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General Certificate of Secondary Education
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Mathematics 4306

Specification A

Paper 1 Higher

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.

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.
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 $\frac{1}{2}$

Q	Answers	Mark	Comment
1	$\frac{50\times100}{20}$ or $\frac{52\times100}{20}$	M1	allow one error in numerator
	250 or 260	A1	
2 (a)	*c*	B1	
2 (b)	*d*	B1	
2 (c)	*g*	B1	
3 (a)	7 points correctly plotted	B2	B1 for 5 or 6 points correctly plotted
3 (b)	strong	B1	Allow eg. very strong/high/very good/excellent
	negative	B1	ft from (a)
3 (c)	line of best fit drawn	B1ft	
3 (d)	76	B1ft	ft from their line
3 (e)	no data around this point	B1	oe eg. the trend may not continue
4	750 ÷ 250 or 3 (p per ml)	M1	oe eg. 50ml for 1.50 or 500 ml for £15
	1280 ÷ 400 or 3.2 (p per ml)	M1	oe they might just state > 3(p per ml) or that it would be £12.00 to be the same as the smaller size or eg. 50ml for 1.60 or 500 ml for £16
	250 (ml) or small **and** correct answers to calculations clearly shown	A1	
4 Alt 1	250 ÷ 750 or $\frac{1}{3}$ or $\frac{5}{15}$ (ml per p)	M1	oe
	400 ÷ 1280 or $\frac{5}{16}$ (ml per p)	M1	oe
	250 (ml) or small **and** correct answers to calculations clearly shown	A1	
4 Alt 2	7.50 + $\frac{150}{250}$ × 7.50 or $\frac{250}{400}$ × 12.80	M1	oe eg. 8 × 7.50 **and** 5 × 12.80
	12.00 for 400 ml of small or 8.00 for 250 ml of large	M1	oe eg. 60 **and** 64
	250 (ml) or small **and** correct answers to calculations clearly shown	A1	

Q	Answers	Mark	Comment
5	8×4.50 or 36	M1	$4.50 \div 3$ or 1.50
	their $36 \div 3$ or 12	M1	1.50×8 or 12
	$104.95 \div$ their 12 or 8.74 ... or their 12×9	M1	oe attempt at $104.95 \div$ their 12 (division seen) or their $12 \times n \geq 104.95$ ($12 \times 9 = 108$ is enough)
	9 (weeks)	A1	
	Note $104.95 \times 3 \div 4.50 \div 8 = 8.74$ ... so two of these steps earns M1 M1 M0 A0 eg. $104.95 \div 36$ (= 3 weeks) and $104.95 \div 1.50$ (= 70 weeks) both score M1 M1 M0 A0 accept eg. 105 used for 104.95 in these calculations		
6 (a)	14	B1	
6 (b)	12	B1	
6 (c) (i)	straight line drawn from (1036, 50) to (1110, 50) **and** straight line drawn from (1110, 50) to (1150, 0)	B1	line need not be ruled allow curve
6 (c) (ii)	$50 \div 40$ ($\times 60$)	M1	oe eg. $50 \div 2 \times 3$ or 25×3
	75	A1	SC1 for 1.25 (km/min)
7 (a) (i)	correct front elevation	B1	
7 (a) (ii)	correct side elevation	B1	Must be elevation from RHS
7 (b)	$(5 + 5 + 3) \times 2$	M1	Look for evidence of adding six values, including two 5's and one 3, for this mark
	26	A1	Must come from adding the six correct values
	cm^2	B1	
8 (a)	$10w - 10$ (= 15) or $w - 1 = 1.5$	B1	
	$10w = 15 + 10$ or $w = 1.5 + 1$	M1	ft from their 3 term equation ... but not from $w - 1 = 5$
	2.5	A1ft	SC1 for 1.4 and 0.5
8 (b)	$(5t + 12 =)\ 3t + 15$	B1	
	$5t - 3t = 15 - 12$ or $2t = 3$	M1	allow 1 sign error ft from their 4 term equation
	1.5	A1ft	oe eg. $\frac{3}{2}$ A1ft only if no sign error in rearranging
	eg. $5t + 12 = 3t + 5 \rightarrow 2t = -7 \rightarrow t = -3.5$ scores B0 M1 A1ft $5t + 12 = 3t + 5 \rightarrow 8t = -7 \rightarrow t = -\frac{7}{8}$ scores B0 M1 A0		

