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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 3301

Specification A

Paper 1 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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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 1H

Q	Answer	Mark	Comments
1	Attempt to find LCM of 12 and 21 or any common multiple of 12 and 21 eg, 252	M1	12, 24 … and 21, 42 … minimum 12×21 is enough Factors of 12 and 21 with attempt at LCM
	84	A1	Allow 85 (those who assume they start after 1 sec)
2	2 out of 3 approximations correct 8000, 50, 0.4	M1	Allow 8010 and 49 (but **not** 0.5)
	8000/20 or 160/0.4 or 20000/50	M1	8010/20 or 160.2/0.4 or 20025/50 score 2nd M1 8000/19.6 and 8010/19.6 do not earn 2nd M1 Unless 19.6 is subsequently rounded to 20
	400	A1	320 (from $0.397 \approx 0.5$) can score M1 M0 A0
3(a)	Complete explanation eg, Quadrilateral can be divided into 2 triangles **and** 2×180 Use of $(n - 2) \times 180$ with $n = 4$	B2	or Using Σ(external angles) = 360 eg, Σ(internal angles + external angles) $= 4 \times 180$ Σ(internal angles) $= 4 \times 180 - 360$ B1 for partial explanation B0 for 2×180 only
3(b)(i)	$3x - 12 + x - 6 + 2x + 90 = 360$ or better eg, $6x + 72 = 360$	B1	B0 for $3x - 12 + x - 6 + 2x + 90 = 180$
3(b)(ii)	$6x = 288$ or $6x = 360 - 72$ or $x =$ (Their 288) $\div 6$	M1	ft M1 for $6x = 108$ or $6x = 180 - 72$ or (Their 108) $\div 6$
	$x = 48$	A1	ft A1 for $x = 18$
	132	B1ft	$3 \times$ (Their x) $- 12$ for $35 \leq x \leq 63$ SC1 48 with no working or using T & I SC2 (48 and)132 with no working or using T & I

Q	Answer	Mark	Comments
4(a)(i)	$\frac{7}{20}$ or 0.35 or 35%	B2	B1 for 7 as numerator or 20 as denominator
4(a)(ii)	(Results are) random or occur by chance	B1	or Too few spins oe
4(b)	$\frac{1}{4} \times 1000$	M1	oe or $\frac{250}{1000}$
	250	A1	
5(a)	$300 \div 3 \times 2$ or $\frac{2}{3} \times 300$ or $\frac{2}{3}$ of 300 or $\frac{2}{3} = \frac{200}{300}$ $300 - \frac{1}{3}$ of 300	B2	$300 \div 3$ or $\frac{1}{3}$ of 300 or $\frac{1}{3} \times 300$ score B1
5(b)	$100 \div 5$ or 20	M1	oe $\frac{1}{3} \times \frac{1}{5}$ earns M1
	(Their 80) $\div 2$ or 40	M1	$\frac{1}{3} \times \frac{4}{5} \times \frac{1}{2}$ earns M1
	60	A1	
6(a)	Enlargement	B1	
	Scale factor $\frac{1}{3}$	B1	
	Centre (of enlargement) (–4, 5)	B1	Marked **and** labelled on diagram sufficient
6(b)	Correct image at (2, 5) (8, 5) (8, 2)	B2	B1 for correct orientation but in wrong place or B1 for identifying $y = x$, even if no more done
7(a)	*B*: volume *C*: none *D*: area	B2	B1 for one or two correct
7(b)	Mixed dimensions	B1dep	oe Dependent on *C* being correct
8(a)	x^8	B1	
8(b)	y^8	B1	
8(c)	$27w^3t^6$	B2	–1 eeoo

Q	Answer	Mark	Comments
9(a)	Jupiter	B1	
9(b)	Pluto	B1	
9(c)	Saturn	B1	
9(d)	4 880 000	B1	
9(e)	$(2.39 \times 10^6) \div 1000$	M1	or 2390 oe
	2.39×10^3	A1	
10(a)	Straight line from (–2, –5) to (–1, –2) or from (–1, –2) to (0, 1)	B2	B1 Line with constant positive gradient through (–1, –2) or Any line with gradient 3
10(b)	$y = -\frac{1}{3}x + 4$	B2	oe B1 for $y = -\frac{1}{3}x + c$ or $y = mx + 4$ oe Must have $y =$ … otherwise 1 mark penalty
11(a)	6	B1	
11(b)	(Girls) average (length is different to boys)	B1	oe or B1 Precise difference not related to average or spread eg, (A boy jumped) the longest length, (The girls) LQ (is different to the boys) For average allow: eg, On the whole, on average, in general, overall, median, (**not** mean or mode),… For spread allow: eg, Range, IQR, consistency, variability,…
	(Girls jump greater) spread (of lengths)	B1	

