International GCSE Maths

Apart from questions 7b, 11a, 11b, 13, 14, 16, 20, 23, 26 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.

Question		Working	Answer	Mark	Notes	
1		For [8 hours 12 minutes =] 8.2 [hours] **or** $8\frac{12}{60}$ oe **or** $\frac{41}{5}$ oe **or** $8 \times 60 + 12$ (= 492) [minutes]		3	B1	For correctly writing the time as a time in hours **or** minutes **or** for a correct calculation to do this
		[Average speed =] $\frac{5658}{8.2}$ oe eg $\frac{5658}{"492"} \times 60$ oe			M1	For use of speed = distance ÷ time (use of their time in hours – if used minutes, then must multiply by 60) (allow 5658 ÷ 8.12 (= 696.79…) for this mark if B0 awarded (allow 696 – 697))
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	690		A1	
						Total 3 marks

2			$91 - 6n$	2	B2	For a correct answer in any form eg $91 - 6 \times n$ **or** $-6n + 91$ **or** $85 + (n - 1)(-6)$ oe (B1 for $-6n + k$ oe (k may be zero or absent)) NB: award full marks for eg $x = 91 - 6n$ **or** nth term = $91 - 6n$ but only B1 for $n = 91 - 6n$
						Total 2 marks

3	$8 \times x$ (= $8x$) **or** $14 \times x$ (= $14x$) **or** $(14 - 8) \times x$ (= $6x$) **or** ½ × (14 – 8) × (13 – x) (= 39 – $3x$) **or** $\frac{13+x}{2} \times (14-8)(=39+3x)$ **or** ½ × 13 × (14– 8) (=39) **or** $\frac{8+14}{2} \times x$ (= $11x$) **or** 14 × 13 (=182) **or** $8 \times (13 - x)$ (= $104 - 8x$) **or** $\left(\frac{8+14}{2} \times (13-x)\right)$ (= 143 – $11x$) oe		4	M1	one correct area linked to the shape
	$14x + 6 \times$ ½ × (13 – x) oe eg $8x + \frac{x+13}{2} \times 6$ **or** $\frac{8+14}{2} \times x + \frac{13 \times (14-8)}{2}$ **or** "182" – $\left(\frac{8+14}{2} \times (13-x)\right)$ **or** $11x$ + 39 oe			M1	ft from correct working expression for total area of shape – with no parts omitted or duplicated Adding up parts of given shape **or** large rectangle subtracting trapezium (or subtracting (rectangle + triangle))
	eg $11x + 39 = 91.8$ **or** $14x + 39 - 3x = 91.8$ **or** $182 - 143 + 11x = 91.8$ **or** $16x + 6x + 78 = 183.6$ oe			M1	fully correct equation with no fractions (allow 91.8 or multiples of 91.8 but no other decimals) **and** no brackets
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	4.8		A1	**or** $4\frac{4}{5}$ oe **or** $\frac{24}{5}$ oe
					Total 4 marks

4		eg (36 ÷ 9) × 5 **or** 20 [ducks] **or** 20 : 36 **or** for writing the 3 parts of the ratio correctly eg 35 : 10 : 18 oe		3	M1	For a fully correct calculation for the number of ducks or stating 20 ducks – may be shown in a ratio – does not need to be labelled if it is clear that the number or calculation refers to the number of ducks
		"20" ÷ 2 = 10 **and** 10 × 7 oe **or** $\frac{36}{18} \times 35$ oe			M1	For a correct calculation to find the number of chickens. (award the M2 for 70 : 20 : 36 or a different order if intention is clear eg by labels)
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	70		A1	
						Total 3 marks

