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Mark Scheme Summer 2009

IGCSE

IGCSE Mathematics (4400)

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4400 Paper 1F 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 15(b) and 18(b)]

Q	Working	Answer	Mark	Notes	
1 a		6012	1	B1	cao
b		6800	1	B1	cao
c		tens	1	B1	Accept 80, 10, T
d		803	1	B1	cao
					Total 4 marks

2 a		54 63	2	B2	B1 each
b	eg Add 9, multiples of 9, 9 times table		1	B1	
c		180	1	B1	cao
					Total 4 marks

3 ai		9 40 pm	2	B1	Allow 20 to 10 pm
ii		21 40		B1	cao
b		−2	1	B1	cao
c		−8 indicated	1	B1	Allow $\pm$ ½ division
					Total 4 marks

4	a		75	1	B1	cao
	b		USA	1	B1	Accept any clear indication
	c		bar	1	B1	Accept 25 < bar < 30
						Total 3 marks

5	ai		line	2	B1	
	ii		isosceles		B1	
	b		lines	2	B2	for 4 correct B1 for 2 correct
	ci		octagon	2	B1	
	ii	eg angles not all equal			B1	
	di		0	2	B1	cao
	ii		2		B1	cao
	ei		$\frac{2}{5}$	2	B1	cao
	ii		0.4		B1	ft from (i) if denominator is 3 or 5 but not if denominator is 2 or 4 If (i) is "$\frac{2}{3}$" (ii) must be $0.\dot{6}$ oe or have at least 2 decimal places rounded or truncated
						Total 10 marks

6	ai		22 24	4	B1	cao
	ii		28		B1	cao
	iii		25		B1	cao
	iv		23 or 29		B1	
	bi		$\frac{1}{9}$	3	B1	
	ii		$\frac{5}{9}$		M1 A1	denominator 9 numerator 5
						Total 7 marks

7	ai		2.645751311	2	B1	for at least 5 figures
	ii		2.65		B1	ft from "2.645…" if at least 3 dp
	bi		0.0841	2	B1	cao
	ii		0.08		B1	ft from "0.0841" if of equal difficulty
	c	3.375 + 0.4		2	M1	for 3.375 or 0.4
			3.775		A1	cao
						Total 6 marks

8	a	1 4 4 5 6 10 10 10 10 10 or $\frac{10+1}{2}$ or $5\frac{1}{2}$ or 6, 10		2	M1	for a clear attempt to list in order
			8		A1	cao
	b		9	2	B2	B1 for 1-10, 10 − 1
						Total 4 marks

9	a		$4q$	1	B1	Accept $4\times q$, $q4$ etc
	b		$5np$	1	B1	Do not accept $\times$ signs Accept $n5p$, $5pn$, $5(pn)$ etc
	c		7	1	B1	cao
	d	$8y = 5 + 1$ or $8y = 6$		2	M1	May be implied by correct answer
			¾ oe		A1	
						Total 5 marks

10	a	eg 0.666…, 0.7, 0.65, 0.625		2	B2	for $\frac{5}{8}\ \frac{13}{20}\ \frac{2}{3}\ \frac{7}{10}$ or for correct decimal equivalents B1 for 3 fractions in correct order or for 2 fractions correctly converted to decimals (at least 2 dp rounded or truncated) or for 2 fractions expressed as equivalent fractions with a denominator of 120
			$\frac{5}{8}\ \frac{13}{20}\ \frac{2}{3}\ \frac{7}{10}$			
	b	$\frac{9}{12} - \frac{5}{12}$		2	M1	Accept $\frac{18}{24} - \frac{10}{24}$ or $\frac{36}{48} - \frac{20}{48}$
			$\frac{4}{12}$		A1	Accept $\frac{8}{24}$ or $\frac{16}{48}$
						Total 4 marks

11	a	$\frac{180 - 48}{2}$		2	M1	
			66		A1	cao
	b	180 − "66" or 114 or $\angle ABC$ = "66°"		3	M1	
		360 − (69 + 106 + "114") or 360 − (106 + 69 + 48 + "66")			M1	
			71		A1	ft from "66"
						Total 5 marks

12 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

13	$\frac{180 - 48}{2}$		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 × time eg 40×13.15 or 526 seen or 40 × 795 or 40 × 13. …
		530		A1	cao
					Total 3 marks