Q	Answers	Mark	Comment
9	$\frac{1}{2} \times 3.14 \times 40$ or 3.14×20	M1	Allow $(2 \times)\ 3.14 \times 40$ and $\frac{1}{2} \times 3.14 \times 20$ oe
	62.8	A1	
	their 62.8 ÷ 4	M1dep	dep on 1st M1
	15.7	A1ft	ft if both M's scored
10	30000 × 5 (÷ 100) or 30000 ÷ 20 or 300 × 5 or 1500	M1	Allow place value error or failure to divide by 100
	their 1500 × 1.20 or 1800	M1	
	their 1800 × 3 or 5400 or 450 × 3 or 1350	M1	
	their 5400 + their 1350 + 500	M1dep	oe Complete correct method
	7250	A1	
10 Alt 1	30000 × 3 or 90000 or 450 × 3 or 1350	M1	Allow place value error or failure to divide by 100
	their 90000 × 5 (÷ 100) or their 90000 ÷ 20 or their 900 × 5 or 4500	M1	
	their 4500 × 1.20 or 5400	M1	
	their 5400 + their 1350 + 500	M1dep	oe Complete correct method
	7250	A1	
11 (a)	50 × 0.4	M1	
	20	A1	
11 (b)	0.3 × 40	M1	oe eg. 200 ÷ 5 (= 40) **and** 60 ÷ 5 (= 12)
	12	A1	
12 (a)	$wy = x - wt$ or $y + t = \frac{x}{w}$	M1	
	$x = wy + wt$ or $x = w(y + t)$	A1	

Q	Answers	Mark	Comment
12 (b)	$2y = x + 6$ or $4y = 2x + 12$ $2y = 4x - 6$ $y = 2x - 3$ or $4y - 12 = y + 3$ or $x + 6 = 2(2x - 3)$ or $x + 6 = 4x - 6$	M1	Equations rearranged as $x - 2y = -6$ or $2x - 4y = -12$ $4x - 2y = 6$ $2x - y = 3$
	$0 = 3x - 12$ or $3y = 15$ or $12 = 3x$	M1	$3x = 12$ or $3y = 15$ … for correct elimination from their equations
	$x = 4$ **and** $y = 5$	A1	SC1 for correct answers with no working or T&I
13 (a)	32.5	B1	accept 32 to 33 inclusive
13 (b)	$39 - 24$	M1	limits are $39.5 - 23.5$ (= 16) and $38.5 - 24.5$ (= 14)
	15	A1	accept 14 to 16 if M mark earned
13 (c)	30 (students) seen	B1	
	5%	B1	SC1 for $570 \rightarrow 95\%$
14 (a)	$15\,x^7y^9$	B2	accept $15 \times x^7 \times y^9$ B1 for two terms correct
14 (b)	$12\left(\frac{x}{2}\right) + 12\left(\frac{x}{3}\right) = 12\left(\frac{5}{4}\right)$	M1	oe eg. multiply all terms by 24 $\frac{3x+2x}{6}$ $\left(=\frac{5}{4}\right)$ oe
	$6x + 4x = 15$	A1	oe eg. $12x + 8x = 30$ $5x = \frac{6 \times 5}{4}$ oe
	(x =) 1.5	A1	oe
15	$\frac{PR}{5} = 0.8$	M1	
	(PR =) 4	A1	
	$\frac{x}{4} = 0.9$	M1	ft their 4 if 1st M1 earned
	(x =) 3.6	A1	
16 (a) (i)	2	B1	$\frac{1}{2}$ Allow 1:2, 2:1 × 2, doubled, halved Condone 2 cm
16 (a) (ii)	4	B1	$\frac{1}{4}$ Allow 1:4, 4:1, × 4
16 (b)	(SF =) 9 or $\frac{1}{9}$	M1	$\left(\frac{7.5}{2.5}\right)^2$ or $\left(\frac{2.5}{7.5}\right)^2$ or $54 \div 7.5 \div 3 \times 2.5$ oe
	6	A1	

Q	Answers	Mark	Comment
17 (a)	3 ÷ 11 attempted … long or short division	M1	Attempt to at least 2 dec pl … accept error in 2nd dp
	0.2727…	A1	Minimum of 4 dp shown
	alternatively		
	$x = 0.2727...$ $100x = 27.2727...$ $99x = 27$ $x = \frac{27}{99}$	M1	sight of $\frac{27}{99}$ is enough
	$\frac{27}{99} = \frac{3}{11}$	A1	$\frac{27}{99}$ cancelled by a factor of 3, clearly shown
17 (b)	0.6 + 0.02727…	M1	$x = 0.62727…$ **and** $100x = 62.72727...$ or oe $10x = 6.2727…$ **and** $1000x = 627.2727…$ Must have decimal parts corresponding
	$\frac{6}{10} + \frac{3}{110}$	M1	$990x = 621$ or $99x = 62.1$ (dep on 1st M1)
	$\frac{66}{110} + \frac{3}{110}$	M1	$\frac{621}{990}$
	$\frac{69}{110}$	A1	Cancelling of $\frac{621}{990}$ to be clearly shown
18	16	B2	B1 for $\frac{1}{\left(\frac{1}{2}\right)^4}, \frac{1}{\left(\frac{1}{16}\right)}, \left(\frac{1}{16}\right)^{-1}, \left[\left(\frac{1}{2}\right)^4\right]^{-1}, (2^{-1})^{-4}, 2^4$ or $\left(\frac{1}{2}\right)^{-4}$ is the reciprocal of $\left(\frac{1}{2}\right)^4$ SC1 for $\left(\frac{1}{2}\right)^4 \rightarrow \frac{1}{16} \rightarrow -\frac{1}{16} (-0.0625)$
19	$CP = CR$ **and** sides of square $CPQR$	B1	
	$AC = AC$ **and** common side	B1	
	angle $ACP = 45 + 90 = 135$ **and** angle $ACR = 45 + 90 = 135$ → angle ACP = angle ACR	B1	
	congruent SAS	B1	

