Version : 1.0: 11.11

General Certificate of Secondary Education
November 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 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.

Further copies of this Mark Scheme are available from: aqa.org.uk

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.
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	$5(2 \times 9 - 6)$ or $5(18 - 6)$ or $5 \times 18 - 5 \times 6$ or 12 or $90 - 30$ or 60	M1	
	$\frac{\text{their } 60}{-4}$ or 5×-3 or $\frac{5 \times 3}{-1}$ or $\frac{15}{-1}$	M1 dep	Their 60 can come from only one error
	–15	A1	

2a	2.56	B1	
2b	81.92	B1	

3	Any three of $a = 2, \quad b = 5$ $a = 7, \quad b = 2$ $a = 7, \quad b = 11$ $a = 11, \quad b = 3$	B3	B1 for each correct pair SC1 if no other marks scored for: $a = 3, \quad b = 3$ (same numbers) $a = 3, \quad b = 19$ oe (prime > 12) Listing all primes less than 12 ie 2, 3, 5, 7, 11 Listing the square numbers (1, 4,) 9, 16, 25

4	60 seen	B1	
	their $60 - \frac{20}{100} \times$ their 60 or 48	M1	oe eg $\frac{80}{100} \times$ their 60
	Yes and 48 seen	A1 ft	Using 70 and getting 56, hence 'no' scores M1 A1 56 with no conclusion is M1A0 SC1 for 12 and Yes

5	$6x - 2$ (=) $2x$	M1	oe
	$6x - 2x = 2$ or $4x = 2$	M1 dep	oe
	$\frac{1}{2}$	A1	oe
	Alternative method		
	Input > 0.5 with correct output	M1	
	Input < 0.5 with correct output	M1	
	0.5	A1	oe

6	20 × 7.50 or 150	M1	
	their 150 ÷ 5 or 30	M1 dep	oe
	Attempt at 429 ÷ their 30 or a multiple of their 30 immediately above or below 429	M1 dep	Multiple of their 30 must be correctly evaluated
	14.3 or 15 (weeks)	A1	15 from division (if used) with no errors SC2 for 15 weeks with no working
	Alternative method 1		
	7.50 ÷ 5 or 1.50	M1	oe
	their 1.50 × 20 or 30	M1 dep	
	Attempt at 429 ÷ their 30 or a multiple of their 30 immediately above or below 429	M1 dep	Multiple of their 30 must be correctly evaluated
	14.3 or 15 (weeks)	A1	15 from division (if used) with no errors SC2 for 15 weeks with no working
	Alternative method 2		
	20 ÷ 5 or 4 (hours)	M1	oe
	their 4 × 7.50 or 30	M1 dep	
	Attempt at 429 ÷ their 30 or a multiple of their 30 immediately above or below 429	M1 dep	Multiple of their 30 must be correctly evaluated
	14.3 or 15 (weeks)	A1	15 from division (if used) with no errors SC2 for 15 weeks with no working

7	240 ÷ 12 (= 20)	M1	
	$\left[\frac{15}{100}\times\text{their } 20+\text{their } 20\right]$ or 23	M1	
	8 × their 23	M1	
	184	A1	
	Correct conclusion from their working with all calculations shown	Q1	Strand (iii) dep on all M marks and working seen The students have saved enough
	Alternative method 1		
	240 ÷ 12 (= 20)	M1	
	their 20 × 8 (= 160)	M1	
	$\frac{15}{100}$ × their 160 + their 160	M1	
	184	A1	
	Correct conclusion from their working with all calculations shown	Q1	Strand (iii) dep on all M marks and working seen The students have saved enough
	Alternative method 2		
	200 ÷ 8 (= 25)	M1	Average amount saved per student
	240 ÷ 12 (= 20)	M1	
	$\left[\frac{15}{100}\times\text{their } 20+\text{their } 20\right]$ or 23	M1	oe eg 1.15 × their 20
	25 and 23	A1	
	Correct conclusion from their working with all calculations shown	Q1	Strand (iii) dep on all M marks and working seen The students have saved enough
	Alternative method 3		
	$\left[\frac{15}{100}\times 240+240\right]$ or 276	M1	oe eg 1.15 × 240
	their 276 ÷ 12 (= 23)	M1	
	their 23 × 8	M1	
	184	A1	
	Correct conclusion from their working with all calculations shown	Q1	Strand (iii) dep on all M marks and working seen The students have saved enough

8a	y^{11}	B1	
8b	w^8	B1	
8c	$y - 2 = 3x$ or $\frac{y}{3} = x + \frac{2}{3}$ or $-3x = 2 - y$	M1	
	$\frac{y-2}{3} = x$ or $x = \frac{2-y}{-3}$	A1	oe SC1 for $x = \frac{2-y}{3}$ or $x = \frac{y+2}{3}$

9	2 parts = 10 marks	M1	
	A (= 5 parts =) 25 and B (= 3 parts =) 15	A1	
	A = 25, B = 15, C = 32	A1	
	Alternative method 1		
	Attempt to write equivalent ratios eg 10 : 6, 15 : 9	M1	oe eg writing consecutive multiples 5, 10, 15, … and 3, 6, 9, …
	(A)25 : 15(B)	A1	25 : 15 selected
	A = 25, B = 15, C = 32	A1	
	Alternative method 2		
	$\frac{m+10}{m} = \frac{5}{3}$	M1	oe eg $5m = 3(m + 10)$
	$m = 15$, hence $m + 10 = 25$	A1	
	A = 25, B = 15, C = 32	A1	

