

Mark Scheme (Results) Summer 2009

IGCSE

IGCSE Mathematics (4400) Paper 3H

Summer 2009 IGCSE Mathematics Mark Scheme - Paper 3H

Except for questions* where the mark scheme states otherwise, the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method. [* Questions 5(b), 11(a), 13(a), 15(d), 20 and 21]

Trial and improvement methods for solving equations score no marks, even if they lead to a correct solution.

Q	Working	Answer	Mark	Notes
1 a	$80 \times \frac{2}{5}, 2 \times \frac{80}{5}$		2	M1 Also award for 80 : 32 or 32 : 80
		32		A1 cao
b	3 + 1 or 4		2	M1 Also award for 60 : 20 or 20 : 60
		20		A1 cao
				Total 4 marks

2	40×13.25 or $\frac{40}{60} \times 795$ oe		3	M2 for 40×13.25 oe or $\frac{40}{60} \times 795$ oe M1 for $\frac{40}{60} \times (13 \times 60 + 15)$ or for $40 \times$ time eg 40×13.15 or 526 seen or 40×795 or $40 \times 13. \dots$
		530		A1 cao
				Total 3 marks

3	correct enlargement vertices (10, 10) (15, 10) (15, 20)	3	B3	B2 for translation of correct shape or 2 vertices correct or for enlargement $1\frac{1}{2}$, centre (0, 0) B1 for one side correct length Allow $\frac{1}{2}$ square tolerance for both vertices and lengths of sides of triangle	Total 3 marks
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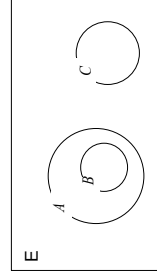
4	Examples of complete, correct explanations (i) 10×0.35 or 3.5 seen (may be in $\frac{3.5}{10}$) AND can't have half beads or there must be a whole number of (red) beads (ii) $3\frac{1}{2}$ red beads is impossible (iii) $\frac{7}{20}$ AND there are (only) 10 beads or you need 20 beads (iv) The probability of any bead/a red bead must be tenths or must have 1 decimal place (v) Gives at least two examples that the probability of taking a red bead is $\frac{n}{10}$ where $2 \leq n \leq 9$ e.g. states 0.3 and 0.4	2	B2	for a complete, correct explanation B1 for a partially correct explanation Examples of partially correct explanations (i) $\frac{1}{10}$ or 0.1 seen (ii) Gives one example that the probability of taking a red bead is $\frac{n}{10}$ where $2 \leq n \leq 9$ (iii) There would be 3.5 red beads. (iv) You can't have half beads (v) $10 \times 0.35 = 3.5$ (vi) $0.35 = \frac{7}{20}$ Treat statements like 'Don't know the number of red beads' as irrelevant.	Total 2 marks
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5	a		$p(p + 7)$	2	B2	Also accept $(p + 0)(p + 7)$ for B2 B1 for factors which, when expanded and simplified, give two terms, one of which is correct. SC B1 for $p(p + 7p)$
	b	$5x = 2$ or $-5x = -2$		3	M2	for $5x = 2$ or $-5x = -2$ or $\frac{5x}{5} = \frac{2}{5}$ M1 for $4 = 5x + 2$ or $5x = 4 - 2$ or $-5x = 2 - 4$ or $5x - 2 = 0$
			$\frac{2}{5}$ or 0.4		A1	for 4 correct B1 for 2 correct
	c		t^9	1	B1	cao
	d	$12y + 15 - 10y - 15$		2	M1	for 3 correct terms inc correct signs or for $12y + 15 - (10y + 15)$
			$2y$		A1	Accept $2y + 0$
						Total 8 marks

6	a	$\frac{266}{760}$ or 0.35		2	M1	
			35		A1	cao
	b	$\frac{204}{0.3}$ or $\frac{204}{30}$ or 6.8 or $\frac{204}{3}$ or 68		2	M1	
			680		A1	cao
						Total 4 marks

