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ASSESSMENT and QUALIFICATIONS ALLIANCE

General Certificate of Secondary Education

Mathematics 4306

Specification A

Paper 1 Higher

Mark Scheme

2009 examination - November series

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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 $\frac{1}{2}$

Q	Answers	Mark	Comments
1	450 and 15 and 90	B3	B2 for any two of 450, 15 and 90 B1 for any one of 450, 15 and 90 **or** for sight of $^{3}/_{4}$ oe **or** for $^{3}/_{2}$ (or $^{2}/_{3}$) (T) or $^{1}/_{20}$ (or 20) (M) or $^{3}/_{10}$ (or $^{10}/_{3}$) (C)
2	$-2(3 \times 3 + 1)$ or better	M1	eg. $-2\ (9 + 1)$ or -2×10 or $(-2 \times 9) + (-2 \times 1)$
	$\frac{-20}{5}$ or -2×2 or $\frac{-18 + -2}{5}$	M1dep	
	-4	A1	SC2 for 4
3	200 - 110 (boys)	M1	or $^{110}/_{200} \times 100$ or $110 \div 2$ or 55
	$^{\text{Their } 90}/_{200} \times 100$ or their $90 \div 2$	M1	or 100 – their 55
	45	A1	
4(a)	Sight of $x + 125$ or $x + 1.25$	M1	
	$3(x + 125)$ $(= 8x)$	A1	oe
4(b)	$375 = 5x$ or $375 = 8x - 3x$	M1	Allow marks for solution done in (a) unless there is a contradiction in (b)
	75	A1	
5(a)	48 76 17 93 95 in correct cells	B3	B2 for 3 or 4 correct B1 for 1 or 2 correct Look for any answers clearly stated in the working
5(b)	For how long do you use the treadmill?	B1	oe Must be a time related question **not** eg. 'how many times used'
	Boxes to cover all possibilities There **must** be a reference to minutes or hours in either the question or the response section	B1	At least 3 boxes including 0 Must not overlap, no gaps
6(a)	Correct reflection	B2	B1 for reflection in $x = 1$ or x-axis or y-axis
6(b)	Correct rotation	B3	B2 for 90° rotation clockwise about any point other than O B2 for 90° rotation **anti**clockwise about O B1 for 90° rotation **anti**clockwise about any point other than O SC2 for their B correctly rotated
7	**Graphical method**		**Algebraic method** $x - 3 = 2$ M1
	correct graph of $y = x - 3$	B1	$x = 5$ A1
	correct graph of $y = 2$	B1	(5, 2) B1 ft if M1 earned
	(5, 2)	B1	SC1 for y coordinate of 2 seen

8	Sight of use of 8 for dotted length	B1	Sight of use of 8 for dotted length
	Alt Top triangle area $= {}^1/_2 \times$ their 8×6 (= 24)	M1	**Alt** Area LH trap $= {}^1/_2 (10 + 4) \times$ their 8 (= 56)
	Lower rectangle area $= 11 \times 4$ (= 44)	M1	Area RH rectangle $= 4 \times 3$ (= 12)
	Alt Area 'surrounding' rectangle $= 11 \times 10$ (= 110)	M1	Sight of use of 8 for dotted length B1
	Area 'missing' trapezium $= {}^1/_2 (11 + 3) \times 6$ (= 42)	M1	**Alt** Area LH scalene Δ $= {}^1/_2 \times 10 \times$ their 8 (= 40) M1
	Their 110 – their 42	M1	Area RH trap $= {}^1/_2 (11 + 3) \times 4$ (= 28) M1
	68	A1	
	cm^2	B1	

9	Any **two** of 400 or 3 or 0.5 seen	M1	
	$\frac{1200}{0.5}$ or 400×6 or 800×3	M1	Allow $\frac{1194}{0.5}$ or 398×6 or 796×3
	2400	A1	Allow 2388 ft for A1 for correct division by 0.5 if first M1 earned

