Version 1.0: 20/06/07

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 3301

Specification A

Paper 2 Higher

Mark Scheme

2007 examination - June series

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.

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Dr Michael Cresswell Director General

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 $\frac{1}{2}$

Paper 2H

Q	Answer	Mark	Comments
1	96.9 ÷ 38 or 96 ÷ (10 + 12 + 16)	M1	2.55
	25.50, 30.60, 40.80	A2	A1 for 1 correct (–1 for incorrect money notation)
2	Circle or part circle centred on **both** A and B	M1	
	Radii within ± 1 mm of 4 and 6 cm and large enough arcs to intersect	A1	Check horizontally or vertically with printed grid
	Correct region indicated	A1ft	ft if one of circles within tolerance
3(a)	$\frac{249.99\times12}{100}$ or $\frac{249.99\times88}{100}$	M1	249.99×0.12 or 249.99×0.88 $249.99 - 0.12 \times 249.99$ or 219.99
	30(.00) or 29.99	A1	219.99 after 30 seen is non-contradictory fw –1 for incorrect money notation
3(b)	Sight of 0.12	B1	12% = 15 M1
	15 ÷ 0.12	M1	(1%) = 15 ÷ 12 (= 1.25)
	125(.00)	A1	–1 for incorrect money notation Penalise for further contradictory working eg, 125 + 15 = 140
4	35 ÷ 500 (× 100) and 28 ÷ 330 (× 100)	M1	$35 \div 500 \times 330$ or $28 \div 330 \times 500$ 500 ÷ 35 **and** 330 ÷ 28 500:35 **and** 330:28 **and** at least one attempt to cancel
	0.07(7) and 0.08(48…)	A1	23(.1) or 42(.42) 14.(29) and 11.(79) or 12 Ratio with same multiple of 7 eg, 100:7 and 82.5:7 or 200:14 and 165:14
	Kelly or Fizzy orange	A1	Must have working with one of two values correct

Q	Answer	Mark	Comments
5	$w - 3 = x/2$	M1	$2w = x + 6$ **NB** $2w = x + 3$ is M0 even though it leads to $x = 2w - 3$ which is a common wrong answer
	$(x =)\ 2(w - 3)$	A1	$(x =)\ 2w - 6$ sc $2(w + 3)$ B1 $2(3 - w)$ B1
6(a)	F, I, E, X	B3	–1 eeoo
6(b)	$a^2 + ab - ba - b^2$	M1	oe Must have 4 terms. Condone 1 sign error
	$= a^2 + \cancel{ab} - \cancel{ba} - b^2$	A1	oe Must show cancelling, either by 'crossing out' or stating $ab - ab = 0$ etc
6(c)	$(p - 10)(p + 10)$	B1	Generally marked
7	$100 \times 0.7 \div 5.5$	M1	Ratio weight biscuit: 100 = 0.7:5.5
	12.72… or 12.73	A1	
	12.7 or 13	B1ft	Award for any value at least 4sf or calculation that is correctly rounded to 2 or 3sf
8(a)(i)	59 to 61	B1	
8(a)(ii)	Reading at 15(.25) and 45(.75)	M1	44– 46, 70 – 71
	24 to 27	A1	
8(b)	60 – Their reading at a mark of 55	M1	
	34 to 36	A1	**SC1** 24 to 26 identified by lines or mark on graph

Q	Answer	Mark	Comments
9(a)	$6x - 4 + 4x + 20$	M1	Allow one error
	$10x + 16$ (=2(5x + 8))	A1	Ignore fw that does not contradict, but do not award A1 for fw such as = 26x
9(b)	$10x + 16 = 4x - 8$	M1	Allow 1 error ft Their answer for (a) ie, Their (a) = $4x - 8$
	$10x - 4x = -8 - 16$ ($6x = -24$)	A2ft	ft on **one error** only for A1 Errors can be in expansion (1 error) Collecting terms to $ax = b$ Solving equation
	–4		
10	Valid method	M1	Method 1: 2 triangles base 15, height 7.5 Method 2: 4 triangles base and height 7.5 Method 3: $x^2 + x^2 = 225$ Method 4: 2 squares sides 7.5 and 7.5 Method 5: 1 rectangle sides 7.5 and 15 Method 6: $7.5^2 + 7.5^2 = x^2$ Method 7: Use of trig, for example 15 sin 45° Method 8: Kite or Rhombus
	Correct values in method	A1	$x = 10.6(0660172)$, $\frac{15\sqrt{2}}{2}$, $2x^2 = 225$ $\frac{1}{2} \times 15 \times 15$
	112.5	A1	Must be exact but allow rounding to 112.5 after 112.49, say
11(a)	Evidence of searching for a pattern or 10n	M1	eg, 100 110 120 130 140 10 10 10 10
	$10n + 90$	A1	oe
11(b)	$4n < 35$	M1	$4n = 35$ leading to $n = 8.75$ is M0 unless n given as 8
	$n < 35 \div 4$ or $n < 8.75$	A1	$4n = 35$ leading to $n < 8.75$ is M1, A1
	$n = 8$	A1	

