even dice $1 - \frac{2}{3}$ or odd dice $1 - \frac{1}{3}$ or odd dice $2 - \frac{1}{2}$ or even dice $2 - \frac{1}{2}$
	One of : A (both even) has 2 outcomes B (both odd) has 1 outcome C (one odd one even) has 3 outcomes	M1 dep	One of: P(both even) $= \frac{1}{2} \times \frac{2}{3} = \frac{1}{3}$ or $\frac{2}{6}$ P(both odd) $= \frac{1}{2} \times \frac{1}{3} = \frac{1}{6}$ P(odd and even any order) $= \frac{1}{2} \times \frac{2}{3} + \frac{1}{2} \times \frac{1}{3} = \frac{1}{2}$ or $\frac{3}{6}$ or $1 - \frac{2}{6} - \frac{1}{6}$
	B, A, C	A1	All three shown and correct and BAC

24	$6x^2 - 15xy + 2xy - 5y^2$	M1	3 terms correct
	$6x^2 - 15xy + 2xy - 5y^2$	A1	
	$6x^2 - 13xy - 5y^2$	A1 ft	ft from four terms

25	$(x =) \dfrac{-2 \pm \sqrt{(2)^2 - 4(6)(-5)}}{2(6)}$	M1	Allow one error
	$(x =) \dfrac{-2 \pm \sqrt{(2)^2 - 4(6)(-5)}}{2(6)}$	A1	$(x =) \dfrac{-2 \pm \sqrt{124}}{12}$
	0.76 and −1.09	A1	

26(a)	$10 \times 10 \times 4$ or 400	M1	
	their 400 $\times$ 25 or 10 000	M1	
	$\frac{4}{3} \times \pi \times 6^3$ or 904.(7…) or 905	M1	oe
	their 10 000 $\div$ their $\frac{4}{3} \times \pi \times 6^3$	M1	Must have come from use of volume of a sphere formula
	11.0(5…)	A1	
	11	B1 ft	ft any correctly rounded down number

Q	Answer	Mark	Comments
26(b)	$500 \div$ their $10 \times 10 \times 4$ or $500 \div$ their 400	M1	ft their 10 x 10 x 4 from (a)
	1.25	A1	oe $\dfrac{5}{4}$

Q	Answer	Mark	Comments
27	$(3n - 1)(n - 2)$ or $(3n + 1)n$	M1	or $n(n - 2)$ as denominator on LHS
	$(3n - 1)(n - 2) - (3n + 1)n$	M1 dep	
	$3n^2 - 6n - n + 2$ or $-3n^2 - n$	M1 dep	dep on first M1 only
	$3n^2 - 6n - n + 2$ and $-3n^2 - n$	A1	Correct common denominators must be used for 4 marks to be awarded

Q	Answer	Mark	Comments
28	$\dfrac{4}{12} \times \dfrac{x}{11}$	M1	oe
	$\dfrac{4}{12} \times \dfrac{4}{11}$ or $\dfrac{4}{12} \times \dfrac{8}{11}$ or $\dfrac{4}{12} \times \dfrac{3}{11}$ or $\dfrac{4}{33}$ or $\dfrac{8}{33}$ or $\dfrac{1}{11}$	M1	0.12(12..) or 0.24(24…) or 0.09(0909…)
	$\dfrac{4}{12} \times \dfrac{4}{11} \times 6$ or $\dfrac{4}{12} \times \dfrac{8}{11} \times 3$ or $1 - (3 \times \dfrac{4}{12} \times \dfrac{3}{11})$	M1	oe
	$\dfrac{8}{11}$ oe or $\dfrac{24}{33}$ or $\dfrac{96}{132}$ or 0.73 or better	A1	oe If replacement used award SC2 for $\dfrac{2}{3}$ or $\dfrac{8}{12}$ or SC1 for $\dfrac{4}{12} \times \dfrac{4}{12}$ or $\dfrac{1}{9}$ or $\dfrac{4}{12} \times \dfrac{8}{12}$ or $\dfrac{2}{9}$

Q	Answer	Mark	Comments
28 Alt	Choose 1st counter in 12 ways	M1	
	Choose 2nd counter in 8 ways (any of the other two colours)	M1	
	$\dfrac{12 \times 8}{12 \times 11}$ or $1 \times \dfrac{8}{11}$	M1	oe
	$\dfrac{8}{11}$	A1	oe $\dfrac{96}{132}$