7	sin		3	M1	for sin	or M1 for cos and
	$\frac{3.6}{7.9}$ or 0.4556...			A1	for $\frac{3.6}{7.9}$ oe or 0.4556...	$\frac{\sqrt{49.45}}{7.9}$ following correct Pythagoras and A1 for 0.8901... or M1 for tan and $\frac{3.6}{\sqrt{49.45}}$ following correct Pythagoras and A1 for 0.5119...
		27.1		A1	for answer rounding to 27.1	
						Total 3 marks

8	a		2	B2	-B1 for eeeo or any repetition	
	b	1 3 9 27	1	B1	for 'Yes' and an acceptable explanation Do not accept an explanation which merely lists, without comment, the members of both sets. Do not accept an explanation which includes the symbol \cap with no indication of its meaning.	
	c	<p>Yes and gives an explanation which either refers specifically to the members of A and their properties eg All the factors of 27 are odd. None of the factors of 27 are even. 2, 4, 6, 8 aren't factors of 27.</p> <p>or</p> <p>gives a general explanation which shows understanding of the statement eg A and C have no members in common. The intersection of A and C is empty.</p>	2	B2	B1 for $B \subset A$ B1 for $A \cap C = \emptyset$ and $B \cap C = \emptyset$ Ignore any individual members shown on the diagram. Mark the layout which must be labelled	
						Total 5 marks



9	$4.7^2 + 5.9^2$ $= 22.09 + 34.81 = 56.9$		4	M1	for squaring & adding
	$\sqrt{4.7^2 + 5.9^2}$			M1	(dep) for square root
	7.5432...			A1	for value which rounds to 7.54
		2.84		A1	for answer which rounds to 2.84 (2.84320...)
					Total 4 marks

10	a	$10 \times 8 + 30 \times 24 + 50 \times 5 + 70 \times 2 + 90 \times 1$ or $80 + 720 + 250 + 140 + 90$ or 1280	4	M1	for finding at least three products $f \times x$ consistently within intervals (inc end points) and summing them
		"1280" $\frac{\quad}{40}$		M1	(dep) for use of halfway values
	b	$d = 25$ indicated on graph	2	A1	(dep on 1st M1) for division by 40 or division by their $8+24+5+2+1$ cao
	c	10 and 30 or $10\frac{1}{4}$ and $30\frac{3}{4}$ indicated on cumulative frequency axis or stated	2	M1	
				A1	Accept 12 - 13 inc
		14 - 17 inc		A1	
					Total 8 marks

11	a	$10x - 15y = 45$ $10x + 8y = 22$	$8x - 12y = 36$ $15x + 12y = 33$		4	M1	for coefficients of x or y the same followed by correct operation or for correct rearrangement of one equation followed by substitution in the other eg $5x + 4\left(\frac{2x - 9}{3}\right) = 11$ For both approaches, condone one arithmetical error cao dep on M1
		$y = -1$	$x = 3$			A1	cao dep on M1
						M1	(dep on 1st M1) for substituting for other variable
			3 -1			A1	cao dep on all preceding marks
	b		3, -1		1	B1	ft from (a)
							Total 5 marks

12	a		1.5×10^8		2	M1	for 1.5×10^m
						A1	if $m = 8$
	b		7.2×10^{-1}		2	M1	for 7.2×10^n or 0.72 or with digits 72 eg 72×10^{-2}
						A1	if $n = -1$
							Total 4 marks

