**General Certificate of Secondary Education
June 2013**

Methods in Mathematics (Pilot)   9365

Unit 1 Higher Tier 93651H

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.
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.

M1 Higher Tier

Q	Answer	Mark	Comments
1(a)	$5x - 35 \ (= 45)$	M1	$x - 7 = \dfrac{45}{5}$
	$5x = 45 + 35$	M1	$x = \dfrac{45}{5} + 7$ isolates variable
	16	A1ft	ft after M1M0 or M0M1 SC1 10.4 or 2
1(b)	$10y - 6y \ (= 4y)$	M1	or $6y - 10y \ (=-4y)$
	$12 - 3 \ (= 9)$	M1	or $3 - 12 \ (=-9)$
	2.25	A1ft	oe ft for M1M0 or M0M1 with only one rearrangement error SC2 3.75 or $\dfrac{9}{16}$ (0.5625) SC1 $\dfrac{15}{16}$ (0.9375)

Q	Answer	Mark	Comments
2	$112 \div 210$	M1	$112 \div 210 \times 100$
	$132 \div 240$	M1	$132 \div 240 \times 100$
	0.53…. **and** 0.55	A1	53… (%) **and** 55(%)
	Their 0.53.… **and** their 0.55 **and** Year 11	Q1	Their 53….(%) **and** their 55(%) **and** Year 11 Strand (iii) M2 and correct decision for their decimals or percentages
2	**Alternative 1**		
	$210 \div 112$	M1	$210 \div 112 \times 100$
	$240 \div 132$	M1	$240 \div 132 \times 100$
	1.875 **and** 1.8(18…)	A1	187.5(%) **and** 181.8…(%)
	Their 1.875 **and** their 1.8(18…) **and** Year 11	Q1	Their 187.5(%) **and** their 181.8…(%) **and** Year 11 Strand (iii) M2 and correct decision for their decimals or percentages

Q	Answer	Mark	Comments
2	**Alternative 2**		
	(210 – 112) ÷ 210	M1	(210 – 112) ÷ 210 × 100
	(240 – 132) ÷ 240	M1	(240 – 132) ÷ 240 × 100
	0.46…..(or 0.47) **and** 0.45	A1	46….(%) (or 47(%)) **and** 45(%)
	Their 0.46…..(or 0.47) **and** their 0.45 **and** Year 11	Q1	Their 46….(%) (or 47(%)) **and** their 45(%) **and** Year 11 Strand (iii) M2 and correct decision for their decimals or percentages
2	**Alternative 3**		
	210 ÷ (210 – 112)	M1	210 ÷ (210 – 112) × 100
	240 ÷ (240 – 132)	M1	240 ÷ (240 – 132) × 100
	2.1(4…) **and** 2.2(2…)	A1	214…(%) **and** 222…(%)
	Their 2.1(4…) **and** their 2.2(2…) **and** Year 11	Q1	Their 214…(%) **and** their 222…(%) **and** Year 11 Strand (iii) M2 and correct decision for their decimals or percentages
2	**Alternative 4**		
	$\dfrac{112}{210}$ **and** $\dfrac{132}{240}$	M1	
	Equates denominators with at least one correct numerator	M1	
	$\dfrac{32}{60}$ **and** $\dfrac{33}{60}$	A1	oe $\dfrac{16}{30}$ **and** $\dfrac{16.5}{30}$
	Their $\dfrac{32}{60}$ **and** their $\dfrac{33}{60}$ **and** Year 11	Q1	oe Strand (iii) M2 and correct decision for their fractions

Q	Answer	Mark	Comments
2	**Alternative 5**		
	112 : 210 **and** 132 : 240	M1	
	Equates one side of ratio with at least one correct on other side	M1	$1 : \dfrac{210}{112}$ **and** $1 : \dfrac{240}{132}$ $\dfrac{112}{210} : 1$ **and** $\dfrac{132}{240} : 1$ oe
	16 : 30 **and** 16.5 : 30	A1	oe
	Their 16 : 30 **and** their 16.5 : 30 **and** Year 11	Q1	oe Strand (iii) M2 and correct decision for their ratios
2	**Alternative 6**		
	112 : (210 – 112) **and** 132 : (240 – 132)	M1	
	8 : 7 **and** 11 : 9	M1	
	72 : 63 **and** 77 : 63	A1	oe
	Their 72 : 63 **and** their 77 : 63 **and** Year 11	Q1	Strand (iii) M2 and correct decision for their ratios
2	**Alternative 7**		
	210 : (210 – 112) **and** 240 : (240 – 132)	M1	
	15 : 7 **and** 20 : 9	M1	
	135 : 63 **and** 140 : 63	A1	oe
	Their 135 : 63 **and** their 140 : 63 **and** Year 11	Q1	Strand (iii) M2 and correct decision for their ratios

