Version 1.0: 1106

ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 3301
Specification A

Paper 1 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 1H

1(a)	Exterior angle = 360° ÷ 6 = 60°	B1	oe
1(b)	Exterior angle = 360° ÷ 8 = 45°	M1	
	Interior angle = 180° – (Their 45°)	M1	(Their 45°) must be acute and must be from a calculation involving division by 8
	135°	A1	

2(a)	*P* at (6, 6)	B1	SC1 Both correctly plotted but not labelled
2(b)	*Q* at (3, 6)	B1	
2(c)	(Their 3) × (Their 6) ÷ 2	M1	(Their 6) × (Their 6) ÷ 2 – (Their 3) × (Their 6)÷ 2 ft Their *O*, *P* and *Q* in any position
	9	A1ft	ft Their *P* and *Q* unless either or both on an axis
	cm^2	B1	Mark independently

3	240 ÷ 12 × 30	M1	oe 240 ÷ 3000 × 100
	600	A1	8
	(Their 600) ÷ 3000 × 100	M1	oe (Their 8) × 30 ÷ 12
	20	A1ft	From (Their 600) or (Their 8)

4(a)	$2 \times \frac{2}{5}$ or $\frac{4}{5}$	M1	oe or $\frac{1}{5}$ left over in 1 day
	$7 \times$ (Their $\frac{4}{5}$)	M1	oe $5 \div \frac{4}{5}$ or $5 \times \frac{5}{4}$ 1 left over in 5 days
	$\frac{28}{5}$ **and** No	A1	oe (No) only lasts 6 ($\frac{1}{4}$) days
4(b)	$\frac{14}{3} \div \frac{7}{4}$	M1	oe eg, $\frac{56}{12} \div \frac{21}{12}$ Allow one error in numerator
	$\frac{14}{3} \times \frac{4}{7}$	M1	oe
	$2\frac{2}{3}$	A1	oe eg, $2\frac{14}{21}$ or $\frac{56}{21}$ or $\frac{8}{3}$

5(a)	Straight lines joining (10, 24), (30, 30), (50, 36), (70, 10) ± 1 small square	B2	B1 for one error or not joined or joined with curve Condone straight lines from (0, 0) and (90, 0)
5(b)	(10 × 24) + (30 × 30) + (50 × 36) + (70 × 10)	M1	or 3640 seen Allow Their consistent mid points
	(Their 3640) ÷ 100	M1	
	36.4	A1	Allow 36 if M2 scored

6	(6 + 6 + 7 + 6 + 6) ÷ 5 **or** (6 + 7 + 6 + 6 + 7) ÷ 5	M1	
	6.2	A1	From correct method
	6.4	M1	From correct method

7	$2^3 \times 5 (\times 2^2 \times 5)$ **or** $2 \times 2 \times 2 \times 5 (\times 2^2 \times 5)$	M1	Two correct attempts at dividing by a factor starting with (Their 800) eg, 2 × 400 ✓ 800 ÷ 5 = 160 ✓ 2 × 2 × 200 ✓ 160 ÷ 2 = 80 ✓ **or** 40 × 20 ✓ 800 ÷ 5 =180 ✗ 2 × 20 × 4 × 5 180 ÷ 3 = 60 ✓ ft 60 ÷ 2 = 30 ✓ ft
	$2^5 \times 5^2$	A1	or 2 × 2 × 2 × 2 × 2 × 5 × 5 or $2^3 \times 5 \times 2^2 \times 5$ oe

8(a)(i)	$\frac{x}{3} = 7$	M1	or $x - 6 = 15$
	$x = 21$	A1	
8(a)(ii)	$4x - 11 = 2x + 6$	M1	Expansion must be correct
	$4x - 2x = 6 + 11$	M1	Condone one error, ft **Their** expansion
	$x = 8\frac{1}{2}$	A1	or 8.5
8(b)	$6x - 3 + 6x + 10$	M1	Allow one error
	$12x + 7$	A1	
8(c)(i)	$y^2 + 5y - y - 5$	M1	4 terms seen allow one error
	$y^2 + 4y - 5$	A1	
8(c)(ii)	Both $(y + 5)$ and $(y - 1)$ are even **and** even × even = even	B1	or y^2 is odd and $4y$ is even **and** odd + even – odd = even oe
8(d)	$2y(x - 3y)$	B2	B1 for $2(xy - 3y^2)$ or $y(2x - 6y)$ or one factor correct

9	Attempt at 'y' ÷ 'x'	M1	
	$a = 2$	A1	
	$b = -1$	B1	SC1 for $a = -1$ **and** $b = 2$

10	Area (A)	B1	
	None (N)	B1	
	Length (L)	B1	
	Volume (V)	B1	

11	$13^2 - 5^2$	M1	$12.5 \div 5$ or 2.5 or $5 \div 12.5$ or 0.4 $\cos Z = \frac{5}{13}$
	√(Their 144)	M1dep	13 × (Their 2.5) or 13 ÷ (Their 0.4) $12.5 \div \frac{5}{13}$
	$12.5 \div 5$ or 2.5 or $5 \div 12.5$ or 0.4 $\tan Z = \frac{12}{5}$	M1	(Their 32.5)^2 – 12.5^2
	(Their 12) × (Their 2.5) or (Their 12) ÷ (Their 0.4) $12.5 \times \frac{12}{5}$	M1dep	√(Their 900)
	30	A1	

