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General Certificate Secondary of Education
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Mathematics 4306/1H

Paper 1 Higher Tier

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.

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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	Answer	Mark	Comments
1	4 (×) (–9 + 3) **or** (4 ×) –6 **or** –36 + 12 **or** –24	M1	Do **not** need to see substitution of $B = 12$
	–24 / 12 **or** –4/2 **or** –6 /3	A1	
	–2	A1ft	ft If M1 awarded **or** ft From 4× -9 = -45 or -27 **only** Answers are: $-2.75, -2\frac{3}{4}$ or $-\frac{11}{4}$ from 4 × –9 = –45 and $-1.25, -1\frac{1}{4}$ or $-\frac{5}{4}$ from 4 × –9 = –27 SC1 2 with no working or 4 as answer
2(a)	1 – (0.6 + 0.1 + 0.1)	M1	oe
	0.2	A1	oe
2(b)	0.6 × 100 (= 60) **or** 0.6 = $\frac{60}{100}$ **or** 0.1 = 10 (discs) or 0.6 = 60 (discs) **or** 10(B) + 10(Y) + 20(G) + 60(R) (= 100) **or** 0.6 in or out of 100 = 60	M1	oe eg $\frac{6}{10}$ of 100 (= 60) or 0.6 = 60% These represent the minimum acceptable for M1
	Yes, with working shown	A1	

Q	Answer	Mark	Comments
3	Area of rectangle 6×12 (or 72)	M1	or Area of enclosed rectangle $12 \times (6 + 3)$ (or 108)
	Area trapezium $\frac{1}{2} \times (12 + 8) \times 3$ **or** $8 \times 3 + 2 \times 0.5 \times 2 \times 3$ **or** $12 \times 3 - 2 \times 0.5 \times 2 \times 3$ **or** 30	M1	Area of two extra Δ's $2 \times 0.5 \times 2 \times 3$ (or 6)
	Total area = 102	A1	
	cm^2	B1	
4(a)	+ 5 and $\times 2$ **or** $\times 2$ and + 10	B2	oe Must be in the correct order B1 + 5 or $\times 2$ (in correct box) **or** $n + 5$ and $2(n + 5)$ $2n$ and $2n + 10$ $2n$ and + 10 $+ n$ and + 10
4(b)	8	B1	
5(a)	63.02	B1	
5(b)	13.7	B1	
5(c)	10	B1	

Q	Answer	Mark	Comments
6(a)	4	B1	Allow embedded answer with no contradiction
6(b)	$7x - 3x = 8 + 2$ **or** $-2 - 8 = 3x - 7x$	M1	Allow one sign error $7x + 3x = 8 + 2 \rightarrow 10x = 10$ $7x - 3x = 8 - 2 \rightarrow 4x = 6$ $-2 - 8 = 3x + 7x \rightarrow -10 = 10x$ $-2 + 8 = 3x - 7x \rightarrow 6 = -4x$
	$4x = 10$	A1	
	$2\frac{1}{2}$ or 2.5 or $\frac{10}{4}$	A1ft	ft $x = 1$ from $10x = 10$ **or** $x = 1.5$ from $4x = 6$ **or** $x = -1$ from $-10 = 10x$ **or** $x = -1.5$ from $6 = -4x$ **or** from M1 awarded
6(c)	$3y + 11 = 8$	M1	$0.75y + 2.75 = 2$ oe
	$3y = 8 - 11$ or $3y = -3$	M1 Dep	$0.75y = 2 - 2.75$ or $0.75y = -0.75$ oe
	-1	A1	
7(a)	$180 - 105 = x + 2x$	M1	oe eg, $75 \div 3$
	25	A1	
7(b)	50°	B1ft	ft (their) 25
	Alternate	B1 Dep	oe

