

Mark Scheme

Q1.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		40	2	M1 for $32 \div 20 (= 1.6)$ or $32 \times 25 (= 800)$ or 20:25 (or use of) A1 cao

Q2.

	Working	Answer	Mark	Notes
		Correct position of T	3	M1 for line drawn or point marked within guidelines from B M1 for line drawn or point marked within guidelines from C A1 for T within region on overlay

Q3.

PAPER: 1MA0 2H				
Question	Working	Answer	Mark	Notes
(a)		Polygon drawn	2	B2 for correct plotting of 5 points and joining with line segments (B1 for points plotted correctly 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 point joined) NB Ignore any histogram drawn and any part of frequency polygon outside range of first and last points plotted
* (b)		Yes with reason	2	M1 for finding a quarter of 51 and for finding how many teachers sent more than 30 emails C1 for 12.75 or 13 compared to 15 and yes she is correct OR M1 for finding how many teachers sent more than 30 emails and '15' $\times 4$ C1 for comparing 60 with 51 and yes she is correct OR M1 for $15 \div 51 (= 0.29...)$ or $\frac{15}{51} \times 100 (= 29... \%)$ C1 for comparing 0.29.. with $\frac{1}{4}$ or 0.25 OR 29...% with 25% and yes she is correct

Q4.

Question	Working	Answer	Mark	Notes
		161.50	5	M2 for a correct method to decrease 6720 by 20%, eg $6720 \times 0.8 (= 5376)$ or $6720 \times 0.2 (= 1344)$ and $6720 - 1344 (= 5376)$ (M1 for a correct method to find 20% of 6720 eg 6720×0.2 or $\frac{20}{100} \times 6720 (= 1344)$) M1 for subtracting 1500 (= 3876) after a percentage calculation M1 "3876" $\div 24$ after the subtraction of 1500 A1 for 161.5(0)

Q5.

Paper 1MA1: 3H				
Question	Working	Answer	Notes	
(a)	$(720+408+304+252)\div 50$	33.68	M1 for finding 4 products <i>fw</i> consistently within interval (including end points) M1 (dep on 1st M) for ' $\Sigma ftw \div 50$ ' A1 cao	

Paper 1MA1: 3H				
Question	Working	Answer	Notes	
(b)		Manager with reasons	M1 for strategy to compare number of small size sold to number ordered C1 clear comparison that small size is not $\frac{3}{4}$ and so Jenny is not correct or the manager is correct	

Q6.

Question	Working	Answer	Notes
		$7.15 \leq x < 7.25$	B1 for 7.15 and 7.25 B1 cao

Q7.

Question	Working	Answer	Mark	Notes
		C, F, A, H	B3 [B2 [B1	for a fully correct table for 2 or 3 correct] for 1 correct]

Q8.

PAPER: 1MA0 2H				
Question	Working	Answer	Mark	Notes
		115	4	M1 for $360 - 4 \times 25 (=260)$ M1 (dep) for $'260' \div 4 (=65)$ M1 for $180 - '65'$ or $(360 - 2 \times '65') \div 2$ A1 for 115 with working OR M1 for $360 \div 4 (=90)$ M1 (dep) for $'90' - 25 (=65)$ M1 for $180 - '65'$ or $(360 - 2 \times '65') \div 2$ A1 for 115 with working

Q9.

5MB1H/01 June 2015				
Question	Working	Answer	Mark	Notes
(a)		0 8 9 1 4 7 8 8 2 0 1 1 2 2 5 6 3 0 3	3	B2 for a fully correct ordered stem and leaf diagram [B1 for a complete unordered diagram or for an ordered diagram with at most 2 errors] B1 (indep) key
(b)		20	2	M1 for $36 \div (5 + 4) (=4)$ A1 cao

Q10.

Question	Working	Answer	Mark	Notes
	$40 \div 5 = 8$ $8 \times 1.5 = 12$ $(37.6 - 12) \div (40 - 8)$ $= 25.6 \div 32 =$	0.8	4	M1 for $40 \div 5 (=8)$ or at least 3 multiples of 1:4 M1 $"8" \times 1.5 (=12)$ M1 $(37.6 - "12") \div (40 - "8")$ or $25.6 \div 32$ A1 for 0.8, accept 800 g OR algebraic approach: M1 for (eg) $k=4c$ and $k+c=40$ M1 for (eg) $1.5c+wk=37.6$ M1 for $"8" \times 1.5 + "32" \times w = 37.6$ A1 for 0.8, accept 800 g

Q11.