Q	Answer	Mark	Comments
3	150 ÷ (2 + 3) **×** 2 or 30	M1	oe
	60	A1	SC1 90

Q	Answer	Mark	Comments
4(a)	Ticks 'T is always odd'	B1	Any indication
	Odd × 5 (or odd) is odd **and** odd – 2 (or even) is odd or 5 × odd ends in 5 so 5 × odd – 2 ends in 3	Q1	Strand (ii) Full explanation with correct box ticked
4(b)	$T + 2 = 5n$	M1	$-T - 2 = -5n$ $\quad \frac{T}{5} = n - \frac{2}{5}$
	$n = \dfrac{T + 2}{5}$ or $n = \dfrac{T}{5} + \dfrac{2}{5}$	A1	$n = \dfrac{-T - 2}{-5}$ SC1 $\quad \dfrac{T + 2}{5}$ or $\dfrac{-T - 2}{-5}$ or $\dfrac{T}{5} + \dfrac{2}{5}$

Q	Answer	Mark	Comments
5	300 ÷ 6 (= 50) or 120 × 6 (= 720)	M1	oe $\dfrac{1}{6}$ oe and $\dfrac{120}{300}$ (= $\dfrac{2.4}{6}$)
	No and 50 or No and 36 (average of the other numbers) or No and 720	A1	No and any sensible comment linking the theoretical probability and experimental outcome with accurate calculation(s). SC1 states or implies that 120 is too large a proportion of 300

Q	Answer	Mark	Comments
6	$\dfrac{1}{2}$ or $\dfrac{1}{3}$	M1	Could be on tree diagram
	$\dfrac{1}{2}$ × $\dfrac{1}{3}$	M1	
	$\dfrac{1}{6}$	A1	oe fraction, decimal or percentage Allow 0.166… or 0.167 or 16.66…% or 16.67%
6	**Alternative**		
	Two-way table constructed with 6 outcomes	M1	6 outcomes listed
	Correct 6 outcomes	M1	
	$\dfrac{1}{6}$	A1	oe fraction, decimal or percentage Allow 0.166… or 0.167 or 16.66…% or 16.67%

Q	Answer	Mark	Comments
7(a)	$6x + 18y = 48$ and $6x + 16y = 38$	M1	oe $16x + 48y = 128$ and $18x + 48y = 114$ Coefficients of one variable equated. Allow one calculation error.
	$2y = 10$	M1dep	$2x = -14$ Isolates variable
	$y = 5$	A1	$x = -7$
	$x = -7$	A1	$y = 5$ SC1 both values correct from non-algebraic method
7(a)	**Alternative 1**		
	$x = \dfrac{16-6y}{2}$ $(= 8 - 3y)$	M1	$x = \dfrac{19-8y}{3}$
	$3\left(\dfrac{16-6y}{2}\right) + 8y = 19$	M1dep	$2\left(\dfrac{19-8y}{3}\right) + 6y = 16$
	$y = 5$	A1	$y = 5$
	$x = -7$	A1	$x = -7$ SC1 both values correct from non-algebraic method
7(a)	**Alternative 2**		
	$y = \dfrac{16-2x}{6}$	M1	$y = \dfrac{19-3x}{8}$
	$3x + 8\left(\dfrac{16-2x}{6}\right) = 19$	M1dep	$2x + 6\left(\dfrac{19-3x}{8}\right) = 16$
	$x = -7$	A1	$x = -7$
	$y = 5$	A1	$y = 5$ SC1 both values correct from non-algebraic method
7(b)	Two equations with a unique solution of $x = 6$ and $y = -5$	B2	If answer is $x = 6$ and $y = -5$ these equations must be on the answer lines B1 one correct equation with at most one incorrect equation B1 two correct equations where one is a multiple of the other If four equations are given, award B2 for all four correct and B1 for two or three correct.

