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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 3301
Specification A

Paper 1 Higher Tier

Mark Scheme

2006 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.

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.

Paper 1H

1(a)	$n^2 + n$ or $n(n + 1)$ or $n \times (n + 1)$ or $(n + 1) \times n$	B2	B1 for n^2 … or brackets omitted
1(b)	42	B2	B1 10 and 11 seen

2(a)	$7x - 14y - 6x + 3y$	M1	Allow one error
	$x - 11y$	A1	
2(b)	$24 - x = 15$	M1	Allow $24 - x = 3 \times 5$
	9	A1	
2(c)(i)	$(y - 2)(y - 3)$	B2	B1 $(y \pm 1)(y \pm 6)$ or $(y \pm 2)(y \pm 3)$
2(c)(ii)	2 <u>and</u> 3	B1ft	
2(d)	$\frac{(x+3)}{4}$	B2	B1 for each of numerator and denominator If denominator = 4, then numerator must be an algebraic expression to earn B1 B1 for $\frac{2}{8}(x + 3)$ $\frac{2(x+6)}{8}$ $\frac{(x+3)^2}{4(x+3)}$
2(e)	$16m^{12}p^4$	B2	– 1 eeoo

3(a)	$\frac{1}{1.5}$	M1	$\frac{1}{\frac{3}{2}}$ and $1 \div 1.5$ both earn M1
	$\frac{2}{3}$	A1	SC1 for $-\frac{2}{3}$
3(b)	10 (÷) 0.2	M1	Both approximations correct
	50	A1	
	7	A1	Allow 7.1
3(c)	3 <u>and</u> common denominator	M1	or $\frac{21}{5} - \frac{5}{3}$ 1.66(6 …)
	$(3 +)\ \frac{3}{15} - \frac{10}{15}$ Allow one error in numerator	M1	or $\frac{63}{15} - \frac{25}{15}$ 4.2 Allow a total of 1 error in <u>either</u> 1st <u>or</u> 2nd M mark
	$2\frac{8}{15}$	A1	oe eg $\frac{38}{15}$ 2.533(3 …) SC2 $(3) - \frac{7}{15}$ oe 2.53 scores M2

4(a)	Reflection	B1	
	$y = x$	B1	oe
4(b)	Rotation	B1	Allow turn
	90º anticlockwise	B1	oe $\frac{1}{4}$ turn anticlockwise scores B2 $\frac{1}{4}$ turn scores B1
	(Centre) (1,1)	B1	
4(c)	Enlargement	B1	No combined transformations
	Scale factor –2	B1	
	Centre (0,0)	B1	

5(a)	0.833(3…) <u>or</u> 0.875 and 0.9 0.166(6…) <u>or</u> 0.125 and 0.1	M1	Allow percentages or fractions with denominators with prime factors of 2 and/or 5 only terminate oe
	$\frac{5}{6}$	A1	Must see working
5(b)	Attempt at 3 ÷ 11	M1	Answer attempted to 2dp, (Accept error in 2nddp)
	0.2727(27…)	A1	Minimum of 4dp or recurring notation SC1 sight of digits 27

6(a)	(2.5 , 1), (7.5 , 2), (12.5 , 7), (17.5 , 9), (22.5 , 7), (27.5, 4) joined within 1 small square, straight lines attempted	B2	B1 One error <u>or</u> not joined <u>or</u> joined with curve SC1 for consistent plots at lcb or ucb
6(b)	Correct comparison of average <u>and</u> spread, or Correct comparison of average or spread <u>and</u> one other valid observation	B2	eg Students average time larger oe Allow eg in general, on average, overall Spread of student times larger oe Allow eg larger range, more varied … Other valid observations eg More students watch from 15 to 25 h Same number (7) watch from 10 to 15 h B1 one correct comparison of average/spread or one valid observation

7(a)	7×10^5	B2	B1 35 000 000 ÷ 50 (: 1), or their 700 000 (: 1), or their 700 000 in correct standard form
7(b)	$3.5 \times 10^3 \div 10^6$	M1	or 3 500 ÷ 1 000 000 or 0.0035
	3.5×10^{-3}	A1	

8	1 → D	B1	$1 \rightarrow y \geq 2x - 4$
	2 → C	B1	$2 \rightarrow y \geq -2x + 4$
	3 → E	B1	$3 \rightarrow y \leq 2x - 4$
	4 → A	B1	$4 \rightarrow y \leq -\frac{1}{2}x + 2$

