GCSE
MATHEMATICS

NEW PRACTICE PAPER SET 2 Higher Tier Paper 3
Mark Scheme (Published November 2015)

8300/3H

Version 1.0

In Spring 2015, students across the country took this set of practice papers as a Mock Examination. Principal Examiners have marked the papers and these mark schemes have, therefore, been through the normal process of standardisation. For some questions, Principal Examiners have written Additional Guidance based on responses seen.

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

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.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

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.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special case. Marks awarded within the scheme for a common misinterpretation which has some mathematical worth.
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.
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.
3.14 …	Allow answers which begin 3.14 eg 3.14, 3.142, 3.1416
Use of brackets	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles

Diagrams

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

Responses which appear to come from incorrect methods

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

Questions which ask students to show working

Instructions on marking will be given but usually marks are not awarded to students who show no working.

Questions which do not ask students to show working

As a general principle, a correct response is awarded full marks.

Misread or miscopy

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

Further work

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

Choice

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

Work not replaced

Erased or crossed out work that is still legible should be marked.

Work replaced

Erased or crossed out work that has been replaced is not awarded marks.

Premature approximation

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

Q	Answer	Mark	Comments
1	x^{10}	B1	
2	360°	B1	
3	250°	B1	
4	$\frac{25x}{4}$	B1	
5	$71.25 \leqslant t < 71.35$	B2	B1 1 correct bound
	Additional Guidance		
	Accept $71.34\dot{9}$ for 71.35		
6(a)	$\frac{3}{4}$	B1	oe
6(b)	**Alternative method 1**		
	6 ÷ 4 or 1.5 or 4 ÷ 6 or $\frac{2}{3}$ or 4 ÷ 3 or $\frac{4}{3}$ or 3 ÷ 4 or $\frac{3}{4}$	M1	oe
	4.5	A1	
	Alternative method 2		
	$\frac{y}{6}$ = their $\frac{3}{4}$	M1	oe
	4.5	A1ft	ft their tan x from (a)

Q	Answer	Mark	Comments

6(b)	**Alternative method 3**		
	$\tan^{-1}$(their $\frac{3}{4}$) or [36.8, 36.9]	M1	This could be on the diagram or seen in part (a)
	4.5	A1ft	ft their tan x from (a)
	Additional Guidance		
	For M1, accept $\frac{2}{3}$ or $\frac{4}{3}$ given as a decimal truncated or rounded to 2dp or better		
	Award both marks for an answer of 8 in part (b) unless an incorrect statement is made; eg		M0A0
	in (a), tan $x = \frac{4}{3}$, in (b), $\frac{3}{4} = \frac{y}{6}$, answer 4.5		M1A1
	in (a), tan $x = \frac{4}{3}$, in (b), tan $x = \frac{6}{y}$ (incorrect), $\frac{4}{3} = \frac{6}{y}$, answer 4.5		M0A0
	in (a), tan $x = \frac{4}{3}$, in (b), tan $x = \frac{y}{6}$, $\frac{4}{3} = \frac{y}{6}$, answer 8		M1A1ft
	If the answer line is blank, but 4.5 is seen correctly embedded or as the correct length on the diagram, award only the method mark		M1A0
	In alt 2 and alt 3 their tan x must be a value for tan x and not a value for x		

Q	Answer	Mark	Comments
7	4×31 or 124	M1	
	5×30 or 150	M1	
	their 150 – their 124	M1dep	dependent on M2
	26	A1	
	Additional Guidance		
8(a)	0	B1	
8(b)	4×4 or 16	M1	May be implied from a diagram or as the denominator of a fractional answer
	12 (and 12) and 16 or 3	M1	May be shown by exactly 3 two-digit outcomes in a list, grid or table or as the numerator of a fractional answer
	$\frac{3}{16}$ or 0.1875 or 18.75%	A1	oe fraction, decimal or percentage
	Additional Guidance		
	For M1, their (sample space) diagram or table may be blank		
	A 4×4 grid with correct values for at least the 3 two-digit numbers seen or implied		M1M1

Q	Answer	Mark	Comments
9	**Alternative method 1**		
	$\frac{\pi \times 15 \times 10}{4}$ or [117.7, 118]	M1	
	$\frac{\text{their } [117.7,118]}{15 \times 10}$ (× 100) or [0.785, 0.787] or 0.79	M1dep	
	[78.5, 78.7] or 79	A1	
	Alternative method 2		
	$\frac{\pi \times 15 \times 10}{4}$ or [117.7, 118]	M1	
	$\frac{150 \text{ - their } [117.7,118]}{15 \times 10} \times 100$ or [21.3, 21.6] or 21	M1dep	
	[78.5, 78.7] or 79	A1	
	Additional Guidance		
	[0.784, 0.785) or [78.4, 78.5) implies M2 – the value may be outside the limits for A1 due to premature rounding		

