Set 1 Mark Scheme

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
1	(a)	equation	B1	for a correct equation, eg $y = -\cos x$ or $y = \cos(x + 180)$ or $y = \cos(x - 180)$ or $y = \sin(x - 90)$	
	(b)	45	B1	for 45 **or** 405 **or** –315 etc	
		1	B1	for 1	
2		x = –1.5, y = –1 x = 4, y = 10	M1	for eliminating one variable, eg 2x + 2 = 2x2 – 3x – 10	
			M1	(dep) for rearranging to get a quadratic (= 0) in one variable	Condone missing "= 0"
			M1	use of factorisation or correct substitution into quadratic formula or completing the square to solve an equation of the form ax2 + bx + c = 0	Condone missing "= 0" Method used must be complete but can contain some error.
			A1	x = –1.5, x = 4 or y = –1, y = 10	
			C1	x = –1.5, y = –1 and x = 4, y = 10 correctly matched x and y values	
3		33π	P1	for $\frac{1}{3}\pi \times 3^2 h + \frac{2}{3}\pi \times 3^3$ (= 30π)	Accept substitution of a value of π (or 30 × π as a value in the range 94 to 95)
			P1	process to find h (= 4)	

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
			P1	use of Pythagoras to find l (= 5)	
			P1	full process to find surface area, eg $2\pi \times 32 + \pi \times 3 \times$ "5"	
			A1	cao	An answer given in the range 103 to 104 should be awarded P4 If an answer is given in the range but then incorrectly rounded award full marks.
4	(a)	$20 < t \leq 30$	B1	cao	
	(b)	Points plotted at (5,10), (15,26),	B2	for correct plotting of 6 points and joining with line segments	
		(25,23), (35,19), (45,14), (55,8) and joined with line segments	(B1	for points plotted at midpoints of intervals or joining points with line segments at the correct heights and consistent within the class interval (including end values) or correct frequency polygon with one point incorrect or correct frequency polygon with first and last points joined)	Ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted
5	(a)	–1, 3, 1, –1, 3	B2	for all correct	
			(B1	for 3 or 4 correct)	

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
	(b)	Correct graph	M1	(dep on at least B1 in (a)) for at least 4 points from their table plotted correctly and joined	
			A1	for fully correct graph	Plots the five correct points and joins with a curve (not with straight line segments).
6		583	P1	starts process using sine rule, eg $\frac{DB}{\sin 70} = \frac{39}{\sin 74}$	Accept any form of the sine rule with the correct values substituted.
			P1	for (DB =) $\frac{39}{\sin 74} \times \sin 70$ (= 38.1...)	
			P1	for angle BDC = 180 – 70 – 74 (= 36)	
			P1	(dep P1) for 0.5 × 52 × [DB] × sin“36”	
			A1	answer in range 582 to 583	

7	(a)	$\frac{1}{2}\times 7\times 10\times \sin 105$	33.8	2	M 1 A 1 for answer in range 33.8 – 33.81
	(b)	$(AB^2 =)\ 7^2 + 10^2 - 2 \times 7 \times 10 \times \cos(105)$	45.2	5	M 1
		$(AB =)\sqrt{100+49--36.2(346)}$ $\left(=\sqrt{185.2(346)}=13.6...\right)$			M 1 for correct order of operations and square root
		$\frac{10}{\sin A}=\frac{"13.6"}{\sin 105}$ oe **or** $10^2 = 7^2 + "13.6"^2 - 2\times 7\times "13.6"\times \cos A$ **or** $\frac{1}{2}\times 7\times "13.6"\times \sin A\left(=33.8(074..)\right)$ **or** E.g. $\frac{\sin B}{7}=\frac{\sin 105}{"13.6..."}$ **or** angle B = 29.7…			M 1 (dep on 1st M1) ft 13.6 ft 33.8 dep on M1 in (a) **or** for a start to a method to find angle B

	E.g. $\sin A = \frac{10\sin 105}{"13.6"}\left(=\frac{9.65(925)}{"13.6"}=0.7(09712)\right)$ or $\sin A = \frac{33.8}{\frac{1}{2}\times 7\times "13.6"}\left(=\frac{33.8}{47.6(353)}=0.7(09712)\right)$ **or** $\cos A = \frac{7^2+"13.6"^2-10^2}{2\times 7\times "13.6"}\left(=0.7(03...)\right)$ **or** $180 - 105 - \sin^{-1}\left(\frac{\sin 105}{"13.6..."}\times 7\right)$			M 1 for a correct expression or value for sin*A* **or** cos*A* **or** *A* A 1 for answer in range 45.2 to 45.3
8	$SQ^2 = 8^2 + 12^2 - 2\times 8\times 12\times\cos 120^o$	91.4	6	M 1 If this mark is awarded then ft on the remaining M marks
	$(SQ) = \sqrt{304}$			M 1 for correct order of operations e.g. 64 + 144 + 96 or 304 or 17.4…. or 419
	sin*R*"304"=sin27°9			M 1
	$R = sin-1\sin 27°\times "304"9$			M 1 can be implied by 61.5833...
	61.58			A 1 for 61.58 - 61.6
				B 1 ft dep M3 180 – "61.6" – 27
9 (a)		4 – 6	1	B 1

	(b)	$2 \times 5 + 5 \times 12 + 8 \times 10 + 11 \times 4 + 14 \times 1$ or $10 + 60 + 80 + 44 + 14$ (= 208)		6.5	4	M2	for at least 4 correct products added (need not be evaluated) If not M2 then award M1 for consistent use of value within interval (including end points) for at least 4 products which must be added OR correct mid-points used for at least 4 products and not added
		$\frac{2\times5+5\times12+8\times10+11\times4+14\times1}{5+12+10+4+1}\left(=\frac{208}{32}\right)$				M1	dep on at least M1 Allow division by their $\sum f$ provided addition or total under column seen
						A1	for 6.5 or $6\frac{1}{2}$ allow 6 or 7 if 6.5 oe seen or 208 ÷ 32 seen
10	(a)		(4), 9, 8, 10, 12	2	M1 for correct calculation to find one frequency e.g. 0.9×10 or 1.6×5 or 1×10 or 0.8×15 or for one frequency correct or shows that 1 cm^2 = 1 A1 for all frequencies correct		
	(b)		$\frac{4}{43}$	2	M1 for 4 (people) or $\frac{1}{3}$ of "12" (their frequency for 35-50) A1ft for 4 out of 43 stated as a percentage (9.3…) or fraction or decimal (0.093…). Accept decimal or % to 1sf with working out.		