9	$2s = (u + v)t$ $\quad s/t = \frac{1}{2}(u + v)$	M1	$2s = (u + v)t$ M1 Look out for missing bracket then recovery $s = ut/2 + vt/2$
	$\frac{2s}{t} = u + v$ $\quad s/t - \frac{1}{2}v = \frac{1}{2}u$	M1	$2s = ut + vt$ $\quad s - vt/2 = ut/2$ M1 (must rearrange for M1)
	$\frac{2s}{t} - v = u$	A1	$2s - vt = ut$ M1 $\quad 2(s - vt/2) = ut$ M1 $(2s - vt) / t = u$ A1 $\quad \frac{2}{t}(s - vt/2) = u$ A1 Look out for equivalent answers eg $u = (\frac{1}{2}vt - s) \div (-\frac{1}{2}t)$ $\quad u = s \div t \div 0.5 - v$

10	Sight of correct ratio or scale factor ie 20 : 30, 2 : 3, $\frac{2}{3}$, $1\frac{1}{2}$	M1	oe sight of $\frac{3}{5}$ or $\frac{2}{5}$ earns this mark
	$\frac{3}{5} \times 40$	M1	oe eg might work out $\frac{2}{5}$ then subtract
	24	A1	**Note** 2 : 3 ratio might be scaled up to give ratio of 16 : 24 (M1, M1) Must state $h = 24$ for A1 Alternatively $h/30 = (40 - h)/20$ M1 $20h = 30(40 - h)$ $20h = 1200 - 30h$ M1 $50h = 1200$ $h = 24$ A1

11	Men: 4 5 4 2 Women: 6 4 7 3		Fully correct **4** marks, M3, A1 Slight slip, attempts to round from correct working allow <u>1</u> or <u>2</u> errors only **3** marks, M1, M1, M1, A0 eg Men: <u>3</u> <u>6</u> 4 2 Women: 6 4 7 3 Correct figures but not rounded allow <u>1</u> or <u>2</u> errors only **2** marks, M1, M1, M0, A0 eg Men: 3.6 <u>5.6</u> 4.2 1.8 Women: 5.8 <u>3.6</u> 7.0 3.4 Correct proportions but no 10% calculation <u>must be correct</u> **1** mark, M1, M0, M0, A0 eg Men: 36 54 42 18 Women: 58 38 70 34 SC Men <u>or</u> Women <u>fully</u> correct (more than 2 errors on other one) scores B2 (with only <u>1</u> error) scores B1

12	$YZ = ZY$	B1	
	Angle MZY = angle NYZ base angles of (Isosceles) ΔXYZ	B1	**Note** Reason necessary eg you might see If $XZ = XY$ then angle XZY = angle XYZ
	Angle MYZ = angle NZY	B1	
	Triangles congruent, ASA	B1dep	**Note** Dependent on earning first 3 marks Must give correct reason for congruence (ASA) Only allow AAS if complete argument stating 'third angles equal'

13	Attempt at $y = x - 1$	M1	'm' or 'c' correct ($y = -1$ scores M0) Table of values seen with at least one pair correct, with attempt at line, earns M1
	<u>Correct</u> <u>ruled</u> line	A1	
	$-2.6 \le x \le -2.5$ <u>and</u> $1.5 \le x \le 1.6$	A1ft	ft their line, **two** solutions only, tolerance of ± 0.05

14(a)	Correct Pythagoras in two appropriate right-angled triangles	M1	or simply $BH^2 = 12^2 + 3^2 + 4^2$
	13	A1	
14(b)	$HB = 13$, $HC = 5$ or $DB = \sqrt{153}$ with attempt at trig. Ratio	M1	Explanations may not involve any calculations eg $BC < BD$ or $HC > HD$ together with some comparison such as BH is common (diagrams drawn, to illustrate, are appropriate)
	Two correct, comparable trig. ratios eg $\sin x = \frac{4}{13}$ and $\sin y = \frac{5}{13}$	A1	For example: BH is common and triangles BHD and BHC are right-angled, so y must be bigger because the height is greater
	y	A1	Good explanation and correct conclusion … this earns all 3 marks

15(a)	Probabilities of 0.7, 0.3, 0.4, 0.6 on ‘2nd game’ column	B1	SC1 either ‘top half’ or ‘bottom half’ correct
	Probabilities of 0.4, 0.6, 0.7, 0.3 on ‘3rd game’ column	B1	
15(b)	0.5×0.7	M1	ft their probabilities (if using values < 1) (**not** 0.5)
	$0.5 \times 0.3 \times 0.4$ or $0.5 \times 0.4 \times 0.7$	M1	ft as above
	addition of three <u>valid</u> probabilities	M1dep	ft their values (**note** dependent on first two marks)
	0.55	A1	If probabilities are all 0.5, and there is a <u>correct attempt</u> at one of the alternatives, award SC 1 If they work out the prob. that Simon wins, 0.5×0.6 (M1) (<u>ft their probs. in all of these</u>) $0.5 \times 0.4 \times 0.3$ or $0.5 \times 0.3 \times 0.6$ (M1) 1 – (addition of <u>valid</u> three) (M1dep) 0.55 (A1)

