International GCSE Maths 4MA1 1HR				
Q	**Working**	**Answer**	**Mark**	**Notes**
1	20 × 14 (= 280)	460	4	M1
	$\frac{20+16}{2} \times (24-14)$ (= 180)			M1
	"280" + "180"			M1 (dep) on at least one of the previous M marks
				A1
				Total 4 marks
	Alternative scheme 1			
	(24 +14)÷2 (= 19) **and** (20−16)÷2 (=2)	460	4	M1
	2 × 19 (= 38) **and** 16 × 24 (= 384)			M1
	"38" + "38" + "384"			M1 (dep) on at least one of the previous M marks
				A1
				Total 4 marks
	Alternative scheme 2			
	20 × 24 (= 480)	460	4	M1
	(20−16)÷2 (=2) **and** 24 − 14 (= 10) 2 × 10 = 20			M1
	"480" – "20"			M1 (dep) on at least one of the previous M marks
				A1
				Total 4 marks

2	$1 \times 5 + 3 \times 9 + 5 \times 24 + 7 \times 40 + 9 \times 7$ (= 495) **or** 5 + 27 + 120 + 280 + 63 (= 495)	5.8	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
	"495" ÷ 85			M1	dep on at least M1 Allow division by their $\sum f$ provided addition or total under column seen
				A1	for 5.8 − 5.824
					Total 4 marks

3	(a)		Correct **R** (5,6), (3,6), (3,5)	2	B2 fully correct If not B2 then B1 for correct orientation of **R** but in wrong position
	(b)		Correct **T** (2,−1), (2,−3), (1,−3)	1	B1
					Total 3 marks

4	675 ÷ (5 + 4) × 5 (= 375)	225	3	M1	M2 675 ÷ (5 + 4) × 3
	"375" ÷ 5 × 3			M1 dep M1	
				A1	
					Total 3 marks

<table>
<tr><td>5</td><td>For example,<table><tr><th>n</th><th>E</th></tr><tr><td>1</td><td>7</td></tr><tr><td>2</td><td>11</td></tr><tr><td>3</td><td>17</td></tr><tr><td>4</td><td>25</td></tr><tr><td>5</td><td>35</td></tr></table></td><td>No + reason</td><td>2</td><td>M1</td><td>for evaluating E correctly for any value of n</td></tr>
<tr><td></td><td></td><td></td><td></td><td>A1</td><td>for No with E evaluated correctly as a non-prime number</td></tr>
<tr><td></td><td></td><td></td><td></td><td colspan="2">Total 2 marks</td></tr>
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<tr><td>6</td><td>Angle EBG = 180 – 2 × 65 (= 50) or
Angle ABE = 180 − (38 + 65) (= 77)</td><td>27</td><td>3</td><td>M1</td><td></td></tr>
<tr><td></td><td>Angle ABE = 180 − (38 + 65) (= 77) and
Angle ABG = “77” – “50”</td><td></td><td></td><td>M1</td><td>for a complete method to find angle ABG</td></tr>
<tr><td></td><td></td><td></td><td></td><td>A1</td><td></td></tr>
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<tr><td></td><td>Alternative scheme 1</td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td>Angle EBG = 180 – 2 × 65 (= 50) or
Angle EBC = 103</td><td>27</td><td>3</td><td>M1</td><td></td></tr>
<tr><td></td><td>Angle EBC = 103 and
Angle ABG = 180 – (103 + ”50”)</td><td></td><td></td><td>M1</td><td>for a complete method to find angle ABG</td></tr>
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7	(a)		$4n + 2$	2	M1	for $4n + k$ (k may be 0 or absent) oe
					A1	oe e.g $6 + (n - 1)4$
	(b)		$4n + 6$	1	B1	oe ft part (a) providing M1 in part (a) is awarded e.g $4 (n + 1) + 2$
						Total 3 marks