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
	(c)		26000	2	M1 ft for finding the interval in which the "21.5th" or "22nd" value lies or 26 or 25.5 A1 for 26000 or 25500 (note that they must have x1000 for this accuracy mark)
11		Use tracing paper overlay	Loci drawn	3	B1 for line parallel to BC and 3 cm from BC B1 for arc drawn, centre B, with radius 4 cm B1 ft for shading a region below their horizontal line and inside their arc (ft if there is both a horizontal line and arc around C)
12			p = 8, q = 9	3	M1 for finding the difference between the x or y coordinates eg 4 − 2 (= 2) or 17 − 5 (= 12) M1 for a complete method to find the value of p {2+3('2')} or the value of q {5 + '12'÷3} A1 cao
13			255	2	M1 for method to identify the angle required {180+75 or 360 – 105}, including on a diagram {attempt at correct method required, this could include a correctly identified angle on the diagram implying 180+75. Do not award this mark if 75 degrees is incorrectly labelled at B} A1 cao

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
14		$\frac{-5 \pm \sqrt{5^2 - 4 \times 2 \times -10}}{2 \times 2}$	1.31 and -3.81	3	M1 for substitution of a = 2, b = 5, c = –10 into the formula (condone one sign error) or for completing the square $\frac{-5 \pm \sqrt{105}}{4}$ M1 for or in simplified form (either correct solution to 3sf or better implies this method mark) A1 for answers in the ranges 1.30 to1.32 and -3.80 to -3.82
15	(a)	8.5 × 5	42.5	1	B1 cao
	(b)		110°	1	B1 cao
	(c)		Correct ×	2	M1 bearing of 40° or at distance 4 cm A1 correctly marked ×
16	(i)		4 × 5	3	B1 for 22 × 5 oe or 20

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
	(ii)		23 × 3 × 52		B2 for 23 × 3 × 52 oe or 600 (B1 for any product using powers of 2 and 3 and 5 or at least 300, 600… and 40, 80, 120 …)
16					
17	(a)		Correct box plot drawn	3	B1 for median (28), B1 for quartiles (20, 42), B1 for whiskers.
	(b)		Two comparisons	2	e.g. range of men's ages is smaller than women's, median age greater than women's, IQR of men's ages smaller than women's
18			Vertices at (3, 2) (3, 4) (4, 4) (4, 3)	2	B2 B1 for shape of correct size and orientation OR a correct enlargement scale factor $\frac{1}{2}$, centre (1, 3)
19			28	5	M1 attempt to find radius or diameter of the circle M1 finding radius or diameter of circle

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
					M1 for finding area of circle or semi-circle M1 for complete method A1 cao
20	(a)	f(x) = $x^3 + 4x - 1$ f(0) = −1, f(1) = 4	Shown	2	M1 Method to establish at least one root in [0, 1] eg. $x^3 + 4x - 1$ (= 0) and f(0) (= –1), f(1) (= 4) oe A1 Since there is a sign change there must be at least one root in 0 < x < 1 (as f is continuous)
	(b)	$4x = 1 - x^3$ or $\frac{x^3}{4} + x = \frac{1}{4}$	Shown	1	C1 for at least one correct step and no incorrect ones
	(c)	$x_1 = \frac{1}{4} - \frac{0}{4} = \frac{1}{4}$ $x_2 = \frac{1}{4} - \frac{\left(\frac{1}{4}\right)^3}{4} = \frac{1}{4} - \frac{1}{256}$	0.246(09375) or $\frac{63}{256}$	3	M1 $x_1 = \frac{1}{4}$ M1 for $x_2 = \frac{1}{4} - \frac{'\left(\frac{1}{4}\right)'^3}{4}$ A1 for 0.246(09375) or $\frac{63}{256}$ oe
21	(a)		320	2	M1 for sight of 1:4 or 4:1 A1 cao

Paper: 1MA1/3H					
Answer		**Mark**	**Mark scheme**		**Additional guidance**
	(b)		1 373 600	3	M1 for sight of 1:8 of 8:1 M1 for 8 × 171700 A1 cao
22	(a)	5 × "2.5" or 5 × $\frac{27.5}{11}$ or $\frac{RQ}{5} = \frac{27.5}{11}$ oe or $\frac{5}{11} = \frac{RQ}{27.5}$ oe	12.5	2	M1 Correct expression for RQ or correct equation to give RQ. ft their answer to (a)
					A1 cao
	(b)	42.5 ÷ "2.5" or $42.5 \times \frac{11}{27.5}$ or $42.5 \times \frac{5}{"12.5"}$	17	2	M1 Correct expression for CD or correct equation to give CD. ft their RQ, if used. ft their answer to (a)