14	correct enlargement vertices (10,10) (15,10) (15,20)		3	B3	B2 for translation of correct shape or 2 vertices correct or for enlargement 1½, centre (0, 0) B1 for one side correct length Allow ½ square tolerance for both vertices and lengths of sides of triangle
					Total 3 marks

15	a	$2\times(12\times7+7\times5+12\times5)$ or $2 \times (84 + 35 + 60)$		2	M1	for correct substn or 179 seen
			358		A1	for correct substn or 179 seen
	b	$12L+16 = 70$ 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 $70=2(4L + 2\times4 + 2L)$ or $70=2(4L + 8 + 2L)$ or $35=4L+ 2\times4 + 2L$ or $35=4L+ 8 + 2L$ or $70 - 2\times2\times4 = 8L + 4L$ or $35 - 2\times4 = 4L + 2L$
			4.5 oe		A1	depends on M2
						Total 5 marks

16	a	$\frac{14}{100}\times850$		2	M1	
			119		A1	cao
	b	$\frac{266}{760}$ or 0.35		2	M1	
			35		A1	cao
	c	$\frac{204}{0.3}$ or $\frac{204}{30}$ or 6.8 or $\frac{204}{3}$ or 68		2	M1	
			680		A1	cao
						Total 6 marks

17	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 or must have 1 significant figure (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) 10 × 0.35 = 3.5 (v) 0.35 = $\frac{7}{20}$ Treat statements like 'Don't know the number of red beads' as irrelevant.
					Total 2 marks

18	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	dep on at least M1
	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 $2y \pm 0$
						Total 8 marks

19	$10\times8 + 30\times24 + 50\times5 + 70\times2 + 90 \times 1$ 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 for division by their 8+24+5+2+1
		32		A1	cao
					Total 4 marks

20	½ × 10 × 12 or 60		3	M1	for area of one triangle
	13 × 15 + 13 × 15 + 10 × 15 or 195 + 195 + 150 or 540			M1	for 13 × 15 + 13 × 15 + 10 × 15 oe
		660		A1	cao
					Total 3 marks

21 a		1 3 9 27	2	B2	−B1 for eeoo or any repetition
b	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. or 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.		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 ∩ with no indication of its meaning.
					Total 3 marks

22	sin		3	M1	for sin	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…
	$\frac{3.6}{7.9}$ or 0.4556…			A1	for $\frac{3.6}{7.9}$ oe or 0.4556…	
						Total 3 marks

4400 Paper 2F Mark Scheme

Q	Working	Answer	Mark	Notes	
1 ai		998 1908 1990 1998 2001	1	B1	
ii		2001	1	B1	
iii		1908	1	B1	
iv		1998 – 998	1	B1	B0 for 998-1998
bi		3478	1	B1	
ii		8734	2	B2	B1 for 8374
					Total 7 marks

2 ai		kite	1	B1	Allow mis-spellings (any *recognisable* attempt)
ii		parallelogram	1	B1	Allow mis-spellings (any *recognisable* attempt)
iii		trapezium	1	B1	Allow mis-spellings (any *recognisable* attempt)
bi		acute	1	B1	Allow mis-spellings (any *recognisable* attempt)
ii		reflex	1	B1	Allow mis-spellings (any *recognisable* attempt)
					Total 5 marks

3 i		A at 0.5 $\pm$ 2mm	1	B1	If no Xs, mark point on line level with middle of letter A,
ii		B at 1 $\pm$ 2mm	1	B1	B or C
iii		C > 0 & < 0.25	1	B1	If no letters then no marks
					Total 3 marks

4 a	5 x 4 + 12			M1	
		32	2	A1	cao
b	(47-12) ÷ 5			M1	M1 for 47-12 or 35 or 47÷5 or 9.4 or 5"n"+12=47
		7	2	A1	cao
					Total 4 marks

5	a		1, 3, 11, 33	2	B2	B2 fully correct (no additions or errors) B1 for any two correct factors 3 correct & 1 wrong = B1
	b		46	1	B1	No embedded answers i.e. $46^2=2116$
	c		243	1	B1	
	d		26	1	B1	No embedded answers i.e. $26^3=17576$
						Total 5 marks