10(a)(i)	${}^{48}/_{200}$	B1	oe
10 (a)(ii)	Yes **and** … **either** Four correct theoretical values for the colours red = 100 green = 50 blue = 25 yellow = 25 **or** Correctly comparing all of the relative frequencies with the theoretical probabilities **or** Correctly comparing the ratios of all the colours, both experimental and theoretical	E2	E1 for Yes **and** … **either** One of the correct theoretical values for the colours **or** One correct relative frequency/theoretical probability comparison **or** Correctly comparing the ratios of two colours, both experimental and theoretical
10(b)	Not enough trials	E1	oe

11(a)	$2x + x + 90 = 180$	M1	oe
	30	A1	
11(b)	Angle *CAD* = (their)30	M1	Look for angles marked on the diagram
	[180 – (their)30] ÷ 2	M1	
	75	A1	

12(a)	$n^2 + n + n + 1$ or $n^2 - n - n + 1$	M1	3 out of 4 terms correct for either expansion
	$n^2 + 2n + 1 + n^2 - 2n + 1$	A1	
	Convincing algebra to get $2n^2 + 2$	A1	Answer given, must show cancelling of terms clearly
12(b)	$2n^2 + 2 = 2(n^2 + 1)$ 2 × anything must be even or $2 \times n^2$ is even, 2 is even, even + even = even	E2	Alternatively … $E^2 + E^2 = E\times E + E\times E = E + E = E$ … or … $O^2 + O^2 = O\times O + O\times O = O + O = E$ E1 for partial explanation

13	$^{15}/_{8}$ (×) $^{12}/_{5}$	M1	Allow one error in numerators
	$^{180}/_{40}$ or $^{3}/_{2} \times {}^{3}/_{1}$	A1ft	oe ft their improper fractions if M1 earned
	$4^{1}/_{2}$ or $^{9}/_{2}$	A1	
	alternatively		
	1.875 × 2.4	M1	
	Evidence of long multiplication	M1	Allow one error 1875 × 24 7500 37500 45000
	4.5(000)	A1	

14	**L**ength **N**one of these **V**olume	B3	B1 for each

15(a)	5^{m-p}	B1	
15(b)	5^{2p}	B1	oe eg. $5^{2\times p}$ 5^{p+p}

16	$6x - 4y = 18$ $3x - 2y = 9$ $x + 4y = 10$ $3x + 12y = 30$	M1	Allow error in **one** term
	$7x = 28$ $14y = 21$	M1	Correct elimination from their equations
	$x = 4$ **and** $y = 1^{1}/_{2}$	A1	SC1 correct answers with no working or using T&I
	alternatively		
	$3(10 - 4y) - 2y = 9$	M1	oe Rearrange **and** substitute … allow one error
	$14y = 21$	M1	Correct simplification from their equation
	$x = 4$ **and** $y = 1^{1}/_{2}$	A1	

17	**D**: $2x + 5y = 10$ **B**: $5x + 2y = 10$ **A**: $5y + 10 = 2x$ **C**: $2y + 10 = 5x$	B3	B2 if two correct or three correct B1 if 1 correct

18(a)	Two **or** three correct pairs of angles Angle *BAC* = Angle *DEC* Angle *ABC* = Angle *EDC* Angle *ACB* = Angle *ECD*	B2	B1 for one correct pair of angles Look for angles marked on the diagram
	Two **or** three correct reasons 'alternate' for *BAC* and *DEC* 'alternate' for *ABC* and *EDC* '(vertically) opposite' for *ACB* and *ECD*	B1	
18(b)	$^{DC}/_{20} = {}^{6}/_{8}$ or $^{DC}/_{6} = {}^{20}/_{8}$	M1	Identifying scale factor of 2.5 ($^{20}/_{8}$) or 0.4 ($^{2}/_{5}$) oe
	$\frac{6 \times 20}{8}$	M1dep	6×2.5 or $6 \div 0.4$ or $6 \times$ their ($^{20}/_{8}$) or $6 \div$ their ($^{2}/_{5}$) oe
	15	A1	

19	$^{BD}/_{18} = {}^{8}/_{BD}$	M1	Accept $\cos x = \frac{?}{18}$ **and** $\tan y = \frac{8}{?}$ for M1
	$BD^2 = 18 \times 8$ (= 144)	M1dep	
	12	A1	

