AQA

General Certificate of Secondary Education
June 2011

Methods in Mathematics (Pilot)　　　93651H

(Specification 9365)

Unit 1: Methods in Mathematics
　　　　Written Paper (Higher)

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 candidates' 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 candidates' 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 candidates' 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.
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 $\frac{1}{2}$

M1 Higher Tier

Section A

Q	Answer	Mark	Comments
1(a)	24 ÷ 5 (= 4.8)	M1	
	(£) 19.20, (£) 4.80	A1	Do not allow 19.2 or 4.8
1(b)	$\frac{5}{8}$	B1	oe fraction, decimal or percentage Ignore incorrect simplification from a correct answer, eg $\frac{5}{8} = \frac{2}{3}$ or $\frac{5}{8} = 0.58$
1(c)	2.50	B1	Condone 2.5

Q	Answer	Mark	Comments
2	80 × 0.55 (= 44)	M1	oe 80 ÷ 100 × 55 (= 44)
	Their 44 + 70 (= 114)	M1	
	Their 114 ÷ 1.5	M1	oe Their 114 ÷ 150 × 100
	76	A1	SC3 79

Q	Answer	Mark	Comments
Alt 2	80 × 0.55 (= 44)	M1	oe 80 ÷ 100 × 55 (= 44)
	Their 44 ÷ 1.5 (= $29\frac{1}{3}$) or 70 ÷ 1.5 (= $46\frac{2}{3}$)	M1	oe Their 44 ÷ 150 × 100 or 70 ÷ 150 × 100
	Their $29\frac{1}{3}$ + their $46\frac{2}{3}$	M1	
	76	A1	SC3 79

Q	Answer	Mark	Comments
3(a)	Shades B apart from intersection with A	B1	
3(b)	A' ∩ B' or (A ∪ B)'	B1	

3(c)	3 letters in P only, 3 letters in intersection, 4 letters in Q only	B2	2, 4, 3, letters, 1 outside
			1, 5, 2, letters, 2 outside
			0, 6, 1, letters, 3 outside
			B1 6 letters in P or 7 letters in Q
			     Numbers in correct sections
			     All correct, but other letters used

Q	Answer	Mark	Comments
*4	$\dfrac{1}{3} + \dfrac{2}{5}$ $(= \dfrac{11}{15})$ or $\dfrac{4}{15}$	M1	
	$1 - $ their $\dfrac{11}{15}$ $(= \dfrac{4}{15})$ and $44 \div$ their 4 or 44×1.5	M1	Sight of 11 Their 11 may then be multiplied
	66	A1	
	Addition, subtraction from 1 and division of 44 by their numerator or multiplication of 44 by 1.5 Sight of $\dfrac{11}{15}$ (or $\dfrac{5}{15}$ and $\dfrac{6}{15}$), $\dfrac{4}{15}$ and 11, with an answer given, in organised working	Q1	QWC - Strand (iii) - To achieve a correct solution a clear and organised approach must be evident
Alt *4	$0.\dot{3} + 0.4$ $(= 0.7\dot{3})$ or $0.2\dot{6}$	M1	$33.\dot{3}\% + 40\%$ $(= 73.\dot{3}\%)$ or $26.\dot{6}\%$
	$1 - $ their $0.7\dot{3}$ and $44 \div$ their $0.2\dot{6}$ ($\times 0.4$) or Sight of 165	M1	$100 - $ their $73.\dot{3}$ and $44 \div$ their $26.\dot{6}$ ($\times 40$) or Sight of 1.65
	66	A1	
	Must see addition, subtraction from 1 (or 100) and division of 44 by their decimal (or percentage) Sight of $0.7\dot{3}$, $0.2\dot{6}$ and 165 with an integer answer Sight of $73.\dot{3}$, $26.\dot{6}$ and 1(.)65 with an integer answer	Q1	QWC - Strand (iii) - To achieve a correct solution a clear and organised approach must be evident

Q	Answer	Mark	Comments
5	$18x + 15y = 105$ or $24x + 20y = 140$ $40x - 15y = 40$ $\qquad$ $24x - 9y = 24$	M1	oe Equates coefficients Allow one arithmetic error
	$58x = 145$ or $29y = 116$	M1	Eliminates one unknown Allow one arithmetic error
	$x = 2.5$ or $y = 4$	A1	Solves for one unknown
	$y = 4$ or $x = 2.5$	A1	Solves for other unknown

Q	Answer	Mark	Comments
6(a)	0, 3	B1	
6(b)	Starts $y = 2x$	B1	Not $y = 2x + 3$
	$(5 \times$ their 2$) + c = 4$	M1	$c = 4 - (5 \times$ their 2$)$ $c = -6$
	$y = 2x - 6$	A1	SC2 $2x - 6$

Q	Answer	Mark	Comments
7(a)	0.1, 0.3, 0.7, 0.3	B1	oe decimal, fraction or percentage
7(b)	0.9×0.7 (= 0.63) or $0.9 \times$ their 0.3 (= 0.27) or Their 0.7 $\times$ their 0.1 (= 0.07)	M1	their 0.1 $\times$ their 0.3
	Their 0.63 + their 0.27 + their 0.07	M1dep	$1 -$ their 0.03
	0.97	A1ft	oe ft their values on tree diagram
7(c)	2 (+) 4 (+) 8 (+) 16 (+) 32	M1	2^1 (+) 2^2 (+) 2^3 (+) 2^4 (+) 2^5
	62	A1	

