Version : 1.0: 06.11

General Certificate of Secondary Education
June 2011

Mathematics 43602H
Higher
Unit 2

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 candidates' 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 candidates' 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 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.

Set and published by the Assessment and Qualifications Alliance.

The Assessment and Qualifications Alliance (AQA) is a company limited by guarantee registered in England and Wales (company number 3644723) and a registered charity (registered charity number 1073334).
Registered address: AQA, Devas Street, Manchester M15 6EX

UMS conversion calculator www.aqa.org.uk/umsconversion

The following abbreviations are used on the mark scheme:

M	Method marks awarded for a correct method.
M dep	A method mark which is dependent on a previous method mark being awarded.
A	Accuracy marks awarded when following on from a correct method. It is not necessary always to see the method. This can be implied.
B	Marks awarded independent of method.
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.
[*a*, *b*]	Accept values between a and b inclusive.

UNIT 2 HIGHER TIER 43602H

1	9 (×) (6 – 10) or 9 × –4 or 54 – 90 or –36	M1	
	$\frac{-36}{-12}$ or $\frac{9}{3}$	A1	
	3	A1 ft	ft if M1 awarded

2	Any two of 800 or 2^2 (or 4) or 10 seen	M1	
	800 ÷ 40 or 200 ÷ 10 or 80 ÷ 4	M1	oe
	20	A1	

3	$\frac{60}{100} \times 210$ or $210 - \frac{40}{100} \times 210$	M1	oe
	(£)126	A1	
	$\frac{2}{3} \times 195$ or $195 - \frac{1}{3} \times 195$	M1	oe Condone use of (0).33 (…) (0).66(…) and (0).67(…)
	(£)130	A1	Accept [128.7(0), 130.65]
	Clix	Q1 ft	Strand (iii) Correct conclusion from their working with all calculations shown Must have both Ms awarded

4	(50 – 43) red or 7 red or 14 (red) or 36 (blue and yellow)	M1	R + 3Y + Y = 43 or 2R + 3Y + Y = 50 oe or R = 7
	their 36 ÷ 4	M1 dep	4Y = 43 – 7 oe
	9	A1	

5a	$7x + 3x = 15$ or $10x = 15$	M1	oe
	1.5 or $1\frac{1}{2}$	A1	oe Accept $\frac{3}{2}$ or $\frac{15}{10}$
5b	$2x + 32$ or $4x - 20$	M1	Accept $ax + ab$ for M1
	$6x + 12$ or $6(x + 2)$	A1	
	$a = 6$ and $b = 2$	A1 ft	ft from their $6x + 12$ if M1 earned SC2 $a = 6$ and $b = 12$ SC1 $a = 6$

6	$\frac{1}{5} - \frac{1}{6}$	M1	Value chosen eg	
			(£)60 and (£)12 or (£)10 seen	(£)100 and (£)20 or (£)[16,17]seen
	$\frac{5}{30}$ or $\frac{6}{30}$ oe	M1	12 and 10 seen	20 and [16, 17] seen
	$\frac{1}{30}$ or $\frac{14}{30}$ seen oe	A1	2 or 28 seen	[3, 4] or [46, 47] seen
	$\frac{6}{30} + \frac{5}{30} + \frac{14}{30}$ or $\frac{25}{30}$ or $\frac{16}{30} - \frac{5}{30} - \frac{6}{30}$ or $1 - \frac{14}{30} - \frac{5}{30} - \frac{6}{30}$	M1	12 + 10 + 28 = 50 or 60 – 28 – 12 – 10	20 + [46, 47] + [16, 17] = [82, 84] or 100 – [46, 47] – 20 – [16, 17]
	$\frac{5}{30}$ or $\frac{1}{6}$	A1	Exact answer for their chosen value	
			(£)10	

7a	Plan A	B1	
	Valid reason	B1	eg cheaper (for 800 minutes)
7b	Attempt at any two readings from Plan B slope	M1	eg (600, 30), (700, 60), (800, 90), (900, 120), (1000, 150) need not be coordinates eg 600(min), (£)30 or (£)30, 600(min)
	Compares cost and time or 6000 (÷) 200 or 60 (÷) 200	M1 dep	oe eg (£)30 in 100 (minutes) (£)120 in 400 (minutes)
	30p or £0.30	A1	

8a	–4 **and** ×3 or ×3 **and** –12	B2	Must be in the correct order for B2 B1 for –4 or n – 4 in first box, or ×3 or 3 × n in first box **Note**: ×3 **and** –4 scores B0 B1 for 3 **and** –12 (missing × sign)
8b	$3(n - 4) = n$ or $3n - 12 = n$	M1	
	6	A1	

9	$(b =)\ 2a - 4$	M1	oe
	$(c =)\ 2b - 4$ or $2(2a - 4) - 4$	M1	oe
	$(c =)\ 4a - 8 - 4$ or $(c =)\ 2a - 4 + 2a - 4 - 4$	A1	SC1 for substitution of value for a and checked in c eg $a = 10$, $b = 16$, $c = 28$ and $4 \times 7 = 28$
	Clear and logical algebraic solution	Q1	Strand (ii) Must have both M marks Do not award for a numerical verification

