International GCSE Maths				
Apart from Questions 2, 5, 7, 12c, 17, 18 and 19 the correct answer, unless clearly obtained by an incorrect method, should be taken to imply a correct method				
Q	**Working**	**Answer**	**Mark**	**Notes**
1 (a)		9	1	B1 allow 3^9
(b)		21	1	B1 allow 5^{21}
(c)	$8 + 2 - p = 6$ oe eg $8 + 2 = 6 + p$ or $7^{8+2-p} = 7^6$ oe		2	M1 (or embedded eg $8 + 2 = 10$, $10 - 4 = 6$)
	Correct answer scores full marks (unless from obvious incorrect working)	4		A1 allow 7^4
				Total 4 marks

2	$4 \times (5 - x)$ **or** $5 \times (2x - 1)$ **or** $20 - 4x$ **or** $10x - 5$ oe			4	M1	for setting up a correct algebraic expression for area *A* or area *B* (could be seen as part of an equation) (condone lack of brackets for multiplying if meaning is clear for this mark only)
	one from: $4(5 - x) = 20 - 4x$ or $2 \times 4(5 - x) = 40 - 8x$ or $0.5 \times 4(5 - x) = 10 - 2x$ oe	**and** one from: $5(2x - 1) = 10x - 5$ or $2 \times 5(2x - 1) = 20x - 10$ or $0.5 \times 5(2x - 1) = 5x - 2.5$ oe			M1	for expanding 2 sets of brackets correctly (one for each shape) [allow ×2 or ÷2 for the wrong shape for this mark] Need not be in an equation at this stage.
	eg $10x + 8x = 40 + 5$ **or** $-5 - 40 = -10x - 8x$ **or** $18x = 45$ **or** $-45 = -18x$ **or** $4x + 5x = 20 + 2.5$ oe				M1	for a correct equation with terms in *x* on one side and number terms the other side
	Working required		2.5		A1	oe dep on M1
						Total 4 marks

3	(a)		$\frac{31}{70}$	1	B1 31/70 Accept 0.44(28571…..) or 44.(2…)%
	(b)	$4 \times 6 + 12 \times 14 + 20 \times 19 + 28 \times 25 + 36 \times 6$ (= 1488) **or** $24 + 168 + 380 + 700 + 216$ (= 1488)		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 midpoints used for at least **4** products and not added)
		$\frac{4 \times 6 + 12 \times 14 + 20 \times 19 + 28 \times 25 + 36 \times 6}{70}$ oe eg '1488' ÷ 70			M1 dep on at least M1 Allow division by their Σf provided addition or total under column seen
		Correct answer scores full marks (unless from obvious incorrect working)	21.26		A1 awrt 21.26 accept 21.3
					Total 5 marks

4	(a)	$\frac{45}{20}$ **or** $\frac{20}{45}$ **or** $\frac{36}{20}$ **or** $\frac{20}{36}$ oe 2.25 **or** 0.44(44…) **or** 1.8 **or** 0.55(55…)		2	M1 for a correct scale factor, accept ratio notation eg 45 : 20
		Correct answer scores full marks (unless from obvious incorrect working)	81		A1
	(b)	54 ÷ '2.25' **or** 54 × '0.44(44…)' oe **or** $36\times\frac{54}{'81'}$		2	M1 can ft if M1 scored in (a)
		Correct answer scores full marks (unless from obvious incorrect working)	24		A1
					Total 4 marks

5	$(5-2)\times 180-112-102-96\ (=230)$ oe eg $540-112-102-96\ (=230)$ **or** $360-(180-112)-(180-102)-(180-96)$ $(=360-68-78-104=360-230=130)$ oe		5	M1
	$\frac{'540'-112-102-96}{2}\ (=115)$ **or** '130' ÷ 2 (= 65)			M1 dep on previous mark
	$\frac{180\times(8-2)}{8}\ (=135)$ **or** 180 – (360 ÷ 8) (= 135) **or** $\frac{360}{8}\ (=45)$ as exterior angle of octagon			M1 indep Withhold the mark for $\frac{360}{8}\ (=45)$ if shown as an interior angle
	360 – '115' – '135' **or** '65' + '45'			M1
	Working required	110		A1 dep on M1
				Total 5 marks

