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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 3301
Specification A

Paper 2 Higher Tier

Mark Scheme

2006 examination - November 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.

The following abbreviations are used on the mark scheme:

M	Method marks awarded for a correct method.
A	Accuracy marks awarded when following on from a correct method. It is not necessary always to see the method. This can be implied.
B	Marks awarded independent of method.
M dep	A method mark which is dependent on a previous method mark being awarded.
ft	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
SC	Special Case. Marks awarded for a common misinterpretation which has some mathematical worth.
oe	Or equivalent.
eeoo	Each error or omission.

Paper 2H

1	S, A, N	B3	−1eeoo

2	30 ÷ 20 (= 1.5)	M1	oe
	Their $(\frac{30}{20}) \times 2.78$	M1dep	2.78 ÷ 0.666.. oe M2
	4.17	A1	4.2

3	Digits 5 or 52 ÷ (360 − 363)	M1	13774 − 14444 M1
	14000	A1	Accept 14300, 14400

4(a)	$3x - 6 \leq 9$	M1	$x - 2 \leq 3$ M1 $3x - 6 = 9$ or $x - 2 = 3$ is M0 unless inequality recovered Allow one error in first or second answer
	$3x \leq 9 + 6$ (= 15)	M1	$x \leq 3 + 2$ (= 5)
	$x \leq 5$	A1	SC $x = 5$ $x \geq$ $x > 5$ B1 $x = \leq 5$ is M2, A0 $x = < 5$ is M2, A0 $x < 5$ M2, A0 x Must be on answer line Embedded $3(5 - 2) \leq 9$ oe SC1
4(b)	**Left Boundary** $-3 \leq$ open circle < -2 or $-3 <$ closed circle ≤ -2 **Right Boundary** Closed circle on 3 or line beyond 3 with any termination (eg, arrow, circle, nothing)	B1	Boundaries must be joined with a line Ignore any markings on intermediate points

5	Evidence of adding at least two frequencies	M1	18, 52,… (92, 100)
	$40 < m \leq 80$	A1	Answer only with no working or no contradictory working M1, A1 Answer from incorrect working (eg, mean = 75.2, $\frac{160}{2}$ = 80), M0, A0

6(a)	40	B1	150 ÷ 100 (×100) = 1.3636… (136.36) is M0 unless 1 or 100% subtracted, then it is M2
	40 ÷ 110 × 100	M1	
	36.4, 36.36…..	A1	$36\frac{4}{11}$ % accept 36% if M1 awarded
6(b)	120% = 110	M1	110 ÷ 1.2 is M2
	1% = 0.9166…	A1	
	100% = 92, 91.7, 91.6…	A1	NB $20 \times \frac{100}{110} = 0.909\ldots$ 0.909 × 20 = 18.18 110 – 18.18 = 92 M0 T & I has to get 91.6 – 91.7 136.4% seen after 36.4 is 2 marks out of 3

7	$20 = \frac{15}{v}$	M1	
	$v = 0.75$	A1	
	Their '0.75' = 0.6 × length	M1	Must be calculated value eg, $\frac{20}{15} = 1.33\ldots$, 1.33 ÷ 0.6 = 2.22… or 300 ÷ 0.6 = 500 are M0, A0, M1 A0
	1.25	A1	

8(a)	$(x^2 =)\ 45^2 + 40^2$	M1	
	$\sqrt{3625}$	M1dep	Mark is for squaring, adding and square rooting $\sqrt{(45^2 + 40^2)}$ is M2 M2 for $45 \div \sin 48.366$ oe
	60.2…	A1	60 with working
	60	B1ft	For rounding Their answer to an integer
8(b)	$\text{Tan}y = \frac{45}{40}$ $\text{Sin}y = \frac{45}{\text{Their(a)}}$ $\text{Cos}y = \frac{40}{\text{Their(a)}}$	M2	M1 for fraction wrong way round M1 for other angle using correct trigonometry. then M1 for subtract from 90º
	48.1º to 48.6º	A1	48º or 49º with working Grads 53.74, Rads 0.844 both M2, A0