Q	Answers	Mark	Comment
20 (a)	$a = 3$	B1	Allow multiples of these if consistent
	$b = -5$	B1	
	$c = 4$	B1	
20 (b) (i)	Cannot calculate the square root of a negative number	B1	oe
20 (b) (ii)	Graph *R*	B1	
21 (a)	$\sqrt{2}\sqrt{2} + \sqrt{2}\sqrt{10} + \sqrt{10}\sqrt{2} + \sqrt{10}\sqrt{10}$ or $2 + \sqrt{2}\sqrt{10} + \sqrt{10}\sqrt{2} + 10$ or $2 + \sqrt{20} + \sqrt{20} + 10$ or $\sqrt{4} + \sqrt{20} + \sqrt{20} + \sqrt{100}$	B1	oe
	$(\sqrt{2}\sqrt{10} =) \sqrt{20} = \sqrt{4}\sqrt{5}$ or $\sqrt{(4 \times 5)} = 2\sqrt{5}$	B1	Clearly shown since answer given
21 (b)	$2^2 + (2 + \sqrt{5})^2$	B1	Must show intent to square **and** add oe
	$(4 +) 4 + 2\sqrt{5} + 2\sqrt{5} + \sqrt{5}\sqrt{5}$	B1	or better
	$13 + 4\sqrt{5}$ **and** No	B1	
22 (a)	$(x - 3)^2 = x^2 - 3x - 3x + 9$	B1	Must see correct four term expansion
22 (b) (i)	correct sketch graph	B1	quadratic to right of origin touching *x*-axis
22 (b) (ii)	$\begin{pmatrix} 3 \\ 0 \end{pmatrix}$	B1	

Q	Answers	Mark	Comment
23	Green from A to B **and** Red from B to A	M1	Statement showing appreciation of the necessary steps needed for A to have only Red counters or sight of arrows indicating Green from A and Red from B or sight of $\frac{1}{6} \times \frac{?}{7}$
	$\frac{1}{6} \times p = \frac{2}{21}$	M1	oe eg. $\frac{1}{6} \times \frac{x}{7} = \frac{2}{21}$ or $\frac{1}{6} \times \frac{(7-y)}{7} = \frac{2}{21}$ where x = Red in B and y = Green in B, when 2nd counter is chosen
	$p = \frac{4}{7}$ ie. prob Red from B on 2nd step = $^4/_7$ or number of Red in B = 4	A1	$p = \frac{12}{21}$ earns this mark $x = 4$ or $7 - y = 4$ ($\rightarrow y = 3$) ie. number of green in B = 3
	2 (Green in B at the start)	A1	Conclusion clearly stated

23Alt	**alternative solution (T & I)**		
	trying wrong value for G eg. G = 3 (ie. 3R and 3G at the start) $\frac{1}{6} \times \frac{3}{7} = \frac{3}{42} \neq \frac{2}{21}$	M2	$\frac{1}{6} \times \frac{3}{7}$ is the first M1 (correct transfer of colours) multiplication of probabilities and checking the answer is the second M1 must use 7 as a denominator, otherwise M0 M0
	other examples G = 1 gives $\frac{1}{6} \times \frac{5}{7} = \frac{5}{42} \neq \frac{2}{21}$ G = 4 gives $\frac{1}{6} \times \frac{2}{7} = \frac{2}{42} \neq \frac{2}{21}$ G = 5 gives $\frac{1}{6} \times \frac{1}{7} = \frac{1}{42} \neq \frac{2}{21}$		all score M2 (if complete) max M2 unless the correct value for G is used (see below)
	trying correct value for G G = 2 (ie. 4R and 2G at the start) $\frac{1}{6} \times \frac{4}{7} = \frac{4}{42} = \frac{2}{21}$	M1 M1 A1	$\frac{1}{6} \times \frac{4}{7}$ is the first M1 (correct transfer of colours) multiplication of probabilities and checking the answer is the second M1 answer of $\frac{2}{21}$ is A1
	2 (Green in B at the start)	A1	Conclusion clearly stated