Q	Answer	Mark	Comments
12	$5x + 6y = 28$ $5x + 6y = 28$ $2x + 6y = 4$ $5x + 15y = 10$	M1	Allow error in **one** term
	$3x = 24$ $-9y = 18$	M1	Correct elimination from their equations Note: If method of substitution used, then rearranging **and** substituting earns 1st M1 simplifying earns 2nd M1 (allow only **one** error in total … eg. $x = 2 + 3y$ or error in manipulation)
	$x = 8$ **and** $y = -2$	A1	SC1 Correct answers with no working or using T & I
13	$\pi \times 15^2$ or $\pi \times 10^2$	M1	Allow use of 3.(14…)
	225π (–) 50π	M1	or $\pi \times 225$ (–) $\frac{1}{2} \times \pi \times 100$ or 3.(14…) × 175 or 525 to 550
	175π	A1	or $\pi \times 175$ or $175 \times \pi$ or $\pi 175$ SC1 for 700π (or $\pi 700$)
	cm^2	B1	

Q	Answer	Mark	Comments
14(a)	$x/4 = 5$ or $x + 4 = 24$	M1	
	$(x=)$ 20	A1	
14(b)	$4 = 3(y + 1)$ or $4 = 3y + 3$	M1	
	$4 - 3 = 3y$	M1dep	$4/3 = y + 1$ earns M2
	$(y=)\ \frac{1}{3}$	A1	oe (0.33 or better if in decimal form)
14(c)	$2ab(3b - 1)$	B2	B1 For incomplete factorisation (6 alternatives) $2(3ab^2 - ab)$ or $2a(3b^2 - b)$ or $2b(3ab - a)$ $ab(6b - 2)$ or $a(6b^2 - 2b)$ or $b(6ab - 2a)$ SC1 for a factor of $2ab$
14(d)	$(3x \pm a)(x \pm b)$	M1	For any a, b such that $ab = 12$
	$(3x - 4)(x + 3)$	A1	
15(a)	$(180° - 56°) \div 2$	M1	
	62°	A1	
15(b)	Angle $ACB = 62°$ or Angle $RBC = 47°$	M1	ft in (b) if M1 earned in (a) Must use alternate segment theorem for M1
	71°	A1ft	
16(a)	$P \propto 1/Q$ or $P = k/Q$ or $PQ = k$	M1	
	$k = 3200$ or $100 = \frac{k}{32}$	M1	
	$P = 3200/Q$ or $PQ = 3200$ or $Q = 3200/P$	A1	
16(b)	Correct sketch graph	B1	
16(c)	$2Q^2$ = (Their 3200)	M1	or $2Q$ = (Their 3200) $\div Q$ or Q = (Their 3200) $\div 2Q$
	$(Q=)$ 40	A1ft	ft Their value of k

Q	Answer	Mark	Comments
17(a)(i)	$\overrightarrow{OQ} = \mathbf{a} + \mathbf{b} + 0.5\mathbf{b} = \mathbf{a} + 1.5\mathbf{b}$	B1	or Fractions equivalent in all part (a) answers
17(a)(ii)	$\overrightarrow{BM} = -\mathbf{b} + \mathbf{a} + 0.5\mathbf{b} = \mathbf{a} - 0.5\mathbf{b}$	B1	
17(a)(iii)	$\overrightarrow{BN} = 0.5\mathbf{a} - 0.25\mathbf{b}$ or $\frac{1}{2}(\mathbf{a} - 0.5\mathbf{b})$	B1ft	ft from (ii) even if unsimplified ie, (Their $\overrightarrow{BN}$) = $\frac{1}{2}$ (Their $\overrightarrow{BM}$)
17(a)(iv)	$\overrightarrow{ON} = \mathbf{b} + 0.5\mathbf{a} - 0.25\mathbf{b}$	M1	ft from (iii) $\mathbf{b}$ + (Their $\overrightarrow{BN}$)
	$\overrightarrow{ON} = 0.5\mathbf{a} + 0.75\mathbf{b}$	A1	This answer **must** be simplified
17(b)	$\overrightarrow{OQ} = 2 \times \overrightarrow{ON}$ or $\overrightarrow{ON} = \overrightarrow{NQ}$ with evidence of $\overrightarrow{NQ}$ **and** O, N and Q are collinear or N is the mid-point of OQ	B2dep	Dependent on correct answers to (a) (i) and (iv) B1 for one of the four statements on the LHS B0 If no (valid) explanation eg, $\overrightarrow{ON} = \overrightarrow{NQ}$ or $ON = NQ$