10a	$m^2 + 4m$	B2	B1 for one term correct
10b	$6y(2xy - 1)$	B2	oe B1 for $6(2xy^2 - y)$ or $3(4xy^2 - 2y)$ or $2(6xy^2 - 3y)$ or $y(12xy - 6)$ or $3y(4xy - 2)$ or $2y(6xy - 3)$ or $6y(? - ?)$ eg $6y(2xy - y)$

11	$3(2x – 3)$ or $4(x – 1)$	M1	oe Denominator not necessary … marks for numerator terms
	$6x – 9 + 4x – 4$	M1 dep	oe allow one incorrect term
	their $10x – 13 = 2 \times 12$	M1 dep	oe eg $20x – 26 = 2 \times 24$ Do not allow their $10x – 13 = 2$
	$(x =)$ 3.7 or $\frac{37}{10}$	A1	
	All steps clearly shown with M3 awarded	Q1	Strand (ii)

12a	$(n + a)(n + b)$	M1	Where $ab = \pm 6$
	$(n + 1)(n + 6)$	A1	
12b	Sight of 11×16	M1	Use of factor tree with one pair of factors of which one is prime or repeated division by primes
	$11 \times 2 \times 2 \times 2 \times 2$ (×1)	A1	
	11×2^4	A1	

13	B or $x + y \geq 3$ **and** D or $2y \geq x + 4$	B2	B1 for one correct and at most one incorrect

14	Gradient = 2 or $y = 2x + c$	M1	$m = 2$ earns this mark
	Substituting $x = 250$, $y = 620$ or $x = 400$, $y = 920$	M1 dep	
	$c = 120$ or $C = (0, 120)$	A1	
	$D = (–60, 0)$	A1	
	Alternative method		
	Sight of 150 and 300 or ratio 1 to 2	M1	
	Finds an intermediate point between B and C eg (100, 320), (200, 520)	M1 dep	This point implies M2
	$C = (0, 120)$	A1	
	$D = (–60, 0)$	A1	

15a	Add one more to both top and bottom or $n + 1 + 1 = n + 2$	B1	
15b	$\frac{n+1}{n+2} - \frac{n}{n+1}$ or $\frac{n}{n+1} - \frac{n+1}{n+2}$	M1	
	Numerator of $(n + 1)^2 - n(n + 2)$ or $n(n + 2) - (n + 1)^2$	M1	oe Denominator not necessary … marks for numerator expression
	$\frac{n^2+2n+1-n^2-2n}{(n+1)(n+2)}$ $= \frac{1}{(n+1)(n+2)}$	A1	Numerator expansion clearly shown … no terms missing or with incorrect signs since answer given oe
15c	$\frac{9}{10}$ and $\frac{10}{11}$	B1	Accept 9(th) and 10(th) terms

16	$x^2 - 7x - 7x + 49$ $(-a)$ or $x^2 - 14x + 49$ $(-a)$	M1	
	$a = -14$	A1	$a = -14$ from no working or an error in the number term of the expansion implies M1 A1
	$b = 63$	A1 ft	ft for $b = 35$ from $a = 14$, if M mark earned
	Alternative method		
	Substitutes a value for x in the identity eg $x = -1$ gives $b = 63$	M1	
	$a = -14$	A1	
	$b = 63$	A1	

17	$(w^2 =)$ 162 or $(h^2 =)$ 150	M1	Allow M1 for $81 \times 2 - 25 \times 6$
	$\sqrt{12}$	A1	
	$2\sqrt{3}$	B1 ft	ft their $\sqrt{12}$ if possible

18	$(x – 3)(x – 3) = x^2 – 3x – 3x + 9$ or $x^2 – 6x + 9$	M1	Allow one error
	$x^2 – 8x – 20$ (= 0)	M1	For expression of the form $ax^2 + bx + c$ (= 0) Correct ft from their expansion
	$(x – 10)(x + 2)$ (= 0)	A1	If formula or completing the square used it must be correct
	$x = 10,\ x = –2$	A1	A1 for one correct (x, y) pair eg $x = 10,\ y = 7$ A1 for a second correct (x, y) pair eg $x = –2,\ y = –5$ SC2 for both correct (x, y) pairs by trial and improvement SC1 for one correct (x, y) pair by trial and improvement
	$y = 7,\ y = –5$	A1	
	Alternative method		
	$y^2 = 2(y + 3) + 29$ or $y^2 – 2y = 29 + 6$	M1	oe Allow one error
	$y^2 – 2y – 35$ (= 0)	M1	For expression of the form $ay^2 + by + c$ (= 0) Correct ft from their substitution and expansion
	$(y – 7)(y + 5)$ (= 0)	A1	If formula or completing the square used it must be correct
	$y = 7,\ y = –5$	A1	A1 for one correct (x, y) pair eg $x = 10,\ y = 7$ A1 for a second correct (x, y) pair eg $x = –2,\ y = –5$ SC2 for both correct (x, y) pairs by trial and improvement SC1 for one correct (x, y) pair by trial and improvement
	$x = 10,\ x = –2$	A1	