6	7 x 1.20 + 6 x 0.75 (= 12.9) 20 – "12.9"	7.1(0)	3	M1 M1 A1	condone omission of final zeros dep
					Total 3 marks

7	a		6	1	B1	
	b	Attempt to add all the numbers "88" ÷ 8	11	3	M1 M1 A1	dep If ans = 76.6(25) M2 A0
	c		11	1	B1	ft (b)
						Total 5 marks

8	a	3 + 5 + 3 + 5 oe	16	2	M1 A1	
	b	46.8 ÷ 7.2	6.5	2	M1 A1	
						Total 4 marks

9	ai		$^{9}/_{36}$	1	B1	
	ii		$^{4}/_{20}$	1	B1	
	b	$^{2}/_{3} \times {}^{9}/_{5}$ $^{x}/_{9}$ and $^{y}/_{9}$ $^{6}/_{9} \div {}^{5}/_{9}$	$^{18}/_{15}$ or $^{6}/_{5}$	3	M2 M2 A1	M1 for inverting 2nd fraction i.e. $^{9}/_{5}$ oe or M1 for 2 correct fractions with a common denominator of a multiple of 9 M1 correct numerators and intention to divide Any fraction equivalent to 1 1/5 Do not allow decimal conversions
						Total 5 marks

10	a		12 cm^2 sq cms	3	B2 B1	B1 for 11 to 13 or 3×4 ind
	b		Correct $\pm$ 2 mm	2	B2	B1 for any 2 vertices correct $\pm$ 2 mm or correct size, shape & orientation
						Total 5 marks

11	a	(10 + 5) x 4	60	2	M1 A1	brackets necessary unless answer correct
	b	28 ÷ 4 – 5	2	2	M1 A1	allow 23 ÷ 4 or 5.75 (i.e. reverse operations but wrong order)
	c	-8 ÷ 4 – 5 or -2 - 5	-7	2	M1 A1	allow -13 ÷ 4 or -3.25 (i.e. reverse operations but wrong order)
	d		$(x + 5) \times 4$ or $4x + 20$ oe	2	B2	B1 for x+5×4 or x+20 or 4 x +5 or "y=" 4x+5 B0 for x=4x+5
						Total 8 marks

12	a	250 x 1.85	462.5(0)	2	M1 A1	462 or 463 = M1 A0
	b	320 ÷ 1.85	172(.97…)	2	M1 A1	awrt 173
	c	1 ÷ 1.85 oe	0.54	2	M1 A1	e.g "172.97" ÷ 320 or 250 ÷ "462.5" awrt 0.54
						Total 6 marks

13	a	90 ÷ 40(=2.25) or 12 ÷ 40(=0.3) or 40 ÷ 12(=3 1/3) then "2.25" x 12 or "0.3" x 90 or 90 ÷ "3 1/3" (scale factors) (students per degree) (degrees per student)	27	3	M1 M1 A1	or M2 for 12 x 90 ÷ 40 M1 for 9 x 12 (=108) then M1(dep) for "108" / 4 dep cao
	b	$^{130}/_{240}$ x 360	195°	2	M1 A1	M1 for $^{130}/_{240}$ cao
						Total 5 marks

14	a		x - 5	1	B1	Accept y=x-5 not x=x-5 or 0=x-5
	bi	3(x – 5) = 39 or 3x-15=39 or x-5=13			M2	M1 for 3x – 5 = 39
	ii	3x = 54 or x - 5 =13	18	4	M1 A1ft	Allow full ft on ax +b =c from bi ans a>1 b,c ≠ 0 18 no wrong working = M1 A1
						Total 5 marks

15	6 × (-9 + 1) = -48 oe (-54+6)	-3	3	M1 M1 A1	allow without brackets M1 for -8 numerator correct (or $6/(-2)$ or $(3/8)$ x -8) cao
					Total 3 marks

16	67 ÷ 2 or (67 +1) ÷ 2 oe			M1	attempt to find middle of frequencies of people
		7	2	A1	cao look for mean (7.56..) rounded down M0 A0
					Total 2 marks

17	a	2 x π x 40 oe	251	2	M1 A1	 awrt 251
	b	8 x 10 or 80 π x 3^2 (value rounding to 28.3 or 28.2) "8x10" – "π x 3^2"	51.7	4	M1 M1 M1 A1	Rectangle area Circle area dep on both M1's awrt 51.7
						Total 6 marks