Question	Working	Answer	Mark	Notes
		100	4	M1 for $360 \div 9 (=40)$ or $(9 - 2) \times 180 (=1260)$ M1 (dep) for $180 - "40"$ or $"1260" \div 9 (=140)$ oe M1 (dep M2) for a complete method to find the required angle, eg $"140" - (360 - "140" - "140") \div 2$ or $(("140" \div 7) \times 5$ A1 for 100 supported by working

Q12.

Question	Working	Answer	Mark	Notes
		Correct region shaded	3	M1 for a circle centre M or N (accept arc of sufficient length to define the region) M1 for circle centre M radius 5 cm and circle centre N radius 3 cm (accept arc of sufficient length to define the region) A1 for correct region shaded

Q13.

Paper 1MA1: 3H				
Question	Working	Answer	Notes	
		252	P1	For start to process eg. radius = $12 \div 4 (= 3)$
			M1	Method to find area of trapezium or semicircle or circle
			P1	Process to find area of the shaded region
			A1	251.7 – 252

Q14.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		$\frac{59}{330}$	3	M1 for $100x = 17.87878787\dots$ or $1000x = 178.7878787\dots$ and $10x = 1.7878787$ M1 (dep) for subtraction, $100x - x$ or $1000x - 10x$ or $\frac{17.7}{99}$ or $\frac{177}{990}$ seen A1 working leading to given fraction

Q15.

5MB3H_01 November 2015				
Question	Working	Answer	Mark	Notes
(a)		$x > -4$	1	B1 cao
(b)		$y \leq 3$	2	M1 for intention to isolate y or for $y = 3$ or $y < 3$ A1 cao
(c)		-1,0,1	2	M1 for listing -3, -2, -1,0,1 or -1, 0,1,2,3 or for $-2 < ? < 2$ A1 for -1,0,1

Q16.

Question	Working	Answer	Notes
		Triangle (-6, 2), (-6, -1), (-3, -1)	M1 for correct shape and the correct orientation in the wrong position or two vertices correct. A1 cao

Q17.

	Working	Answer	Mark	Notes
(a)	$3x + 12 + 10x - 2$	$13x + 10$	2	M1 for correct method to expand one bracket eg $3 \times x + 3 \times 4$ or $3x + 12$ or $2 \times 5x - 2 \times 1$ or $10x - 2$ A1 for $13x + 10$
(b)	$2x^2 - 8x + x - 4$	$2x^2 - 7x - 4$	2	M1 for all 4 terms (and no additional terms) correct ignoring signs or 3 out of no more than four terms correct A1 for $2x^2 - 7x - 4$
(c)		$3y(2y - 3x)$	2	B2 for $3y(2y - 3x)$ (B1 for $3(2y^2 - 3xy)$ or $y(6y - 9x)$ or $3y(2y + 3x)$ or $3y(2y - ax)$ where a is any positive integer except 3 or $3y(by - 3x)$ where b is any positive integer except 2)

Q18.

Question	Working	Answer	Mark	Notes
(a)		$6x^3 + 5x^2 - 17x - 6$	M1 M1 A1	for multiplying out two brackets with at least three terms out of four correct (dep M1) for a complete method cao
(b)		$\frac{7}{n^2}$	B1	oe

Q19.

Question	Working	Answer	Mark	Notes
(a)		Correct diagram	2	B2 cao (B1 for correct orientation)
(b)		Enlargement, sf 4, centre (0,1)	3	B1 for enlargement B1 for scale factor 4 B1 for centre (0, 1)

Q20.

Question	Working	Answer	Mark	Notes
(a)		$6ab - 7g$	2	M1 for $6ab$ or $-7g$ A1 cao
(b)		$3(2m - 3)$	1	B1 cao
(c)		t^5	1	B1 cao
(d)		$2xy(x + 2y)$	2	B2 cao (B1 for $xy(2x + 4y)$ or $2x(xy + 2y^2)$ or $2y(x^2 + 2xy)$ or $2xy(\dots)$ where (\dots) has two terms one of which is correct)
(e)	$w^2 - 5w - 5w + 25$	$w^2 - 10w + 25$	2	M1 for all 4 terms (and no additional terms) correct with or without signs or 3 out of no more than 4 terms correct with signs A1 cao

Q21.