6	12×2.45 (= 29.4) **or** $21 \div 12$ (= 1.75)		3	M1
	$\frac{'29.4'-21}{21} \times 100$ oe **or** $\frac{2.45-'1.75'}{'1.75'} \times 100$ oe **or** $(\frac{'29.4'-21}{12}) \div '1.75' \times 100$ oe **or** $(\frac{2.45}{'1.75'} \times 100) - 100$ oe			M1 or an answer of 140(%)
	Correct answer scores full marks (unless from obvious incorrect working)	40		A1
				Total 3 marks

7	$\frac{4.5}{100} \times 25\,000\ (=1125)$ **or** $\frac{104.5}{100} \times 25\,000 (= 26\,125)$ **or** $1150 \times 3\ (= 3450)$ **or** $25\,000 + 1150 \times 3\ (= 28\,450)$ (allow $\frac{3 \times 4.5}{100} \times 25\,000 (= 3375)$ for this mark)		4	M1 finding 4.5% or 104.5% of 25 000 (allow for $3 \times 0.045 \times 25\,000$ oe) **or** the total interest for T bank **or** the total amount gained for T bank	M2 for $1.045^3 \times 25\,000$ (=28 529.(15313))
	$\frac{4.5}{100} \times$ (25 000 + '1125') (= 1175.625 or 1175 or 1176) **and** $\frac{4.5}{100} \times$ (25 000 + '1125' + '1175.625') (= 1228.529) **or** $\frac{104.5}{100} \times 26125 (= 27300.625)$ **and** $\frac{104.5}{100} \times 27300.625 (= 28529.15....)$			M1 completing the interest for C bank **or** completing the total amount for C bank	
	'1125' + '1176' + '1229' (= 3530) **or** '28 529' – 25 000 (=3529) **and** 3 × 1150 (= 3450) **or** '28 529' **and** 25 000 + '3450' (= 28 450)			M1 for total interest for C bank and total interest for T bank **or** total amount for C bank and total amount for T bank	
	Working required	79 or 80		A1 dep on M2 Allow 79 - 80	
					Total 4 marks

8	(a)		1	1	B1
	(b)(i)	$(x \pm 4)(x \pm 9)\ (= 0)$		2	M1 or $(x + a)(x + b)$ where $ab = -36$ **or** $a + b = -5$
		Correct answer scores full marks (unless from obvious incorrect working)	$(x+4)(x-9)$		A1 (isw if they also solve the equation in this part)
	(ii)	*Answers must ft from (b)(i)*	-4 and 9	1	B1 ft Answer **must** ft from their $(x + p)(x + q)$ in (b)(i) Award B0 for -4 and 9 if no marks scored in (i)
					Total 4 marks

9	(a)	$1.75 \times 10^6 \div 2.4 \times 10^7$ or 1 750 000 ÷ 24 000 000 oe eg $\frac{1.75}{24}$		3	M1
		0.0729(16…) or 0.072 or 0.073 or for $\frac{7}{96}$ or 7.29(16…)% or 7.2% or 7.3%			A1
		Correct answer scores full marks (unless from obvious incorrect working)	7.3×10^{-2}		A1 accept 7.3×10^{-2} or better $(7.29(16….) \times 10^{-2})$
	(b)	$2.4 \times 10^7 \times 5.01 \times 10^{21} \div 3$ oe		2	M1
		Correct answer scores full marks (unless from obvious incorrect working)	4×10^{28}		A1 accept 4×10^{28} , 4.0×10^{28} , 4.01×10^{28} , 4.008×10^{28}
					Total 5 marks