8	(a)		1.39×10^6	1	B1	
	(b)		5×10^{-3}	1	B1	
						Total 2 marks

9	$2.5 - 0.6 = 1.9$	2 hours 51 minutes	4	M1	
	$3 \times 12 \times$ "1.9" (= 68.4)			M1	for using length × width × height to find a volume
	"68.4" × 1000 ÷ 400 (= 171 minutes)			M1	for their volume × 1000 ÷ 400
				A1	
					Total 4 marks
	Alternative scheme				
	$250 - 60 = 190$	2 hours 51 minutes	4	M1	
	$300 \times 1200 \times$ "190" (= 6.84×10^7)			M1	for using length × width × height to find a volume
	"6.84×10^7" ÷ 10^6 × 1000 ÷ 400 (= 171 minutes)			M1	for their volume ÷ 10^6 × 1000 ÷ 400
				A1	
					Total 4 marks

10	$16x = 32$ or $32y = 144$	(2, 4.5)	3	M1	for a correct sequence of operations which leads to 1 equation in one unknown, allowing one arithmetical error
	$3 \times$ '2' $+ 2y = 15$ or $3x + 2 \times$ '4.5' $= 15$			M1	(dep) substitute found value of one variable in one equation
				A1	
					Total 3 marks

11	72×1000 (= 72000) or $72 \div 60$ (= 1.2) or $72 \div 60 \div 60$ (= 0.02) or $60 \div 60 \times 1000$ (= 3.6)	20	3	M1	for at least **one** of $\times 1000$ or $\div 60$
	$\frac{72}{60 \times 60} \times 1000$			M1	(dep) for a complete method
				A1	
					Total 3 marks

12	(a)	$6 \times 25 + 6 \times 45$ (= 150 + 270 = 420)	20	4	M1	for 6×25 (=150) or 6×45 (=270)
		"150" + "270" – 350 (= 70) or "420" – 350			M1	
		$\frac{"70"}{350} \times 100$			M1	(dep on M2)
					A1	
		Alternative scheme				
		$6 \times 25 + 6 \times 45$ (= 150 + 270 = 420)	20	4	M1	for 6×25 (=150) or 6×45 (=270)
		$\frac{"420"}{350} \times 100 = 120$			M1	
		"120" – 100			M1	(dep on M2)
					A1	
	(b)	$500\,000 \div 8$ (=62 500)	6 250 000	3	M1	
		$500\,000 \div 8 \times 100$			M1	for a complete method
					A1	
						Total 7 marks

13	$\frac{1}{3}+\frac{1}{5}$ (= $\frac{8}{15}$) or 0.53... or 53.3.....% or 53%	900	4	M1
	1– "$\frac{8}{15}$" (= $\frac{7}{15}$) or 0.46..... or 0.47 or 46.6...% or 47%			M1
	420 ÷ "$\frac{7}{15}$" (= 900) oe			M1
				A1
				Total 4 marks

14	(a)		$8e^6f^9$	2	B2 B1 for 2 correct terms in a product of 3 terms
	(b)	$3x^2+9xy-4yx-12y^2$	$3x^2+5xy-12y^2$	2	M1 M1 for 3 correct terms out of 4 **or** for 4 correct terms ignoring signs **or** for $3x^2+5xy+c$ for any non zero value of c **or** for $d+5xy-12y^2$ for any non zero value of d
					A1
	(c)	$a^{\frac{1}{2}}\times a=a^{\frac{3}{2}}$ or $\frac{a}{a^{-2}}=a^3$ or $\frac{a^{\frac{1}{2}}}{a^{-2}}=a^{\frac{5}{2}}$	$\frac{7}{2}$	2	M1 for one correct step
					A1 oe
	(d)	$\frac{2^n-1}{(2^n-1)(2^n+1)}$	$\frac{1}{2^n+1}$	2	M1 for $(2^n-1)(2^n+1)$
					A1
					Total 8 marks