Question	Working	Answer	Notes
		proof	C1 starts proof eg $n(n+1)$ or $(n - 1) \times n$ C1 $n(n+1) + n+1$ or $(n - 1) \times n + n$ C1 for convincing proof including $(n+1)^2$ or n^2

Q22.

PAPER: 1MA0_2H				
Question	Working	Answer	Mark	Notes
(a)	$\frac{(2x-3)(x-1)}{(x+6)(x-1)}$	$\frac{2x-3}{x+6}$	3	M1 for $(2x-3)(x-1)$ M1 for $(x+6)(x-1)$ A1 cao
(b)	$\frac{mb - tv}{vb} = \frac{m - t}{R}$ $mbR - tvR = mvb - tvb$ $mbR - mvb = tvR - tvb$ $m(bR - vb) = tvR - tvb$ OR $\frac{m}{v} - \frac{t}{b} = \frac{m}{R} - \frac{t}{R}$ $\frac{m}{v} - \frac{m}{R} = \frac{t}{b} - \frac{t}{R}$ $\frac{mR - mv}{vR} = \frac{tR - tb}{bR}$ $\frac{m(R - v)}{vR} = \frac{tR - tb}{bR}$	$m = \frac{tv(R - b)}{b(R - v)}$	4	M1 for putting LHS over a common denominator with at least one correct numerator (ignore signs) or for showing an intention to multiply each term on both sides by R or v or b M1 for rearranging correctly to isolate terms in m M1 for factorising with common factor m from 2 terms A1 for $m = \frac{tv(R - b)}{b(R - v)}$ oe

Q23.

Question	Working	Answer	Mark	Notes
		$2n^2 + n + 1$	M1 M1 A1	for a correct start to a method to find n th term, eg. equal 2nd differences imply a term in n^2 or sight of $an^2 + bn + c$ for a method leading to $2n^2$ and either n or 1 for $2n^2 + n + 1$ oe

Q24.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
(a)		-3 -2 -1 0 1 2 3 -5 8 9 4 -1 0 13	2	B2 for all 3 correct values (B1 for 2 correct values)
(b)			2	M1 (dep on B1) for plotting at least 6 values from their table A1 for a correct graph

Q25.

PAPER: 1MA0_2H				
Question	Working	Answer	Mark	Notes
		116	3	M1 for 80% or 0.8 seen oe or $\frac{464}{0.8}$ (=580) M1 for $\frac{464}{0.8} - 464$ A1 cao OR M1 for 80% or 0.8 seen oe M1 for $464 \div 4$ or $464 \div (80 \div 20)$ A1 cao

Q26.

PAPER: 1MA0_2H				
Question	Working	Answer	Mark	Notes
	Gradient of N = 3 Gradient of perpendicular to line N = $-\frac{1}{3}$	$y = -\frac{1}{3}x + 1$	3	M1 for complete method to find gradient of line N or for drawing a perpendicular line M1 for method to find the gradient of a perpendicular line A1 $y = -\frac{1}{3}x + 1$ oe

Q27.

Question	Working	Answer	Mark	Notes
(a)		Venn Diagram	B1 M1 M1 C1	for labels on diagram for just 15 in the intersection for just 5 and 25 in only set B or just 3, 9, 21 and 27 in only set A or just 1, 7, 11, 13, 17, 19, 23, 29 in $(A \cup B)'$ for all numbers correctly placed in the Venn Diagram Ignore all entries except the region you are marking for each method mark
(b)		$\frac{7}{15}$	P1 A1	ft for $\frac{7}{a}$ where $a \geq 7$ or $\frac{b}{15}$ where $b \leq 15$ ft $\frac{7}{15}$ oe

Q28.

Question	Working	Answer	Mark	Notes
		$7.3 \leq x < 7.4$	B2 (B1)	cao (for 7.3 and 7.4)

Q29.