5	(a)	$6x^2 + 9x - 3x^2 - 5x$		2	M1	expansion with at least 3 correct terms (must see for example, $6x^2$ and not just $3x \times 2x$)(can assume that no sign in front of a number is a + if terms written in a list or table)
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$3x^2 + 4x$		A1	**or** $4x + 3x^2$ **or** $x(3x + 4)$ **or** $x(4 + 3x)$
	(b)	eg $p + d = at$ **or** $-at = -d - p$ **or** $\frac{p}{a} = \frac{at}{a} - \frac{d}{a}$ oe		2	M1	Correct first stage in rearrangement
		Working not required, so correct answer scores full marks	$t = \frac{p+d}{a}$		A1	oe eg $t = \frac{p}{a} + \frac{d}{a}$ **or** $t = \frac{-d-p}{-a}$ Must have "$t =$" either in working or on answer line
	(c)	$w^2 \times w^n = w^{10}$ **or** $w^5 \times w^n = w^{13}$ **or** $w^5 \times w^{n-3} = w^{10}$ **or** $\frac{w^{5+n}}{w^3} = w^{10}$ oe **or** $5 + n - 3 = 10$ **or** $2 + n = 10$ **or** $5 + n = 13$		2	M1	A correct first stage simplifying at least one index in a correct equation **or** a clearly correct subsequent stage showing correct use of a rule of indices eg $w^5 \times w^n = w^{30}$ **and** $w^n = w^{30-5}$ **or** a correct equation using indices only
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	8		A1	accept w^8 (trial and error gains full marks if correct and no marks if incorrect unless a rule of indices is clearly shown)
						Total 6 marks

6	(a)	eg 1 – (0.2 + 0.12 + 0.08) (= 0.6) $1-\left(\frac{20}{100}+\frac{12}{100}+\frac{8}{100}\right)\left(=\frac{60}{100}\right)$oe **or** 100(%) – (20(%) + 12(%) + 8(%)) (= 60(%)) **or** 0.2 + 0.12 + 0.08 + 3x + x = 1 oe		3	M1	For a correct calculation for the remaining probability **or** a correct equation for the remaining probability
		"0.6" ÷ 4 (= 0.15) oe **or** "0.6" ÷ 4 × 3 **or** "0.6" × 0.75 oe (Sight of 0.15 in the table for Orange or Pink or 0.45 for Pink gains M2)			M1	For dividing the remaining probability by 4 or finding ¾ of the remaining probability NB "0.6" means 0.6 must come from correct working
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	0.45		A1	**or** $\frac{9}{20}$ oe **or** 45% (if working in % final answer must have % sign). Allow $\frac{0.45}{1}$ If no answer on answer line, check in the correct space in table above. Value on the answer line takes precedence over the table.
	(b)	0.12 × 150 oe eg 12 + 6		2	M1	For a correct calculation to find the number of times the spinner lands on blue
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	18		A1	(an answer of $\frac{18}{150}$ scores M1A0 as this is a probability not a number of times)
						Total 5 marks

7	(a)		$-2, -1, 0, 1, 2$	2	B2	(B1 for 4 correct values and no incorrect values (eg –1, 0, 1, 2) **or** for 6 values with no more than one incorrect value (eg –2, –1, 0, 1, 2, 3))
	(b)	$7t - 2t \leq 31 + 3$ **or** $5t \leq 34$ **or** $-3 - 31 \leq 2t - 7t$ **or** $-34 \leq -5t$ oe		2	M1	t terms on one side and numbers on the other. Condone = rather than ≤ or any other sign for this mark.
		Working required	$t \leq 6.8$		A1	oe (dep on M1) eg $t \leq \frac{34}{5}$ **or** $t \leq 6\frac{4}{5}$ **or** $6.8 \geq t$ Must have correct sign on answer line (sight of correct answer in working space and just 6.8 oe on answer line gains M1 only)
						Total 4 marks

8	(a)	$1.4 \times 10^9 - 8.2 \times 10^7$ **or** $1.4 \times 10^9 - 0.082 \times 10^9$ **or** $140 \times 10^7 - 8.2 \times 10^7$ $(= 131.8 \times 10^7)$		2	M1	**or** for 1 318 000 000 oe but not in standard form eg 1318×10^6 **or** 1.318×10^n where $n \neq 9$
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	1.318×10^9		A1	Allow 1.32×10^9 or 1.3×10^9
	(b)	$\frac{9.9 \times 10^6}{9.1 \times 10^5}$ oe		2	M1	
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	11		A1	allow 10.8 – 11 (inclusive) SC: if M1 not scored, award B1 for an answer of $\frac{1}{11}$ allow 10.8 – 11 for the denominator
						Total 4 marks