Q	Answer	Mark	Comments
12(a)	$x^2 = 35^2 - 22^2$ (=741)	M1	$x^2 + 22^2 = 35^2$
	(x =) $\sqrt{741}$	M1dep	For squaring, subtracting and evidence of square rooting
	27.2…	A1	27 after working seen
12(b)	Sight of tangent	M1	
	(y =) 20 ÷ tan 38	M1dep	20 tan 52
	25.6, 25.5988…	A1	25.599, 26 after working seen Any alternative methods must be complete to score M2. For example: Use of sine rule must get to $y = 20 \times \sin 52 \div \sin 38$ for M2 otherwise M0
13	T, F, T	B3	–1 eeoo
14	250 × 0.7 (= 175)	M1	oe 297.5 ÷ 0.7 (=425)
	297.5 ÷ 175 (1.7)	M1	425 ÷ 250
	1.7 (0)	A1	
15(a)	0 × 6 + 1 × 10 + 2 × 13 + 3 × 21 + 4 × 49 + 5 × 1	M1	Total is 300
	'Their 300' ÷ 'Their 100'	M1dep	
	3	A1	
15(b)	Their mean × 4 + (5 – Their mean) × –1	M1	$-5 \times 6 + 0 \times 10 + 5 \times 13 + 10 \times 21 + 15 \times 49 + 20 \times 1$
	10	A1	ft Their mean eg, 2 → 5, 4 → 15, 3.06 → 10.3 **NB** Start again and 10 × 0 = 10 gives 10.1⇒ M1, A0

Q	Answer	Mark	Comments
16	Breaks down into areas of rectangles and areas of (quarter) circles	M1	Any combination of rectangles and circles πr^2 or 12.56… or $4 \times \pi$ is enough evidence for area of circles **NB** 12.56 from $2 \times \pi \times 2$, if seen is M0 **NB** 3.14 on its own is not evidence of the area of a quarter circle as it is π
	Uses an 'addition' method (method 1) and finds Area of one (or 5) 'external' quadrants $(5\times)\ 2 \times 2 - \frac{1}{4}\pi \times 2^2$ or $(5\times)\ 4 - \pi$ or $(5\times)\ \frac{1}{4}(16 - \pi \times 2^2)$	M1Dep	Uses a 'subtraction' method (methods 2 and 3) and finds $5 \times$ area one quadrant $5 \times \frac{1}{4}\pi \times 2^2$ or $5 \times \pi$
	= 0.8584…, {0.9, 0.86, 0.858} or = (× 5) 4.292… {4.3, 4.29}	A1	15.71, 15.7
	52.3 or 52.29… $68 - 5\pi$	A1	Allow 52 if 52.3 or 52.29… or a full method seen
17(a)	4^{th} term = $a + 2b$ or ($a = 1$ and $b = 1$ and) 3(1) + 5(1)	M1	oe Accept 5^{th} term = $2a + 3b$ (oe) for M1 if 4^{th} term not seen.
	6^{th} term = 2a + 3b (+) a + 2b	A1	Must see 4^{th} and 5^{th} terms
17(b)	Continuing sequence to 9^{th} term = $3a + 5b$, $5a + 8b$, $8a + 13b$, $13a + 21b$	M1	Must come from continuing sequence and not from $4 \times 6^{th} - 3^{rd}$
	$13a + 21b - (a + b) = 12a + 20b$	A1	Allow subtraction to be 'assumed'. Condone missing bracket if answer correct
	$12a + 20b = 4(3a + 5b)$	A1	Either way round, expansion or factorisation