Question	Working	Answer	Mark	Notes
18 (a)	values 0, 2, 5, 10, 18	130	M1 M1	for starting to find area under the curve, eg $0.5 \times 5 \times 2 (= 5)$ for a complete method to find the area under the curve using 4 strips of equal width, eg $5 + 0.5 \times 5 \times (2+5) (= 17.5) + 0.5 \times 5 \times (5+10) (= 37.5) + 0.5 \times 5 \times (10+18) (= 70)$
(b)		overestimate with reason	A1 C1	for 130 or answer in range 130.1 to 132 supported by accurate working for "overestimate" and appropriate reason linked to method eg area between trapeziums and curve also included

Q30.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
*	eg $2a + 3c = 28.2$ $3a + 5c = 44.75$ $6a + 9c = 84.6$ $6a + 10c = 89.5$ $c = 4.9$ $2a + 14.7 = 28.2$ $2a = 13.5$ $a = 6.75$	Adult ticket £6.75 Child ticket £4.90	5	M1 for correctly stating both equations algebraically M1 for correct process to eliminate one variable (condone one arithmetic error) M1 (dep) for correct substitution of their found value to find other variable OR (indep) correct process to eliminate second variable (condone one error in arithmetic) A1 for 6.75 or 4.9 C1 for Adult ticket £6.75 and Child ticket £4.90 in correct money notation

Q31.

Paper 1MA1: 2H			
Question	Working	Answer	Notes
(a)		3 to 4	C1 for a tangent drawn at $t = 6$ B1 for answer in range 3 to 4
(b)		452	C1 for splitting the area into 3 strips and a method of finding the area of one shape under the graph, eg. $\frac{1}{2} \times 4 \times 35 (= 70)$ M1 for complete process to find the area under the graph, eg "70" + $\frac{1}{2} \times 4 \times (35 + 51) (= 172) + \frac{1}{2} \times 4 \times (51 + 54) (= 210) [= 452]$ A1 for 452

Q32.

PAPER: 5MB3H_01					
Question	Working	Answer	Mark	Notes	
(a)		-2, -1, 0, 1, 2	2	B2 for -2, -1, 0, 1, 2 (B1 for one error or omission)	
(b)		$x > 3$	2	M1 for isolating either the constant terms or algebraic terms or for $x = 3$ A1 cao	

Q33.

PAPER: 5MB3H_01				
Question	Working	Answer	Mark	Notes
		$x = 0.4, y = -2$	4	M1 for a correct method leading to either x or y (condone one error) A1 for $x = 0.4$ or $y = -2$ M1 for a correct substitution into one of the equation or a correct method leading to the second value A1 cao

Q34.

Paper 1MA1: 2H			
Question	Working	Answer	Notes
(a)		0.4	B1 For 0.4 oe
(b)		0.586	B1 for 3.48207..... or 17.34 or 0.200811... B1 for 0.585 to 0.586

Q35.

Question		Working	Answer	Mark	Notes
	(a)		5 and 6	2	M1 for evidence that ($x =$) 4, 5, 6 or evidence that ($y =$) 5, 6, 7, 8 A1 cao
	(b)		Region identified	4	M1 for two of the lines $y = -1$, $y = 3x - 1$ and $y = 4 - x$ drawn M1 for three of the lines $y = -1$, $y = 3x - 1$ and $y = 4 - x$ drawn M1 any correct shading (in or out) satisfying at least two of the inequalities where the shading must extend from the appropriate line A1 Fully correct region shown by either shading in, shading out or the use of R Accept lines that are solid or dashed

Q36.

PAPER: IMA0 2H					
Question		Working	Answer	Mark	Notes
	(a)		7.5	3	M1 for $4.5^2 + 6^2 (=56.25)$ M1 for $\sqrt{56.25}$ or $\sqrt{(4.5^2 + 6^2)}$ A1 for 7.5
	(b)		217	4	M1 for use of appropriate trig ratio eg $\tan CAB = \frac{4.5}{6}$ (= 0.75), $\sin CAB = \frac{4.5}{\text{"7.5"}} (= 0.6)$, $\cos CAB = \frac{6}{\text{"7.5"}} (= 0.8)$ M1 for inverse trig shown correctly eg $CAB = \tan^{-1} \frac{4.5}{6}$ (= 0.75), $CAB = \sin^{-1} \frac{4.5}{\text{"7.5"}} (= 0.6)$, $CAB = \cos^{-1} \frac{6}{\text{"7.5"}} (= 0.8)$ A1 for 36.8 to 37 (or 53 to 53.2 if identified as ACB) B1ft for bearing $180 + \text{"36.8"}$ if "36.8" is not 40-50 eg 216.8 to 217

Q37.

