General Certificate of Secondary Education
June 2012

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.

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.

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1a	48	B1	

1b	14 (+) 20 (+) 10	M1	oe Allow one error
	44	A1	SC1 for 45

1c	E to F	B1	
	Steepest (gradient)	B1	oe

2	600 and 50 and 200	B3	B2 for any two of 600, 50, 200
			
			B1 for any one of 600, 50, 200
			or for sight of $^2/_3$ or $^3/_2$ or 2 : 3
			or 3 : 2 oe
			accept 66%, 67% or 150%
			
			If no correct values seen,
			B1 for any correct proportion
			eg Potatoes = 3 × Stock
			    Potatoes = 12 × Carrots
			    Stock = 4 × Carrots

3	Any two numbers approximated	M1	ie 400, 402, 403, 2, 39 or 40

	All three numbers approximated
	  or a calculation using two
	      approximated values
		M1	eg $\dfrac{402.5}{78}$

	5	A1	must come from $\dfrac{400}{2 \times 40}$

4a	$w^2 + 6w$	B2	B1 for w^2 or (+) 6w Award B1 if further working seen after correct answer

4b	4(2y + 5)	B2	B1 for 2(4y + 10) or 8(y + 2.5) Award B1 if further working seen after correct answer

5	$\dfrac{40}{100} \times 8(.00)$ (= 3.2(0))	M1	oe 1.4 seen oe eg $\dfrac{140}{100}$
	8 + their 3.2(0)	M1 dep	$\dfrac{140}{100} \times 8(.00)$
	11.20	Q1	Strand (i) Do not accept 11.2 11.2 or 1120 implies M2

6	Any pair of numbers that give a product of –10 eg any column pair from this table 	x	–6	–1	2	3	5	6	9	14
y	–2	–1	2	7	–13	–8	–5	–4 | x and y values such that $y = \dfrac{2-3x}{x-4}$ eg $x = 0$, $y = -\dfrac{1}{2}$	B2	B1 for a pair giving a product of +10 eg any column pair from this table | x	–6	–1	2	3	5	6	9	14
y	–4	–5	–8	–13	7	2	–1	–2 | B1 for $y = \dfrac{2-3x}{x-4}$ or $x = \dfrac{2+4y}{y+3}$ oe

7a	Identifies at least one pair of factors 2 (×) 63, 3 (×) 42, 6 (×) 21, 7 (×) 18, 9 (×) 14	M1	Do not accept 1 (×) 126 Accept eg 3, 6, 7
	$2 \times 3 \times 3 \times 7$	A1	oe must see multiplication signs SC1 for 2 (×) 3 (×) 7

7b	Identifies at least one pair of factors 2 (×) 36, 3 (×) 24, 4 (×) 18, 6 (×) 12, 8 (×) 9	M1	Accept 2 (×) 2 (×) 2 (×) 3 (×) 3 Do not accept 1 (×) 72
	18	A1	SC1 for 6 or 9 or $2 \times 3 \times 3$

8	$3x - 6 \, (= 5x + 8)$	M1	ft for maximum of 2 marks if there is only **one** error … this might be an error in the expansion or a sign error in rearranging the terms
	$-6 - 8 = 5x - 3x$ or $3x - 5x = 8 + 6$	M1	
	−7	A1 ft	eg $3x - 2 = (5x + 8)$ or $3x - 2 = (5x + 8)$ $-2 - 8 = 5x - 3x \qquad 3x - 5x = 8 + 2$ $\qquad -10 = 2x \qquad\qquad -2x = 10$ $\qquad x = -5 \qquad\qquad x = -5$ Scores M0 M1 A1 ft must see 2nd or 3rd lines of working for M1 $3x - 6 = (5x + 8)$ or $3x - 6 = (5x + 8)$ $-6 + 8 = 5x - 3x \qquad 3x - 5x = 8 - 6$ $\qquad 2 = 2x \qquad\qquad -2x = 2$ $\qquad x = 1 \qquad\qquad x = -1$ Scores M1 M0 A1 ft must see 2nd or 3rd lines of working to enable A1ft $3x - 6 = (5x + 8)$ or $3x - 6 = (5x + 8)$ $-6 - 8 = 5x + 3x \qquad 3x + 5x = 8 + 6$ $\qquad -14 = 8x \qquad\qquad 8x = 14$ $x = -\dfrac{14}{8}$ oe $\qquad\qquad x = \dfrac{14}{8}$ oe Scores M1 M0 A1 ft must see 2nd or 3rd lines of working to enable A1ft SC2 for $x = 7$ from $2x = 14$ seen

9	−4, −3, −2, −1, 0, 1	B2	One error or omission B1 also $-4 \le n < 2$ B1

10	(Billie = £)8 $\left(\dfrac{2}{3} = \right)$ 8	B1	
	their $8 \div 2 \times 3 \, (= 12)$	M1	oe
	their $12 \div 4 \times 5$	M1	oe
	15	A1	

11a	(0).00246	B1	

| 11b | 0.2×10^3 | M1 | 180 000 (÷) 900 <br> or 200   or $18 \times 10^4 \div 9 \times 10^2$
 or $\dfrac{1.8 \times 10^3}{9}$
 or other correct equivalent expression |
| | $2(.0) \times 10^2$ | A1 | |

