General Certificate of Secondary Education
June 2012

Mathematics (Linear) B **4365**
Paper 1
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.

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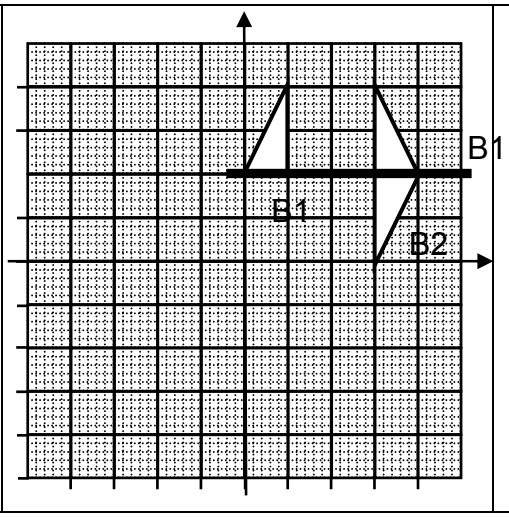
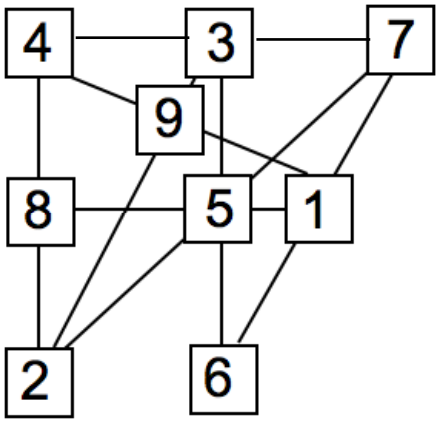
Glossary for Mark Schemes

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.
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	A mark that can be awarded for quality of written communication
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. e.g., accept 0.5 as well as $\frac{1}{2}$
[*a*, *b*]	Accept values between *a* and *b* inclusive.

Q	Answer	Mark	Comments
1		B2	B2 correct B1 reflection in $x = 2$ or $y = 2$ drawn with no other lines drawn
2(a)	$3x - 18$	B1	
2(b)	$5(y - 2)$	B1	
2(c)	$12w + 3 - 15w + 10$ $(12w + 3) - (15w - 10)$	M1	Allow one sign or arithmetic error for M1
	$12w + 3 - 15w + 10$	A1	A1 if all correct
	$-3w + 13$	A1ft	ft their expansion if M awarded Ignore any non-contradictory further work such as solving an equation but do not award A1 if contradictory further work such as = $10w$
3	(Exterior angle =) $360 \div 6$ (= 60)	M1	
	$180 - 60$	A1	
3 Alt 1	(interior angles =) 4×180	M1	8×90
	$720 \div 6$	A1	

Q	Answer	Mark	Comments
3 Alt 2	Showing the hexagon can be split into equilateral triangles and one angle of 60 shown or stated	M1	
	Showing 60 + 60 at one vertex	A1	
4		B3	B2 3 lines that total 14 using different numbers B1 2 lines that total 14 using different numbers
5(a)	Points plotted correctly	B2	B1 if 4 or 5 plotted correctly ($\pm\frac{1}{2}$ a small square)
5(b)	Mark or LOBF on graph within range (25, 40) to (25, 44)	M1	
	40 – 44	A1ft	ft their line or their mark SC1 if no marks or no LOBF shown and answer in range [40, 44]
5(b) Alt	Any attempt at interpolation or 'build up'	M1	Shows sales **and** temperature for two points either side of 25, eg one of (20, 36) or (21, 37) or (22, 39) and (29, 47) or a calculation such as $39 + 3 \times (47 - 39) \div 7$
	40 – 44	A1ft	SC1 if the 'interpolation' is not convincing but answer in range [40, 44]
5(c)	No as the sales at low temperatures are constant No as at 9° sales are (about) same	B1	At low temperatures sales do not increase

Q	Answer	Mark	Comments
6	Radius = 3 [2.9, 3.1] or diameter = 6 [5.9 to 6.1]	B1	Radius = 30 [29, 31] or diameter = 60 [59, 61] SC1 if only 3, 6, 30 or 60
	$\pi \times$ (their radius)^2 or $\pi \times (\frac{1}{2}$ their diameter)^2 or $\pi \times$ (any length but 6 if no diameter or radius seen)^2	M1	
	9π or $\pi 9$ or $9 \times \pi$ or $\pi \times 9$ or $\frac{198}{7}$ or answer in range [27.9, 28.3]	A1	900π or $\pi 900$ or $900 \times \pi$ or $\pi \times 900$ or answer in range [2790, 2830]
	cm^2	B1	mm^2 Accept units if seen in working but not stated on answer line
7	$6x - 2x$ (= $4x$) or 13 + 5 (= 18)	M1	
	$4x = 18$	A1	
	4.5, $\frac{18}{4}$, $\frac{9}{2}$, $4\frac{1}{2}$, etc.	A1ft	ft on one error incorrect cancelling after a correct fraction seen is not penalised
8	Enough angles (at least 2) marked or stated to complete the proof with no incorrect angles marked or stated	M1	180 – (62 + 62)
	56	A1	
	Complete method, showing 2 angles of 62 and subtraction from 180	Q1	Strand (ii)
8 Alt	AMQ **and** AML **and** PMB **and** NMB marked (stated) as 62	M1	(360 – 4 × 62) ÷ 2
	56	A1	
	Complete method, showing 4 angles of 62 and subtraction from 360 and division by 2	Q1	Strand (ii)