Q	Answer	Mark	Comments
18	$\frac{\text{Sin } RQP}{1} = \frac{\sin 30}{0.7}$	M1	oe (100 cm, 70 cm) Do not accept sin $RQP = \frac{\sin 30}{0.7}$ for M1 only
	Sin $RQP = 0.714\ldots$	A1	Accept 45.58… {45.6} as evidence for A1
	134.4… or 134	A1	
19	$\frac{-(-6) \pm \sqrt{(-6)^2 - (4)(2)(-1)}}{2 \times (2)}$	M1	oe Allow 1 error from: Wrong sign for $-b$ (ie, –6) -6^2 evaluated as –36 $-4ac$ evaluated as –8 Do not accept wrong formula, which includes not dividing all of top by $2a$ or giving $2a$ as 2
	$\frac{6 \pm \sqrt{144}}{4}$	A1	
	3.16, –0.16 (Accept –0.158)	A1ft	ft on above M1 errors Wrong sign for $-b$, –3.16, 0.16 -6^2 evaluated as –36, no ft as no root $-4ac$ evaluated as –8, 2.82, 0.18 No working no marks as graphical calc could be used
19Alt	$2(x - 1.5)^2 - 5.5 = 0$ or $(x - 1.5)^2 - 2.75 = 0$	M1	
	$x = 1.5 \pm \sqrt{2.75}$	A1	$1.5 \pm \sqrt{1.658}\ldots$
	3.16, –0.16 (Accept –0.158)	A1	
20(a)	$x^2 + (x + 3)^2 = 29$	M1	
	$x^2 + x^2 + 3x + 3x + 9 = 29$	A1	
	$2x^2 + 6x - 20 = 0$ $\Rightarrow x^2 + 3x - 10 = 0$	A1	An indication of factorisation of 2 or mention of cancelling by 2 gets this mark if final line not seen
20(b)	$x = -5$ and $x = 2$	B1	Can be awarded for work done in (a)
	$A = (-5, -2)$, $B = (2, 5)$	B1	A and B can be transposed

Q	Answer	Mark	Comments
21	Volume of one (or two) spheres $(2\times)\ 4\pi\times 5^3\div 3$	M1,	Allow 10 for *r* for M1
	= 523.6 (1047.2) {524} {1048, 1050}	A1	oe $500\pi/3$ or $1000\pi/3$ (523.3 to 523.7) or (1046.6 to 1047.4)
	Volume of cylinder $V=\pi\times 5^2\times 20$	M1	Allow 10 for *h* or 10 for *r* for M1 (not both)
	= 1570.8 {1570, 1571}	A1	oe 500π (1570 to 1571)
	Volume remaining (1570.8 – 1047.2 =) 523.6, 524	A1ft	oe $166\frac{2}{3}\pi$ Due to different values of π an answer between 523.3 and 523.7 gets full marks ft If both Ms awarded and one value is correct.

Q	Answer	Mark	Comments
22	Calculation of any 2 point average	M1	Can use summer values for this mark only
	Moving averages 10.65, 10.9, 11.35, 12.15, 12.55, 13.3, 14.15, 15.05, 16.15	A1	Answers to 1dp correctly rounded or truncated Allow one error Implied by points on graph
	Plotting values of moving averages	A1ft	ft Their values. Allow one error Must plot at 'halfway points' for this mark
	Use trend to predict next moving average If reading from graph allow $\pm \frac{1}{2}$ square accuracy	M1Dep	Say 17 Trend can be curved or straight line or series of dots and but the value (or dot) must be read from line after winter 2006 or from a consistent point if MAs mis-plotted (at Summer values, say) or trend can be done from differencing the moving averages
	$2 \times$ 'Their 17' – 14.2	M1Dep	Dependent on first M only and a value being read from a trend
	19.8	A1ft	ft Their value read from a trend 16.8 $\Rightarrow$ 19.4, 16.9 $\Rightarrow$ 19.6, 17 $\Rightarrow$ 19.8, 17.1 $\Rightarrow$ 20, 17.2 $\Rightarrow$ 20.2, 17.3 $\Rightarrow$ 20.4, 17.4 $\Rightarrow$ 20.6, 17.5 $\Rightarrow$ 20.8, 17.6 $\Rightarrow$ 21, 17.7 $\Rightarrow$ 21.2, 17.8 $\Rightarrow$ 21.4, 17.9 $\Rightarrow$ 21.6
23(a)	(0, 1)	B1	Generally marked
23(b)	Matching any (non zero for x) Values eg, $a^1 = 3$, $a^2 = 9$, etc	M1	Must show as power
	$a = 3$	A1	

Q	Answer	Mark	Comments
24	$\frac{1}{12} \times \pi \times 2.5^2$	M1	oe $\frac{330}{360} \times \pi \times 2.5^2$
	(Area sector circle) = 1.634 to 1.637 {1.6, 1.63, 1.64}	A1	or (Full circle – $\frac{1}{12}$ circle) = 17.98 to 18.01
	Height triangle = $2.5 \times \tan 75$ or $2.5 \div \tan 15$	M1	Attempt to find area of triangle using $\frac{1}{2}ab\sin C$ with sides 5, 9.33 or 9.66 and angles 30°, 75°
	Height = 9.33… {9, 9.3}	A1	Area triangle = 23.3… {23}
	Appropriate combination of areas	M1Dep	eg, 330º sector + triangle, circle + triangle – 30º sector Dependent on both Ms.
	41.3…	A1	Allow 41 if 41.3… seen