Question	Working	Answer	Mark	Notes
		30.1	4	<p>M1 for a correct trigonometric statement to find an unknown angle, eg. $\sin(30+x)$ or $\cos A = \frac{10.4+5.2}{18}$ or $\frac{\sin ADC}{18} = \frac{\sin 30}{10.4}$</p> <p>M1 for a complete method to find the angle, eg. $\sin^{-1}\left(\frac{10.4+5.2}{18}\right)$ ($= 60.07\dots$) or $\cos^{-1}\left(\frac{10.4+5.2}{18}\right)$ ($= 29.92\dots$) or $\sin^{-1}\left(\frac{18 \times \sin 30}{10.4}\right)$ ($= 59.92\dots$ or $180 - 59.92\dots = 120.07\dots$)</p> <p>M1 (dep on M2) for a fully complete method to find angle x, eg. "60.07." - 30 or $60 - "29.92\dots"$ or $90 - "59.92\dots"$</p> <p>A1 for answer in the range 30.07 to 30.1</p> <p>OR</p> <p>M1 for $(BC^2 =) 18^2 - (10.4 + 5.2)^2$ or $BC^2 + (10.4 + 5.2)^2 = 18^2$ M1 for $(BC =) \sqrt{18^2 - (10.4 + 5.2)^2}$ ($= 8.97\dots$) M1 (dep on M2) for a fully complete method to find angle x, eg. $\tan^{-1}\left(\frac{5.2}{8.97\dots}\right)$</p> <p>A1 for answer in the range 30.07 to 30.1</p>

Q38.

Question	Working	Answer	Mark	Notes
		31.1	5	<p>M1 for $\frac{1}{2} \times 8.4 \times x \times \sin 40 = 100$</p> <p>M1 for $100 \div (0.5 \times 8.4 \times \sin 40)$ ($= 37.041\dots$)</p> <p>M1 (dep on 1st M1) for substituting the appropriate figures into the cosine rule eg $8.4^2 + 37.041^2 - 2 \times 8.4 \times 37.041 \times \cos 40^\circ$</p> <p>M1 (dep on previous M1) for correct order of evaluation or $(c^2 =) 965.897\dots$</p> <p>A1 31.07 - 31.1</p>

Q39.

	Working	Answer	Mark	Notes
		15.0	3	<p>M1 for $8^2 + 8^2 - 2 \times 8 \times 8 \times \cos 140$</p> <p>M1 (dep) for correct order of evaluation or 226.05...</p> <p>A1 for answer in range 15.0 - 15.04</p> <p>OR</p> <p>M1 for $\frac{PR}{\sin 140} = \frac{8}{\sin\left(\frac{180-140}{2}\right)}$</p> <p>M1 for $PR = \frac{8}{\sin\left(\frac{180-140}{2}\right)} \times \sin 140$</p> <p>A1 for answer in range 15.0 - 15.04</p> <p>OR</p> <p>M1 for $8 \times \sin 70$ or $8 \times \cos 20$</p> <p>M1 for $2 \times 8 \times \sin 70$ or $2 \times 8 \times \cos 20$</p> <p>A1 for answer in range 15.0 - 15.04</p>

Q40.

Question	Working	Answer	Mark	Notes
		1.03	P1	for process to find the mass of either A or C, e.g. $7 \times 1.42 (= 9.94)$ or $(7 + 125) \times 1.05 (= 138.6)$
			P1	(dep) for a complete process to find the density of B, e.g. $(“138.6” - “9.94”) \div 125$
			A1	for answer in the range 1.029 to 1.03

Q41.

Question	Working	Answer	Notes
(a)		36.4	<p>P1 start process eg method to find area of trapezium</p> <p>P1 complete process to find volume of tank</p> <p>P1 process to find time eg volume $\times 1000 \div 300$</p> <p>P1 process to find 85% of volume or of time</p> <p>A1 for 36.4 or 36 mins 24 secs</p>
(b)			<p>C1 explanation eg if the average rate was slower it would take more time, if the average rate was faster it would take less time</p>

Q42.