15 (a)			$\frac{9}{20}$ on first red branch	3	B1
			Correct binary structure		B1
		$\frac{9}{16}, \frac{7}{16}, \frac{9}{16}, \frac{7}{16}$	Labels and correct probabilities on all second branches		B1
(b)		$\frac{'9'}{20} \times \frac{'7'}{16}$	$\frac{63}{320}$ or 0.196(875)	2	M1
					A1 oe ft diagram Accept 0.20 or better
(c)		$\frac{'9'}{20} \times \frac{'7'}{16} + \frac{11}{20} \times \frac{9}{16}$	$\frac{162}{320}$ or 0.506(25)	3	M1 for $\frac{11}{20} \times \frac{9}{16}$
					M1 for $\frac{'9'}{20} \times \frac{'7'}{16} + \frac{11}{20} \times \frac{9}{16}$
					A1 oe Accept 0.51 or better
					Total 8 marks

16 (a)	$x(x+4)=12(12+x)$	Shown	3	M1	
	$x^2+4x=144+12x$			M1	for at least one correct expression
				A1	for completion
(b)	$x=\frac{--8\pm\sqrt{(-8)^2-4\times1\times(-144)}}{2}$ or $\frac{8\pm\sqrt{8^2-4\times1\times(-144)}}{2}$ or $\frac{8\pm\sqrt{-8^2-4\times1\times(-144)}}{2}$	20.6	4	M1	M1 for correctly substituting into the quadratic formula condone one sign error in substitution; allow partial correct evaluation
	$\frac{8\pm\sqrt{640}}{2}$ **or** $\frac{--8\pm\sqrt{(-8)^2--576}}{2\times1}$ **or** $\frac{8\pm8\sqrt{10}}{2}$ NB denominator must be 2×1 or 2 **and** there must be evidence for correct order of operations in the numerator Allow + instead of ± in the formula			M1	If the first M1 is awarded and an answer of 16.6.... or $4+4\sqrt{10}$ seen award this M mark
				A1	(dep on M1) 16.6….
				B1	(dep on M1) 20.6 - 20.65 ft
					Total 7 marks

17	FDs are 2, 3, 2.8, 0.7, 0.8	Correct histogram	3	M1	for any two correct FD calculations (can be implied by at least two correct bars)
				M1	for any three correct FDs (can be implied by at least three correct bars)
				A1	fully correct histogram
				(SC: B2 for all five bars of correct width with heights in the correct ratio)	
				(SC:B1 for three bars of correct width with heights in the correct ratio)	
					Total 3 marks

18	$SQ^2 = 8^2 + 12^2 - 2\times 8\times 12\times \cos 120^o$	91.4	6	M1	If this mark is awarded then ft on the remaining M marks
	$(SQ) = \sqrt{304}$			M1	for correct order of operations e.g. 64 + 144 + 96 or 304 or 17.4…. or $4\sqrt{19}$
	$\frac{\sin R}{"\sqrt{304}"} = \frac{\sin 27^\circ}{9}$			M1	
	$R = sin^{-1}\left(\frac{\sin 27^\circ \times "\sqrt{304}"}{9}\right)$			M1	can be implied by 61.5833...
	61.58			A1	for 61.58 - 61.6
				B1	ft dep M3 180 – "61.6" – 27
					Total 6 marks

19	$\frac{dy}{dx} = 3x^2 - 27$	108		M1	for at least one of $3x^2$ or 27
	$3x^2 - 27 = 0$			M1	(dep) for a 2 or 3 term quadratic =0
	$x = \pm 3$			A1	
	When $x = -3$, $b = (-3)^3 - 27(-3) + k$ $(= 54 + k)$ When $x = 3$, $d = 3^3 - 27(3) + k$ $(= -54 + k)$			M1	for either substituting $x = 3$ or $x = -3$ into the y expression. Only award this mark if k or a number representing k is in the expression for b or d
	$b - d = 54 + k - (-54 + k)$			M1	dep on all previous M marks Expressions for b and d must have k or the same number representing k
				A1	
					Total 6 marks