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
		$\frac{CD}{42.5}=\frac{11}{27.5}$ or $\frac{CD}{42.5}=\frac{5}{"12.5"}$ oe			
					A1 cao
23.	(a)		28.5	1	B1 for 28.5 or 2850 cm or 28.499 or 28.49… or 28.49 recurring oe
	(b)	2 × (147.5 + 28.5)	352	3	B1 for upper bound of length = 147.5 or 14750 cm or 147.49 recurring oe M1 for 2 × (“upper bound width” + “upper bound length”) where these are not the given values. A1 cao 351.999 − 352
24			85.6	4	M1 for 360 ÷ 5 (= 72) M1 (dep) for $\frac{1}{2}$ × 62 × sin"72" (= 17.12) M1 for completing full method to find total area of pentagon A1 for 85.5 − 85.6 OR

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
					M1 for 360 ÷ 10 (= 36) or $\frac{1}{2}$ (180 − 360 ÷ 5) (= 54) M1(dep) for e.g. 6 × sin"36" × 6 × cos"36" (= 17.12) or $\frac{1}{2}$ 6 × sin"54" × 6 × cos"54" (= 8.55) M1 for completing full method to find total area of pentagon A1 for 85.5 − 85.6
25.			14.4	3	M1 for π × 6.52 × 11.5 (= 1526.42...) M1 (dep) for $\frac{\text{'1526.42...'}}{\pi \times 5.8^2}$ A1 for 14.4 – 14.5 OR M1 for $\frac{5.8}{6.5}$ or $\frac{6.5}{5.8}$ or 0.89(23…) or 1.12(06896…) M1 for $11.5 \div \left(\frac{5.8}{6.5}\right)^2$ or $11.5 \div \left(\frac{6.5}{5.8}\right)^2$ A1 for 14.4 – 14.5
26			congruency proved	3	M1 for correct statement with correct reason M1 for a second correct statement with correct reason C1 for complete proof justifying congruency, eg SAS or AAS

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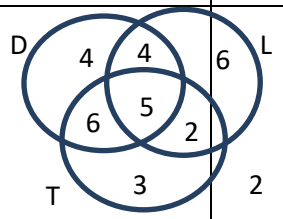
Answer		Mark	Mark scheme		Additional guidance
					Eg DAE = BCF (opposite angles of parallelogram are equal) AE = FC (E and F are midpoints of lines of equal length) AD = BC (opposite sides of parallelogram are equal) AED ≡ CFB (SAS)
			explains why DE = FB	1	C1 for relevant statement using congruency Eg DE and FB are corresponding sides of congruent triangles
27					M1 for 5 in the middle and 1 from 4(D ∩ L ∩ T′) or 2(L ∩ T ∩ D') or 6(D ∩ T ∩ L') M1 for any 4 correct entries A1 for all correct including 2 outside the circles inside the rectangle
			5/9		B1 ft from incorrect diagram
28		eg. $\frac{3}{9}\times\frac{2}{8}\times\frac{1}{7}\left(=\frac{6}{504}=\frac{1}{84}\right)$		5	M1 (probabilities from selecting 2, 2, 2) allow $\frac{3}{9}\times\frac{2}{9}\times\frac{1}{9}\left(=\frac{6}{729}\right)$ or $\frac{3}{9}\times\frac{3}{9}\times\frac{3}{9}\left(=\frac{27}{729}\right)$

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
		eg. $\frac{2}{9}\times\frac{3}{8}\times\frac{4}{7}\left(=\frac{24}{504}=\frac{1}{21}\right)$			M1 (probabilities from selecting 1, 2, 3) allow $\frac{2}{9}\times\frac{3}{9}\times\frac{4}{9}\left(=\frac{24}{729}\right)$
		$6\times"\frac{24}{504}"\left(=\frac{144}{504}=\frac{6}{21}=\frac{2}{7}\right)$			M1 (probabilities for all combinations of 1, 2, 3) allow $6\times"\frac{24}{729}"\left(=\frac{144}{729}\right)$
		$6\times\frac{2}{9}\times\frac{3}{8}\times\frac{4}{7}\ +\ \frac{3}{9}\times\frac{2}{8}\times\frac{1}{7}\ \left(=\frac{6}{21}+\frac{1}{84}\right)$	$\frac{150}{504}$		M1 complete correct method A1 oe eg. $\frac{25}{84}$, 0.298, 0.297619…
29	(a)	4500×1.04^2	4867.20	3	M1 for 4500×1.04 or for $4500 + 0.04 \times 4500$ or for 4680 or 180 or 360 or 4860 M1 (dep) '4680' × 1.04 or for '4680' + 0.04 ×

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
					'4680' A1 for 4867.2(0) cao (If correct answer seen then ignore any extra years) Alternative method M2 for 4500×1.04^2 or 4500×1.043 A1 for 4867.2(0) cao [SC: 367.2(0) seen B2]
	(b)	2400×1.075^n 2580 2773.5 2981.5125 3205.12… 3445.51…	5	2	M1 for an attempt to evaluate 2400×1.075^n for at least one value of n (not equal to 1) or $3445.51 \div 1.075n$ ($n \geq 2$) or $\frac{3445.51}{2400}$ (=1.4356...) and 1.075^n evaluated, $n \geq 2$ A1 for 5 cao
30		$25 \div 50 = 0.5$ h = 30 min $25 \div 60 = 0.416$h = 25 min	5	3	M1 for $25 \div 50$ or $\frac{60}{50}\times25$ or 30 (min) or 0.5(h)

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					or 25 ÷ 60 or $\frac{60}{60} \times 25$ or 25 (min) or 0.41(6)(h) M1(dep) '0.5' –'0.41(6)'or '30' – '25' A1 cao OR M1 for 60 ÷ 25 (= 2.4) and 60 ÷ "2.4" or 50 ÷ 25 (= 2) and 60 ÷ "2" M1(dep) for '30' – '25' A1 cao
31		16 × 7 = 112 112 – 87	25	2	M1 for 6 × 14.5 (= 87) or 7 × 16 (=112) or 6 × 1.5 (= 9) or 7 × 1.5 (= 10.5)