PAPER: 1MA0 2H				
Question	Working	Answer	Mark	Notes
*	Distance \div speed: $30 \div 70$ $(= 0.42-0.43)$; Distance \div time: $30 \div 26$ $(=1.15\dots)$; Speed \times time: $= 70$ $\times 26$ $(=1820$ mins); mph to miles/min $= 70 \div 60$ $(=1.16-1.17)$; Minutes to hours is $26 \div 60$ $(=0.43\dots)$	No with correct figure	3	M1 for a calculation which uses the Time \times Speed = Distance relationship OR a conversion of units eg between hours & minutes or between mph & miles per min M1 for a calculation involving both of the above C1 for “no” with a correct calculation, with units, from working: 25.2-25.8 minutes, 30.1-30.8 miles, 69-69.3 mph NB: $70 \div 26 \times 30$ as a single stage calculation gets 0 marks

Q43.

PAPER: 1MA0/2H				
Question	Working	Answer	Mark	Notes
(a)		$y^2 + 7y + 10$	2	M1 for all 4 terms (and no additional terms) correct ignoring signs or 3 terms correct A1 for $y^2 + 7y + 10$
(b)		$(e - 3)(e + 4)$	2	M1 for $(e \pm 3)(e \pm 4)$ A1 for $(e - 3)(e + 4)$
(c)		0.77, -0.43	3	M1 for $\frac{- -1 \pm \sqrt{(-1)^2 - 4 \times 3 \times -1}}{2 \times 3}$ (condone one sign error) M1 for $\frac{1 \pm \sqrt{13}}{6}$ A1 for one answer in the range 0.767 to 0.77 and one answer in the range -0.43 to -0.4343

Q44.

Question	Answer	Mark	Mark scheme	Additional guidance
	905	P1	for correct use of formula for the volume of a sphere eg $\frac{1}{4} \times \frac{4}{3} \times \pi \times r^3 (= 576\pi \text{ or } 1809\dots)$ OR $576\pi \times 4 \text{ or } 2304\pi \text{ or } 7238\dots (= \frac{4}{3} \times \pi \times r^3)$	We do not need to see what is in the brackets to award this mark. The contents of the bracket alone would score P0
		P1	for a complete correct process to find r , eg $r = \sqrt[3]{\frac{576 \times 4 \times 3}{4}} \text{ or } r = 12$	Could be shown in several stages $\sqrt[3]{\frac{576 \times 4 \times 3}{4}} = \sqrt[3]{1728}$
		P1	for a process to find the curved surface area eg $\frac{4 \times \pi \times [\text{radius}]^2}{4} (= 144\pi \text{ or } 452\dots)$ OR the surface area of both flat surfaces eg $(2 \times \frac{\pi \times [\text{radius}]^2}{2})$ OR complete expression for the total surface area eg $\frac{4\pi r^2}{4} + \frac{\pi r^2}{2} \times 2 \text{ oe}$	Radius used must be clearly identified as their radius of the solid
		P1	for process to find the complete surface area eg $\frac{4 \times \pi \times [\text{radius}]^2}{4} + (2 \times \frac{\pi \times [\text{radius}]^2}{2})$	
		A1	answer in the range 904.7 – 905 or 288π (SCB2 for an answer in the range 358.1 – 359.2)	If an answer is given in the range but then incorrectly rounded, award full marks.

Q45.

Paper 1MA1: 2H			
Question	Working	Answer	Notes
		203	P1 translate into algebra for rectangle: $4x + 4x + 3x + 4 + 3x + 4$ ($= 14x + 8$) or for trapezium: $5x + 5x + x - 3 + 7x - 3$ ($= 18x - 6$) P1 equating: eg. $18x - 6 = 14x + 8$ ($4x = 14$) A1 solving for x : $x = 14/4 = 3.5 \text{ oe}$ P1 process to find area: “3.5” $\times 3 + 4$ (ft) or “3.5” $\times 4$ ft A1 cao

Q46.

Question	Working	Answer	Mark	Notes
	Note $DOC=DOA$, $ADO=CDO$	21.6	P1 P1 P1 P1 A1	Recognises that OAD or OCD is 90° or right angle for using trigonometry to set up an equation in DOA or ADO eg $\cos DOA = \frac{5}{9}$ for using inverse trigonometry to find DOA or ADO eg $DOA = \cos^{-1} \frac{5}{9}$ ($= 56.25\dots$) for a complete process to find arc length ABC or AC eg $\frac{360-2 \times 56.25}{360} \times 2 \times \pi \times 5$ ($= 21.598\dots$) or $\frac{2 \times 56.25}{360} \times 2 \times \pi \times 5$ ($= 9.8174\dots$) for answer in the range 21.5 to 21.65

Q47.