13	a	$12L + 16 = 70$ or $8L + 4L = 54$ or $12L = 54$	$6L + 8 = 35$ or $4L + 2L = 27$ or $6L = 27$		3	M2	for correctly collecting Ls or constants or both M1 for correct substitution in given formula or in a correct rearrangement of the given formula in which L is not the subject eg $70 = 2(4L + 2 \times 4 + 2L)$ or $70 = 2(4L + 8 + 2L)$ or $35 = 4L + 2 \times 4 + 2L$ or $35 = 4L + 8 + 2L$ or $70 - 2 \times 2 \times 4 = 8L + 4L$ or $35 - 2 \times 4 = 4L + 2L$
				4.5 oe		A1	depends on M2
	a	alternative method					
		$L = \frac{A - 2HW}{2(W + H)}$ oe eg $\frac{70 - 2 \times 2 \times 4}{2(4 + 2)}$			3	M1	for making L the subject of the given formula
						M1	for correct substitution into a correct expression for L
			4.5 oe			A1	depends on both method marks

13	b	$A=2LW+2WH+2HL$ or $\frac{A}{2} = LW + WH + HL$ $A-2HL=2LW+2WH$ or $\frac{A}{2} - HL = LW + WH$ $A-2HL=2W(L+H)$ or $A-2HL=W(2L+2H)$ or $\frac{A}{2} - HL = W(L+H)$	$\frac{A-2HL}{2(L+H)}$ or $\frac{A-2HL}{2L+2H}$ or $\frac{\frac{A}{2}-HL}{L+H}$ oe	4	M1 M1 M1 A1	for a correct equation following expansion or division by 2 May be implied by second M1 for correct equation with W terms isolated for correct equation with W as a factor	Total 7 marks
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14	ai	47	alternate angles	2	B1	cao	
	ii				B1	Award this mark if 'alternate' appears	
	b	124		1	B1	cao	
	ci	47		2	B1	cao	
	ii		angle between a chord and a tangent = angle in the alternate segment		B1	Accept 'alternate segment'	
							Total 5 marks

15	a		12	1	B1	cao Do not accept (3, 12)
	b	0.2 3.6 6.1 or 6.2 or values rounding to these		2	B2	for all 3 correct solutions (B1 for 2 correct solutions or for 3 coordinates with correct solutions as x-coordinates)
	c	5 seen		2	M1	
			0		A1	cao
	d	tan drawn at (1, 16)		3	M1	tan or tan produced passes between points (0.5, 11 ≤ y ≤ 13) and (1.5, 19 ≤ y ≤ 21)
		<u>vertical difference</u> horizontal difference			M1	finds their <u>vertical difference</u> horizontal difference for two points on tan or finds the intercept of their tangent on the y-axis and substitutes $y = 16$, $x = 1$ and their c into $y = mx + c$ or finds their <u>vertical difference</u> horizontal difference for two points on curve, where one of the points has an x-coordinate between 0.5 and 1 inc and the other point has an x-coordinate between 1 and 1.5 inc
			6-10 inc		A1	dep on both M marks
						Total 8 marks

16	a	$\pi \times 4^2 + \pi \times 4 \times 9$		2	M1	
			163		A1	for ans rounding to 163 ($\pi \rightarrow 163.3628 \dots$ 3.14 \rightarrow 163.28 3.142 \rightarrow 163.384)
	b	$\frac{6}{4}$ or 1.5 oe or 6 : 4 oe or $\frac{4}{6}$ oe or 4 : 6 oe		2	M1	May be implied by 13.5 or 12.09... Also award for cube of any correct values or cube of correct ratios
			3.375 oe		A1	for 3.375 or $3\frac{3}{8}$ or $\frac{27}{8}$ oe Accept 3.38 if M1 scored Do not award A1 if slant heights used as h in $V = \frac{1}{3}\pi r^2 h$
						Total 4 marks