18(a)	Evidence of width × freq. density	M1	oe Any of 15, 25, 25, 20 or 5 correct
	90	A1	SC1 for 18 or 450
18(b)	Attempt to halve the area	M1	ft from (Their 90) eg, $\frac{1}{2}$ of 90 = 45, 45th plant lies in 20 – 30 group (Identification of 'correct' group needed for M1)
	22	A1	

19(a)	(–1, 4) (0, 1) (1, 0) (2, 1) (3, 4)	B1	Vertex + correct shape
19(b)	(–1, 4) (0, –2) (1, –4) (2, –2) (3, 4)	B1	Vertex + correct shape
19(c)	$(-\frac{1}{2}, 2)$ (0, –1) $(\frac{1}{2}, -2)$ (1, –1) $(1\frac{1}{2}, 2)$	B1	Vertex + correct shape Note: Tolerate 'just' missing one or two points in all three sketch graphs (but **not** the vertex)

Q	Answer	Mark	Comments
20(a)	**Either** $32 + \sqrt{32}\sqrt{2} + \sqrt{32}\sqrt{2} + 2$	M1	or Better Allow one error
	$\sqrt{32}\sqrt{2} = 4\sqrt{2}\sqrt{2} = 8$ sum = 50 or $\sqrt{32}\sqrt{2} = \sqrt{64} = 8$ sum = 50	A1	**Clearly** shown, must see surds used correctly Evidence of $\sqrt{64} = 8$ needs to be seen
	or $\sqrt{32} = 4\sqrt{2}$ Hence $\sqrt{32} + \sqrt{2} = 5\sqrt{2}$	M1	Expanding $(4\sqrt{2} + \sqrt{2})^2$ Allowing one error, also earns this mark $4\sqrt{2}\sqrt{2} = 8$ must be shown eventually to earn A1 using this approach
	$(5\sqrt{2})^2 = 25 \times 2 = 50$	A1	25×2 oe Needs to be seen
20(b)	$\frac{1}{2} \times 4\sqrt{3} \times h = 30$	M1	oe eg, $60 \div 4\sqrt{3}$
	$(h =) \frac{30}{2\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ or $2h = \frac{30}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ or $4h = \frac{60}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$	M1	Attempt to rationalise denominator (This mark can still be gained if M0 in 1st step) or Other valid method eg. Using surds correctly to obtain a product of 30 eg, Squaring and solving (eg, $12h^2 = 900$ etc)
	$5\sqrt{3}$	A1	
21(a)	$a = 3$	B1	
	Using $a^2 + b = -11$	M1	Sight of this is sufficient oe
	$b = -20$	A1	Note: $(x + 3)^2 - 20$ seen earns all 3 marks
21(b)	$x + 3 = \sqrt{20}$	M1	$(x + 3)^2 - 20$ seen here means part (a) marks can be awarded as long as there is no contradictory attempt at (a) M1 for $\{-6 \pm \sqrt{(6^2 - 4 \times 1 \times -11)}\} \div 2$ or better
	$x = -3 \pm \sqrt{20}$	A1	$(-6 \pm \sqrt{80}) \div 2$ or better earns A1

Q	Answer	Mark	Comments
22	Angle *PCD* = angle *RCB* both = (90 – angle *BCP*)	B1	**Must** give a reason for the equal angles
	DC = *BC*	B1	
	PC = *RC*	B1	
	Congruent Δs SAS so *DP* = *BR*	B1	**Must** state SAS This B1 is dependent upon all three previous B marks being awarded