12(a)	$\frac{300}{360} \times \pi \times 12^2$	M1	oe $\frac{60}{360} \times \pi \times 12^2 = 24\pi$ scores M1 A0
	120π	A1	SC1 for using $\pi = 3$ and answer = 360
12(b)	$\frac{300}{360} \times 2 \times \pi \times 12$	M1	oe
	20π	A1	SC1 for using $\pi = 3$ and answer = 60
	$20\pi + 24$	A1	For '+24'

13	**Using** $\frac{50}{300}$ × one of the values	M1	eg, $\frac{50}{300} \times 86$ is sufficient for M1
	14, 16, 8, 7, 5 respectively	A2	A1 for at least 3 correct (**must** be integer values) SC1 For 2 correct, no method shown

14(a)	(±) 6	B1	
	$\frac{1}{4}$	B1	
	(±) 1.5	B1	oe
14(b)	$\frac{1}{100}$	B2	oe eg, 0.01 B1 for 100 or $\frac{1}{10}$ or $\frac{1}{1000000}$

15(a)	$\sqrt{300}$	M1	oe eg, $\sqrt{(2 \times 3)} \times \sqrt{(2 \times 25)}$ or $\sqrt{(2 \times 2 \times 3 \times 25)}$ $\sqrt{}$ (correct product of factors which includes '3')
	$10\sqrt{3}$	A1	SC1 for $5\sqrt{12}$ or $2\sqrt{75}$
15(b)	$4\sqrt{3}$ **or** $5\sqrt{3}$ seen	M1	
	$9\sqrt{3}$	A1	
15(c)	Attempt to rationalise ie, Multiply num. and denom. By $\sqrt{3}$	M1	oe eg, $\frac{6\times3}{\sqrt{3}}$ scores M1
	$6\sqrt{3}$	A1	

16(a)	$(y =) (x + 2)(x - 8)$	M1	Substituting the coordinates into the equation to give the simultaneous equations $0 = 4 - 2q + r$ **and** $0 = 64 + 8q + r$ or substituting $x = -2$ and $x = 8$ into the equation of the curve and verifying that $y = 0$
	$(y =) x^2 - 6x - 16$ (from expansion)	A1	$q = -6$ **and** $r = -16$ (could be by verifying that these values satisfy the pair of simultaneous equations)
16(b)	x coordinates = 3	B1	
	y coordinates = -25	B1	
16(c)	$x + 3 = -2$	M1	Translation Expand as far as $x^2 - 25$ (= 0)
	$x + 3 = 8$	M1	$\begin{bmatrix} -3 \\ 0 \end{bmatrix}$ Factorise to $(x + 5)(x - 5)$ (= 0)
	$x = -5$ **and** $x = 5$	A1	SC2 for solutions of $x = 1$ **and** $x = 11$ (this comes from a translation 3 units to the right) SC1 for $x = -1$ **and** $x = -11$ (this comes from $x + 3 = 2$ and $x + 3 = -8$)

17	$(2x + 3)(x - 6)$	B2	$(2x - 3)(x + 6)$ is B1 otherwise B0
	$(x + 6)(x - 6)$	B1	
	$\frac{2x+3}{x+6}$	B1	ft from $\frac{(2x \quad 3)(x \quad 6)}{(x \quad 6)(x \quad 6)}$ for final B1

18	Sight of one correct product $\frac{1}{4} \times \frac{9}{10} \times \frac{4}{5}$ or $\frac{3}{4} \times \frac{1}{10} \times \frac{4}{5}$ or $\frac{3}{4} \times \frac{9}{10} \times \frac{1}{5}$	M1	SC $\frac{3}{4}$ for prob. 'passes' only one test M1 M1 M1 A0 as follows: $\frac{1}{4} \times \frac{1}{10} \times \frac{4}{5}$ **and** $\frac{1}{4} \times \frac{9}{10} \times \frac{1}{5}$ **and** $\frac{3}{4} \times \frac{1}{10} \times \frac{1}{5}$ for 1st M1
	Correct evaluation of at least two correct products ie, two of $\frac{36}{200}$, $\frac{12}{200}$ or $\frac{27}{200}$	M1	Two correct of $\frac{4}{200}$, $\frac{9}{200}$ or $\frac{3}{200}$ For 2nd M1 (dep) 3rd M1 (dep on 1st M1), as below
	Attempt to add **Their three** products	M1	Each product relating to: brakes × steering × lights
	$\frac{75}{200}$	A1	oe

19(a)	$4 = 9x - 2x^2$	M1	Multiply through by x, $4 = x(9 - 2x)$ is enough
	$2x^2 - 9x + 4 = 0$	A1	Expanding and rearranging must be seen (answer given)
19(b)	Attempt at $y = 9 - 2x$	M1	$(y =)\ 9 - 2x$ identified as being required line
	Points worked out	M1dep	eg, table of values (2 points minimum)
	Correct line plotted	A1	With ruler, must intersect the curve twice
19(c)	$x = \frac{1}{2}$	B1	Solutions can come from factorising $2x^2 - 9x + 4$ ie, $= (2x - 1)(x - 4)$
	$x = 4$	B1	No ft from incorrect factors

20(a)	$\pi rl = 2\pi r^2$	M1	or $\pi rl = \frac{4\pi r^2}{2}$
	$l = 2r$	A1	Clearly shown since answer given
20(b)	$h^2 = 4r^2 - r^2$	M1	Attempt to use Pythagoras' theorem correctly
	$h = \sqrt{3}r$	A1	$h^2 = 3r^2$ is sufficient or $h = \sqrt{(3r^2)}$
20(c)	$\frac{1}{3}\pi r^2\sqrt{3}r \ : \ \frac{2}{3}\pi r^3$	M1dep	ft with Their h if 1st M1 earned
	$\sqrt{3} \ : \ 2$	A1	