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					A1 for 25
32	(a)		Negative	1	B1 cao
	(b)		117–123	2	M1 for a line of best fit drawn between (9, 130) & (9, 140) and between (13, 100) & (13,110) inc..
					A1 for 117 − 123 inclusive
33			17.7(014…)	3	B1 for 7.75 or7.85 or 5.15 or 5.25 or 62.5 or 63.5 M1 for $\frac{1}{2} \times 7.75 \times 5.15 \times \sin 62.5$ A1 for 17.7(0140994…)
34	(a)	2, −4, 2, 8	B2	all 4 values correct	
			(B1	for 2 or 3 correct values)	
	(b)	Graph	M1	(dep B1) for at least 5 points plotted correctly ft from part a	

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			A1	for a fully correct curve drawn	Accept freehand curves drawn that are not line segments; there must be some attempt to draw the minimum point below y = −4
	(c)	−2.6 or 1.6	B1	for 1 correct value, ft a non linear graph	Award for −2.6 or 1.6 or both values but do not award the mark if a correct value is given with an incorrect value. Accept 1.56 or −2.56 Note for ft to be applied if the graph may be joined by line segments
35		(−3.5, 1)	M1	for a complete method to show the transformations	Image at (−4,1), (−3,1) and (−3.5, −2)
			A1	cao	
36		73.6	P1	for correct initial use of Pythagoras eg $5^2 + 5^2$ (=50) or a trigonometric ratio in the form $\frac{5 \div 2}{0.5AC}$ = sin 45 oe	
			P1	for finding the length of half of the diagonal eg $\sqrt{"50"} \div 2$ (	do not accept $\sqrt{20} \div 2$

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				= 3.5...) or $0.5AC = \frac{5 \div 2}{\sin 45}$ (=3.5...) oe	
			P1	for process to use tan eg tan TAC = (12 ÷ "3.5..") (=3.3..) or complete alternative method arriving at an equation with the subject as sin TAC or cos TAC	
			A1	for an answer in the range 73.58 to 74.1	
37		60	M1	use of parallel lines to find an angle eg ABE=70 or EBG=75 or EBC = 110 or shows parts of x as 35 or 25	Parts of x should be identified on the diagram by the insertion of a dividing line through angle x (need not be identified or drawn parallel).
			M1	for a complete method to find angle x; could be in working or on the diagram	Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
			A1	for x = 60	
			C1	(dep on M1) for one reason linked to parallel lines and one other reason, supported by working taken from:	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit. There should be no incorrect reasons

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				alternate angles are equal, allied angles / co-interior angles add up to 180, angles on a straight line add up to 180, angles in a triangle add up to 180o	given.
38	(a)	Ben (supported)	P1	shows how to work interest out for one year eg 2000 × 0.025 (= 50) or 1600 × 0.035 (= 56) or 150 or 168 or 2000×1.025 (= 2050) or 1600 × 1.035 (= 1656)	Throughout accept figures ±1 pence which do not need to be presented in money notation (to 2dp) or with monetary symbols.
			P1	shows compound interest calculation for one account eg 2050→51.25 or 2101.25→52.53 or 1656→57.96 or 1713.96→59.99 eg 2000×1.0253 (= 2153.78) or 1600 × 1.0353 (= 1773.95)	Award mark for a correct process shown, for which these figures can be taken as implying the process.
			P1	shows complete compound interest calculation for both accounts eg 2000×1.0253 (= 2153.78)	As above, award mark for both correct processes shown for both accounts, which these figures can be taken as implying the process.

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				and 1600 × 1.0353 (= 1773.95) OR one interest stated correctly eg 153.78 or 173.95	
			C1	Ben (shares) supported by 153.78 and 173.95	Accept an answer of "shares".
39		84.9	P1	shows a process to find the radius or diameter eg 44 = 2 × π × r $r = \frac{22}{\pi}$ or $d = \frac{44}{\pi}$ or r = 7.0028 or d = 14.0056..	Allow r in the range 7 to 7.1 and d in the range 14 to 14.1 Could be shown on the diagram.
			P1	(dep on P1) complete method to find the area eg ½ × "d" 2 × Sin60 oe, ½ × 14 × Tan60 oe, ½ × 14 × $\sqrt{14^2 - 7^2}$ oe	
			A1	for answer in the range 84.8 to 85	If the correct answer in the range is given in working and then rounded incorrectly award full marks.

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
40		proof	C1	uses cyclic quad eg if CAB = x then CRO = 180 – x (Opposite angles of a cyclic quadrilateral add up to 180o.)	Underlined words need to be shown; reasons need to be linked to their method; any reasons not linked do not credit.
			C1	establishes relationship outside a circle eg ORB = x (Angles on a straight line add up to 180)	Correct method can be implied from angles on the diagram if no ambiguity or contradiction.
			C1	uses properties of a circle eg RO = OB (both radii) so ABC = x (Base angles of an isosceles triangle are equal.)	
			C1	Complete proof and conclusion	Full reasons given without any redundant reasons and correct reasoning throughout.
41			460	P1	for a process to find the cost after the first reduction, e.g. 293.25 ÷ 0.85 (= 345)
				P1	(dep) for a complete process to find the initial cost, e.g. “345” ÷ 0.75

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
				A1	cao
42		x = 0.4575757… 10x = 4.575757… 1000x = 457.575757… 990x = 453 OR 100x = 45.7575757… 99x = 45.3	$\frac{151}{330}$	M1	for 0.4575757… or 0.4 + 0.05757…
				M1	(dep) for two recurring decimals that when subtracted would give an integer or terminating decimal or for $\frac{453}{990}$
				A1	conclusion to proof to given fraction
43			Region identified	B1	for x = 4 or 2x + y = 6 or y = $\frac{1}{3}$ x
				B1	for x = 4 and 2x + y = 6 and y = $\frac{1}{3}$ x
				A1	for lines drawn and correct region identified by either shading in or out; the letter R is not required, but necessary if no shading
44			y = 0.4x – 17.4	P1	for process to find p, e.g. $\sqrt{261-15^2}$
				P1	for process to find gradient of OA, e.g. −15 ÷ 6