Q	Answer	Mark	Comments	
8(a)	$\frac{5}{6} \times \frac{4}{3}$ or $\frac{10}{12} \div \frac{9}{12}$	M1	oe eg, $\frac{20}{24} \div \frac{18}{24}$	
	$\frac{20}{18}$ or $\frac{10}{12} \times \frac{12}{9}$	M1	Also award for correct cancelling of factor of 2	
	$\frac{10}{9}$ or $1\frac{1}{9}$ or 1.11(...)	A1	A0 $10 \div 9$	
8(b)	3 **and** Attempt at common denominator	M1	$\frac{22}{5} - \frac{4}{3}$	Allow one error in numerator in first step
	$\frac{6-5}{15}$ oe	M1	(their) $\frac{6}{15}$ $\frac{6}{}$ – (their) $\frac{20}{15}$ ft Their numerators	ft Their attempt at common denominator
	$3\frac{1}{15}$	A1	Accept $\frac{46}{15}$	
Alt 8(b)	4.4 or 1.33...	M1		
	4.4 – 1.33(3...)	M1		
	3.066 ... or 3.067	A1		

9	How many hours of homework did you do (last week)?	B1	Must refer to hours and imply week (not a question asking for how many hours each day)
	Boxes must be mutually exclusive exhaustive include '0 hours' have an open ended upper limit	B1	At least three boxes with no overlap and no gaps

Q	Answer	Mark	Comments
10(a)	360 ÷ 8 (= 45) **or** 360 ÷ 45 = 8 **or** 8 × 45 = 360	B1	∑Interior angles (= 6 × 180) = 1080 Interior angle = 1080 ÷ 8 = 135 → Exterior angle = 45
10(b)	(Exterior angle =) 180 – 168 or 12	M1	168n = 180(n – 2) (oe)
	360 ÷ (their) (180 – 168)	M1	360 = 180n – 168n or 360 = 12n
	30	A1	
11	140 – 112 or 28	M1	112/140 × 100 or 80
	(their) 28/140 × 100	M1	100 – (their) 80
	20	A1	
12(a)	7	B1	
	–2	B1	
12(b)	Correct curve from x = –1 to x = 5 ± 1mm from integer points	B2	B1 5 points plotted correctly from (their) (–1, 7), (0, 2), (1, –1), (their) (2, –2), (3, –1), (4, 2) and (5, 7) ± 1 mm from integer points
12(c)	0.5 to 0.7 **and** 3.3 to 3.5	B1ft	Both values needed ... ft from their graph
13(a)	6.9×10^{-3}	B1	or 0.0069 B1 For digits 69 seen
13(b)	3.2×10^{6}	B1	or 3 200 000 B1 For digits 32 seen
13(c)	0.18	B1	Accept .18
13(d)	$4.5 \times 10^{5} \times 10^{-2}$ **or** 450000 × 0.01 **or** 450000×10^{-2} **or** 450000 × 1/100 **or** 4500	M1	
	4.5×10^{3}	A1	

Q	Answer	Mark	Comments
14(a)	180 – 37 – 28	M1	oe
	115	A1	
14(b)	(Scale Factor =) $\frac{20}{8}$ **or** 2.5 **or** $\frac{8}{20}$ **or** 0.4	M1	$\frac{DF}{15} = \frac{20}{8}$ (oe)
	15 × (their) 2.5 (oe) **or** 15 ÷ (their) 0.4 (oe)	M1dep	*DF* = 20 × 15 ÷ 8 (oe)
	37.5	A1	
15(a)	$\frac{38000+29000+25000+34000}{4}$ **or** $\frac{126000}{4}$	M1	Allow (38 + 29 + 25 + 34) ÷ 4 or 126 ÷ 4
	31 500	A1	
15(b)	28000 = $\frac{29000+25000+34000+?}{4}$	M1	or 28000 × 4 (or 112000)
	24 000	A1	SC1 For 32000 (using the last four values)
16(a)	$x^2 + 5x - 2x - 10$	B1	
	$3x + 3$	B1	
16(b)	$(x - 1)(x + 7)$	B2	B1 For $(x + 1)(x - 7)$
16(c)	(their) 1	B1ft	$(x + 3)^2 - 16 = 0$ or better $\frac{-6 \pm \sqrt{(6^2 - 4 \times 1 \times -7)}}{2}$
	(their) –7	B1ft	B1 For (their) solutions from (their) incorrect factorisation after restart