Q	Answer	Mark	Comments
8	$(2n + 1)^2$	M1	
	$4n^2 + 2n + 2n + 1$	M1	Condone one error if there are four terms, including one in n^2 and two in n
	$4n^2 + 4n + 1$	A1	
	$4(n^2 + n) + 1$ or $4n(n + 1) + 1$ or Explains that $4n^2 + 4n$ is a multiple of 4	Q1	QWC - Strand (ii) - Clear proof with each step shown and explanation

6

Q	Answer	Mark	Comments
9(a)	$\dfrac{y}{d}$	M1	$y \times (y-1)$ or $d \times (d-1)$
	$\dfrac{y}{d} \times \dfrac{y-1}{d-1}$ $(=\dfrac{y^2-y}{d^2-d})$	A1	
9(b)	$7 \times 6 = 42$ or $d^2 - d = 110$ or $b^2 - b = 42$	M1	$b(b-1) = 42$ or $d(d-1) = 110$ $(d =) 11$ Any letters
	$\dfrac{7}{11}$	A1	
	Their $\dfrac{4}{11}$ × their $\dfrac{3}{10}$	M1	
	$\dfrac{12}{110}$	A1	oe $\dfrac{6}{55}$

Section B

Q	Answer	Mark	Comments
10	$4x + 24 \;(- x) \; (= 3x + 24)$	M1	$3x + 3a$ or $(3x +) \, 24 = (3x +) \, 3a$
	$3(x + 8)$ or $(a =) 8$	A1	
	Expansion, simplification and solution Shows $3x + 24$ and $(a =) 8$	Q1	QWC - Strand (ii) - Logical algebraic steps to a solution Allow one arithmetic error.

11	4, 8, 4	B2	B1 For 2 correct

Q	Answer	Mark	Comments
12	$\dfrac{12}{5}$	B1	oe fraction or decimal
	$\dfrac{3}{20}$	B1	oe fraction or decimal
	Common denominator with correct numerators	M1	$\dfrac{48}{20} \; (-) \; \dfrac{3}{20}$ Their 2.4 – their 0.15
	$\dfrac{45}{20}$	A1	oe $2\dfrac{5}{20}$, $2\dfrac{1}{4}$, 2.25

Q	Answer	Mark	Comments
13(a)	$8x - 5x = 5 + 1$	M1	$5x - 8x = -1 - 5$ Allow one arithmetic or rearrangement error
	$3x = 6$	A1	$-3x = -6$
	2	A1 ft	ft if M1 awarded
13(b)	$5a = 20 - b$	M1	
	1 correct pair	A1	eg, 1, 15
	2nd correct pair	A1	eg, 2, 10
13(c)	$3(7x - 2)\ (+)\ 4(5x + 8)$	M1	or multiple
	$21x - 6\ (+)\ 20x + 32$	M1	or multiple Allow one expansion or arithmetic error
	$41x + 26 = 108$	A1	or multiple
	2	A1 ft	ft one expansion or arithmetic error M2 and equation in the form $ax + b = c$

14	Completes in 3 moves	B3	D into B B into A E into C (could be first) B2 Completes in four moves D into A, A into B, D into A, E into C B1 Completes in more than four moves

15(a)	$[-2.8, -2.6]$ and $[0.6, 0.8]$	B2	B1 For either SC1 $[-2.9, -2.8]$ and $[0.8, 0.9]$ or $\quad\quad [-2.4, -2.3]$ and $[0.3, 0.4]$
15(b)	$\pm[2.6, 2.8]$ or $\pm[1.6, 1.8]$	M1	Vertical lines drawn down from the curve at $y = 3$ and $y = 7$
	$\pm[0.8, 1.2]$	A1	Not from incorrect working

Q	Answer	Mark	Comments
16	$4x + 4t \; (= 9t + 2)$	M1	
	$4x = 9t - 4t + 2$	M1	oe $x + t = \dfrac{9t + 2}{4}$
	$x = \dfrac{5t + 2}{4}$	A1	oe $x = \dfrac{9t + 2}{4} - t$

Q	Answer	Mark	Comments
17	$G \propto \dfrac{1}{H}, \; G = \dfrac{k}{H}$	M1	oe $GH = k$
	$8 = \dfrac{k}{7}$	M1	$8 \times 7 = k$
	$G = \dfrac{56}{H}$	A1	Allow k = 56 if $G = \dfrac{k}{H}$ seen

Q	Answer	Mark	Comments
18	$p(p + 3)$ and $(p + 1)(p + 2)$ $p^2 + 3p$ and $p^2 + 2p + p + 2$ $\qquad\qquad (= p^2 + 3p + 2)$ $p^2 + 3p + 2 \; (=) \; p^2 + 3p + 2$	B3	$p(p + 3) + 2 = p^2 + 3p + 2$ $= (p + 1)(p + 2)$ $= qr$ B2 For first two stages only B1 For first stage only

Q	Answer	Mark	Comments
19	$(\sqrt{12})^2 - (\sqrt{3})^2$	M1	$\sqrt{144} \; (+ \sqrt{3}\,\sqrt{12} - \sqrt{3}\,\sqrt{12}) - \sqrt{9}$ oe Changes $\sqrt{12}$ to $2\sqrt{3}$
	9	A1	
	$(\sqrt{2})^2 + 2\sqrt{2}\,\sqrt{8} + (\sqrt{8})^2$ $(= 2 + 2\sqrt{16} + 8)$	M1	oe Changes $\sqrt{8}$ to $2\sqrt{2}$
	18	A1	
	$\dfrac{1}{2}$	A1	