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Answer		**Mark**	**Mark scheme**		**Additional guidance**
					(= $\frac{-5}{2}$)
				P1	(dep on previous P1) for process to find the perpendicular gradient using $-\frac{1}{m}$ or states gradient as $\frac{2}{5}$
				P1	for process to find the y-intercept of the gradient, e.g. $-15 = \frac{2}{5} \times 6 + c$
				A1	oe
45	(a)		$\frac{1}{5}$	B1	for $\frac{1}{5}$ oe
	(b)		2.129754359	B1	for 9.66(…)
				B1	for 2.1297 – 2.1298

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Answer		**Mark**	**Mark scheme**			**Additional guidance**
46		eg $7x + 7y = 105$ $-$ $5x + 5y = 75$ $+$ $7x - 5y = 3$ $7x - 5y = 3$ $7(15 - y) - 5y = 3$ **or** $7x - 5(15 - x) = 3$ oe		3	M1	Correct method to eliminate x or y: coefficients of x or y the same **and** correct operation to eliminate selected variable (condone any one arithmetic error in multiplication) **or** writing x or y in terms of the other variable and correctly substituting
		"6.5" + y = 15 **or** x + "8.5" = 15 **or** 7 × "6.5" – 5y = 3 **or** $7x - 5 \times$ "8.5" = 3			M1	dep Correct method to find second variable using their value from a correct method to find first variable or for repeating above method to find second variable
			$x = 6.5$, $y = 8.5$		A1	dep on first M1
47		E.g. $\left(\frac{y^8}{256x^{20}}\right)^{\frac{1}{4}}$ or $\left(\frac{4x^5}{y^2}\right)^{-1}$ or $\frac{x^{-5}}{4y^{-2}}$ or $\frac{\frac{1}{4}x^{-5}}{y^{-2}}$ or $k\frac{y^a}{x^b}$ or $\frac{ky^a}{x^b}$ with 2 of k = $\frac{1}{4}$ oe , a = 2, b = 5 or $\frac{y^a}{mx^b}$ with 2 of m = 4, a = 2, b = 5	$\frac{y^2}{4x^5}$	2	M1	for a correct first step leading to a correct partially simplified expression

Paper: 1MA1/3H							
Answer			**Mark**	**Mark scheme**			**Additional guidance**
						A1	for $\frac{y^2}{4x^5}$ or $\frac{\frac{1}{4}y^2}{x^5}$ or $0.25\frac{y^2}{x^5}$ or 0.25y2x-5
48		(area =) 2 × 1.25 (=2.5)			3	M1	
		(F =) 42 × "2.5" or 42 = $\frac{F}{\text{"2.5"}}$				M1	Correct substitution into pressure formula
				105		A1	cao

49	eg $(4x + 3)(x – 2)$ or $(x =) \frac{-(-5) \pm \sqrt{(-5)^2 - 4 \times 4 \times (-6)}}{2 \times 4}$		4	M1	first step to finding the critical values
	$(x =) -\frac{3}{4}$ and 2			A1	for two correct critical values
				M1	(dep on two critical values having been found) for a diagram showing the inequalities **OR** $x < a$ and $x > b$ where a is their lower critical value and b is their upper critical value **OR** $x > 2$ **OR** $x < \frac{-3}{4}$ **OR** $\frac{-3}{4} > x > 2$
		$x < -\frac{3}{4}$ $x > 2$		A1	for both correct inequalities

50.		$15 \div 70 = 120 \div n$ $120 \times 4.66(\ldots)$		M2	$\frac{120 \times 70}{15}$ or $120 \times 4.66\ldots$ or 8×70 or $\frac{15}{70} \times \frac{8}{8} = \frac{120}{n}$ (oe)	

		OR $\frac{120 \times 70}{15}$ OR 8×70 OR $\frac{15}{70} \times \frac{8}{8} = \frac{120}{n}$ OR $120 \div 21.4 \times 100$			or $120 \div 21.4 \times 100$ (M1 for $\frac{15}{70}$ oe or 21.4% seen or $120 \div 15$ (= 8) or $\frac{15}{120}$ $(=\frac{1}{8})$ or 4.66(…) seen)
			560	A1	cao
				C1	Correct mathematical assumption, e.g. population hasn't changed overnight or sample is random, etc.

Question 51 (Total 2 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	For even numbers $2n$: $(2n)^2 - 2n = 4n^2 - 2n = 2(2n^2 - n)$ so even For odd numbers $2n + 1$: $(2n + 1)^2 - 2n + 1 = 4n^2 + 4n + 1 - (2n + 1)$ $= 4n^2 + 2n$ $= 2(n^2 - n)$ so even Thus for all integer value of n, $n^2 - n$ is never	C2	This mark is given for a fully correct proof (C1 is given for a partial explanation)

	an odd number		

Question 52 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	P : **Q** = 1 : 2.5 **Q** : **R** = 2.5 : 3.75	P1	This mark is given for a process to find the ratio of the volumes of **P** and **Q**, and of **Q** and **R**
	P : **R** = 1 : 3.75 = 4 : 15	P1	This mark is given for a process to find the ratio of the volume of **P** to the volume of **R**
	$\frac{4}{15}$	A1	This mark is given for a correct answer only

Question 53 (Total 2 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
	$n^2 + (n + 1)^2 = n^2 + n^2 + 2n + 1$ $= 2n^2 + 2n + 1$ $= 2(n^2 + n) + 1$ $2(n^2 + n)$ is always even; thus for all integer values of n, $n^2 + (n + 1)^2$ is always an odd number	C2	This mark is given for a fully correct proof (C1 is given for a partial explanation)