9	(a)		$5a^4c^3(5c^4d + 9a^5h)$	2	B2	If not B2 then award B1 for any **correct** factorisation with at least 2 of: the 5, a term in a, a term in c, outside the bracket eg $5ac(5a^3c^6d + 9a^8c^2h)$ **or** $a^2c(25a^2c^6d + 45a^7c^2h)$ (NB: not just a^4 etc as we want to know students have considered more than just one letter or the number) **or** the correct common factor **and** a 2 term expression inside the bracket eg $5a^4c^3(5c^4 + 9a^5)$ (this is missing d in first term and h in the second but the common factor is correct)
	(b)	$4x^2 + 10x + 10x + 25 = 4x^2 - 2x + 6x - 3$ $4x^2 + 20x + 25 = 4x^2 + 4x - 3$		3	M1	Correct expansion of $(2x + 5)^2$ **or** $(2x + 3)(2x - 1)$ **or** expansion of **both** sets of brackets with at least 3 of 4 terms correct in both (NB: if written as a 3 term quadratic (and not seen as 4 terms) then the middle term must be correct as it is equivalent to 2 correct terms) (eg (RHS) $4x^2 + 4x + 3$ has 1 error, $2x^2 + 4x - 3$ has 1 error, $4x^2 + 10x - 3$ has 2 errors)
		$10x + 10x - 6x + 2x = -3 - 25$ **or** $3 + 25 = -16x$ **or** $16x = -28$ oe			M1	ft if previous mark awarded. For terms in x on one side and number terms on the other side in a correct ft equation dependent on a linear equation
		Working not required, so correct answer scores full marks (unless from obvious incorrect working eg -1.75 oe from $2x^2 + 20x + 25 = 2x^2 + 4x - 3$ scores M2A0)	-1.75		A1	**or** $-1\frac{3}{4}$ **or** $-\frac{7}{4}$ **or** $-\frac{28}{16}$ **or** $-1\frac{12}{16}$ oe
						Total 5 marks

10		5 × 74 (= 370) **or** 6 × 77 (= 462) **or** 5 × 0.74 (= 3.7) **or** 6 × 0.77 (= 4.62)		3	M1	one correct product	M2 for 74 + (3 × 6) oe **or** 77 + (3 × 5) oe (where 3 = 77 – 74)
		6 × 77 – 5 × 74 **or** "462" – "370" **or** (6 × 0.77 – 5 × 0.74) × 100 **or** ("4.62" – "3.7") × 100			M1	from correct working	
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	92		A1	allow 92/100 **or** 92% **or** 92 out of 100 (trial and error scores no marks unless correct – and then it gains full marks)	
							Total 3 marks

11	(a)	$2^{\frac{1}{2}} \times 2^4$ **or** eg $2 \times (2^4)^2 = (2^x)^2$ or $2^9 = 2^{2x}$		2	M1	for a correct expression in powers of 2 that is equivalent to 2^x eg $2^{\frac{1}{2}} \times 2^4$ **or** for showing $\sqrt{2} = 2^{\frac{1}{2}}$ **and** $16 = 2^4$ **or** for writing the equation in powers of 2 eg $2 \times (2^4)^2 = (2^x)^2$ or $2^9 = 2^{2x}$
		Working required	$\frac{9}{2}$		A1	**or** 4.5 **or** 4½ dependent on M1
	(b)	$\frac{11^{-30}}{11^4}$ **or** $-30 - 4 = n$ **or** $-30 = n + 4$ oe		2	M1	For $(11^{-6})^5$ written as 11^{-30} in the equation or $(11^{-6})^5 = 11^{-30}$ shown in working **or** a correct equation with indices only (no marks for $3.914....\times 10^{-36}$)
		Working required	−34		A1	dep on M1 (as we have asked for working)
						Total 4 marks

12		$\frac{50}{360} \times \pi \times 7 \times 2$ oe eg $\frac{14\pi}{36} \times 5$ **or** "43.98…"÷ 360 × 50 oe		2	M1	Students may use π or 3.14, 3.142 or $\frac{22}{7}$
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	6.1		A1	Accept answers in the range 6.05 – 6.2
						Total 2 marks