Paper 1MA1:3H				
Question	Working	Answer	Notes	
		Proof	B1 state the difference of two squares in algebraic notation eg $p^2 - q^2$ M1 for writing down expressions for the two different numbers eg $6n + 1$ and $6m + 1$ M1 for expanding one bracket to obtain 4 terms with all 4 correct without considering signs or for 3 terms out of 4 correct with correct signs A1 for $36(m^2 - n^2) + 12(n - m)$ oe M1 (dep M2) for extracting a factor of 12 from their expression C1 for fully correct working with statement justifying $(n - m)(3(n + m) + 1)$ as a multiple of 2 eg considering odd and even combinations	

Q48.

Question	Working	Answer	Mark	Notes
(a)		Shown	M1 A1	for method to establish at least one root in (2, 3), e.g. $f(x) = x^3 - 3x^2 + 3$, $f(2) (= -1)$, $f(3) (= 3)$ oe for supportive explanation e.g. “since there is a change in sign there must be at least one root in $2 < x < 3$ (as f is continuous)” oe
(b)		Shown	C1	for at least $x^3 = 3x^2 - 3$ and no incorrect steps.
(c)		2.153	M1 A1 A1	for $x_1 = \sqrt[3]{3 \times 2^2 - 3}$ for $x_1 = 2.080(\dots)$ for $x_2 = 2.153(\dots)$

Q49.

Question	Working	Answer	Mark	Notes
		6.55	5	<p>P1 process to find area of sector AOB</p> $\frac{80}{360} \times \pi \times 30^2 (= 200\pi)$ <p>P1 process to find area of triangle AOB</p> $\frac{1}{2} \times 30^2 \times \sin 80 (= 443\dots)$ <p>P1 process to find segment area</p> $\frac{80}{360} \times \pi \times 30^2 - \frac{1}{2} \times 30^2 \times \sin 80$ <p>P1 process to find percentage</p> $\left(\frac{80}{360} \times \pi \times 30^2 - \frac{1}{2} \times 30^2 \times \sin 80 \right) \div \pi \times 30^2 \times 100$ <p>A1 answer in range 6.5-6.6</p>

Q50.

Question		Working	Answer	Mark	Notes
				4	<p>C1 draws AO and OC and considers angles around the point O (algebraic notation may be used, e.g. angles labelled x and y)</p> <p>C1 uses "angle at centre..." to find angle ABC (e.g. $\frac{1}{2}x$) or angle ADC (e.g. $\frac{1}{2}y$)</p> <p>C1 for $ABC + ADC = \frac{1}{2}x + \frac{1}{2}y$</p> <p>C1 complete proof with all reasons given, e.g. <u>angles at a point</u> add up to 360°, the <u>angle at the centre</u> of a circle is <u>twice the angle at the circumference</u></p> <p>NB: do not accept "opposite angles of a cyclic quadrilateral add up to 180°"</p>

Q51.

Paper: 5MB3H_01					
Question	Working	Answer	Mark	Notes	
		proof	4	<p>B1 for $\overrightarrow{AM} = 0.5\mathbf{b}$ or $\overrightarrow{MC} = 0.5\mathbf{b}$ or $\overrightarrow{BC} = \mathbf{a}$ or $\overrightarrow{CX} = \mathbf{a}$ or $\overrightarrow{BX} = 2\mathbf{a}$ Note: This could be shown on the diagram or in a correct vector expression M1 for a correct relevant vector expression for \overrightarrow{OM} or \overrightarrow{MX} or \overrightarrow{OX} eg $\overrightarrow{OM} = \overrightarrow{OA} + \overrightarrow{AM}$ or $\overrightarrow{OX} = \mathbf{b} + 2\mathbf{a}$ A1 for any two from $(\overrightarrow{OM}) = \mathbf{a} + 0.5\mathbf{b}$, $(\overrightarrow{MX}) = \mathbf{a} + 0.5\mathbf{b}$ and $(\overrightarrow{OX}) = \mathbf{b} + 2\mathbf{a}$ B1 for a fully correct proof, eg. "$\overrightarrow{OX} = 2\overrightarrow{OM}$ so the vectors are parallel and have a common point O"</p> <p>OR (geometric proof) M1 for $\angle OAM = \angle MCX$ or $OA = CX$ and $AM = CM$ A1 for $\angle OAM = \angle MCX$ with reason (alternate angles) and $OA = CX$ and $AM = CM$ B1 for $\triangle OAM \equiv \triangle XCM$ with reason, eg SAS B1 for correct proof, eg $\angle AMO = \angle CMX$ with reason (vertically opposite angles)</p>	

Q52.