16(a)(i)	w^8	B1	
16(a)(ii)	w^6	B1	
16(a)(iii)	w^{12}	B1	
16(b)(i)	$\frac{x}{y}$	B1	Allow $x \div y$ or $x \times y^{-1}$
16(b)(ii)	x^2	B1	Allow $x \times x$
16(b)(iii)	$9y$	B1	Allow $y9$ $9 \times y$ $y \times 9$ $3^2 \times y$ $y \times 3^2$

17	Substitute one pair of data into $t = k\sqrt{m}$, $t = k / m$ or $t = k / \sqrt{m}$	M1	Look for valid alternative methods which will still earn this mark eg The first rule might be eliminated by reasoning that the relationship must be an inverse one since as t increases, m decreases
	Test one of the rules to reach a conclusion	M1	ie Test value of k found from first pair on another pair or find a contradictory value of k
	Test a second rule to reach a conclusion	M1	Repeat as above (2-stage process)
	Select correct rule (*C*)	A1	If testing *C* only, must use all three pairs otherwise max of M1 M1 M0 A0

18(a)	**either** $12 + \sqrt{12}\sqrt{3} + \sqrt{12}\sqrt{3} + 3$	M1	Allow $\sqrt{12}\sqrt{12} + \sqrt{12}\sqrt{3} + \sqrt{12}\sqrt{3} + \sqrt{3}\sqrt{3}$ Allow one error (might see $\sqrt{36}$ used here)
	$\sqrt{12}\sqrt{3} = 2\sqrt{3}\sqrt{3} = 6 \rightarrow$ sum = 27 $\sqrt{12}\sqrt{3} = (\sqrt{36}) = 6 \rightarrow$ sum = 27	A1	Clearly shown, must see surds used correctly
	or $\sqrt{12} = 2\sqrt{3}$ and $\sqrt{12} + \sqrt{3} = 3\sqrt{3}$	M1	Expanding $(2\sqrt{3} + \sqrt{3})^2$, allowing one error, also earns this mark
	$(3\sqrt{3})^2 = 9 \times 3 = 27$	A1	$2\sqrt{3}\sqrt{3} = 6$ must be seen eventually to earn A1
18(b)(i)	$(\sqrt{8} + \sqrt{2})^2 = 18$	M1 A1	Marked as in Part (a)
	Use of Pythagoras in Δ *PQS* ie $(\sqrt{12} + \sqrt{3})^2 - (\sqrt{8} + \sqrt{2})^2$	M1	or Subtraction of QS^2 from PQ^2 with their value for QS^2
	$PS^2 = 9$	A1	Must be clearly shown ($PS = 3$ cm, given)
18(b)(ii)	$\sqrt{8} + \sqrt{2} + \sqrt{2} = 4\sqrt{2}$	B1	Could be seen at any stage
	Area = $\frac{1}{2} \times (\sqrt{8} + \sqrt{2} + \sqrt{2}) \times 3$	M1	Could be $\frac{1}{2} \times (\sqrt{8} + \sqrt{2}) \times 3 + \frac{1}{2} \times \sqrt{2} \times 3$
	$6\sqrt{2}$	A1	

19(a)	$\frac{4}{3}\pi r^3 = 2 \times \frac{1}{3}\pi r^2 x$	M1	Must include the factor of 2 Allow use of h instead of x
	Simplified to give $x = 2r$	A1	Alternatively Allow substitution of $2r$ for height of cone and verification of result ie 2 × Vol cone $= 2 \times \frac{1}{3} \times \pi \times r^2 \times 2r$ M1 $= \frac{4}{3}\pi r^3$ (must be seen) A1
19(b)	$(l)^2 = r^2 + 4r^2$	M1	$(l)^2 = r^2 + (2r)^2$ is M1 $(l)^2 = r^2 + 2r^2$ is M0
	$(l) = \sqrt{5}\, r$	A1	
	Surface area cone $= \pi \times r \times \sqrt{5}\, r$	M1	Using their l if from an attempt at Pythagoras
	$4 : \sqrt{5}$	A1	Allow $\sqrt{5} : 4$ SC2 for a complete numerical solution