13		$4x(3x + 1) = 12x^2 + 4x$ **or** $4x(2x - 3) = 8x^2 - 12x$ **or** $(3x + 1)(2x - 3) = 6x^2 - 9x + 2x - 3$ $(= 6x^2 - 7x - 3)$		3	M1	for expanding two of the three factors, allow one error
		$(12x^2 + 4x)(2x - 3) = 24x^3 - 36x^2 + 8x^2 - 12x$ oe $(8x^2 - 12x)(3x + 1) = 24x^3 + 8x^2 - 36x^2 - 12x$ oe $4x(6x^2 - 7x - 3) =$ eg $24x^3 - 28x^2$.... oe			M1	(dep)ft for expanding by the third factor, allow one error (some may do the expansion in one stage and will get to $24x^3 - 36x^2 + 8x^2 - 12x$ without firstly expanding two factors)
		Working required	$24x^3 - 28x^2 - 12x$		A1	dep on M1 isw correct factorisation eg $4(6x^3 - 7x^2 - 3x)$ $x(24x^2 - 28x - 12)$ $4x(6x^2 - 7x - 3)$ do not isw incorrect simplification eg $24x^3 - 28x^2 - 12x = 6x^3 - 7x^2 - 3x$ gets M2A0
						Total 3 marks

14		16 — 9		2	M1	9 and 16 clearly identified either in list or stated. Some may have also identified the second 13 which we will allow as working so long as not intended as the LQ or UQ
		Working required	7		A1	Dep on M1
						Total 2 marks

15	$ORQ = 90 - 60$ (=30) **or** $OQR = 30$ **or** $PQR = 0.5 \times (360 - 238)$ (= 61) **or** $QPR = 60$ **or** $OPR = \frac{180-(360-238)}{2}$ (= 29)		4	M1	The correct working or the correct angle for *ORQ* **or** *OQR* **or** *PQR* **or** *QPR* **or** *OPR*. Must be clearly stated as the correct angle or shown on the diagram in correct position. (eg just seeing 30 in working without a label is not sufficient for the award of this mark)
	Working not required, so correct answer scores M1A1 (unless from obvious incorrect working)	31		A1	if not on answer line, may be seen on diagram or clearly labelled
	NB: degrees symbol not essential for reasons *We will allow the symbol* Δ *for 'triangle'* ∠ *for angle* Σ *for sum*	full reasons for method used		B2	(dep on a fully correct method that should lead to the answer) for fully correct reasons for method used (underlined words **must** be seen) eg Angle between tangent and radius is 90° Angles around a point total 360° Angle at centre is twice angle at circumference/edge Total of angles in triangle is 180° / triangle 180° Base angles in an isosceles triangle (or 2 sides equal, so 2 angles equal) Angles in a quadrilateral total 360° or quadrilateral 360º / Accept "4-sided shape" or "quad" Alternate segment theorem (B1 dep on M1 for at least one reason for method used)
					Total 4 marks

16		eg $10\,000x = 2813.13\ldots$ $100x = 28.13\ldots$ **or** $1000x = 281.313\ldots$ $10x = 2.813\ldots$ **or** $100x = 28.1313\ldots$ $x = 0.2813\ldots$ oe		2	M1	For 2 recurring decimals that when subtracted give a whole number or terminating decimal (27.85 or 278.5 or 2785 etc) eg $10\,000x = 2813.13...$ and $100x = 28.1313....$ **or** $1000x = 281.313\ldots$ and $10x = 2.81313\ldots$ **or** $100x = 28.1313\ldots$ and $x = 0.281313\ldots$ with intention to subtract. (if recurring dots not shown then showing at least **one** of the numbers to at least 6sf) **or** $0.28 + 0.00\dot{1}\dot{3}$ **and** eg $100x = 0.1313...$, $10\,000x = 13.1313...$ with intention to subtract.
		eg $10\,000x - 100x = 2813.13... - 28.1313... = 2785$ **and** $\frac{2785}{9900} = \frac{557}{1980}$ **or** $1000x - 10x = 281.313... - 2.81313... = 278.5$ **and** $\frac{278.5}{990} = \frac{557}{1980}$ **or** $100x - x = 28.1313... - 0.281313... = 27.85$ **and** $\frac{27.85}{99} = \frac{557}{1980}$ **or** eg $10\,000x - 100x = 13.1313... - 0.1313... = 13$ **and** $0.28 + \frac{13}{9900} = \frac{28\times99+13}{9900} = \frac{2785}{9900} = \frac{557}{1980}$ oe	shown		A1	for completion to $\frac{557}{1980}$ dep on M1 *(NB: this is a "use algebra to show that…" question, so we need to see algebra as well as seeing all the stages of working to award full marks)*
						Total 2 marks