9(a)(i)	C	B3	−1eeoo
9(a)(ii)	F		
9(a)(iii)	D		
9(b)	$830 \div 10\ (\times 11)$	M1	oe 83
	913	A1	

10(a)	Lowest 'whisker' 8 Lower quartile 18 Median 25 Upper quartile 32 Highest 'whisker' 57	B3	−1eeoo plotted to half square Failure to draw box is 1 error Failure to draw 'whisker' is 1 error
10(b)	25%	B1	

11(a)	$4p + 4r = 7r + 11$	M1	Allow one error eg, $4p + r = 7r + 11$ $p + r = \frac{7r+11}{4}$ is M1, A1
	$4p = 3r + 11$	A1	
	$p = \frac{3r+11}{4}$ or $\frac{1}{4}(3r + 11)$	A1ft	Dividing by 4 must be done correctly eg, $3r + 11 \div 4$ is A0 but $(3r + 11) \div 4$ is A1 ft if M1 awarded ie, $p = (6r + 11) \div 4$ oe eg, $p = \frac{7r+11}{4-r}$ A2
11(b)	$(3x + 5y = 4)$ $6x + 10y = 8$ $30x + 5y = 130$ $(6x + y = 26)$	M1	oe Allow error in 1 term M1 for substituting one equation into the other
	$27x = 126$ $9y = -18$	M1dep	oe Elimination from Their equations at least one term correct
	$x = 4\frac{2}{3}$ and $y = -2$	A1	oe (4.66, –2) (4.67, –2) SC1 for correct answer with no working or using trial and improvement.

12(a)	Convincing algebra	B1	Must see $(p + q)(p + q) = p(p + q) + q(p + q)$ or box method and $p^2 + pq + pq(qp) + q^2$
12(b)	$(2x + 3 + x - 1)^2$	M1	$4x^2 + 12x + 9 + 2(2x^2 + x - 3) + x^2 - 2x + 1$ Allow one sign or coefficient error For middle term accept $(4x + 6)(x - 1)$ or $(2x + 3)(2x - 2)$
	$(3x + 2)^2$	A1	$4x^2 + 12x + 9 + 4x^2 + 2x - 6 + x^2 - 2x + 1$
	$9x^2 + 12x + 4$	A1ft	ft if M1 awarded and no further errors

13	$[(2x - 1)(2x + 1)] = 4x^2 - 1$	M1, A1	or $(4xy - 2y)(2x + 1)$ M1 Allow one error Lack of brackets is 1 error but no ft possible $8x^2y - 4xy + 4xy - 2y$
	$8yx^2 - 2y$	A1ft	ft if M1 awarded no further errors SC2 $16y^2x^2 - 4y^2$

14(a)	$ABC = 65$	B1	
	$ADC = 115$	B1ft	$180 - (ABC)$
14(b)	$ACO = 90 - 56$ (=34) **and** $BAC = 65$ or $ABC = 56$	B1	Many different methods
	$OBA = 360 - 65 - 230 - 34$	M1	Complete method Angles must be identified or marked on diagram (Allow incorrect angles for M1)
	$(OBA) = 31$	A1	

15(a)	$\sum$(fd × width)	M1	
	6, 26, 19, 17, 32	A1	Allow 4 out of 5
	= 100	A1	
15(b)	$\sum$(fm)	M1	Use of incorrect *m* eg, ucb or lcb consistently allow M1
	$10 \times 6 + 30 \times 26 + 45 \times 19 + 55 \times 17 + 80 \times 32$ 60, 780, 855, 935, 2560	A1ft	A1 for correct combination (allow one error) or identifying at least 4 out of 5 values ft Their values from (a)
	5190	A1ft	
	51.9	A1ft	ft Their $\sum$f if M1 awarded in (a) and also $\sum$mf if M1 awarded in (b)