10	eg $\cos 38 = \frac{9.3}{(AB)}$ oe **or** $\sin'52' = \frac{9.3}{(AB)}$ oe **or** $\frac{(BC)}{\sin 38} = \frac{2\times 9.3}{\sin'104'}$ oe or $\frac{\sin'52'}{9.3} = \frac{\sin 90}{(BC)}$ oe		4	M1 or $BN = \frac{9.3\sin 38}{\sin'52'}$ or $9.3\tan 38 (= 7.2659...)$ **and** $(AB^2) = 9.3^2 + '7.2659...'^2$
	eg $(AB =) \frac{9.3}{\cos 38}$ (= 11.80….) **or** $(AB =) \frac{9.3}{\sin'52'}$ (= 11.80….) **or** $(BC =) \frac{2\times 9.3\times \sin 38}{\sin'104'}$ (= 11.80…) oe			M1 or $(AB =) \sqrt{9.3^2 + '7.2659...'^2}$ (= 11.80...)
	'11.8' + '11.8' + 9.3 + 9.3 or '11.8' × 2 + 9.3 × 2 oe			M1
	Correct answer scores full marks (unless from obvious incorrect working)	42.2		A1 awrt 42.2
				Total 4 marks

11	*BOC*(*BOD*) = 180 – 48 – 90 (= 42) oe **or** *EOC* = 180 – (90 – 48) or 90 + 48 (= 138) oe		3	M1 for method to find angle *BOC* or *EOC* (may be shown in the correct place on the diagram)
	$\frac{180-'42'}{2}$ oe **or** '138' ÷ 2 oe			M1 a fully correct method to find angle *DFE*
	Correct answer scores full marks (unless from obvious incorrect working)	69		A1
				Total 3 marks

12	(a)		$16p^6q^8$	2	B2 for all three correct terms (B1 for 2 correct terms in a product of 3 terms or for $(4p^3q^4)^2$ or $(4096p^{18}q^{24})^{\frac{1}{3}}$)
	(b)	eg $\frac{2\times10}{3x\times10}+\frac{4\times6}{5x\times6}-\frac{9\times3}{10x\times3}$ $(=\frac{20}{30x}+\frac{24}{30x}-\frac{27}{30x})$		2	M1 for a common denominator for all 3 terms with at least 2 correct equivalent fractions (no need for signs) [NB: fraction can be done in 2 parts]
		Correct answer scores full marks (unless from obvious incorrect working)	$\frac{17}{30x}$		A1 or $\frac{17}{30}x^{-1}$
	(c)	eg $4x(x-5)=4x^2-20x$ or $4x(2x+3)=8x^2+12x$ or $(x-5)(2x+3)=2x^2+3x-10x-15$ $=2x^2-7x-15$		3	M1 allow one error in the expansion of $4x(x-5)$ or $4x(2x+3)$ or $(x-5)(2x+3)$
		eg $(4x^2-20x)(2x+3)=8x^3+12x^2-40x^2-60x$ or $(8x^2+12x)(x-5)=8x^3+12x^2-40x^2-60x$ or $4x(2x^2+3x-10x-15)=8x^3+12x^2-40x^2-60x$ or $4x(2x^2-7x-15)=8x^3-28x^2-60x$			M1ft but dep on previous M1 for correctly expanding – allow one extra error or one omission.
		Working required	$8x^3-28x^2-60x$		A1 dep on M1 May be factorised if $8x^3-28x^2-60x$ seen
					Total 7 marks

13		$y \geq -3$ oe $x + y \leq 1$ oe $y \leq 2x + 2$ oe	3	B3 for all 3 correct inequalities (B2 for 2 correct inequalities B1 for 1 correct inequality) Allow < instead of ≤ and > instead of ≥
				Total 3 marks