18	a	1 – (0.3 + 0.1 + 0.4)	0.2oe	2	M1 A1	Look for answer in table Decimals, fractions, % only
	b	0.3 + 0.4	0.7oe	2	M1 A1	 Decimals, fractions, % only
						Total 4 marks

19	a	$5.1^2 + 3.2^2$ (= 36.25) √"36.25"	6.02	3	M1 M1 A1	M2 for $5.1/\cos(\tan^{-1}(3.2/5.1))$ or $3.2/\sin(\tan^{-1}(3.2/5.1))$ awrt 6.02
	b	tan selected (*AB* =) 6.5 x tan 32°	4.06	3	M1 M1 A1	$\sin 32° = {}^{AB}/_{6.5/\cos 32}$ (*AB* =) $\sin 32° \times {}^{6.5}/_{\cos 32}$ awrt 4.06
						Total 6 marks

20	12-x=21 or 12-21=x or –x=21-12 [12 - 21 = x] or [-x = 21 – 12] oe	-9	3	M2 A1	[$-{}^{x}/_{3} = 7 - {}^{12}/_{3}$] or [$^{12}/_{3} - 7 = {}^{x}/_{3}$] M1 for 12-x=3x7
					Total 3 marks

21	A product of 3 or more factors of which 2 are from 2,2,3,11	1,2,2,3,11or 2,2,3,11 2 x 2 x 3 x 11	3	M1 M2 A1	Product can be implied from a factor tree or repeated division These combinations can be implied from a factor tree or repeated division cao
					Total 3 marks

22	$[{}^{80}/_{40}]$ or $[{}^{84}/_{42}]$ √36 or 6	12	3	B1 B1 B1	Dep on both previous b1's (Accept 10 if $^{80}/_{40}$, 6 used)
					Total 3 marks

Total 100 marks

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
					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 × time eg 40 × 13.15 or 526 seen or 40 × 795 or 40 × 13. …
		530		A1	cao
					Total 3 marks

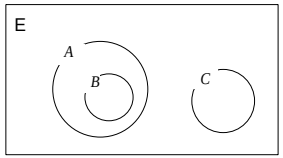
3	correct enlargement vertices (10,10) (15,10) (15,20)	3	B3	B2 for translation of correct shape or 2 vertices correct or for enlargement 1½, centre (0, 0) B1 for one side correct length Allow ½ square tolerance for both vertices and lengths of sides of triangle
				Total 3 marks

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

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 $\frac{\sqrt{"49.45"}}{7.9}$ 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…
	$\frac{3.6}{7.9}$ or 0.4556…			A1	for $\frac{3.6}{7.9}$ oe or 0.4556…	
		27.1		A1	for answer rounding to 27.1	
						Total 3 marks

8	a		1 3 9 27	2	B2	−B1 for eeoo or any repetition
	b	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. or 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.		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 ∩ 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
						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	10×8 + 30×24 + 50×5 + 70×2 + 90 × 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
		32		A1	cao
b	d = 25 indicated on graph		2	M1	
		12 or13		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	
					Total 8 marks

11	a	$10x-15y=45$ $8x-12y=36$ $10x+8y=22$ $15x+12y=33$		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
		$y = -1$ $x = 3$			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 oe 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 $70=2(4L + 2\times4 + 2L)$ or $70=2(4L + 8 + 2L)$ or $35=4L+ 2\times4 + 2L$ or $35=4L+ 8 + 2L$ or $70 - 2\times2\times4 = 8L + 4L$ or $35 - 2\times4 = 4L + 2L$
			4.5 oe		A1	depends on M2
a	alternative method					
	$L = \frac{A - 2HW}{2(W + H)}$ oe			3	M1	for making L the subject of the given formula
	eg $\frac{70 - 2\times2\times4}{2(4 + 2)}$				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 $\frac{A}{2} = LW + WH + HL$		4	M1	for a correct equation following expansion or division by 2 May be implied by second M1
	$A-2HL=2LW+2WH$ or $\frac{A}{2} - HL = LW + WH$			M1	for correct equation with W terms isolated
	$A-2HL=2W(L+H)$ or $A-2HL=W(2L+2H)$ or $\frac{A}{2} - HL = W(L + H)$			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	
					Total 7 marks