Question 54 (Total 2 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\tan 60° = \sqrt{3}, \quad \sin 30° = \frac{1}{2}$	M1	This mark is given for find two exact values of tan 30° and sin 30°
	$\sqrt{3} \times \frac{1}{2} = \frac{\sqrt{3}}{2}$	A1	This mark is given for a correct answer only

Question 55 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	Cone: $\frac{1}{3} \times \pi \times 6^2 \times 20 = 240\pi$ Hemisphere: $\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3 = 144\pi$	M1	This mark is given for a method to use the formulae to find the volumes of the cone and the hemisphere
	$(\frac{1}{3} \times \pi \times 6^2 \times 20) + (\frac{1}{2} \times \frac{4}{3} \times \pi \times 6^3)$	M1	This mark is given for a complete method to find the total volume of the shape
	$240\pi + 144\pi$	M1	This mark is given for a correct partial simplification
	384	A1	This mark is given for the correct answer only

Question 56 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\frac{x^2}{-2x+12} = \frac{1}{2}$	P1	This mark is given for a process to form an equation
	$2x^2 = -2x + 12$ $2x^2 + 2x - 12 = 0$	P1	This mark is given for a process to write a quadratic equation to be solved
	$(2x - 4)(x + 3) = 0$	P1	This mark is given for a process to factorise the quadratic equation
	$x = 2, x = -3$	A1	This mark is given for the correct answers only

Question 57 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\sqrt{2} + \sqrt{(2 \times 9)} = \sqrt{2} + 3\sqrt{2}$	M1	This mark is given for a method to use $\sqrt{18} = \sqrt{(2 \times 9)}$ and simplify
	$4\sqrt{2}$	A1	This mark is given for the correct answer only

Question 58 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes

(i)	$x^2 - 8x + 16 = (x - 4)^2$ $a = 4$	M1	This mark is given for method to find a value for a
	$x^2 - 8x + 1 = (x - 3)^2 - 15$ $b = 15$	A1	This mark is given for method to find a value for b
(ii)	$(4, -15)$	B1	This mark is given for the correct answer only

Question 59 (Total 7 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)	$\frac{x+2}{3}$	M1	This mark is given for a method to change the subject, for example $y = 3x - 2$ or $y + 2 = 3x$
		A1	This mark is given for the correct answer only
(b)	$fg(x) = 3(x^2 + 2) - 2$	M1	This mark is given for finding $fg(x)$
	$gf(x) = (3x - 2)^2 + 2$	M1	This mark is given for finding $gf(x)$
	$3x^2 + 4 = 2(9x^2 - 12x + 4) + 4$	M1	This mark is for setting up the equation of $fg(x) = 2gf(x)$
	$3x^2 + 4 = 18x^2 - 24x + 8$	M1	This mark is given for multiplying out

Part	Working or answer an examiner might expect to see	Mark	Notes
			the expression for $2gf(x)$
	$15x^2 - 24x + 8 = 0$	C1	This mark is given for a correct conclusion following from correct working

Question 60 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\pi \times 7^2 = 49\pi = 153.938\ldots$	P1	This mark is given for a process to find the area of the circle that the sector is part of
	$\frac{30}{49\pi} \times 360 = 70.16$	P1	This mark is given for a process to find the angle of the sector at O
	$\frac{70.16}{360} \times 2 \times \pi \times 7 = 8.57$	P1	This mark is given for a process to find the length of the arc AB
	8.57 + 7 + 7 = 22.6 (to 3 significant figures)	A1	This mark is given for the correct answer only

Question 61 (Total 4 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes

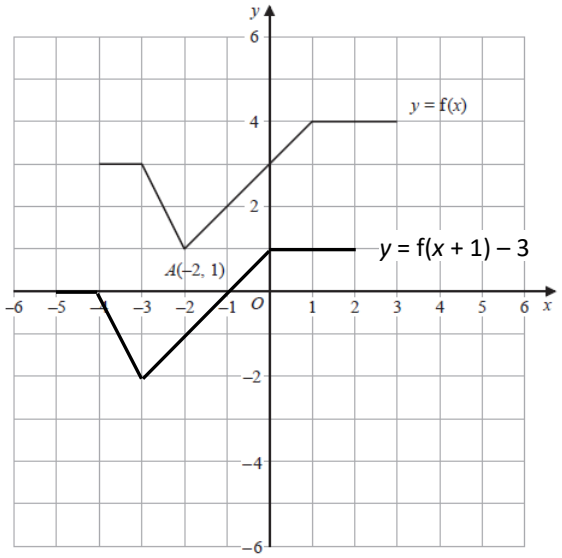
	$6 + \left[(x+4) \div \frac{(x+4)(x-2)}{x-1} \right]$	B1	This mark is given for factorising $x^2 + 2x - 8$
	$= 6 + \left[(x+4) \times \frac{x-1}{(x+4)(x-2)} \right]$ $= 6 + \frac{x-1}{x-2}$	M1	This mark is given for a method to rearrange the fraction in brackets and cancel through by $(x - 4)$
	$= \frac{6(x-2)}{x-2} + \frac{x-1}{x-2}$ $= \frac{6(x-2)+(x-1)}{x-2}$	M1	This mark is given for putting the two terms of the expression over the same common denominator
	$\frac{7x-13}{x-2}$	A1	This mark is given for a correct answer only

Question 62 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$(3^2)^{-\frac{1}{2}} = (3^3)^{\frac{1}{4}} \times 3^{-(x+1)}$ $3^{-1} = 3^{\frac{3}{4}} \times 3^{-(x+1)}$	P1	This mark is given for a process to convert to a common base

