Version 1.0

General Certificate of Secondary Education November 2011

Mathematics 4306

Specification A

Paper 2 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.

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.

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	Answer	Mark	Comment
1	Sight of 1.025	B1	
	34 600 × 1.025	M1	
	35 465	A1	Allow 34, 465 but not 35.465
1 Alt	2.5 ÷ 100 × 34 600 (= 865)	M1	oe 346 + 346 + 173 (= 865)
	34 600 + their 865	M1dep	
	35 465	A1	Allow 34, 465 but not 35.465
2	<table><tr><th></th><th>Boys</th><th>Girls</th><th>Total</th></tr><tr><td>Vegetarian</td><td>4</td><td>6</td><td>10</td></tr><tr><td>Non-vegetarian</td><td>18</td><td>12</td><td>30</td></tr><tr><td>Total</td><td>22</td><td>18</td><td>40</td></tr></table>	B3	B2 4 or 5 entries correct or both columns transposed B1 one condition true
3 (a)	(3) + (–10)(7)	M1	oe
	– 67	A1	
3 (b)	$7.3 \pm 5.1 = 5a$ $1.46 = 1.02 + a$ $12.4 \div 5 = a$	M1	Must complete one operation beyond substitution $\frac{7.3}{5} \pm \frac{5.1}{5} = a$
	0.44	A1	SC1 2.48
4 (a)	44	B1	
4 (b) (i)	44	B1ft	ft same answer as (a)
4 (b) (ii)	Corresponding	B1	Can be written and/or circled

Q	Answer	Mark	Comment
5 (a)	1500 – 7 × 120 (=660)	M1	oe 15 – 0.07 × 120 (= 6.60)
	66	A1	
5 (b)	140 × 7 + 2 × (a) × 10	M1	140 × 0.07 + 2 × (a) × 0.1
	£23	A1ft	oe ft their answer in (a)
6	Separating into rectangles and/or trapezia that would lead to a correct solution	M1	
	$11 \times 14 + \frac{1}{2} \times 14 \times 2$	M1	Correct calculation implies M2 $2 \times \frac{1}{2} \times (11 + 13) \times 7$ oe $\frac{1}{2} \times 14 \times 13 + 2 \times \frac{1}{2} \times 11 \times 7$ $13 \times 14 - 2 \times \frac{1}{2} \times 7 \times 2$
	168	A1	
7 (a)	$18x - 12$	B1	$18 \times x - 12$ **or** $(18 \times x) - 12$ **or** $x \times 18 - 12$
7 (b)	$8x + 4 - 3x + 12$	M1	Allow one sign or arithmetic error
	$5x + 16$	A1	Penalise contradictory further work, eg $5x + 16 = 21x$
8 (a) (i)	360 ÷ 6 or 6 × 60 = 360	B1	It is an equilateral triangle All same and when added up come to 360
8 (a) (ii)	6 × 120	M1	6 × (180 – 60) (6 – 2) × 180
	720	A1	720 ÷ 6 = 120 720 seen and further working A0
8 (b)	360 ÷ 18	M1	
	20	A1	Allow 20 × 18 = 360 20 seen and further working A0

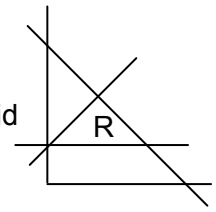
Q	Answer	Mark	Comment
9 (a)	(3, 8), (8, 12), (6, 8)	B2	B1 for (2, 12), (4, 6)
9 (b)	(12, 15) or (15, 18)	B2	B1 for (12, 18)
10 (a)	$\frac{4}{10}$ **or** $\frac{2}{5}$ **or** 40% **or** 0.4	B1	oe
10 (b)	$400 \times \frac{7}{20}$ (= 140)	M1	
	140	A1	140 ÷ 400 scores M1, A0
11 (a)	$6x - 2x = 4 + 1$	M1	
	$4x = 5$	A1	
	1.25	A1ft	oe, ft on one error
11 (b)	$2(2y - 5) = 3(4y - 1)$	M1	
	$4y - 10 = 12y - 3$	M1dep	Allow one sign or expansion error Allow denominator of 6
	$8y = -7$	A1	oe
	– 0.875, $\frac{-7}{8}$, $\frac{-21}{24}$	A1ft	oe ft on one error
11 (b) Alt	$\frac{2y}{3} - \frac{5}{3} = \frac{4y}{2} - \frac{1}{2}$	M1	
	$\frac{2y}{3} - \frac{4y}{2} = \frac{5}{3} - \frac{1}{2}$	M1	Allow one sign or division error
	$-\frac{4y}{3} = \frac{7}{6}$	A1	oe
	–0.875	A1ft	oe ft on one error

