

4400 Paper 3H Mark Scheme

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
				<b>Total 4 marks</b>

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

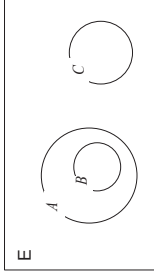
3	correct enlargement vertices (10, 10) (15, 10) (15, 20)	3	B3	B2 for translation of correct shape or 2 vertices correct or for enlargement $1\frac{1}{2}$ , centre (0, 0) B1 for one side correct length Allow $\frac{1}{2}$ square tolerance for both vertices and lengths of sides of triangle	<b>Total 3 marks</b>
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4	Examples of complete, correct explanations (i) $10 \times 0.35$ 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.	<b>Total 2 marks</b>
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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 $5x - 2 = 0$
	c		$\frac{2}{5}$ or 0.4 $t^9$	1	A1 B1	for 4 correct B1 for 2 correct cao
	d	$12y + 15 - 10y - 15$		2	M1	for 3 correct terms inc correct signs or for $12y + 15 - (10y + 15)$
			$2y$		A1	Accept $2y + 0$
						<b>Total 8 marks</b>

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
						<b>Total 4 marks</b>

7	sin		3	M1 A1	for sin for $\frac{3.6}{7.9}$ oe or 0.4556...	or M1 for cos and $\frac{\sqrt{"49.45"}}{7.9}$ 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	
<b>Total 3 marks</b>						

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		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	
<b>Total 5 marks</b>						

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...)
					<b>Total 4 marks</b>

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
				M1	(dep) for use of halfway values
		$\frac{"1280"}{40}$		M1	(dep on 1st M1) for division by 40 or division by their $8+24+5+2+1$
	b	$d = 25$ indicated on graph	2	A1	cao
				M1	
		12 or 13		A1	Accept 12 - 13 inc
	c	10 and 30 or $10\frac{1}{4}$ and $30\frac{3}{4}$ indicated on cumulative frequency axis or stated	2	M1	
		14 - 17 inc		A1	
					<b>Total 8 marks</b>

11	a	$10x - 15y = 45$ $10x + 8y = 22$	$8x - 12y = 36$ $15x + 12y = 33$		4	M1	<p>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 <math>5x + 4\left(\frac{2x - 9}{3}\right) = 11</math></p> <p>For both approaches, condone one arithmetical error</p>
		$y = -1$	$x = 3$			A1	cao dep on M1
						M1	(dep on 1st M1) for substituting for other variable
	b		3 -1			A1	cao dep on all preceding marks
			3, -1		1	B1	ft from (a)
							<b>Total 5 marks</b>

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

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 $35 - 2 \times 4 = 4L + 2L$ depends on M2
				4.5 oe		A1	
	a	alternative method					
		$L = \frac{A - 2HW}{2(W + H)}$ oe			3	M1	for making L the subject of the given formula
		eg $\frac{70 - 2 \times 2 \times 4}{2(4 + 2)}$				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 $\frac{A}{2} - HL = W(L+H)$			4	M1	for a correct equation following expansion or division by 2 May be implied by second M1
						M1	for correct equation with $W$ terms isolated
						M1	for correct equation with $W$ as a factor
		$\frac{A-2HL}{2(L+H)}$ or $\frac{A-2HL}{2L+2H}$ or $\frac{\frac{A}{2}-HL}{L+H}$ oe				A1	
							<b>Total 7 marks</b>

14	ai	47		2	B1	cao	
	ii	alternate angles			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'	
							<b>Total 5 marks</b>



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	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)
		vertical difference horizontal difference		M1	finds their <u>vertical difference</u> 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> <u>horizontal difference</u> 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
					<b>Total 8 marks</b>

16	a	$\pi \times 4^2 + \pi \times 4 \times 9$		2	M1 A1	for ans rounding to 163 ( $\pi \rightarrow 163.3628 \dots$ 3.14 $\rightarrow$ 163.28 3.142 $\rightarrow$ 163.384) May be implied by 13.5 or 12.09... Also award for cube of any correct values or cube of correct ratios
	b	$\frac{6}{4}$ or 1.5 oe or 6 : 4 oe or $\frac{4}{6}$ oe or 4 : 6 oe	163	2	M1	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 $V = \frac{1}{3}\pi r^2 h$
						<b>Total 4 marks</b>

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 $\frac{1}{5} \times 2 + \text{their(i)}$
							Sample space method - award 2 marks for $\frac{11}{25}$ otherwise no marks
							<b>Total 5 marks</b>

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 $(5x-1)(x+3)$	or B2 for factorising denominator
					B1	for factorising denominator as $2(25x^2-1)$	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		
							<b>Total 4 marks</b>

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	
	eg $\frac{78}{360} \times \pi \times 12$ 8.16 - 8.17 inc oe inc $\frac{13\pi}{5}$ , 2.6 $\pi$ oe			M1	for answer rounding to 7.55
				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 $2\pi \times 6$ ( $\pi \rightarrow 37.699...$ 3.14 $\rightarrow$ 37.68 3.142 $\rightarrow$ 37.704)
				A1	for 8.17 or better ( $\pi \rightarrow 8.168...$ 3.14 $\rightarrow$ 8.164 3.142 $\rightarrow$ 8.1692)
		15.7		A1	for ans rounding to 15.7 ( $\pi \rightarrow 15.7199...$ 3.14 $\rightarrow$ 15.7158... 3.142 $\rightarrow$ 15.7202...)
					<b>Total 6 marks</b>

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
					<b>Total 3 marks</b>

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
			<b>Total 10 marks</b>	