Q	Answer	Mark	Comments
10	**Alternative method 1**		
	$3a$ (+) $4c$ (=) 23 and $3a$ (+) $15c$ (=) 45	$15a$ (+) $20c$ (=) 115 and $4a$ (+) $20c$ (=) 60	M1	oe eg works in pence Multiplies one or both equation(s) to equate coefficients of a or c Allow one error in multiplication
	$11c$ (=) 22	$11a$ (=) 55	M1	oe Subtracts equations to eliminate one variable Allow one error in subtraction
	(a =) 5 or (c =) 2		A1	
	(a =) 5 and (c =) 2		A1	
	Alternative method 2		
	$a = \frac{23 - 4c}{3}$ or $a = 15 - 5c$	$c = \frac{23 - 3a}{4}$ or $c = \frac{15 - a}{5}$	M1	oe Makes a or c the subject
	$\frac{23 - 4c}{3} = 15 - 5c$	$\frac{23 - 3a}{4} = \frac{15 - a}{5}$	M1	oe Correctly substitutes their expression to eliminate one variable
	(a =) 5 or (c =) 2		A1	
	(a =) 5 and (c =) 2		A1	
	Additional Guidance		
	Accept any letters, or ‘adult’ and ‘child’, as variables		
	To allow one error in the first mark of alt 1, the ‘equal’ coefficients must be the same. eg allow $3a + 4c = 23$ and $3a + 15c = 15$ but not $3a + 4c = 23$ and $3a + 5c = 45$		

Q	Answer	Mark	Comments
11	**Alternative method 1**		
	24 + 276 or 300	M1	
	$\frac{24}{\text{their } 300}$ or 0.08	M1	oe eg 8%
	8% and the doctor is correct or Two correct comparable values and The doctor is correct	A1	eg 0.08 and 0.16 $\frac{48}{300}$ and $\frac{24}{300}$ 48 : 300 and 24 : 300
	Alternative method 2		
	24 + 276 or 300	M1	
	$\frac{\text{their } 300}{24}$ or 12.5	M1	
	Two correct comparable values and The doctor is correct	A1	eg 12.5 and 6.25 $\frac{300}{48}$ and $\frac{300}{24}$ 300 : 48 and 300 : 24
	Alternative method 3		
	24 + 276 or 300	M1	
	0.16 × their 300	M1dep	
	48 from correct method and 24 and The doctor is correct	A1	
	Additional Guidance		
	In alt 2, 12.5% and 6.25% instead of 12.5 and 6.25 cannot get the accuracy mark		M1M1A0

Q	Answer	Mark	Comments
12(a)	Explanation that in $A \times 10^b$ the value of A must be range $1 \leqslant A < 10$	B1	eg the first part should be 1.01376 Accept the correct conversion to 1.01376×10^5
	Additional Guidance		
	Ignore errors in inequalities given as a range for the acceptable first part of a number in standard form if the written answer shows clear understanding eg in $a \times b^n$, a must be less than 10, $0 < a > 10$	B1	
12(b)	Explanation that the power should be positive	B1	eg the power should be 5, not -5 this gives 0.0000101376 (or $\frac{99}{9\,765\,625}$) Accept the correct conversion to 1.01376×10^5 unless awarded in 12(a)
	Additional Guidance		
	Allow an incorrect conversion with a correct statement eg the power should be positive, -5 gives 0.00000101376	B1	

Q	Answer	Mark	Comments
13	35 : 21 and 21 : 12 or $5 : 3 : \frac{12}{7}$ or $\frac{35}{7} : \frac{21}{7} : \frac{12}{7}$ or $\frac{35}{3} : 7 : 4 :$ or $\frac{35}{3} : \frac{21}{3} : \frac{12}{3}$	M1	Any correct pair of ratios where the values for women are equal or a correct three-part ratio
	their 35 + their 21 + their 12 or 68 or their 21 + their 12 or 33	M1dep	Could be multiples of these numbers
	35 ÷ 68 = 0.51… or 51…% or 35 and (half of 68 is) 34 or 35 (men) and 33 (women and children)	A1	oe

