



**General Certificate of Secondary Education
November 2011**

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 students' 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 students' 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.

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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.
Mdep	A method mark dependent on a previous method mark being awarded.
Bdep	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	Comment
1 (a)	Correct and ordered $\begin{array}{l l} 0 & 5 \ 8 \ 9 \\ 1 & 1 \ 2 \ 2 \ 3 \ 6 \ 6 \ 8 \\ 2 & 0 \ 2 \ 4 \ 4 \\ 3 & 0 \ 5 \ 8 \\ 4 & 3 \ 6 \\ 5 & 1 \end{array}$	B2	Ordered with one or two errors or omissions B1 or Not ordered, with at most one error B1
	Correct key eg $1 6 = 16$	B1	
1 (b)	19	B1	
1 (c)	21	B1	
2	Any two of 20, 5 and 10	M1	
	$\frac{400}{50}$ or $\frac{80}{10}$ or $\frac{40}{5}$	A1	
	8	A1ft	ft their $400 \div 50$
3	$3 \times (7 + 11)$ or 54	M1	
	Their 54 – their 18	M1	$2 \times$ their 18 scores M2
	36	A1	
4 (a)	8 (cm) seen	B1	allow [7.8, 8.1]
	Their 8×2 or 16	M1	allow [15.6, 16.2]
	7	A1ft	ft 23 – their 16 allow [6.8, 7.4]
4 (b)(i)	045	B1	do not allow 45
4 (b)(ii)	Point C 6 cm from A	B1	allow [5.9, 6.1]
	Point C on a bearing of 045° from A	B1	allow [043°, 047°]

Q	Answer	Mark	Comment
5 (a)	$\pi \times 10 \times 10$ or $3.14 \times 10 \times 10$	M1	oe eg $\pi \times 10^2$ allow 3.14 or better
	314	A1	Condone [314, 314.2]
	cm ²	B1	units mark ... may be seen in (a) or (b)
5 (b)	$\frac{1}{2} (9 + 5)4$ or 28	M1	oe eg $\frac{1}{2} \times 8 \times 2 (\times 2)$
	their 28×2	M1dep	oe eg $9 \times 8 - \frac{1}{2} \times 8 \times 2 \times 2$ or $72 - 16$ or 7×8 (for M1M1)
	56	A1	
6	$x - 1 = 5$	B1	
	$x = 6$	B1	
	(6, 5)	B1ft	full marks if only (6,5) seen with no working
6 Alt	correct graph of $y = x - 1$	B1	
	correct graph of $y = 5$ or y coordinate = 5	B1	
	(6, 5)	B1ft	ft point of intersection of their graphs if at least one of them is correct Must be (6, 5) for 3 marks
7 (a)	$4n - 3$	B2	oe B1 for $4n (+ c)$
7 (b)	Their $4n - 3 < 300$	M1	allow their $4n - 3 = 300$ allow equivalent arithmetic method based on 5 terms less than 20 with extrapolation ... or other valid arithmetic method
	75	A1	SC1 for either 74 or 76

Q	Answer	Mark	Comment
8 (a)	$12w - 28 (= 32)$	B1	$3w - 7 = 8$
	$12w = 32 + 28$ or $12w = 60$	M1	$3w = \text{their } 8 + 7$ or $3w = 15$
	5	A1ft	ft from one error in their expansion eg $12w - 7 = 32$ B0 $12w = 32 + 7$ M1 $w = \frac{39}{12}$ A1ft
8 (b)	$26 - y = 4 \times 5$ or $26 - y = 20$ or $(y =) 26 - 20$	M1	
	6	A1	
8 (c)	$4t > 24$	M1	Works out $4t + 1$ for any integer
	$t > \frac{24}{4}$ or $t > 6$	M1dep	oe Works out $4t + 1$ for a different integer
	7	A1	SC1 for 6 SC2 for $4 \times 7 + 1 = 29$
9	$\frac{1}{2} \times 8 \times 6$ or $8 \times 6 \times 11$	M1	oe
	$\frac{1}{2} \times 8 \times 6 \times 11$	M1dep	oe
	$\frac{1}{2} \times 8 \times 6 \times 11 \times 0.5$	M1	oe
	132	A1	SC2 for 264