17		eg $2n$, $2n + 2$, $2n + 4$ **or** $2n - 2$, $2n$, $2n + 2$ etc		3	M1	3 consecutive even numbers in algebraic form (any letter can be used)
		eg $(2n + 4)^2 - (2n)^2$ $(= 4n^2 + 8n + 8n + 16 - 4n^2 \ (= 16n + 16))$ **or** $(2n + 2)^2 - (2n - 2)^2$ $(= 4n^2 + 4n + 4n + 4 - (4n^2 - 4n - 4n + 4) \ (= 16n))$			M1	for squaring the largest and smallest even numbers and subtracting (no need to expand or simplify for this mark)
		eg $8(2n + 2) = 16n + 16$ **or** eg $16n + 16 = 8(2n + 2)$ **or** eg $16n = 8(2n)$ **or** eg $8n + 8n = 8(n + n)$ **or** eg $\frac{16n+16}{2n+2} = 8$	Correctly shown		A1	dep on M2 for use of algebra to show correct conclusion (SCB1 for eg $(p + 4)^2 - p^2$) (SCB2 for use of eg $(p + 4)^2 - p^2 = 8p + 16 = 8(p + 2)$ If the student shows this and also says "it is true for all numbers, so it must be true for even numbers" oe then this would gain M2A1
		Alternative				**Total 3 marks**
		eg a, b, c are consecutive even numbers where $a < b < c$ **and** one of $b = \frac{a+c}{2}$ **or** $a + c = 2b$ **or** $c - a = 4$ oe		3	M1	3 numbers defined as consecutive even numbers with one correct equation, writing one term in terms of one or more of the others or $c - a = 4$
		eg a, b, c are consecutive even numbers where $a < b < c$ **and** all of $b = \frac{a+c}{2}$ **and** $a + c = 2b$ **and** $c - a = 4$ oe			M1	3 numbers defined as consecutive even numbers with three correct equations that involve all letters in some place
		Now $c^2 - a^2 = (c - a)(c + a) = 4 \times 2b = 8b$	Correctly shown		A1	dep on M2 for use of algebra to show correct conclusion
						Total 3 marks

18	(a)	eg height of first bar labelled as FD 4 **or** one 1 cm by 1 cm square = 5 people **or** 1 line of 5 small squares = 1 person **or** one 2cm by 2 cm square = 20 people etc		2	M1	for the use of frequency density – ie that area is proportional to frequency – with either a correct frequency density unambiguously labelled on axis **or** for an area representing a correct number of people **or** 2 correct frequencies completed
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	35, 39, 56		A1	All 3 correct
	(b)		Correct bar	1	B1	Width from 30 – 60 and height 1 cm
	(c)	0.5 × "56" + 30 (= 58) **or** 40 + "35" + "39" + "56" + 30 (= 200)		2	M1ft	follow through **their** stated value for $20 \leq d < 30$ for total greater than 25 or ft **their** 3 values in the table for total
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$\frac{58}{200}$		A1ft	ft dep on a completed table oe eg $\frac{29}{100}$ **or** 0.29 **or** 29%
						Total 5 marks

19	(i)		45	3	B1
	(ii)		12		B1
	(iii)		28		B1
					Total 3 marks

20		9.65, 9.75, 5.85, 5.95, 2.5, 3.5		3	B1	for any one of these stated or used, accept $9.74\dot{9}$, $5.94\dot{9}$, $3.4\dot{9}$
		$\frac{9.75-5.85}{2.5}$			M1	for $\frac{\mathrm{UB}_t-\mathrm{LB}_w}{\mathrm{LB}_y}$ where $9.7 < \mathrm{UB}_t \leq 9.75$, $5.85 \leq \mathrm{LB}_w < 5.9$, $2.5 \leq \mathrm{LB}_y < 3$ This allows for the student who uses some sort of lower/upper value, but are slightly inaccurate eg using 9.74 for t
		Working required	1.56		A1	dep on previous marks (as working is requested)
						Total 3 marks