Q	Answer	Mark	Comments
9	5×58 (= 290) + 64 (= 354)	M1	(64 – 58) ÷ 6 (= 1)
	Their 354 ÷ 6	M1dep	58 + their 1 NB $\frac{58 \times 5}{6} + \frac{64}{6}$ is M2
	59	A1	
10	$1 \times x$ **or** $3 \times (x + 2)$ **or** $1 \times (3 + x)$ **or** $3 \times (x + 1)$	M1	Shows the area of any appropriate rectangle Allow invisible brackets
	$x + 3(x + 2)$ **or** $(3 + x) + 3(x + 1)$	M1dep	Allow invisible brackets
	$x + 3x + 6 = 12$ **or** $3 + x + 3x + 3 = 12$	M1dep	oe eg $4x + 6 = 12$ Invisible brackets expanded correctly
	1.5	A1	oe
10 Alt 1	$(x + 2)(x + 3)$ **or** $x(x + 1)$	M1	Allow invisible brackets
	$(x + 2)(x + 3) – x(x + 1)$	M1dep	Allow invisible brackets
	$x^2 + 2x + 3x + 6 – x^2 – x = 12$	M1dep	oe Invisible brackets must be expanded correctly
	1.5	A1	oe eg $\frac{6}{4}$
10 Alt 2	Guess a value for x and correctly works out area below 12 cm^2	M1	eg $x = 1$ gives (1 + 9) = 10 or (4 + 6) = 10 Value (0.5, 8)
	Guess a value for x and correctly works out area above 12 cm^2	M1	eg $x = 2$ gives (2 + 12) = 14 or (5 + 9) = 14 Values (2.5, 16), (3, 18), (3.5, 20)
	Tries a value between 1 and 2 and correctly works out area	M1dep	
	1.5	A1	oe SC2 3×3.5 and 1×1.5 seen **or** 3×2.5 and 1×4.5 seen

Q	Answer	Mark	Comments
11	0.05 – 0.03 (= 0.02)	M1	0.05 × 1600 (= 80) or 0.03 × 1600 (= 48)
	Their '0.02' × 1600	M1dep	Their 80 – their 48
	32	A1	SC1 Digits 32 eg 0.32, 320 etc imply method SC2 Use of 0.015 for Monday instead of 0.03 giving an answer of 56
12	$6x + 12y = 3$ **and** $6x - 10y = 14$ **or** $10x + 20y = 5$ **and** $12x - 20y = 28$	M1	Condone poor arithmetic if one coefficient is balanced
	Either $x = 1.5$ or $y = -0.5$	A1	$\frac{33}{22}, -\frac{11}{22}$
	Substituting their x or y into any of the linear equations and solving for the other variable, or balances again to eliminate and solve for the other variable	M1dep	Condone poor arithmetic and rearrangement errors if the intention to solve is clear
	Either $y = -0.5$ or $x = 1.5$	A1	oe SC1 if T&I used and both answers correct
12 Alt	$x = \frac{1}{2} - 2y$ **and** $3(\frac{1}{2} - 2y) - 5y = 7$	M1	Rearranging one equation to isolate a variable and substituting into the other equation. Allow errors as long as the intention is clear
	$-11y = 5\frac{1}{2}$	M1dep	Expanding to an equation of the form $ax = b$ or $cy = d$ Allow errors
	$x = 1.5$	A1	
	$y = -0.5$	A1	
13(a)	1.8×10^{15}	B2	B1 for an equivalent expression such as 18×10^{14} B1 for 9×10^{14} B1 for 1 800 000 000 000 000 B1 for 1.8^{15}
13(b)	5×10^{-5}	B2	B1 for an equivalent expression such as 0.5×10^{-4} B1 for -3×10^{-4} B1 for $\frac{1}{2} \times 10^{-4}$ B1 for 0.00005 B1 for 5^{-5}