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'
					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 $\leq y \leq$ 13) and (1.5, 19 $\leq y \leq$ 21)
	$\frac{\text{vertical difference}}{\text{horizontal diffrerence}}$			M1	finds their $\frac{\text{vertical difference}}{\text{horizontal difference}}$ 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 $\frac{\text{vertical difference}}{\text{horizontal difference}}$ 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… 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 $\frac{1}{5}\times\frac{1}{5}\times 2$ + 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 $(5x-1)(10x+2)$ or $(5x+1)(10x-2)$
				B1	for factorising $25x^2-1$ as $(5x+1)(5x-1)$	
		$\frac{x+3}{2(5x+1)}$ or $\frac{x+3}{10x+2}$		B1		
						Total 4 marks

19	$2 \times 6 \sin 39°$ or $2 \times 6 \cos 51°$ or $6^2 + 6^2 - 2\times6\times6\cos 78°$ or $\frac{6\sin 78°}{\sin 51°}$		6	M1	
	7.551…			A1	for answer rounding to 7.55
	eg $\frac{78}{360}\times\pi\times12$			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 $\pi\times12$ or for $2\pi\times6$ ($\pi\rightarrow$ 37.699… 3.14$\rightarrow$ 37.68 3.142$\rightarrow$ 37.704)
	8.16 - 8.17 inc oe inc $\frac{13\pi}{5}$, 2.6π oe			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…)
					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	$(x + 4)^2 = x^2 + (x + 6)^2 - 2x(x + 6)\cos 60°$ or $\cos 60° = \frac{(x+6)^2 + x^2 - (x+4)^2}{2x(x+6)}$		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	Omitted brackets may be implied by correct subsequent working.
	$x^2 + 8x + 16 = x^2 + x^2 + 12x + 36 - x^2 - 6x$ or $x^2 + 6x = x^2 + 12x + 36 + x^2 - x^2 - 8x - 16$ oe			B1	for correctly dealing with $\cos 60°$ and obtaining a correct equation with no fractions and no brackets	
	$2x = 20$ oe			B1	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

4400 Paper 4H Mark Scheme

Except for questions 9, 11, 21 (where the marking scheme states otherwise), unless clearly obtained by an incorrect method, a correct answer should be taken to imply a correct method.

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

Q	Working	Answer	Mark	Notes	
1	$^{2}/_{3} \times {}^{9}/_{5}$			M2	M1 for inverting 2nd fraction i.e. $^{9}/_{5}$ or
	$^{6a}/_{9a}$ and $^{5a}/_{9a}$				M1 2 correct fractions with common denominators of a multiple of 9
	$^{6a}/_{9a} \div {}^{5a}/_{9a}$			M2	correct numerators and intention to divide
		$^{18}/_{15}$ or $^{6}/_{5}$	3	A1	any fraction equivalent to $1^{1}/_{5}$ Do not allow decimal conversions
					Total 3 marks

2	i	3x -15 = 39 or 3(*x* – 5) = 39 or x-5=39/3		B3	do not accept x-5 =13 B2 for 3*x* – 5 = 39 if x-5 seen otherwise B1 B1 for x-5 seen B0 for x= 39/3 +5 oe
	ii	3x = 54 or x - 5 = 13		M1	ft from any linear equation ax+b=c a>1 b,c ≠ 0 ax= c-b or x=c/a – b/a
			18	5 A1	**18 with no working for answer in i) or ii) gets M1 A1**
					Total 5 marks

3	6 × (-9 + 1) or -8 seen			M1	allow 6 x -9 + 1
	-48 or -54+6			M1	Accept $6/(-2)$ or $(3/8)$ x -8
		-3	3	A1	**Total 3 marks**

4	67 ÷ 2 or (67 +1) ÷ 2 oe			M1	attempt to find middle of cumulative frequency or listing of people.
		7	2	A1	cao look for mean (7.56..) rounded down (M0 A0)
					Total 2 marks

5	a	2 x π x 40 oe			M1	
			251	2	A1	answer rounding to 251
	b	8 x 10 or 80			M1	
		π x 3^2 (awrt 28.2 or 28.3)			M1	
		"8x10" – "π x 3^2"			M1	dep on both M1's
			51.7	4	A1	answer rounding to 51.7
						Total 6 marks