Q	Answer	Mark	Comments
17(a)	$2x(3x - 5y)$	B2	B1 $2(3x^2 - 5xy)$ **or** $x(6x - 10y)$ **or** $2x(? \pm ?)$
17(b)	$125a^{12}b^3$	B2	B1 2 out of 3 parts correct eg, $5a^{12}b^3$
18	$(81^{0.5} =) \ (\pm) \ 9$	B1	
	$(6^{-2} =) \ \left(\frac{1}{6}\right)^2$ or $\frac{1}{36}$	B1	B2 $(\pm)\frac{9}{36}$
	$(\pm)\frac{1}{4}$	B1	or $(\pm)0.25$ or $(\pm)4^{-1}$
19	$c = 14$	B1	
	$0 = 2^2 + 2b + 14$ **or** $0 = 7^2 + 7b + 14$	M1	This mark is for using one of these equations to find b $c = 14$ might appear in a T&I attempt
	$b = -9$	A1	$x^2 - 9x + 14$ scores M1A1B1
19 Alt 1	(Factors) $(x - 2)(x - 7)$	M1	
	$b = -9$	A1	
	$c = 14$	B1	$x^2 - 9x + 14$ scores M1A1B1
19 Alt 2	$0 = 2^2 + 2b + c$ **and** $0 = 7^2 + 7b + c$ **and** Attempt to eliminate an unknown	M1	eg, $0 = 4 + 2b + c$ $0 = 49 + 7b + c$ $\rightarrow 0 = 45 + 5b$
	$b = -9$	A1	
	$c = 14$	B1	$x^2 - 9x + 14$ scores M1A1B1

Q	Answer	Mark	Comments
20	Attempt at $\sum fx$ $90 \times 1.2 + 130 \times 2 + 80 \times 3.5 + 60 \times 5$ **or** $108 + 260 + 280 + 300$ **or** 948	M1	$90 \times 1.20 \times 5$ (or 540) **and** $130 \times 2.00 \times 5$ (or 1300) **and** $80 \times 3.50 \times 5$ (or 1140) **and** $60 \times 5.00 \times 5$ (or 1500)
	(their) 948×5	M1 Dep	(their) $(540 + 1300 + 1140 + 1500)$
	4740	A1	
21	(Cylinder volume =) $\pi r^2 \times 2r$	B1	$2\pi r^3$
	(Space =) $\pi r^2 \times$ (their) $2r - \frac{4}{3}\pi r^3$	M1	(Ball as fraction of cylinder =) $\frac{\frac{4}{3}\pi r^3}{(\pi r^2 \times \text{(their) } 2r)}$	Accept **only** r or h for (their) $2r$
	(their) space/$(\pi r^2 \times$ (their) $2r)$	M1 Dep	$1 -$ (their) ball/cylinder	Dep on 1st M1
	$\frac{1}{3}$	A1	A0 $\frac{1}{3}$ using numerical values of r and/or π	
Note Using numerical values for r and/or π: can score B1M1M1depA0				

Q	Answer	Mark	Comments
22	Correct 1st step using surds	M1	For example $\sqrt{w}\sqrt{8} = \sqrt{(8w)}$ **or** $\sqrt{8} = 2\sqrt{2}$ **or** RHS = $2\sqrt{3}\sqrt{3} = 6$ (must get 6) **or** LHS = $\sqrt{(\frac{8w}{3})}$ **or** RHS = $\sqrt{12}$ **or** Squaring both sides to get $\frac{8w}{3} = 2\sqrt{3} \times 2\sqrt{3}$ (or 12) **or** Attempt to rationalise LHS eg, $\sqrt{w}\sqrt{24/3}$ **or** $\sqrt{(24w)/3}$
	Obtaining an equation where the solution is just 'one step' away	M1	For example $8w = 36$ **or** $\sqrt{(8w)} = \sqrt{36}$ **or** $\sqrt{(8w)} = 6$ **or** $\sqrt{8}\sqrt{w} = 6$ **or** $\sqrt{w} = 6/\sqrt{8}$ **or** $\sqrt{w} = (2\sqrt{9}/\sqrt{8})$ **or** $w = (2\sqrt{9}/\sqrt{8})^2$ **or** $2w = 9$ **or** $\sqrt{(2w)} = \sqrt{9}$ **or** $\sqrt{(2w)} = 3$
	$4\frac{1}{2}$ or 4.5 or $\frac{9}{2}$ or $\frac{36}{8}$	A1	
23	$(x-2)^2 - 4 - 15 = 0$ **or** $(x-2)^2 = 19$	M1	Allow $(x-2)^2 = k$ $(k > 0)$
	$x - 2 = (\pm)\sqrt{19}$ **or** $(x =)\ 2\ (\pm)\ \sqrt{19}$	A1ft	Allow positive root only ft from (their) k
	$(x =)\ 2 \pm \sqrt{19}$	A1	
Alt 23	$\frac{4 \pm \sqrt{\{(-4)^2 - 4 \times 1 \times (-15)\}}}{2}$	M1	Condone one error (substitution or using + instead of $\pm$) **Not** $4 \pm \frac{\sqrt{\{(-4)^2 - 4 \times 1 \times (-15)\}}}{2}$ ... this is M0
	$\frac{4 \pm \sqrt{76}}{2}$	A1ft	Allow positive root only A0 for negative square root
	$(x =)\ 2 \pm \sqrt{19}$	A1	