Q	Answer	Mark	Comments
14	$\frac{-11\pm\sqrt{11^2-4\times5\times(-2)}}{2\times5}$	M1	Allow one error Condone missing brackets
	$\frac{-11\pm\sqrt{11^2-4\times5\times(-2)}}{2\times5}$ or $\frac{-11\pm\sqrt{161}}{10}$ or –2.3688…. and 0.1688… or –2.37 or 0.17	A1	oe Fully correct Condone missing brackets
	–2.37 and 0.17	A1	
	Additional Guidance		
	Condone the method of completing the square for M1A1A0 or M1A1A1		

15(a)	Square numbers cannot be prime	B1	oe
	Additional Guidance		
	Accept any correct explanation why square numbers cannot be prime, eg prime numbers have exactly 2 factors and square numbers have an odd number of factors		
	An incorrect statement, even with a correct statement, scores B0 eg prime numbers cannot be square numbers as prime numbers have no factors		B0

15(b)	$\frac{n}{2}$ + 1	B1	

Q	Answer	Mark	Comments
16	**Alternative method 1**		
	[3.1415, 3.14153334]	B1	
	their 3.14153 ÷ 3.14159 × 100 or 99.997… or 99.998…	M1	
	100 – their 99.99…	M1dep	
	[0.0018…, 0.003…]%	A1	
	Alternative method 2		
	[3.1415, 3.14153334]	B1	
	3.14159 – their 3.14153 or [0.00005666, 0.00009]	M1	
	their 0.00005667 ÷ 3.14159 × 100	M1dep	
	[0.0018…, 0.003…]%	A1	
	Alternative method 3		
	[3.1415, 3.14153334]	B1	
	3.14159 × 0.9999 or 3.1412758… or 3.14159 × 1.0001 or 3.14190…	M1	
	3.14159 × 0.9999 or 3.1412758… and [3.1415, 3.14153334]	M1	
	3.14159 × 0.9999 or 3.1412758… and [3.1415, 3.14153334] and states that value is between lower bound and given value	A1	
	Additional Guidance		
	Numbers in the correct range can come from finding a percentage of their value, which can only gain the B mark.		

Q	Answer	Mark	Comments
17	Draws the line $x = -3$ as a dashed line	B1	at least from $y = 0$ to $y = 5$
	Draws the line $x + y = 2$ as a solid line	B1	at least from $x = -3$ to $x = 2$
	Draws the line $y = \frac{x}{2} - 1$ as a solid line	B1	at least from $x = -3$ to $x = 2$
	Correctly labels or shades the region satisfying all three inequalities	B1ft	ft their three lines
	Additional Guidance		
	Only withhold a mark for an incorrect line style on the first occasion. With only one or two or with four or more lines drawn it is impossible to score the last B1		
18	$c(d + 3) = 4 - d$	M1	
	$cd + 3c = 4 - d$	M1dep	
	$cd + d = 4 - 3c$ or $d(c + 1) = 4 - 3c$	M1dep	
	$d = \frac{4 - 3c}{c + 1}$	A1	oe $d = \frac{-4 + 3c}{-c - 1}$
	Additional Guidance		
19	(1, 4)	B1	
20	$7\sqrt{7}$	B1	

Q	Answer	Mark	Comments
21	**Alternative method 1**		
	$(w =)\ x - 2$ and $(y =)\ x + 2$	M1	Allow $(x =)\ w + 2$ and $(x =)\ y - 2$
	$(x - 2)(x + 2) + 4$ or $wy = (x - 2)(x + 2)$ and $wy = x^2 - 4$	M1	
	$= x^2 - 4 + 4$ and $x^2 - 4 + 4 = x^2$	A1	All steps must be seen SC1 correct numerical example with all steps shown
	Alternative method 2		
	$(x =)\ w + 2$ and $(y =)\ w + 4$	M1	Allow $(x =)\ w + 2$ and $(x =)\ y - 2$
	$(w)(w + 4) + 4$	M1	
	$= w^2 + 4w + 4$ and $w^2 + 4w + 4 = (w + 2)^2$ and $(w + 2)^2 = x^2$	A1	All steps must be seen SC1 correct numerical example with all steps shown
	Alternative method 3		
	$(x =)\ y - 2$ and $(w =)\ y - 4$	M1	Allow $(x =)\ w + 2$ and $(x =)\ y - 2$
	$(y)(y - 4) + 4$	M1	
	$= y^2 - 4y + 4$ and $y^2 - 4y + 4 = (y - 2)^2$ and $(y - 2)^2 = x^2$	A1	All steps must be seen SC1 correct numerical example with all steps shown
	Additional Guidance		
	$x = 3$, $w = 1$, $y = 5$ and $1 \times 5 + 4 = 9$		0
	$x = 3$, $w = 1$, $y = 5$ and $1 \times 5 + 4 = 9$ and $9 = 3^2$		SC1
	$1 \times 5 + 4 = 9$ and $9 = 3^2$		0