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Q	Answer	Mark	Comments
8(a)	$(x - 7)(x + 4)$	B2	B1 for $(x + a)(x + b)$ where $a + b = -3$ or $ab = \pm 28$
8(b)	$(x - 4)(x + 4)$	M1	
	$\dfrac{x - 4}{x - 7}$	A1 ft	ft from (a) if M1 scored and simplification possible This must be their final answer. Withhold the A mark for further work.

Q	Answer	Mark	Comments
9	$\dfrac{1}{1}$ (−) $\dfrac{1}{4}$ (+) $\dfrac{1}{9}$ (−) $\dfrac{1}{16}$ (+) $\dfrac{1}{25}$ or 1 (−) 0.25 (+) 0.$\dot{1}$ (−) 0.0625 (+) 0.04 [0.8386, 0.8387]	M1	Allow one error
	10.06….	A1	$\dfrac{3019}{300}$
	$\sqrt{\text{their } 10.0633333}$	M1dep	[3.172, 3.173] dep on first M1
	Their 3.17228 ÷ 3.142 × 100	M1	$\dfrac{\text{their } 3.17228 - 3.142}{3.142} \times 100$
	[100.96, 100.97](%) and Yes	A1 ft	[0.96, 0.97](%) and Yes
9	**Alternative 1**		
	$\dfrac{1}{1}$ (−) $\dfrac{1}{4}$ (+) $\dfrac{1}{9}$ (−) $\dfrac{1}{16}$ (+) $\dfrac{1}{25}$ or 1 (−) 0.25 (+) 0.$\dot{1}$ (−) 0.0625 (+) 0.04 [0.8386, 0.8387]	M1	Allow one error
	10.06….	A1	$\dfrac{3019}{300}$
	$\sqrt{\text{their } 10.0633333}$	M1 dep	[3.172, 3.173] dep on first M1
	Their 3.17228 − 3.142	M1	
	[0.03, 0.031] and 0.03142 and Yes	A1 ft	

Q	Answer	Mark	Comments
9	**Alternative 2**		
	$\dfrac{1}{1}$ (–) $\dfrac{1}{4}$ (+) $\dfrac{1}{9}$ (–) $\dfrac{1}{16}$ (+) $\dfrac{1}{25}$ or 1 (–) 0.25 (+) $0.\dot{1}$ (–) 0.0625 (+) 0.04 [0.8386, 0.8387]	M1	Allow one error
	10.06….	A1	$\dfrac{3019}{300}$
	3.142^2 (= 9.872164)	M1	
	$\sqrt{\text{Their } 10.063333 \div 9.872164}$	M1 dep	$\sqrt{\text{Their } 10.063333 \div 9.872164} \times 100$ dep on first M1
	[1.0096, 1.0097] and Yes	A1 ft	[100.96, 100.97]% and Yes
9	**Alternative 3**		
	$\dfrac{1}{1}$ (–) $\dfrac{1}{4}$ (+) $\dfrac{1}{9}$ (–) $\dfrac{1}{16}$ (+) $\dfrac{1}{25}$ or 1 (–) 0.25 (+) $0.\dot{1}$ (–) 0.0625 (+) 0.04 [0.8386, 0.8387]	M1	Allow one error
	10.06….	A1	
	$\sqrt{\text{their } 10.0633333}$	M1 dep	[3.172, 3.173] dep on first M1
	3.142 × 1.01 or 3.17342	M1	3.142 × 0.99 or 3.11058
	3.1734(2) and [3.172, 3.173] and Yes	A1ft	

Q	Answer	Mark	Comments
10	(Gradient of PQ =) $\dfrac{-4}{7}$	B1	Allow 0.57 or better for $\dfrac{4}{7}$
	$0 = \dfrac{-4}{7} \times 14 + K$	M1	(K =) 14 × their $\dfrac{4}{7}$ or –14 × their $\dfrac{-4}{7}$ (= 8) 8 marked at the y-intercept ft non-integer gradient
	$y = \dfrac{-4}{7} x + 8$	A1 ft	ft non-integer gradient
	$4x + 7y = 56$	A1 ft	oe ft their equation with a non-integer coefficient of x and M1 awarded

Q	Answer	Mark	Comments
11(a)	35	B1	
11(b)	$920 \div 100 \div 2$	M1	oe $9.2 \div 2$ 920×0.005
	4.6	A1	