14	(a)	0.8, 2.6, 1.9, 1.6, 0.3	Correct histogram	3	B3 fully correct histogram (B2 for at least 3 correct frequency densities or at least 3 correct bars **or** all five bars of correct width with heights in the correct ratio B1 for 2 correct frequency densities or 2 correct bars – but these bars must be of different widths, ie not 1st and 3rd) **or** three bars of correct width with heights in the correct ratio)
	(b)			2	M1 for $\frac{n}{40}$ where $n < 40$ or for $\frac{4}{m}$ where $m > 4$
		Correct answer scores full marks (unless from obvious incorrect working)	$\frac{4}{40}$		A1 for $\frac{4}{40}$ oe If M0 then SCB1 for $\frac{2}{35}$ (or 0.057…)
					Total 5 marks

15	(a)		$-\frac{1}{3}$	1	B1 oe allow $-0.\dot{3}$ or -0.33 or better allow $x = -\frac{1}{3}$ or $x \neq -\frac{1}{3}$
	(b)	$\frac{2x-3}{3(2x-3)+1}$		2	M1 for substituting f(x) into g(x) Allow $\frac{f}{3f+1}$
		Correct answer scores full marks (unless from obvious incorrect working)	$\frac{2x-3}{6x-8}$		A1 oe (do not isw incorrect cancelling)
	(c)	$y(3x+1) = x$ and $3xy + y = x$ or $x(3y+1) = y$ and $3xy + x = y$		3	M1 for moving the denominator to the other side of the equation and expanding correctly
		$x(1-3y) = y$ or $x(3y-1) = -y$ or $y(1-3x) = x$ or $y(3x-1) = -x$			M1 for collecting and factorising the variable on one side in a correct equation
		Correct answer scores full marks (unless from obvious incorrect working)	$\frac{x}{1-3x}$		A1 oe eg $-\frac{x}{3x-1}$ or $\frac{-x}{-1+3x}$ oe
					Total 6 marks

16	$\frac{4}{15}\times\frac{4}{15}$ or $\frac{5}{15}\times\frac{5}{15}$ or $\frac{6}{15}\times\frac{6}{15}$ oe (where 6 = 15 – 4 – 5)		3	M1 oe for one correct product (allow decimals to 2 dp rounded or truncated) $(\frac{4}{15})^2 = (0.26(6...))^2 = 0.07(11...)$ $(\frac{5}{15})^2 = (0.33(3...))^2 = 0.11(1...)$ $(\frac{6}{15})^2 = (0.4)^2 = 0.16$
	$\frac{4}{15}\times\frac{4}{15}+\frac{5}{15}\times\frac{5}{15}+\frac{6}{15}\times\frac{6}{15}$oe eg $\frac{16}{225}+\frac{1}{9}+\frac{4}{25}$ (where 6 = 15 – 4 – 5)			M1 oe for the sum of all three correct products
	Correct answer scores full marks (unless from obvious incorrect working)	$\frac{77}{225}$		A1 oe 0.34(222….) or 34.(222…)% (if no marks awarded, SCB2 for $\frac{31}{105}$ oe from non-replacement, SCB1 for a fully correct method for non-replacement)
				Total 3 marks

17	$\left(\frac{8}{\sqrt{5}-1}\right)\times\frac{\sqrt{5}+1}{\sqrt{5}+1}$ **or** $\frac{8\left(\sqrt{5}+1\right)}{4}$ **or** $\frac{8\sqrt{5}+8}{4}$ oe		3	M1 for rationalising the denominator – award for seeing intention to multiply by $\frac{\sqrt{5}+1}{\sqrt{5}+1}$ **or** $\frac{-\sqrt{5}-1}{-\sqrt{5}-1}$
	Working required	$2\sqrt{5}+2$		A1 from correct working
		$\sqrt{20}+2$		B1ft for $k\sqrt{5}+c=\sqrt{5k^2}+c$ where $5k^2$ is a single integer Accept $a = 20$ and $b = 2$
				Total 3 marks