10a	$8x^4y^7$	B2	B1 for two out of three parts correct eg $6x^4y^7$
10b	$4y(5y - 2x)$	B2	B1 for $4y(? - ?)$ or $4(5y^2 - 2xy)$ or $8y(2.5y - x)$ or $y(20y - 8x)$ or $8(2.5y^2 - xy)$ or $2(10y^2 - 4xy)$ or $2y(10y - 4x)$
10c	$w - y = \frac{x}{r}$	M1	$wr = yr + x$ or $-x = yr - wr$ oe
	$r(w - y) = x$	A1	$wr - yr = x$ Must have $x = \ldots$ oe
10d	$6x^2y^2$	B2	B1 for $18x^3y^3$ or any other common multiple

11	$3(x - 16) = x$	M1	oe
	$3x - x = 48$ or $2x = 48$	M1 dep	
	$x = 24$	A1	
	Girls original number = 35	A1	
	Alternative method 1		
	1st trial with B + 11 = G B – 16 checked against G – 11 for 1 : 3	M1	Must be clearly shown eg B = 20, G = 31
	2nd trial with B + 11 = G, fully checked	M1 dep	
	B = 8 or G = 24	A1	
	Girls original number = 35	A1	
	Alternative method 2		
	16 boys = 2 parts of ratio 1 : 3	M1	
	1 part = $\frac{16}{2}$	M1 dep	
	24 (+11)	A1	
	35	A1	
	Alternative method 3		
	$x + 16 = 3x$	M1	x = Final number of boys at bus stop
	$16 = 3x - x$	M1 dep	
	(x =) 8	A1	
	Girls original number = 35	A1	
	Alternative method 4		
	G = B + 11	M1	oe eg G – 11 = B
	3(B – 16) = G – 11	M1	
	B = 24	A1	
	G = 35	A1	G = 35 scores both A marks
	Alternative method 5		
	1st trial using ratio 1 : 3, fully checked	M1	eg B : G = 10 : 30 B + 16 = 26 26 ≠ 30
	2nd trial using ratio 1 : 3, fully checked	M1	eg B : G = 7 : 21 B + 16 = 23 23 ≠ 21
	8 : 24	A1	
	35	A1	

12	$2x^2 - 7x - 3 + 3^2$	M1	
	$2x^2 - 7x + 6$	A1	
	$(2x + a)(x + b)$ (= 0)	M1	ab = ± their 6 Must be a quadratic in $2x^2$ Substitution in quadratic formula (if used) must be correct for M1 eg for $2x^2 - 7x + 6$ (= 0) $x = \frac{7 \pm \sqrt{7^2 - 4(2)(6)}}{4}$
	1.5 **and** 2	A1	oe SC3 for $2x^2 - 7x + 3$ (= 0) leading to answers of 0.5 and 3

13	$7x + \frac{10x}{x+2} = 9$ or $7(x + 2) + 10 = \frac{9}{x}(x + 2)$ or $7 + \frac{10}{x+2} - \frac{9}{x} = 0$	M1	M1 for equating two correct fractions $\frac{7(x+2)+10}{x+2} = \frac{9}{x}$ or $\frac{10}{x+2} = \frac{9-7x}{x}$ Also M1 for $7 + \frac{10x}{x(x+2)} = \frac{9(x+2)}{x(x+2)}$
	$7x(x + 2) + 10x = 9(x + 2)$	M1 dep	oe
	$7x^2 + 14x + 10x = 9x + 18$ or $7x^2 + 14x + 10x - 9x - 18 = 0$	A1	

14	$\sqrt{10}\ \sqrt{15} - \sqrt{10}\ \sqrt{3}$ (+) $\sqrt{2}\ \sqrt{15} - \sqrt{2}\ \sqrt{3}$	M1	or better … Allow one error (sign or term) in the expansion
	Eliminating the two 'middle' terms	M1	These must be the correct two middle terms
	$\sqrt{10}\ \sqrt{15}$ simplified to $5\sqrt{6}$	M1	
	$4\sqrt{6}$	A1	
	Alternative method 1		
	$(\sqrt{5}\ \sqrt{2} + \sqrt{2})(\sqrt{5}\ \sqrt{3} - \sqrt{3})$ or $\sqrt{5}\ \sqrt{5}\ \sqrt{2}\ \sqrt{3} + \sqrt{5}\ \sqrt{2}\ \sqrt{3} - \sqrt{2}\ \sqrt{5}\ \sqrt{3} - \sqrt{2}\ \sqrt{3}$	M1	or better … Allow one error (sign or term) in the expansion
	Eliminating the two 'middle' terms	M1	These must be the correct two middle terms
	$\sqrt{5}\ \sqrt{5}\ \sqrt{2}\ \sqrt{3}$ simplified to $5\sqrt{6}$	M1	
	$4\sqrt{6}$	A1	
	Alternative method 2		
	$(\sqrt{5}\ \sqrt{2} + \sqrt{2})(\sqrt{5}\ \sqrt{3} - \sqrt{3})$	M1	
	$\sqrt{2}\ \sqrt{3}\ (\sqrt{5} + 1)(\sqrt{5} - 1)$	M1	
	$\sqrt{2}\ \sqrt{3} \times (5 - 1)$	M1	
	$4\sqrt{6}$	A1	

15a	$\frac{1}{27}$	B3	B2 for 27 or $\frac{1}{3}$ or $\frac{1}{729}$ or 27^{-1} B1 for 3 or 729 or $\frac{1}{9^{\frac{3}{2}}}$ or –27
15b	2^{3m} (= 2^{m^2}) or $(2^3)^m$ (= 2^{m^2})	M1	oe
	$m^2 = 3m$ or $m^2 - 3m = 0$ or $m(m - 3) = 0$ or $(m =) 0$ or $(m =) 3$	M1 dep	oe
	0 **and** 3	A1	