Q	Answer	Mark	Comments
24	$\angle ACD = 40$	B1	Angle in same segment (oe)
	$\angle DAE = 40$	B1	Angle in alternate segment
	$(x) = 180 - (40 + 32 + 40)$	M1	Angle sum $\triangle AEC$
	$(x =)$ 68	A1	
	At least two reasons including alternate segment	E1	Dep on M1
Alt 1 24	$\angle ACD = 40$	B1	Angle in same segment (oe)
	$\angle DAE = 40$	B1	Angle in alternate segment
	(Method leading to) $\angle ADE = 72$	M1	ft (their) $\angle ACD$ (40) and 32 $\angle CDA = 108$ (ft) angle sum $\triangle ACD$ and $\angle$ on straight line **or** exterior angle property $\triangle ACD$
	$(x =)$ 68	A1	Angle sum $\triangle ADE$
	At least two reasons including alternate segment	E1	Dep on M1
Alt 2 24	$\angle DBC = 32$	B1	Angle in same segment (oe)
	$\angle DAE = 40$	B1	Angle in alternate segment
	(Method leading to) $\angle ADE = 72$	M1	ft (their) $\angle DBC$ (32) and 40 $DA = 108$ (ft) opposite angles of cyclic quadrilateral are supplementary (oe) and $\angle$ on straight line **or** exterior angle of cyclic quadrilateral
	$(x =)$ 68	A1	
	At least two reasons including alternate segment	E1	Dep on M1
Note	$\angle ACD = 40$ and $\angle DBC = 32$ does not score 2 marks. These two angles are not part of the same solution		

Q	Answer	Mark	Comments
Alt 3 24	$\angle DAE = 40$	B1	Angle in alternate segment
	$\angle CA? = 108$	B1	Angle on straight line
	(Method leading to) $\angle ADE = 72$	M1	$\angle CDA = 108$ angle in alternate segment and $\angle$ on straight line
	$(x =)$ 68	A1	Angle sum $\triangle ADE$
	At least two reasons including alternate segment	E1	Dep on M1
Alt 4 24	$\angle DAE = 40$	B1	Angle in alternate segment
	$\angle CA? = 108$	B1	Angle on straight line
	$\angle CDA = 108$	M1	Angle in alternate segment
	$(x =)$ 68	A1	Exterior angle property $\triangle ADE$
	At least two reasons including alternate segment	E1	Dep on M1
25(a)	$\frac{5}{8} \times p = \frac{1}{4}$	M1	or $\frac{1}{4} \div \frac{5}{8}$
	$(p =) \frac{2}{5}$ or $\frac{8}{20}$	A1	oe
25(b)	$\frac{3}{8} \times [1 -$ (their) $\frac{2}{5}]$	M1	$1 - [\frac{1}{4} + \frac{5}{8} \times$ (their) $\frac{3}{5} + \frac{3}{8} \times$ (their) $\frac{2}{5}]$
	$\frac{9}{40}$	A1	oe