17	i	$\frac{3}{5} \times \frac{2}{4}$		5	M1		Sample space method - award 2 marks for a correct answer, otherwise no marks
		$\frac{6}{20}$ or $\frac{3}{10}$			A1		
	ii	$\frac{1}{5} \times \frac{1}{4} \times 2 + \frac{6}{20}$ or $\frac{2}{5} \times \frac{1}{4} + \frac{6}{20}$			M1	for $\frac{1}{5} \times \frac{1}{4}$ or $\frac{2}{5} \times \frac{1}{4}$	Award M0 M0 A0 for $\frac{1}{5} + \frac{1}{5} = \frac{2}{5}$ Sample space method - award 3 marks for a correct answer, otherwise no marks
					M1	for complete sum	
		$\frac{8}{20}$ or $\frac{2}{5}$ oe			A1		SC
						M1 for $\frac{1}{5} \times \frac{1}{5}$ or $\frac{1}{25}$	
						M1 for $\frac{1}{5} \times \frac{1}{5} \times 2 + \text{their(i)}$	Sample space method - award 2 marks for $\frac{11}{25}$ otherwise no marks
Total 5 marks							

18		$\frac{(5x-1)(x+3)}{2(25x^2-1)}$ $\frac{(5x-1)(x+3)}{2(5x+1)(5x-1)}$		4	B1	for factorising numerator as $(5x-1)(x+3)$	
					B1	for factorising denominator as $2(25x^2-1)$	or B2 for factorising denominator as $(5x-1)(10x+2)$
					B1	for factorising $25x^2-1$ as $(5x+1)(5x-1)$	or $(5x+1)(10x-2)$
		$\frac{x+3}{2(5x+1)}$ or $\frac{x+3}{10x+2}$			B1		
Total 4 marks							

19	$2 \times 6 \sin 39^\circ$ or $2 \times 6 \cos 51^\circ$ or $6^2 + 6^2 - 2 \times 6 \times 6 \cos 78^\circ$ or $\frac{6 \sin 78^\circ}{\sin 51^\circ}$ 7.551...		6	M1	for answer rounding to 7.55
	eg $\frac{78}{360} \times \pi \times 12$			M1	for $\frac{78}{360}$ oe inc 0.2166... rounded or truncated to at least 3 decimal places or for $\frac{360}{78}$ oe inc 4.6153... rounded or truncated to at least 3 decimal places
				M1	for $\pi \times 12$ or for $2\pi \times 6$ ($\pi \rightarrow 37.699 \dots$ 3.14 \rightarrow 37.68 3.142 \rightarrow 37.704)
	8.16 - 8.17 inc oe inc $\frac{13\pi}{5}$, 2.6 π oe			A1	for 8.17 or better ($\pi \rightarrow 8.168 \dots$ 3.14 \rightarrow 8.164 3.142 \rightarrow 8.1692)
		15.7		A1	for ans rounding to 15.7 ($\pi \rightarrow 15.7199 \dots$ 3.14 \rightarrow 15.7158... 3.142 \rightarrow 15.7202...)
					Total 6 marks

20	225 seen		3	B1	
	$\sqrt{225}$ or 15			B1	Award B1 for 15 only if 225 seen
	60			B1	cao Award only if preceding 2 marks scored
					Total 3 marks

21	$(x + 4)^2 = x^2 + (x + 6)^2 - 2x(x + 6)\cos 60^\circ$ or $\cos 60^\circ = \frac{(x + 6)^2 + x^2 - (x + 4)^2}{2x(x + 6)}$	5	M1	
	$x^2 + 4x + 4x + 16$ or $x^2 + 8x + 16$ and $x^2 + 6x + 6x + 36$ or $x^2 + 12x + 36$		B1	dep on M1 for correct expansion of $(x + 4)^2$ and $(x + 6)^2$ in correct statement of Cosine Rule
	$x^2 + 8x + 16 = x^2 + x^2 + 12x + 36 - x^2 - 6x$ or $x^2 + 6x = x^2 + 12x + 36 + x^2 - x^2 - 8x - 16$ oe $2x = 20$ oe		B1	for correctly dealing with $\cos 60^\circ$ and obtaining a correct equation with no fractions and no brackets for correct linear equation e.g. $2x = 20$ $-2x = -20$, $4x = 40$, $2x - 20 = 0$
		10	A1	cao dep on all preceding marks
			Total 10 marks	