Q	Answer	Mark	Comment
10 (a)	correct mid-points \times correct frequencies	M1	$6 \times 5, 10 \times 15, 20 \times 25, 8 \times 35, 6 \times 45$ or 30, 150, 500, 280, 270 ... allow up to two errors in these answers
	Σ their mid-pt \times frequency	M1	must be consistent, all lcb or all ucb
	their $1230 \div 50$	M1dep	dep on 2 nd M mark
	24.6	A1	Allow 25 with working seen
10 (b) (i)	Plots at mid-points of intervals	B1	Correct plots are (5,6) (15,10) (25, 20) (35, 8) (45, 6)
	Correct heights	B1	
10 (b) (ii)	Comparative statement about average time or location	B1ft	eg The girls on average (in general/overall) took less time than the boys eg The mean (median/mode) for the boys will be greater than for the girls
	Comparative statement about range or spread	B1ft	eg Boys' times were more varied than girls' times eg The range of times for boys was greater than the range of times for girls
11	$3p + 2r = 75$ and $4p + r = 65$	M1	oe
	$3p + 2r = 75$ and $8p + 2r = 130$ or $12p + 8r = 300$ and $12p + 3r = 195$	M1dep	oe allow error in one term
	$5p = 55$ or $5r = 105$	M1	correct elimination from their equations
	$p = 11$ and $r = 21$	A1	
12	$(2.4 \times 10^{11}) \div (3 \times 10^8)$ or 240 000 000 000 and 300 000 000	M1	oe
	800	A1	oe eg 0.8×10^3 or $2400 \div 3$
	[13, 14]	A1	SC2 for 133(3...) with error in place value

Q	Answer	Mark	Comment
13	SF = $\frac{15}{12}$ or $\frac{12}{15}$ or 1.25 or $\frac{4}{5}$ or ratio of sides of triangle 2:3 or 3:2	M1	oe eg $\frac{BC}{8} = \frac{15}{12}$
	$8 \times$ their $\frac{15}{12}$ or $8 \times$ their 1.25 or $\frac{15}{\text{their } 1.5}$ or $15 \times$ their $\frac{2}{3}$	M1	oe eg $BC = \frac{15 \times 8}{12}$
	10	A1	
13 Alt	line drawn through D parallel to AC with value written for BX (eg $BX = y$)	M1	oe X is the point where this line cuts BC
	$\frac{y}{3} = \frac{8}{12}$	M1	oe
	$(BC =) 10$	A1	
14 (a)	B and D (in any order) or $y = 2x + 3$ and $3x + 2y = 6$	B2	B1 for one correct (and 1 incorrect) (eg A and D) B1 for two correct and 1 incorrect (eg B and D and E) B0 for two correct and 2 or more incorrect (eg B and D and A and C (and E and F))
14 (b)	A or $y = 3x + 2$	B1	B0 for A or $y = 3x + 2$ plus any other(s)
14 (c)	C or $2x + 3y = 6$	B1	B0 for C or $2x + 3y = 6$ plus any other(s)
14 (d)	E and F (in any order) or $x = 3y + 2$ and $x = 2y + 3$	B2	B1 for one correct (and 1 incorrect) (eg A and E) B1 for two correct and 1 incorrect (eg E and F and A) B0 for two correct and 2 or more incorrect (eg E and F and A and B (and C and D))

Q	Answer	Mark	Comment
15 (a)	$5m^9t^7$	B2	B1 for two correct terms
15 (b) (i)	$x(y - 6) = 1 - 2y$ or $xy - 6x = 1 - 2y$	M1	may be seen in (ii)
	$xy + 2y$ or $1 + 6x$	M1	oe may be seen in (ii)
	their $y(x + 2) =$ their $1 + 6x$	M1	oe may be seen in (ii)
	$y = \frac{1 + 6x}{x + 2}$	A1	oe may be seen in (ii)
15 (b) (ii)	$\frac{1 + 6(-1)}{-1 + 2}$	M1	$-1 = \frac{1 - 2y}{y - 6}$ or $-1(y - 6) = 1 - 2y$
	-5	A1ft	do not accept $\frac{-5}{1}$ ft from (b)(i) answer
16 (a)	1	B1	
16 (b)	$\sqrt[3]{1000}$ or 10 or 1000^2 or 1 000 000 seen	M1	
	100	A1	
16 (c)	$\frac{1}{2}$ or $(\pm)8$ seen or 2^3 seen	M1	
	$(\pm) 4$	A1	
17	Attempt at $\sum fx$ $800 \times 1.50 + 1000 \times 2.80 + 400 \times 5$ or $1200 + 2800 + 2000$ or 6000	M1	$800 \times 1.50 \times 2.5$ (or 3000) oe and $1000 \times 2.80 \times 2.5$ (or 7000) oe and $400 \times 5 \times 2.5$ (or 5000) oe
	their 6000×2.5 oe	M1	their (3000 + 7000 + 5000)
	their 15000×50 oe	M1	Condone use of 46 or 48 instead of 50 for this mark
	750 000	A1	