Q	Answer	Mark	Comments
22	(*C* has coordinates) (2, 4)	B1	
	(Gradient =) –2	B1	Implied by $y = -2x \ldots$
	$\frac{-1}{\text{their gradient}}$ or (Gradient =) $\frac{1}{2}$	M1	Implied by $y = \frac{1}{2}x \ldots$
	their 4 = their $\frac{1}{2}$ × their 2 + c or $c = 3$	M1	oe
	$y = \frac{1}{2}x + 3$	A1ft	oe $y = \frac{1}{2}(x + 6)$ ft their coordinates of *C* and their initial gradient if M1M1 scored
	Additional Guidance		
	(Gradient =) $\frac{1}{2}$ or $y = \frac{1}{2}x \ldots$ implies the second B mark and the first M mark.		

Q	Answer	Mark	Comments
23	(With 90°) $\sin x = \frac{6}{10}$ or (x =) 36.8698…	M1	
	(With 85°) $\frac{\sin x}{6} = \frac{\sin 85}{10}$ or (x =) 36.7…	M1	oe both fractions inverted or $\sin x = \frac{6 \sin 85}{10}$
	(with 90°) (x =) 36.8698… and (with 85°) (x =) 36.7… and suitable comment	A1	eg they are the same to the nearest degree they are different to 1 decimal place his answer will give a (slightly) larger angle
24(a)	4**b**	B1	
24(b)	($\overrightarrow{ED}$ =) $\frac{1}{3}$(**a** + 3**b**) or ($\overrightarrow{ED}$ =) $\frac{1}{3}$**a** + **b**	B1	
	$\overrightarrow{EC}$ = their ($\frac{1}{3}$**a** + **b**) – $\frac{1}{3}$**a** or $\overrightarrow{EC}$ = **b**	M1	
	Valid justification	A1	eg $\overrightarrow{ED} = \frac{1}{3}$**a** + **b** and $\overrightarrow{EC}$ = **b** and $\overrightarrow{AB} = 4\overrightarrow{EC}$ (so $\overrightarrow{AB}$ is a multiple of $\overrightarrow{EC}$)
	Additional Guidance		

Q	Answer	Mark	Comments
25	$T = k\sqrt{l}$	M1	
	$1.6 = k\sqrt{64}$ or $1.6 = k \times 8$	M1	
	$k = \frac{1.6}{\sqrt{64}}$ or $k = \frac{1.6}{8}$ or $k = 0.2$ or $T = 0.2\sqrt{l}$	M1	oe
	(T =) their $0.2 \times \sqrt{132.25}$ or (T =) their 0.2×11.5	M1dep	dependent on first two method marks
	2.3	A1ft	ft their 0.2 if M1M1M0M1 scored
	Additional Guidance		
26	$y = (x - 2)^2$	B1	

Q	Answer	Mark	Comments
27	**Alternative method 1**		
	$\frac{1}{2} \times 8 \times 9$ or 36 and 6×9 or 54 or $\frac{1}{2} \times (14 + 6) \times 9$ or 90	M1	oe
	$\frac{1}{2} \times (9 + 7) \times (t - 14)$	M1	oe
	their 36 + their 54 + $8t - 112 = 7.2t$	M1	oe
	$0.8t = 22$	M1	
	27.5	A1	
	Alternative method 2		
	$\frac{1}{2} \times 8 \times 9$ or 36 and 6×9 or 54 or $\frac{1}{2} \times (14 + 6) \times 9$ or 90	M1	oe
	$\frac{1}{2} \times (9 + 7) \times x$ or $8x$	M1	oe any letter using x to denote $t - 14$
	their 36 + their 54 + $8x$ $= 7.2x + 100.8$ or $0.8x = 10.8$ or $x = 13.5$	M1	oe
	their 13.5 + 14	M1	
	27.5	A1	
	Additional Guidance		

Q	Answer	Mark	Comments
28	$5f(x) = 4x - 3$ or $5f(x) + 3 = 4x$ or $5y = 4x - 3$ or $5y + 3 = 4x$ or $5x = 4y - 3$ or $5x + 3 = 4y$	M1	accept any letter used for y
	$\frac{5f(x)+3}{4}$ $(= x)$ or $\frac{5y+3}{4}$ $(= x)$	M1	
	$\frac{5x+3}{4}$	A1	Condone $y =$ (or any other letter)
	Additional Guidance		

SP/03/15