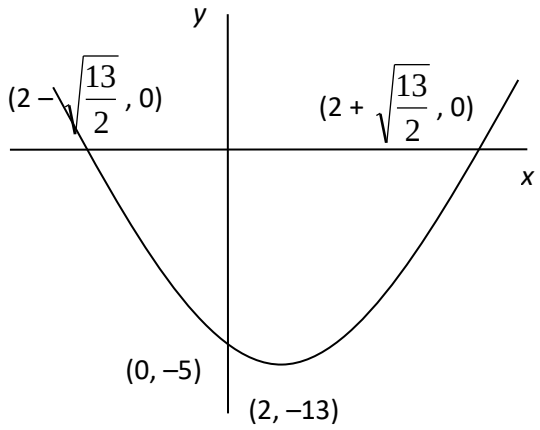
	$-1 = \frac{3}{4} - (x + 1)$	P1	This mark is given for a process to use the index laws to derive an equation in x
	$x = \frac{3}{4}$	A1	This mark is given for the correct answer only

Question 63 (Total 3 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
(a)		C1	These marks are given for a graph drawn translated by the vector $\begin{pmatrix} -1 \\ -3 \end{pmatrix}$ (C1 is given for a translation of the graph by vector $\begin{pmatrix} a \\ -3 \end{pmatrix}$ or $\begin{pmatrix} b \\ -3 \end{pmatrix}$ where $a \neq 1$ or $b \neq -3$)
(b)	(2, 1)	B1	This mark is given for the correct answer

Part	Working or answer an examiner might expect to see	Mark	Notes
			only

Question 64 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$x = \frac{--8 \pm \sqrt{(-8)^2 - 4 \times 2 - 5}}{2 \times 2}$	M1	This mark is given for a method to find the roots of $y = 0$
	$x = 2 + \sqrt{\frac{13}{2}}$, $2 - \sqrt{\frac{13}{2}}$	M1	This mark is given for finding the roots of $y = 0$
	x-coordinate for turning point = $\frac{1}{2}(2 + \sqrt{\frac{13}{2}} + 2 - \sqrt{\frac{13}{2}}) = 2$ When $x = 2$, $y = -13$	M1	This mark is given for the turning point of $y = 2x^2 - 8x - 5$
		C2	These marks are given for a fully correct parabola drawn with axes labelled, a turning point at (2, –13) and intercepts at (0, –5), (2 + $\sqrt{\frac{13}{2}}$, 0) and (2 – $\sqrt{\frac{13}{2}}$, 0) clearly shown

Question 65 (Total 4 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\angle ACB = \angle ADB = 60°$ Angles in the same segment are equal $\angle DBC = \angle DAC = 60°$ Angles in the same segment are equal Thus $\angle ACB = \angle DBC = 60°$	C1	This mark is given for arguments to show that $\angle ACB = \angle ADB$ and $\angle DBC = \angle DAC$ with reasons given to show that $\angle ACB = \angle DBC$
	$\angle ABC = 60 + \angle ABD = 60 + \angle ACD \quad = \angle DCB$ Angles in the same segment are equal	C1	This mark is given for an argument to show that $\angle ABC = \angle DCB$
	BC is common to both triangles	C1	This mark is given for finding a side common to both triangles
	Thus triangles *ABC* and *DCB* are congruent (AAS)	C1	This mark is given for a correct conclusion with reference to AAS

66	87.5	P1	for a process to find the volume of a shape eg $\frac{1}{8} \times \pi \times 10^2 \times 10 \left(= \frac{1000\pi}{8}\right)$	The process marks can be awarded if a value for π is used instead of the symbol.

			or $\frac{1}{6} \times \pi \times 10^2 \times 5$ $(=\frac{500\pi}{6})$ oe	
		P1	for process to find the density of a shape eg $40\pi \div \frac{1000\pi}{8}$ or $50\pi \div \frac{500\pi}{6}$ oe	
		P1	for complete process to find the densities, eg $40\pi \times \frac{8}{1000\pi} = \frac{320}{1000}$ (= 0.32) **and** $50\pi \times \frac{6}{500\pi} = \frac{300}{500}$ (= 0.6) oe	Needs to be a complete process associated with the densities of both shapes
		P1	for process to find the percentage eg $\frac{"0.6" - "0.32"}{"0.32"}$ or $\frac{"0.6"}{"0.32"}$ oe	If following-through any of these numbers previous correct method leading to these numbers must be shown.
		A1	cao	
67	$-28 - 20\sqrt{2}$	M1	first step eg multiplies numerator and denominator by $1 + \sqrt{2}$	
		M1	method to simplify $\sqrt{128}$ eg $\sqrt{128} = 8\sqrt{2}$	Steps for the second and third marks may be in reverse order

		M1	method to expand numerator eg $12 + 12\sqrt{2} + \sqrt{128} + \sqrt{2}\sqrt{128}$ or $12 + + 8\sqrt{2} + 12\sqrt{2} + 16$	
		A1	for $-28 - 20\sqrt{2}$	Accept $a = -28$ and $b = -20$
68	300	P1	process which recognises $AB = BC$	Could be indicated on the diagram.
		P1	process to find length of tangent by using Pythagoras to find distance AB, eg $x^2 + 10^2 = 18^2 + (x - 6)^2 + 10^2$ oe **or** process to solve equation as far as $12x = 18^2 + 36$ (=360)	
		P1	shows a complete process to find the length of a tangent eg $x = 30$ **or** shows a process to find the area using their length of tangent eg $10 \times x$	
		A1	cao	

69	$\frac{2\mathbf{a}+3\mathbf{b}}{5}$	M1 M1 A1	for $\overrightarrow{AB} = \mathbf{b} - \mathbf{a}$ **or** $\overrightarrow{BA} = \mathbf{a} - \mathbf{b}$ **or** the correct use of the ratio for a complete method eg $\frac{3}{5}(\mathbf{b}-\mathbf{a})+\mathbf{a}$ $\frac{2\mathbf{a}+3\mathbf{b}}{5}$ oe