Q	Answer	Mark	Comment
18 Alt 1	$3x + 7x = 180$ or $10x = 180$ or $x = 18$	M1	oe opposite angles of cyclic quad are supplementary
	angle $DBC = 180 - (8 \times \text{their } 18)$ or 36	M1	angle sum $\triangle DBC$
	angle $DEB = \text{their angle } DBC$ or 36	M1dep	base angle isos $\triangle DEB$
	angle $BDA = 2 \times \text{their angle } DBE$ or $2 \times \text{their angle } DEB$ or 72	M1dep	ext angle property $\triangle DEB$ oe
	angle DBA $= 180 - \text{their } 72 - \text{their } 54$ or 54	M1dep	angle sum $\triangle DAB$
	so (angle $BAD =$) angle $DBA = 54$ (hence $\triangle DAB$ is isosceles)	A1	This mark is for comparing the angles BAD and DBA and including at least two reasons in the proof
18 Alt 2	$3x + 7x = 180$ or $10x = 180$ or $x = 18$	M1	oe opposite angles of cyclic quad are supplementary
	angle $DBC = 180 - (8 \times \text{their } 18)$ or 36	M1	angle sum $\triangle DBC$
	angle $DEB = \text{their angle } DBC$ or 36	M1dep	base angle isos $\triangle DEB$
	angle $EBA = 180 - \text{their angle } DEB$ $- (3 \times \text{their } 18)$ or 90	M1dep	angle sum $\triangle EBA$
	angle $DBA = \text{their } 90 - \text{their } 36$ or 54	M1dep	
	so (angle $BAD =$) angle $DBA = 54$ (hence $\triangle DAB$ is isosceles)	A1	This mark is for comparing the angles BAD and DBA and including at least two reasons in the proof
18 Alt 3	$3x + 7x = 180$ or $10x = 180$	M1	opposite angles of cyclic quad are supplementary
	angle $DBC = 2x$	M1	angle sum $\triangle DBC$
	angle $DEB = 2x$	M1dep	base angle isos $\triangle DEB$
	hence angle $BDA = 4x$	M1dep	ext angle property $\triangle DEB$ oe
	angle $DBA = 10x - 4x - 3x$ or $3x$	M1dep	angle sum $\triangle DAB$
	so (angle $BAD =$) angle $DBA = 3x$ (hence $\triangle DAB$ is isosceles)	A1	This mark is for comparing the angles BAD and DBA and including at least two reasons in the proof

Q	Answer	Mark	Comment
18 Alt 4	$3x + 7x = 180$ or $10x = 180$	M1	opposite angles of cyclic quad are supplementary
	angle $DBC = 2x$	M1	angle sum ΔDBC
	angle $DEB = 2x$	M1dep	base angle isos ΔDEB
	angle $EBA = 10x - 3x - 2x$ or $5x$	M1dep	angle sum ΔEBA
	angle $DBA = 5x - 2x = 3x$	M1dep	these steps might be combined for M2
	so (angle $BAD =$) angle $DBA = 3x$ (hence ΔDAB is isosceles)	A1	This mark is for comparing the angles BAD and DBA and including at least two reasons in the proof
19	$lwh + \frac{1}{3}lwh$ or $8 \times 3 \times h$ or $\frac{1}{3} \times 8 \times 3 \times h$	M1	oe stating that volume of pyramid is one-third of volume of cuboid
	$8 \times 3 \times h$ and $\frac{1}{3} \times 8 \times 3 \times h$	M1	oe or $160 \div 4 (\times 3)$ or $40 (\times 3)$ or 120
	$32h = 160$ or $\frac{160}{32}$	M1	oe or $24h = 120$ or $120 \div 24$ or $8h = 40$ or $40 \div 8$
	$(h =) 5$	A1	5
	10	A1	10

Q	Answer	Mark	Comment
20 (a)	$\sqrt{(50x)} \sqrt{(50x)} + \sqrt{(50x)} \sqrt{(2x)}$ $+ \sqrt{(50x)} \sqrt{(2x)} + \sqrt{(2x)} \sqrt{(2x)}$	M1	allow one error
	$\sqrt{(2500x^2)} + \sqrt{(100x^2)} + \sqrt{(100x^2)}$ $+ \sqrt{(4x^2)}$	M1	oe allow one error
	$50x + 10x + 10x + 2x$	A1	
	$72x$ or $k = 72$	A1ft	must see evidence of correct working to award 4 marks ft if M marks earned
20 (a) Alt	Taking out $\sqrt{2}$ or $\sqrt{(2x)}$ as a common factor	M1	
	$\{\sqrt{2} (\sqrt{25} \sqrt{x} + \sqrt{x})\}^2$ $\{\sqrt{(2x)} (\sqrt{25} + 1)\}^2$	A1	oe
	$2 \times x \times 6^2$	A1	
	$72x$ or $k = 72$	A1	
20 (b)	$\sqrt{150} \sqrt{150} + \sqrt{150} \sqrt{6}$ $+ \sqrt{150} \sqrt{6} + \sqrt{6} \sqrt{6}$ or better eg $150 + 2\sqrt{150} \sqrt{6} + 6$	M1	$x = 3$ or 72×3
	216	A1	