Q	Answer	Mark	Comment
12	Sight of 0.92	B1	
	24 288 ÷ 0.92	M1	
	26 400	A1	NB 26231.04 is M0
12 Alt	92(%) = 24 288	M1	
	1(%) = 24 288 ÷ 92 (= 264)	M1	
	26 400	A1	
13 (a)	4.75×10^{-7}	B1	
13 (b)	Sight of 24×10^{8} **or** 0.17×10^{9} Or 2 400 000 000 **and** 170 000 000	M1	Digits 257 imply M1
	2.57×10^{9}	A1	
14 (a)	–2.1 to –2.3 inclusive	B1	
14 (b)	–1	B1	
	2	B1	

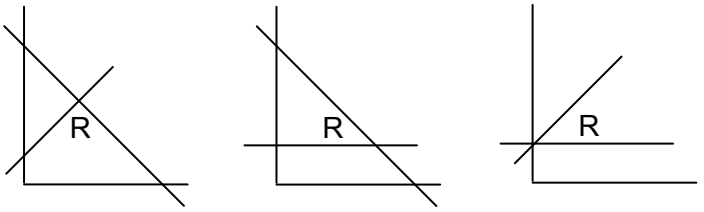
Q	Answer	Mark	Comment
15	See Scheme below	B3	

Answer scheme for 15

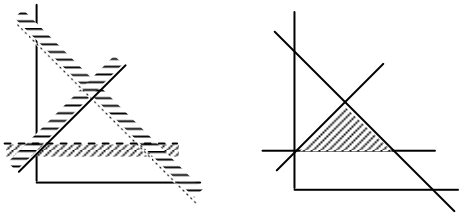
3 marks.
All lines correct,
drawn dashed/solid
R marked.



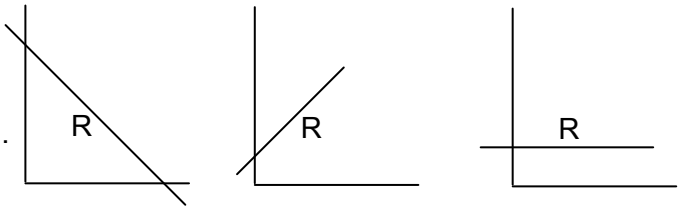
2 marks
R marked correct relative to two correct dashed/solid lines
3rd line incorrect or missing.



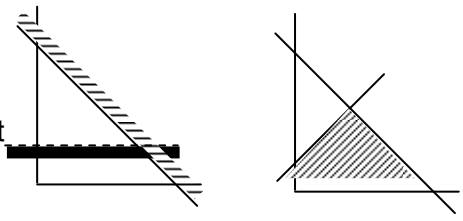
2 marks
All lines correct
drawn dashed/solid
Shaded in or out R not marked.



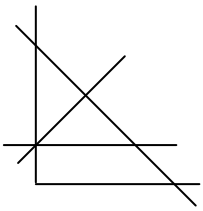
1 mark
R marked correct relative to one correct dashed/solid line other lines incorrect or missing.



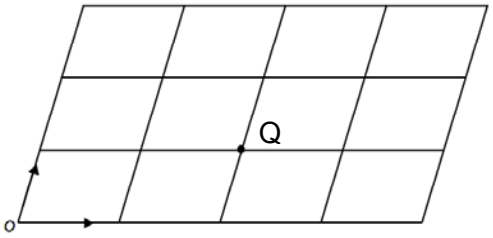
1 mark
Two lines correct
drawn dashed/solid
Shaded in or out R not marked, e.g.



1 mark
All lines correct
drawn dashed/solid
No shading
R not marked



Q	Answer	Mark	Comment
16	$\frac{-(4) \pm \sqrt{(4)^2 - 4(2)(-7)}}{2(2)}$	M1	Allow one error but not wrong formula or just dividing square root by $2a$ or dividing by 2 Allow $-b = 4$ **or** -56 for $-4ac$
	$\frac{-4 \pm \sqrt{72}}{4}$	A1	
	1.12 and –3.12	A1ft	ft on $b = 4$ (–1.12 and 3.12) only Must see working
16 Alt	$2((x + 1)^2 - 1) - 7 = 0$	M1	oe
	$x + 1 = \pm \sqrt{4.5}$	A1	
	1.12 and –3.12	A1	
17 (a)	$32.6^2 - 15.8^2$	M1	$x^2 + 15.8^2 = 32.6^2$
	$\sqrt{813.12}$	M1Dep	
	28.5152…	A1	
	29 or 28.5	B1ft	ft their answer if ≥ 4s.f. and rounded to 2 or 3 s.f.
17 (b)	Sight of cos	M1	
	$y = \cos^{-1}(11 \div 25)$	M1dep	Cos $y = \frac{11}{25} = 0.44$
	63.9	A1	64 with working Grads 70.996, Radians 1.115
18 (a)	50	B1	
18 (b)	3.3	B1	
18 (c)	3.9 and 2.8 seen or marks on graph at 60 and 20	M1	
	1.1	A1	