18	$(AC^2 =)\ 9^2 + 12^2 - 2 \times 9 \times 12 \times \cos 60\ (= 117)$ or $(AC^2 =)\ 81 + 144 - 108\ (= 117)$ oe		5	M1 oe eg $BM = 9\cos 60 (= 4.5)$ **and** $AM = 9\sin 60 (= \frac{9\sqrt{3}}{2})$ **and** $AC^2 = '(\frac{9\sqrt{3}}{2})'^2 + (12 - '4.5')^2$ (where AM is perpendicular to BC)
	$(AC =)\ \sqrt{117}$ or $3\sqrt{13}$ or 10.8(16653…)			A1 oe
	(area ABC =)$0.5 \times 9 \times 12 \times \sin 60\ (= 27\sqrt{3}$ or 46.7(653….))			M1 indep or $\frac{1}{2} \times '(\frac{9\sqrt{3}}{2})' \times 12\ (= 27\sqrt{3})$ oe
	(area ACD =)$0.5 \times 7 \times '\sqrt{117}' \times \sin 84$ (=37.6(50896…))			M1 dep on 1st M1
	Working required	84.4		A1 dep on M3 awrt 84.4
				Total 5 marks

19	$y = x - 3$	$x = y + 3$		6	B1 for correct rearrangement of linear equation
	eg $3x^2 - (x-3)^2 + x(x-3) = 9$	eg $3(3+y)^2 - y^2 + y(3+y) = 9$			M1 substitution of their linear equation into quadratic in x or y alone(even if B0 scored)
	eg $3x^2 + 3x - 18\ (= 0)$ **or** $x^2 + x - 6\ (= 0)$	eg $3y^2 + 21y + 18\ (= 0)$ **or** $y^2 + 7y + 6\ (= 0)$			M1ft from their substitution (dep on previous M1) for a complete correct method to get a 3-term or 2-term quadratic expression in the form $ax^2 + bx\ (+ c)\ (= 0)$ [allow $ax^2 + bx = c$]
	eg $(x-2)(x+3)\ (= 0)$ $x = \frac{-1 \pm \sqrt{1^2 - 4\times1\times-6}}{2\times1}$ eg $\left(x - \frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2 = 6$	eg $(y+1)(y+6)\ (= 0)$ $y = \frac{-7 \pm \sqrt{7^2 - 4\times1\times6}}{2\times1}$ eg $\left(y - \frac{7}{2}\right)^2 - \left(\frac{7}{2}\right)^2 = -6$			M1 (dep on M1) for a complete method to solve their 3-term or 2- term quadratic equation ($ax^2 + bx\ (+ c) = 0$) – correct factorisation or substitution into formula or completing square (allow one sign error and some simplification – allow as far as $\frac{-1 \pm \sqrt{1+24}}{2}$ or $\frac{-7 \pm \sqrt{49-24}}{2}$) or for seeing $x = 2, x = -3$ **or** $y = -1, y = -6$
	$x = -3, x = 2$ **and** $y = -1,\ y = -6$ or one correct midpoint coordinate ie $x = -\frac{1}{2}$ **or** $y = -\frac{7}{2}$				A1 (dep on M2) for $x = 2, x = -3$ **and** $y = -1, y = -6$ **or** one correct midpoint ie $x = -\frac{1}{2}$ or $y = -\frac{7}{2}$
	Working required		$\left(-\frac{1}{2}, -\frac{7}{2}\right)$		A1 (dep on M2) oe
					Total 6 marks