20	$y(x - 2) = w + x$	M1	
	$yx - 2y = w + x$	M1dep	
	$xy - x = w + 2y$ **or** $x(y - 1) = w + 2y$	M1dep	$-2y - w = x - xy$ **or** $-2y - w = x(1 - y)$ … for rearranging/factorising
	$x = \frac{w + 2y}{y - 1}$	A1	$x = \frac{-2y - w}{1 - y}$ must have $x =$ … (A0 if not)

21(a)	Attempt at 7.00(0…) ÷ 11	M1	Sight of $^{63}/_{99}$ scores M1
	0.6363(6…)	A1	4 d.p. minimum
21(b)	$x =$ 0.3939… $100x =$ 39.3939…	M1	
	$100x - x =$ 39.3939… – 0.3939…	M1	oe
	$x = {}^{39}/_{99}$ (= $^{13}/_{33}$)	A1	SC1 for 0.3939… = $^{39}/_{99}$ (= $^{13}/_{33}$)
	alternatively		
21(b)	$^{13}/_{33} = {}^{7}/_{11} \times {}^{13}/_{(7 \times 3)}$	M1	
	($^{13}/_{33}$ =) 0.6363… × $^{13}/_{21}$ = 0.0303… × 13	M1	
	($^{13}/_{33}$ =) 0.3939…	A1	

22(a)	2nd bar drawn at height of 1.5	B1	
	3rd number = 100	B1	
22(b)	Answer in region $110 < T < 120$	M1	
	$^{20}/_{50}$ of 20 or sight of 8 or $^{30}/_{50}$ of 20 or sight of 12 or 100 small squares = 20 vehicles	M1	oe for example, if drawn on $1cm^2$ grid, 4 cm^2 = 20 vehicles or $1cm^2$ = 5 vehicles
	112	A1	

23	Sight of a correct product $^{7}/_{10} \times {}^{6}/_{9}$ or $^{7}/_{10} \times {}^{3}/_{9}$ or $^{3}/_{10} \times {}^{7}/_{9}$ or $^{3}/_{10} \times {}^{2}/_{9}$	M1	
	$^{7}/_{10} \times {}^{3}/_{9} + {}^{3}/_{10} \times {}^{7}/_{9} + {}^{3}/_{10} \times {}^{2}/_{9}$	M1	$1 - {}^{7}/_{10} \times {}^{6}/_{9}$
	$^{48}/_{90}$ or $^{24}/_{45}$ or $^{16}/_{30}$ or $^{8}/_{15}$	A1	oe

24	$y \propto 1/x$ or $y = k/x$ or $9 = k/8$	M1	
	$k = 72$ or $y = 72/x$	A1	
	$z \propto \sqrt{y}$ or $z = c\sqrt{y}$ or $20 = c \times \sqrt{16}$	M1	
	$c = 5$ or $z = 5\sqrt{y}$	A1	
	(when $x = 2$) $y = 36$	M1dep	ft their value of k … dependent on 1st M1
	(when $y = 36$) $z = 30$	A1ft	ft their value of c **and** (their) $y = 36$ if first two M1 marks earned
			SC1 for $x \propto 1/z^2$ oe

25	(s =) 20	B1	
	(area ΔABC =) $\sqrt{(20 \times 2 \times 8 \times 10)}$	M1	Allow their 20 if from $s = \frac{a + b + c}{2}$
	$\sqrt{3200}$	A1	oe
	$^{1}/_{2} \times 10 \times h$ = their $\sqrt{3200}$ **or** $40\sqrt{2}$ seen	M1dep	Dependent on 1st M1 **and** $s > 18$
	$h = \frac{\text{their } \sqrt{3200}}{5}$ or $\frac{40\sqrt{2}}{5}$	M1dep	Dependent on 2nd M1
	(h =) $8\sqrt{2}$	A1	
	alternatively		
	$\cos C = (10^2+12^2-18^2) / (2\times10\times12)$	M1	Correct expression for cosine of obtuse angle C
	$\cos C = - {}^{1}/_{3}$	A1	
	$CD = 4$	A1	D is (their) 'foot of perpendicular'
	(h^2 =) $12^2 - 4^2$	M1	
	(h =) $\sqrt{128}$	M1dep	
	(h =) $8\sqrt{2}$	A1	