Q	Answer	Mark	Comment
18 (d)	Median for Africa = 2.9 (kg) **or** IQR for Africa = 0.9 **or** Range for Europe = 3 to 3.8 **and** Range for Africa = 2.2	M1	Values may be on diagram These can be implied by comment such as 'median is 0.4 lower'
	Comment on medians with values mentioned	B1ft	ft on their median
	Comment on spread with values mentioned	B1ft	ft on their IQR Comment on median and spread without values mentioned is B1 Comment on median and spread without a comparison but with values is B1
19 (a)	Correct point marked If letter only and no cross or dot then Q must be close to point	B1	
19 (b)	4**a** + 2**b** **or** 2(2**a** + **b**)	B1	2**b** + 4**a** **or** 2(**b** + 2**a**)
19 (c) (i)	They are parallel with a common point	B1	$\overrightarrow{OM} = 3\overrightarrow{ON}$
19 (c) (ii)	1 : 2	B1	
20	104.5 (105.5) and 75.5 (76.5) **or** 180	B1	Ignore incorrect upper limits
	2 × (the sum of their lower limits)	M1	360
	10 000 ÷ their 360	M1dep	
	27.7, 27.8, 28 times	A1	Must come from correct working
21	13	B1	oe
	$\pi \times 5^2$ (= 78.5 to 78.55)	B1	25π
	$\pi \times 5 \times$ their 13 (204.1 to 204.23)	M1	65π, their 13 from use of Pythagoras
	282.6 to 282.78, 283	A1	90π

Q	Answer	Mark	Comment
22 (a)	15	B1	
22 (b) (i)	5050	B1	
22 (b) (ii)	$\frac{1}{2}n(n+1)+\frac{1}{2}(n+1)(n+2)$	M1	oe
	$\frac{1}{2}(n+1)(n+n+2)$	M1	Factorising
	$\frac{1}{2}(n+1)(2n+2)$	A1	Oe $n^2 + 2n + 1$
	$(n+1)^2$	A1	Clear algebra to get to this stage
23 (a)	$\frac{2}{5} \times \frac{1}{5}$	M1	
	$\frac{2}{25}$, 0.08	A1	oe
23 (b)	$1 - \text{P(none)}$	M1	
	$1 - \text{P}(\frac{3}{5} \times \frac{1}{5})$	A1	oe
	$\frac{22}{25}$, 0.88	A1	oe
23 (b) Alt	$\text{P}(\frac{2}{5} \times \frac{4}{5}) + \text{P}(\frac{3}{5} \times \frac{4}{5})$ + their $\frac{2}{25}$	M1, A1ft	M1 for identifying WW, WL and LW with correct probs shown or for 2 out of 3 correct products or all 4 correct products A1 for complete correct 3 products
	$\frac{22}{25}$, 0.88	A1	

Q	Answer	Mark	Comment
24	$x^2 + (x - 3)^2 = 17$	M1	
	$x^2 + x^2 - 6x + 9 = 17$	A1	
	$2x^2 - 6x - 8 = 0$	M1	Expansion of $(x - 3)^2$ must have x^2, x and a constant term $x^2 - 3x - 4 = 0$
	$(2)(x - 4)(x + 1) = 0$	M1	M1 for a valid method to solve their 3 term quadratic
	$x = 4$, $y = 1$	A1	
	$x = -1$, $y = -4$	A1	SC1 for $x = 4$ and $x = -1$
24 Alt	$(y + 3)^2 + y^2 = 17$	M1	
	$y^2 + y^2 + 6y + 9 = 17$	A1	
	$2y^2 + 6x - 8 = 0$	M1	Expansion of $(y + 3)^2$ must have y^2, y and a constant term $y^2 + 3y - 4 = 0$
	$(2)(y + 4)(y = 1) = 0$	M1	M1 for a valid method to solve their 3 term quadratic
	$x = 4$, $y = 1$	A1	
	$x = -1$, $y = -4$	A1	SC1 for $y = -4$ and $y = 1$