20	$\frac{3k}{4}-k$ or $\frac{k}{2}-\frac{3k}{4}$ or $\frac{k}{4}-\frac{k}{2}(=-\frac{k}{4})$ or $\frac{90+2k-k}{14}=(\frac{90+k}{14})$		5	M1 for finding the common difference (d) in terms of k
	eg $90+2k=k+(15-1)'\left(\frac{3k}{4}-k\right)'$ oe or $'\frac{3k}{4}-k'='\frac{90+k}{14}'$ oe			M1 dep equating 2 different expressions in terms of k using their value(s) of d in terms of k (or from working using k) or other correct method to find k
	$k=-20$			A1
	$\frac{30}{2}\left[2('-20')+(30-1)\left(\frac{-'-20'}{4}\right)\right]$ oe			M1 dep on previous M1 for correctly substituting, into $(S_n=)\frac{30}{2}[2k+(30-1)d]$ or $\frac{30}{2}(k+l)$ where $l=k+29d$ all values to be numerical
	Correct answer scores full marks (unless from obvious incorrect working)	1575		A1
				Total 5 marks

21	(a)		$(-2, 9)$	1	B1
	(b)		$(y =)\ 9-3(x-4+2)^2$	1	B1 oe eg $(y =)-3x^2+12x-3$ accept f$(x-4)$
	(c)		Reflection in the line $y = 0$ or x-axis	1	B1 with no mention of another transformation
	(d)	$(3, -90, 2)$ $(-3, 90, 2)$ $((3, 270, 2)$ $(-3, 450, 2)$ etc	eg $a = 3$ $b = -90$ $c = 2$	3	B3 for all 3 correct values eg 3, −90, 2 or −3, 90, 2 (If not B3 then B2 for any 2 correct values NB. 2 values from 3, −90, 2 **or** 2 values from −3, 90, 2 NB: accept a value of $(90 + 360n)$ in place of 90 or $(-90 + 360n)$ in place of −90 where n is an integer (could be negative) If not B2 then B1 for any 1 correct value **or** the graph of $y = \cos x°$ for $0 \leq x \leq 360$)
					Total 6 marks

22	eg $\frac{4}{3}\pi r^3 = 288\pi$ oe $\frac{4}{3}\pi\left(\frac{x}{2}\right)^3 = 288\pi$ oe		6	M1 for using the formula for the volume of a sphere correctly and equating it to 288π
	$x = 12$			A1
	$\sqrt{(5\times'12')^2+(0.5\times'12')^2}\,(=6\sqrt{101}=60.299...)$ oe **or** $(OC=)0.5\sqrt{'24'^2+'12'^2}\,(=6\sqrt{5})$ **and** $AC=\sqrt{'(6\sqrt{5})'^2+'60'^2}\,(=6\sqrt{105})$ **and** $\sqrt{'(6\sqrt{105})'^2-'12'^2}\,(=6\sqrt{101})$ oe			M1 (dep on first M1 and using their value for x) for using Pythagoras to find the perp height of faces *CAD* or *BAE* or a correct method to find angle *CAD* or *BAE*
	$\sqrt{(5\times'12')^2+(1\times'12')^2}\,)(=12\sqrt{26}=61.188...))$ oe **or** $(OC=)0.5\sqrt{'24'^2+'12'^2}\,(=6\sqrt{5})$ **and** $AC=\sqrt{'(6\sqrt{5})'^2+'60'^2}\,(=6\sqrt{105})$ **and** $\sqrt{'(6\sqrt{105})'^2-'6'^2}\,(=12\sqrt{26})$ oe			M1 (dep on first M1 and using their value for x) for using Pythagoras to find the perp height of faces *ABC* or *AED* or a correct method to find angle *BAC* or *DAE*
	(‘12’ × 2(‘12’)) + 2(0.5 × ‘12’ × ‘$12\sqrt{26}$ ’) +2(0.5 × 2‘12’ × ‘ $6\sqrt{101}$ ’) oe eg $'288'+2\times'72\sqrt{26}'+2\times'72\sqrt{101}'$ or ‘288’ + 2 × ‘367.129’…+ 2 × ‘723.59…’ oe			M1 (dep on first M1 using their value for x and correct working for heights of each triangle)for working out the total surface area of the pyramid
	Correct answer scores full marks (unless from obvious incorrect working)	2469		A1 2469 - 2470
				Total 6 marks