6	a	1 – (0.3 + 0.1 + 0.4)			M1	
			0.2oe	2	A1	Look for answer in table if missing from answer line
	b	0.3 + 0.4			M1	
			0.7oe	2	A1	
						Total 4 marks

7	a		Correct $\pm$ 2 mm	2	B2	B1 for any 2 vertices correct $\pm$ 2 mm or translation of correct image
	b		Translation $\begin{pmatrix} -4 \\ 5 \end{pmatrix}$	2	B1 B1	translate or translated or -4 in *x* dir'n, or 4 to left or 4 west (not backwards or across) AND 5 in y dir'n or 5 up or 5 north (not (-4,5) or vectors without brackets) penalise contradictions
						Total 4 marks

8	a	$5.1^2 + 3.2^2$ (= 36.25) √"36.25"	6.02	3	M1 M1 A1	M2 for $5.1/\cos(\tan^{-1}(3.2/5.1))$ or $3.2/\sin(\tan^{-1}(3.2/5.1))$ Must be complete methods answer rounding to 6.02
	b	tan selected 6.5 x tan 32°	4.06	3	M1 M1 A1	sin 32° = $^{"AB"}/_{6.5/\cos 32}$ or "AB"/sin32 = 6.5/sin 58 (*AB* =) sin 32° × $^{6.5}/_{\cos 32}$ or (AB=) sin 32 x 6.5 / sin 58 answer rounding to 4.06
						Total 6 marks

9	12 - *x* = 21 or 12-21=x or-x=21-12	-9	3	M2 A1	or $[-^{x}/_{3} = 7 - {}^{12}/_{3}]$ or $[{}^{12}/_{3} - 7 = {}^{x}/_{3}]$ M1 for 12–x=3x7 **(Answer only gains no marks)**
					Total 3 marks

10	A product of 3 or more factors of which 2 are from 2,2,3,11 1,2,2,3,11 or 2,2,3,11	2 x 2 x 3 x 11	3	 M2 A1	M1 can be implied from a factor tree or repeated division M2 can be implied from a factor tree or repeated division product must be stated (not dots for product)
					Total 3 marks

11	$[^{80}/_{40}]$ or $[^{84}/_{42}]$ $\surd 36$ or 6	12	3	B1 B1 B1	dep on both previous B1's (Accept 10 only if $^{80}/_{40}$, 6 used) **(Answer only gains no marks)**
					Total 3 marks

12	a	$^{v}/_{h}$ in a correct Δ	½ oe	2	M1 A1	M1 A0 for ½ x
	b		y = "½"x + 2 oe	2	B2	B1 for "½"x + 2 or L= "½"x + 2
	c		y = "½"x + c	1	B1	c any number $\neq 2$ or letter or y = "0.5"x or a line parallel to their b)
						Total 5 marks

13	a		60	1	B1	
	b	$^{y}/_{7.5} = {}^{4}/_{5}$ oe	6	2	M1 A1	correct ratios or correct use of sf (0.8 or 1.25 or 1.5 or 2/3)
	c	$[{}^{z}/_{5} = {}^{3}/_{4}]$ oe or $[{}^{z}/_{7.5} = {}^{3}/_{\text{"6"}}]$	3.75	2	M1 A1	allow ft on their "6" or correct use of sf (0.8 or 1.25 etc) cao
						Total 5 marks

14	a		$^{1}/_{4}$ binary tree structure all probs & labels correct	3	B1 B1 B1	P(tail) on Ist throw
	b	"$^{1}/_{4}$" x "$^{1}/_{4}$"	$^{1}/_{16}$ or 0.0625	2	M1 A1	ft their 2 tail branches cao
						Total 5 marks

15	a		$3c^7d^5$	2	B2	B1 for c^7 or d^5 Accept 3 x c^7 xd^5
	b		$16x^{12}y^4$	2	B2	B1 for 16 or x^{12} or y^4 Accept 16 x x^{12} x y^4
	c	$^{2(x-3)}/_{x(x-3)}$	$^{2}/_{x}$	2	M1 A1	either factorisation correct. Accept (x±0) (2±0) Accept $^{2\pm0}/_{x\pm0}$ **Look for incorrect algebra**
						Total 6 marks