Q	Answer	Mark	Comments
14	Square drawn connecting midpoints of each square	M1	Evidence that they know the area of the centre square is $1m^2$. This may be marked or shown elsewhere
	Area of small triangle = $\frac{1}{4}$	M1	Or all 4 triangles = 1 Must be clearly seen or stated
	2	A1	Answer of 2 with no supporting evidence is 2 marks
14 Alt 1	Both diagonals drawn across the middle square and 2 marked as length of at least one of them, or 1 diagonal drawn and marked as 2 and the height of one triangle shown as 1	M1	
	Area of half triangle = 1 or Area of small triangle = $\frac{1}{2}$	M1	Must be clearly seen or stated
	2	A1	Answer of 2 with no supporting evidence is 2 marks
14 Alt 2	$x^2 + x^2 = 1$	M1	oe $y^2 + y^2 = 4$
	$x^2 = \frac{1}{2}$ or $x = 1/\sqrt{2}$ or $2x = \sqrt{2}$ Accept x = [0.7, 0.71]	A1	$y^2 = 2$, $y = \sqrt{2}$ Accept y = [1.4 ,1.41]
	2	A1	
15	Evidence of finding gradient eg 20 ÷ 400 or triangle on diagram	M1	
	0.05 or 5, $\frac{1}{20}$ (cost per unit)	A1	
	$C = 10 + 0.05n$ $C = 1000 + 5n$	Q1	Strand (i) for formula written as C = their gradient $\times$ n + 10 if in £ or their gradient $\times$ n + 1000 if in p. If no working seen and an answer of form $C = kn$ + 10 or 1000 where k is a number ≠ 1, is Q1. Accept $C = n \div 20 + 10$, for example but not, for example, $C = \frac{\frac{1}{2}}{10}n + 10$

Q	Answer	Mark	Comments
15 Alt	Evidence of comparing a correct cost to a number of units or building up a table of comparative values	M1	Comparison must be, for example £5 to 100 units or table of units to costs eg 100 units £5, 200 units £10. **Not** a list of 'coordinates'
	0.05 or 5, $\frac{1}{20}$ (cost per unit)	A1	
	C = 10 + 0.05n oe $C = \frac{n}{20}$ + 10 C = 1000 + 5n oe eg $C = \frac{1000 + 5n}{100}$	Q1	Strand (i) for formula written as C = their gradient $\times$ n + 10 if in £ or their gradient $\times$ n + 1000 if in p. If no working seen and an answer of form $C = kn$ + 10 or 1000 where k is a number ≠ 1, is Q1. Accept C = n ÷ 20 + 10, for example but not, for example, $C = \frac{\frac{1}{2}}{10}n$ + 10
16(a)	$y = \frac{k}{x^2}$ or $y \propto \frac{1}{x^2}$	M1	oe
	8 = $\frac{k}{3^2}$ or k = 72	A1	This mark is for substituting 8 and 3 into their proportionality equation
	$y = \frac{72}{x^2}$ or yx^2 = 72	A1	oe eg $\frac{y}{72} = \frac{1}{x^2}$
16(b)	$y = \frac{72}{12^2}$	M1	ft their equation from (a)
	$\frac{1}{2}$ or 0.5	A1ft	
17(a)	$(2x \pm a)(x \pm b)$	M1	ab = ± 3
	$(2x - 3)(x + 1)$	A1	Ignore non contradictory further work such as solving the quadratic
17(b)	$(2x - 3)(2x + 3)$	B1	
	$\frac{x+1}{2x+3}$	B1ft	Do not award if incorrect further work. ft their (a) if common factor cancelled eg (a) = $(2x + 3)(x - 1)$ answer is $\frac{x-1}{2x-3}$

Q	Answer	Mark	Comments
18(a)	$6\sqrt{2}$	B1	
18(b)	$(\sqrt{6})^2 + \sqrt{6} \times \sqrt{12} + \sqrt{6} \times \sqrt{12} + (\sqrt{12})^2$	M1	oe any expansion with 4 correct terms implied
	$6 + \sqrt{72} + \sqrt{72} + 12$	A1	oe eg $\sqrt{36} + 2\sqrt{72} + \sqrt{144}$
	$18 + 12\sqrt{2}$	A1ft	ft $18 + 2 \times$ their (a) for $\sqrt{2}$ term
18(b) Alt	$(\sqrt{6})^2 (1 + \sqrt{2})^2$	M1	
	$6(1 + 2\sqrt{2} + 2)$	A1	
	$18 + 12\sqrt{2}$	A1ft	
19(a)	$y = x^2 + 2$	B1	oe eg $y - 2 = x^2$
19(b)	Same shape graph with vertex touching negative x-axis (within 1 mm) at any point > 2 mm from the origin	B1	Allow any incorrect labelling
20	90	B1	
	280	B1ft	ft 370 – their 90
	Bar from 250 to 300 with a height of 2.4	B1	
	Bar from 300 to 500 with a height of 1.4	B1ft	ft their 280 ÷ 200