Question 70 (Total 5 marks)

Part	Working or answer an examiner might expect to see	Mark	Notes
	$\overrightarrow{OP} = \frac{1}{3}\overrightarrow{OX} = \frac{1}{3}\mathbf{a}$ $\overrightarrow{OR} = \frac{1}{4}\overrightarrow{OY} = \frac{1}{4}\mathbf{b}$	P1	This mark is given a process to find $\overrightarrow{OP}$ and $\overrightarrow{OR}$
	$\overrightarrow{ZO} = \frac{1}{3}\overrightarrow{YX} = \mathbf{a} - \mathbf{b}$ $\overrightarrow{ZY} = \mathbf{a}$	P1	This mark is given for a process to use vector equivalence of opposite sides of a parallelogram to find vector expressions for $\overrightarrow{ZO}$ and $\overrightarrow{ZY}$
	$\overrightarrow{ZP} = \mathbf{a} - \mathbf{b} + \frac{1}{3}\mathbf{a}$		This mark is given for a process to find $\overrightarrow{ZP}$ and $\overrightarrow{ZR}$ in terms of **a** and **b**

	$\overrightarrow{ZR}$ = **a** – **b** + $\frac{1}{4}$ **b**		
	12 $\overrightarrow{ZP}$ = 12**a** – 12**b** + 4**a** = 16**a** – 12**b** 12 $\overrightarrow{ZR}$ = 12**a** – 12**b** + 3**b** = 12**a** – 9**b** 16**a** – 12**b** = $\frac{4}{3}$ (12**a** – 9**b**) so $\overrightarrow{ZP}$ = $\frac{4}{3}$ $\overrightarrow{ZR}$		This mark is given for a process to write $\overrightarrow{ZP}$ and $\overrightarrow{ZR}$ as multiples of the same vector
	4 : 3		This mark is given for the correct answer only (or an equivalent ratio)

Question 71 (Total 6 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes
(a)	$\overrightarrow{FE}$ = $\overrightarrow{FC}$ + $\overrightarrow{CD}$ + $\overrightarrow{DE}$ = (**a** – **b**) + **a** + **b**	M1	This mark is given for a method to find a vector expression for $\overrightarrow{FE}$
	= 2**a**	A1	This mark is given for the correct answer only
(b)	$\overrightarrow{MF}$ = – $\overrightarrow{DM}$ – $\overrightarrow{CD}$ – $\overrightarrow{FC}$	P1	This mark is given for a method to find a vector expression for $\overrightarrow{MF}$

	$= -\frac{1}{2}\mathbf{b} - \mathbf{a} - (\mathbf{a}-\mathbf{b})$ $= \frac{1}{2}\mathbf{b} - 2\mathbf{a}$			
	$\overrightarrow{CE} = \overrightarrow{CX} + \overrightarrow{XE}$ $\overrightarrow{CX} = \overrightarrow{CD} + \overrightarrow{DM} + \frac{1}{n+1}\overrightarrow{MF}$ $\overrightarrow{XE} = \overrightarrow{XM} + \overrightarrow{ME}$ $= \frac{1}{n+1}\overrightarrow{FM} + \overrightarrow{ME}$ $\overrightarrow{CE} = \mathbf{a} + \mathbf{b}$ $\overrightarrow{CX} = \mathbf{a} + \frac{1}{2}\mathbf{b} + \frac{1}{n+1}(\frac{1}{2}\mathbf{b} - 2\mathbf{a})$ $= \mathbf{a} - \frac{2}{n+1}\mathbf{a} + \frac{1}{2}\mathbf{b} + \frac{1}{2(n+1)}\mathbf{b}$ $= \frac{n+1}{n+1}\mathbf{a} - \frac{2}{n+1}\mathbf{a} + \frac{(n+1)}{2(n+1)}\mathbf{b} + \frac{1}{2(n+1)}\mathbf{b}$ $= \frac{n-1}{n+1}\mathbf{a} + \frac{(n+2)}{2(n+1)}\mathbf{b}$ $\overrightarrow{XE} = \frac{1}{n+1}(2\mathbf{a} - \frac{1}{2}\mathbf{b}) + \frac{1}{2}\mathbf{b}$		P1	This mark is given for a method to find vector expressions for $\overrightarrow{CX}$ and $\overrightarrow{XE}$

	$= \frac{2}{n+1}\mathbf{a} - \frac{1}{2(n+1)}\mathbf{b} + \frac{1}{2}\mathbf{b}$ $= \frac{2}{n+1}\mathbf{a} - \frac{1}{2(n+1)}\mathbf{b} + \frac{(n+1)}{2(n+1)}\mathbf{b}$ $= \frac{2}{n+1}\mathbf{a} + \frac{n}{2(n+1)}\mathbf{b}$		

Question 71 continued (Total 6 marks)

Part	Working an or answer examiner might expect to see	Mark	Notes	
	$\overrightarrow{CE} = \overrightarrow{CX} + \overrightarrow{XE}$ $\mathbf{a} + \mathbf{b} = \frac{n-1}{n+1}\mathbf{a} + \frac{(n+2)}{2(n+1)}\mathbf{b} + \frac{2}{n+1}\mathbf{a} + \frac{n}{2(n+1)}\mathbf{b}$ Thus $\frac{n-1}{n+1} = \frac{(n+2)}{2(n+1)}$ **or** $\frac{2}{n+1} = \frac{n}{2(n+1)}$ $2(n+1)(n-1) = (n+1)(n+2)$ $2(n-1) = n+2$ $n-2 = 2$		P1	This mark is given for a process to find the value of n

	or $4(n + 1) = n(n + 1)$			
	$n = 4$	A1	This mark is given for the correct answer only	