16(a)	$x^2 = 8^2 + 7^2 - 2 \times 7 \times 8 \times \cos 48^\circ$	M1	$1 \times \cos 48$ implied M1
	$x^2 = 38.(\ldots..)$	A1	Grads $x^2 = 31.355$
	(x) = root any value 38.1 or better eg, 6.168…, 6.169…, 6.17, 6.2	A1ft	Grads x = 5.6 is 2 marks out of 3 Allow ft on one arithmetical error
16(b)	$\frac{\sin x}{7} = \frac{\sin 48}{6.17}$	M1	ft Their '6.17' from (a) $7^2 = \text{'6.17'}^2 + 8^2 - 2 \times \text{'6.17'} \times 8 \times \cos x$
	$\sin x = \frac{7 \times \sin 48}{6.17} (= 0.8432)$	M1dep	Grads 0.8557 $\text{Cos}\, x = \frac{\text{'6.17'}^2 + 8^2 - 7^2}{2 \times \text{'6.17'} \times 8} (= 0.5374)$
	$x = 57.5^\circ$	A1ft	ft Their value from (a) Grads $x = 65.4\ \frac{3}{3}$ Answer to nearest degree after working is OK

17	$C \propto d^2$ or $C = kd^2$	M1	
	$k = 50 \div 3600 = (0.013888\ldots)$	A1	$50 \div 60^2 \times 90^2$ M2
	(C) = £112.50	A1	112.5 is A0

18	Mid point (5, 8)	B1	
	Gradient $AB = -\frac{1}{3}$	B1	Accept any indication eg, 6 across, 2 down
	Attempt to find gradient MC or 'stepping' from M to C	M1	M1 for using 'Their gradient'
	Valid conclusion with justification. eg, No because gradient MC not 3	A1	Accept any indication eg, (5, 8) plus (3, 9) = (8, 17), $mm' \neq -1$
18 Alt	Mid point (5, 8)	B1	
	Use of Pythagoras	M1	
	Three correct lengths $\sqrt{109}$, 11, $\sqrt{10}$	A1	
	Correct conclusion at least 2 correct values	A1	

19	$3yx + 2x = x + 3$	M1	$3y + 2 = 1 + \frac{3}{x}$
	$3yx + x = 3$	A1	$3y + 1 = \frac{3}{x}$
	$x(3y + 1) = 3$	M1	$\frac{1}{(3y+1)} = \frac{x}{3}$ $\quad x(3y - 1) = 1$
	$x = \frac{3}{3y + 1}$	A1ft	oe x must be seen eg, $x = 1 \div (3y - 1)$

20	$55 \leq$ (speed < 65)	B1	55 alone gets B1 Ignore incorrect upper limit
	$14500 \leq$ file < 15500 (15499.9)	B1	15500 (15499.9) alone gets B1 Ignore incorrect upper limit
	Their 'greatest file' ÷ Their 'minimum speed'	M1	Attempts at limits must be made
	282, 281.8…	A1ft	ft if M1 awarded and attempt to find lower speed and upper file made **and** one correct NB check answer comes form correct work ft answer must be at least 3sf

21	(area base) $= \frac{1}{2} \times 5 \times 5 \times \sin 60$	M1	oe eg, Use of trigonometry or Pythagoras but must give full method to find area of a triangle Height of triangle = 4.33
	Area = 10.825…	A1	10.83
	Height $= \frac{3 \times 36}{\text{area base}}$	M1	
	10, 9.98, 9.977, 9.9766…	A1ft	ft Their base area eg, 8.64 from $0.5 \times 5 \times 5$

22(a)	$x^2 + 4$	B1	
22(b)	$2x^2$	B1	
22(c)	$(x - 1)^2$	B1	oe

23(a)(i)	$-3\mathbf{a} + 1\frac{1}{2}\mathbf{b}$	B1	oe
23(a)(ii)	OX = OA + AX	M1	oe
	$1\frac{1}{2}\mathbf{a} + 1\frac{1}{2}\mathbf{b}$	A1	oe
23(a)(iii)	AZ = AO + OZ	M1	oe M1 for $-3\mathbf{a} + \frac{2}{3}$ (Their OX)
	$\mathbf{b} - 2\mathbf{a}$	A1	oe
23(b)	ZY = $\frac{1}{2}\mathbf{b} - \mathbf{a}$	M1	Their 'AY' – Their 'AZ'
	2:1	A1ft	