12	2.2 + 1.6x or 4(.0) + 1.4x or 220 + 160x or 400 + 140x	M1	oe (an extra) (£)1.80 or 180p or 20p (per kilometre) seen

	2.2 + 1.6x = 4(.0) + 1.4x
	 or 220 + 160x = 400 + 140x
	 or
	 1.6x − 1.4x = 4(.0) − 2.2
	 or 160x − 140x = 400 − 220
		M1 dep	oe allow one error
			
			   or 180p is equivalent
			        to 20p per kilometre oe

	(x =) 9	A1	Journey is 9 kilometres
	2.20 + 1.60 × their 9 or 4.00 + 1.40 × their 9 or 1.70 × their 9	M1dep	dep on second M1
	(£)16.6(0) **and** (£)15.3(0)	A1 ft	ft their 9
	Correct conclusion from their working with all steps shown	Q1	Strand (iii) eg yes, it is cheaper

13	(5x − 4y = 24) 2x + 4y = 18	(5x − 4y = 24) 5x + 10y = 45	M1	oe for equating coefficients Allow error in **one** term
	7x = 42	14y = 21	M1	Correct elimination from their equations
	x = 6 **and** y = 1.5		A1	SC1 correct answers with no working or using trial and improvement
	Alternative method			
	x = 9 − 2y **and** 5(9 − 2y) − 4y = 24 or y = $\dfrac{9-x}{2}$ **and** 5x − 4$\dfrac{(9-x)}{2}$ = 24		M1	Allow **one** error ... it can be a substitution error (eg x = 9 + 2y) or a sign error in the equation
	Simplifying and solving as far as 14y = 21 or 7x = 42		M1	Correct simplification from their substitution
	x = 6 **and** y = 1.5		A1	SC1 correct answers with no working or using trial and improvement

14	Recognises the repeating pattern of 5	M1	This might be indicated in the table
	Uses 5 eg 2012 ÷ 5 gives remainder 2 or 2012 ÷ 5 = 402 rem 2 or the answer for 3^{2012} is the same as for 3^2, 3^7, 3^{12} etc or states the formula $5n + 2$ or 2000 ÷ 5 = 400 (so the pattern starts again at 1 for 3^{2000})	M1	oe eg continues the pattern for at least five more entries (ie up to 3^{12}) or pattern must repeat every 10, so 2012 ÷ 10 gives remainder 2 or when 2015 is divided by 5 the remainder is 0 (so the answer for 3^{2015} is the same as for 3^5, 3^{10} 3^{15} etc)
	9	A1	

15	$x(y - 5) = 2 + 3y$	M1	
	$xy - 5x = 2 + 3y$	M1dep	oe
	$xy - 3y = 2 + 5x$ or $y(x - 3) = 2 + 5x$	M1dep	or $-5x - 2 = 3y - xy$ or $-5x - 2 = y(3 - x)$
	$y = \dfrac{2 + 5x}{x - 3}$	A1	or $y = \dfrac{-5x - 2}{3 - x}$ SC3 for $y = \dfrac{7}{x - 3}$ or $y = \dfrac{-7}{3 - x}$ **only** from an incorrect expansion of $xy - 5 = 2 + 3y$ at 2nd stage

16a	$(\sqrt{175} =) \sqrt{(25 \times 7)}$ or $\sqrt{25} \times \sqrt{7}$ $\sqrt{(5 \times 5 \times 7)}$ or $\sqrt{5} \times \sqrt{5} \times \sqrt{7}$	M1	
	$5\sqrt{7}$	A1	Accept $a = 5$ and $b = 7$ or $5 \times \sqrt{7}$

16b	$\dfrac{24\sqrt{3}}{\sqrt{3}\sqrt{3}} \left(= \dfrac{24\sqrt{3}}{3} \right)$	M1	
	$8\sqrt{3}$	A1	Accept $8 \times \sqrt{3}$

17	A = (3, 0)	B1	
	B = (0, 6)	B1	
	C = (−3, 12)	B1ft	ft from their A and B C= (−3, 12) seen scores B3
	Gradient of $DC = \dfrac{12 - 0}{-3 - (-7)}$ (= 3) or Uses $y = mx + c$ and substitutes the coordinates of D and their C	M1	oe $0 = 7m + c$ and $12 = -3m + c$ ft their C
	$y = 3x + 21$	A1	oe

18	c^2 = 16 or c = 4 or c = −4	M1	
	$3x^2 + 3cx + cx + c^2$ (= $3x^2 - dx + 16$)	M1	$3x^2 + 12x + 4x + 16$ or $3x^2 - 12x - 4x + 16$ oe
	c = 4 **and** c = −4 or $4c = -d$ or $16 = -d$ or $-16 = -d$	M1	oe
	c = 4 and d = −16 **or** c = −4 and d = 16	A1	One pair of answers or all four answers seen but not paired
	c = 4 and d = −16 **and** c = −4 and d = 16	A1	Both pairs of answers must be correctly paired SC3 for one correct pair or both correct pairs or all four answers seen but not paired from **no** working