20	$h = f\left(\frac{x+1}{2}\right) = 1 + \frac{1}{\frac{x+1}{2}}$ $\left(= 1 + \frac{2}{x+1}\right)$	$\frac{2}{x-1} - 1$ or $\frac{3-x}{x-1}$	4	M1	for $1 + \frac{1}{\frac{x+1}{2}}$
	$\left(y = 1 + \frac{2}{x+1}\right)$ $y - 1 = \frac{2}{x+1}$ or $y(x+1) = 1(x+1) + 2$			M1	(dep on M1) for a correct first step to change the subject
	$x + 1 = \frac{2}{y-1}$ or $xy - x = 3 - y$			M1	(dep on M1)
	$x = \frac{2}{y-1} - 1$ or $x = \frac{3-y}{y-1}$			A1	oe
					Total 4 marks
	Alternative scheme				
	$h = f\left(\frac{x+1}{2}\right) = 1 + \frac{1}{\frac{x+1}{2}}$ $\left(= 1 + \frac{2}{x+1} = \frac{x+3}{x+1}\right)$	$\frac{3-x}{x-1}$	4	M1	for $1 + \frac{1}{\frac{x+1}{2}}$
	$\left(y = \frac{x+3}{x+1}\right)$ $y(x+1) = (x+3)$			M1	(dep on M1) for a correct first step to change the subject
	$xy - x = 3 - y$			M1	(dep on M1)
	$x = \frac{3-y}{y-1}$			A1	oe
					Total 4 marks
Note: Allow candidates to swap *x* and *y* when finding the inverse					

21	(a)	$x(x^2-1)$ or $(x^2-x)(x+1)$	$x^3 - x$	1	B1 for correct expansion of a pair of brackets and then $x^3 - x$ written down
	(b)	(One of the numbers) is even **or** multiple of 2 **or** 2 is a factor	Proof	3	M1
		(One of the numbers) is a multiple of 3 **or** 3 is a factor			M1
		Hence a multiple of 6			A1
					Total 4 marks

22	$\frac{4}{3}\times\pi\times R^3-\frac{4}{3}\times\pi\times1.2^3$ or $\frac{4}{3}\times\pi\times(1.2+t)^3-\frac{4}{3}\times\pi\times1.2^3$	3.9	5	M1	for an expression for the volume of the inner sphere
	$\left(\frac{4\pi}{3}R^3-\frac{4}{3}\times\pi\times1.2^3\right)\times2700=1980$			M1	
	$\frac{4\pi}{3}R^3=\frac{4}{3}\times\pi\times1.2^3+\frac{1980}{2700}$ = 7.238229474 + 0.7333333 = 7.97(1562807)			M1	for a correct expression **or** sight of 7.23(8229474) + 0.73(33333) **or** sight of 7.97(1562807)
	$R=\sqrt[3]{\left(\frac{3}{4\pi}\times(\frac{4}{3}\times\pi\times1.2^3+\frac{1980}{2700})\right)}$ =1.2392… 1.2392 − 1.2 = 0.0392			M1	for a correct expression **or** sight of $\sqrt[3]{1.90(3070437)}$ **or** sight of 1.23(9229151) **or** sight of 0.0392(29151)
				A1	for 3.9 – 3.92
					Total 5 marks

23	(First term = 3 and last term = 999) or a = 3 and d = 3	166 833	4	M1	
	999 ÷ 3 (= 333)			M1	for finding the number of terms Allow 1000÷3 = 333.3 = 333
	Sum = $\frac{333}{2}(3+999)$ or Sum = $\frac{333}{2}(2\times3+(333-1)3)$			M1	for using a correct method to find the sum
				A1	
					Total 4 marks