Question	Working	Answer	Mark	Notes
		proof	B1 M1 A1 C1	<p>for $\overrightarrow{BC} = 2b - 3a$ or $\overrightarrow{CB} = 3a - 2b$ or $\overrightarrow{BE} = 6b$</p> <p>for a correct vector expression for \overrightarrow{AD} or \overrightarrow{DE}, or \overrightarrow{AE}</p> <p>e.g. $\overrightarrow{AD} = \overrightarrow{AB} + \frac{3}{4} \overrightarrow{BC}$ or $\overrightarrow{AD} = \overrightarrow{AC} + \frac{1}{4} \overrightarrow{CB}$ or $\overrightarrow{DE} = \frac{3}{4} \overrightarrow{CB} + \overrightarrow{BE}$, or $\overrightarrow{AE} = \overrightarrow{AB} + 3 \overrightarrow{AC}$</p> <p>for $\overrightarrow{AD} = \frac{3}{4}(2b + a)$ and $\overrightarrow{DE} = \frac{9}{4}(2b + a)$ or $\overrightarrow{AE} = 3(2b + a)$</p> <p>with either $\overrightarrow{AD} = \frac{3}{4}(2b + a)$ or $\overrightarrow{DE} = \frac{9}{4}(2b + a)$</p> <p>for a fully correct proof, eg $\overrightarrow{DE} = 3 \overrightarrow{AD}$, so the vectors are parallel and have point D in common</p>

Q53.

Question	Working	Answer	Mark	Notes
		$y = -4x + 5$	5	<p>P1 for appropriate process to find gradient e.g. $\frac{12-7}{11-9} (= \frac{1}{4})$</p> <p>P1 process to find y coordinate $7 + \frac{2}{5} \times 5 (= 9)$ or x coordinate $-9 + \frac{2}{5} \times 20 (= -1)$</p> <p>P1 method to find gradient of line L $\frac{-1}{\frac{1}{4}} (= -4)$</p> <p>M1 substitution of found values for x, y and m into equation for straight line</p> <p>A1 $y = -4x + 5$</p>

Q54.

Question	Working	Answer	Mark	Notes
(a)		(0,1)	B1	(0,1)
(b)		Circle radius 4 Centre (3,0) and (-1,0) and (7,0) labelled	M1	For centre (3,0) implied by drawing or label or a circle of radius 4 or intersections on the x-axis at -1 or 7 implied by drawing or labels
			M1	for 2 of centre (3,0) implied by drawing or label intersections on the x-axis at -1 and 7 implied by drawing or label circle drawn with radius 4
			A1	for a fully correct answer

Q55.

Question	Working	Answer	Mark	Notes
(a)		Graph drawn	2	B2 correct graph drawn (B1 for a graph translated up/down)
(b)		Graph drawn	2	B2 for correct graph drawn (B1 for a graph reflected in the x axis or stretched by sf 2 parallel to the y axis)

Q56.

Question	Working	Answer	Mark	Notes
		$y = 0.4x - 17.4$	P1	for process to find p , e.g. $\sqrt{261-15^2}$
			P1	for process to find gradient of OA , e.g. $-15 \div 6 (= \frac{-5}{2})$
			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

Q57.

Question	Working	Answer	Mark	Notes
		68.5	B1	for angle $OAB = 90^\circ$ or angle $OCB = 90^\circ$, may be seen on diagram
			P1	for a process to find the length of AB or the length of CB ($= 10\sqrt{3}$ oe) eg $10 \times \tan 60^\circ (= 17.3\dots)$ or the length of $OB (= 20)$, eg $10 \div \cos 60^\circ$
			P1	for a process (dep previous P1) to find the area of the triangle OAB ($= 50\sqrt{3}$ oe) or area of triangle OCB ($= 50\sqrt{3}$ oe) or area of kite $OABC$ ($= 100\sqrt{3}$ oe)
			P1	for a process to find the area of the sector OAC e.g. $\frac{1}{3} \times \pi \times 10^2 (= 104.7\dots)$, accept rounded or truncated to 3 significant figures or more
			A1	for 68.4 – 68.6