Q	Answer	Mark	Comments
12	$2a = 10 + 4$ or 14	M1	
	7	A1	

Q	Answer	Mark	Comments
13	$x + 4$ $4x$ $4x + 16$ or $4(x + 4)$ $4x + 6$ $4x + 6$ or $4x + 16 - 10$ or $4(x + 4) - 10$	B2	B1 for either column correct
	$4x + 6$ $4x + 6$	Q1	Strand (ii) Fully correct algebra seen leading to identical outcomes

Q	Answer	Mark	Comments
14	Gives coordinates of at least two points	M1	
	Correctly plots their points	M1	
	Correct graph from $x = -3$ to $x = 3$	A1	

Q	Answer	Mark	Comments
15(a)	$1 - (0.3 + 0.25 + 0.1)$	M1	
	0.35	A1	oe
15(b)	0.4	B1	oe

Q	Answer	Mark	Comments
16	Divides 8 by 11, showing at least 0.7	M1	
	$0.\dot{7}\dot{2}$	Q1	Strand (i) Correct notation Accept 0.7272…

Q	Answer	Mark	Comments
17	$6x^2$ (+) $3x$ (+) $8x$ (+) 4	M1	4 terms, including one in x^2, with at least 3 correct
	$6x^2 + 3x + 8x + 4$	A1	
	$6x^2 + 11x + 4$	A1ft	ft correct simplification of their four terms, including one in x^2 SC1 $6x^2 + ax + 4$, $a \neq 0$, M1 not awarded

Q	Answer	Mark	Comments
18(a)	$\dfrac{29}{50}$	B1	oe 0.58
18(b)	$\dfrac{23}{50}$	B1	oe 0.46 SC1 incorrect but consistent denominator, greater than 29, in (a) and (b) with correct numerators.
18(c)	Ĺ	B1	
18(d)	$\dfrac{40}{50}$ or 40 seen	M1	6, 23 and 11 identified
	L ∪ T	A1	T ∪ L SC1 A ∪ B or B ∪ A

Q	Answer	Mark	Comments
19(a)	$-17 - 3 \leqslant 4x < 11 - 3$	M1	$-20 \leqq 4x < 8$ or $-5 \leqslant x$ or $x < 2$
	$-5 \leqslant x < 2$	A1	
19(b)	−5 (×) −4 (×) −3 (×) −2 (×) −1 (×) 0 (×) 1	M1	Allow one error if subsequent product is correct
	Correct and complete list and 0	A1ft	ft their (a) with at least two integers to multiply, at least one of which is negative or zero SC1 0

Q	Answer	Mark	Comments
20	$3 \div 2\dfrac{1}{4}$	M1	$2.25x = 3$
	$3 \div \dfrac{9}{4}$	M1	$4.5x = 6$ or multiple eg $9x = 12$
	$3 \times \dfrac{4}{9}$	M1	$(x =)$ $12 \div 9$
	$\dfrac{12}{9}$	A1	oe $\dfrac{4}{3}$ $1\dfrac{1}{3}$ 1.33 …

Q	Answer	Mark	Comments
21	$\dfrac{4}{10}$ **and** $\dfrac{3}{9}$	M1	
	$\dfrac{4}{10} \times \dfrac{3}{9}$	M1	
	$\dfrac{12}{90}$	A1	oe $\dfrac{2}{15}$ SC1 $\dfrac{12}{100}$ or $\dfrac{16}{90}$ oe

Q	Answer	Mark	Comments
22(a)	$5^2 \; (+) \; 5\sqrt{7} \; (+) \; 5\sqrt{7} \; (+) \; (\sqrt{7})^2$	M1	oe 4 terms, at least 3 correct
	$32 + 10\sqrt{7}$	A1	
22(b)	$\dfrac{1}{\sqrt{3}\sqrt{6}}$ or $\dfrac{1}{\sqrt{18}}$ or $\sqrt{18}^{-1}$	M1	
	$\dfrac{\sqrt{18}}{18}$	M1	
	$\dfrac{3\sqrt{2}}{18} = \dfrac{\sqrt{2}}{6}$	A1	
22(b)	**Alternate**		
	$\dfrac{1}{\sqrt{3}\sqrt{6}}$ or $(3\sqrt{2})^{-1}$	M1	
	$\dfrac{1}{\sqrt{3}\sqrt{3}\sqrt{2}} = \dfrac{1}{3\sqrt{2}}$	M1	
	$\dfrac{\sqrt{2}}{3\sqrt{2}\sqrt{2}} \; (= \dfrac{\sqrt{2}}{3 \; x \; 2} \;) = \dfrac{\sqrt{2}}{6}$	A1	