16	a		$(2x - 3)(x + 1)$	2	B2	B1 for one correct factor or $(2x + 3)(x - 1)$ (integers only)
	b		"1.5" and "-1"	1	B1	both req^d ft (a) if 2 linear factors
						Total 3 marks

17	a		$2x + 3$	2	B2	B1 each term (accept $3x^0$)
	b		"-5"	1	B1	ft their $ax + b$ ($a, b \neq 0$)
	c	"$2x + 3$" = 0 $x = -^3/_2$	$(-^3/_2, -^9/_4)$ oe	3	M1 A1 A1	only ft their $^{dy}/_{dx}$, if $ax + b$ ($a, b \neq 0$) cao dependent on 2x+3=0 cao Answer dependent on 2x +3 =0 seen
						Total 6 marks

18	a		-**x** oe	1	B1	can be unsimplified
	b		**x** + **y** oe	1	B1	can be unsimplified
	c	Unsimplified expression in terms of *x* and **y** for PA or AP (either correct or ft from b) e.g.(AP=) "**x**+*y*"+*y*-½**x** or (PA=) ½**x**-**y**-"**x**-**y**"	-0.5**x**-2**y**	3	B2 B1	B1 Correct vector statement with at least 3 terms including AP or PA e.g.PA = PC + CA or AP = AC + CP can include x and/or y cao
						Total 5 marks

19	a	$^{80}/_{150}$ x 15 or 4 x 2 (small squares) (freq den)	8	2	M1 A1	M1 for any fd value in correct position and no errors or 1 large square=2.5 leaves or 1 small square=1/10 (leaf) oe
	b	Freq 4-5 = 12 and (freq 5-6 = 6 or freq 5-9=24) ½ ×(freq 4-5 + freq 5-6) or (½ x freq 4-5 + 1/8 x freq 5-9)	9	3	M1 M1 A1	12 & 6 seen or 12 & 24 or 60 & 30 (small squares) dep e.g. (0.5 x 12) +(0.5 x 6) or (0.5 x12)+(1/8 x 24) or 1/10 x 90
						Total 5 marks

20	ai	*BM* = 1 or CM =1			B1	(can be marked on diagram) allow cosine rule method
	ii	*(AM*^{2} =) $2^2 - 1^2$ (= 3) *(AM* =) $\sqrt{}(2^2 - 1^2)$ (= $\sqrt{}3$)	$^{\sqrt{}3}/_2$ or $\sqrt{}¾$	4	M1 M1 A1	(dependent on 1 line of Pythagoras or sine rule)
	b	$(^{\sqrt{}3}/_2)^2 + (^1/_2)^2$ = ¾ + ¼ oe		2	M1 A1	$(^{\sqrt{}3}/_2)^2$ Must be seen allow 0.75 + 0.25 if M1 gained
						Total 6 marks

21	a	$\frac{-3 \pm \sqrt{3^2 - 4 \times 2 \times (-1)}}{2 \times 2}$ $\frac{-3 \pm \sqrt{17}}{4}$	0.281 and -1.78	3	M1 M1 A1	allow one sign error both answers rounding to 0.281 & -1.78 **(answer only gains no marks)**
	b	$\frac{2(x+1)-x}{x(x+1)} = 1$ $2(x+1)-x = x(x+1)$ $x^2 - 2 = 0$ oe	$\pm\sqrt{2}$ or ±1.41…	4	M1 M1 M1 A1	$\frac{2(x+1)}{x} - 1 = x + 1$ or $2 - \frac{x}{x+1} = x$ removal of denominator correct gathering of terms answer rounding to ±1.41 **(answer only gains no marks)**
						Total 7 marks

22	a	$x \times 10^5 + 0.1y \times 10^5 = z \times 10^5$	$x + 0.1y$ oe	2	M1 A1	M1 for $0.1y$ or $(10^x \times 10^4 + y \times 10^4 = 10z \times 10^4)$ or $(10x + y = 10z)$
	bi		7.5	1	B1	
	ii	$0.75 \times 10^{n-m}$ $(= a \times 10^p)$	$n - m - 1$	2	M1 A1	0.75 and n-m seen (even in part i))
						Total 5 marks

Total 100 marks

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