21		$[x=]\ \dfrac{5}{9\left(\dfrac{5}{5a-2}\right)+5}$ oe **or** $y=\dfrac{5}{9x}-\dfrac{5}{9}$ oe		4	M1	A correct substitution for y **or** writing y in terms of x
		$[x=]\ \dfrac{5(5a-2)}{45+5(5a-2)}$ oe **or** $(5-5x)(5a-2)=45x$ oe **or** $9x=\dfrac{5(45a-18)}{35+25a}$ oe			M1	Multiplying each term in the numerator and denominator by $(5a-2)$ to eliminate the fraction in the denominator **or** equating y's and getting rid of fractions as far as shown on left **or** single fraction in terms of a
		$[x=]\ \dfrac{25a-10}{35+25a}$ oe **or** $[x=]\ \dfrac{5(5a-2)}{5(7+5a)}$			M1	A correct fraction not in simplest form with all brackets expanded **or** numerator and denominator factorised with the same common factor taken out
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$x=\dfrac{5a-2}{7+5a}$		A1	Correctly simplified $x=$ needed for the answer, or $x=$ previously seen in working with correct simplified expression Do not isw if students have tried to do some incorrect cancelling eg $x=\dfrac{5a-2}{7+5a}=\dfrac{-2}{7}$ gets M3A0
						Total 4 marks

22		$[AM =]\sqrt{5^2+15^2}\,(=\sqrt{250}=15.8...)$ where M is midpoint of EF, oe other correct method to find AM $[AD =]\sqrt{12^2+15^2}\,(=\sqrt{369}=19.2...)$ $[DM =])\sqrt{12^2-5^2}\,(=\sqrt{119}=10.9...)$		4	M2	for a complete method to find **two** of AM, AD, DM (where M is the midpoint of EF) Other longer ways to find AM, AD, DM may be used but must be a complete method eg $\angle DEM = \cos^{-1}(\frac{5}{12})(=65.37...)$ **and** $DM = 12\sin 65.37...$ $\angle DEM = \cos^{-1}(\frac{5}{12})(=65.37...)$ **and** $DM = 5\tan 65.37...$ Use $10 \div 2$ as 5 throughout
					(M1	For a complete method to find **one** of AM, AD, DM (where M is the midpoint of EF))
		eg $\tan DAM = \frac{"\sqrt{119}"}{"\sqrt{250}"}\left(=\frac{"10.9..."}{"15.8..."}\right)$ oe **or** $\sin DAM = \frac{"\sqrt{119}"}{"\sqrt{369}"}\left(=\frac{"10.9..."}{"19.2..."}\right)$ oe **or** $\cos DAM = \frac{"\sqrt{250}"}{"\sqrt{369}"}\left(=\frac{"15.8..."}{"19.2..."}\right)$ oe			M1	a correct method to find the required angle –other longer methods may be used but they must get to the stage of an equation for the required angle eg $\sin DAM = \frac{"10.9..."}{\sqrt{"15.8..."^2+"10.9..."^2}}$ NB: "10.9…" and "15.8…" must come from correct working
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	34.6		A1	any answer which rounds to 34.6
						Total 4 marks

23		$a + d = 8.5$, $a + 4d = 13$ oe		5	M1	for at least 1 correct equation **or** for $d = 1.5$
		$a = 7$, $d = 1.5$			A1	both values correct
		$\frac{N}{2}(2\times 7+(N-1)1.5)=292$ (eg $3N^2 + 25N - 1168$ [= 0] **or** $1.5N^2 + 12.5N - 584$ [= 0])			M1	A correct equation for the total of the first N terms of the series with a and d substituted in. The mark can be gained by using **their** values of a and d even if no previous marks awarded.
		eg $(3N + 73)(N - 16)$ [=0] [N =] $\frac{-25\pm\sqrt{25^2-4\times 3\times -1168}}{2\times 3}$			M1	A correct method dep on the previous M1 for solving **their** 3 term quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-25\pm\sqrt{625+14016}}{6}$) oe (may be ± or just +) or if factorising, allow brackets which expanded give 2 out of 3 terms correct, or if completing the square allow as far as the stage $3((N+\frac{25}{6})^2-\frac{25^2}{6^2})-1168$ (= 0)
		Working required	16		A1	dep on M2
						Total 5 marks

24	(a)	g(2) = 7 × 2 – 6 (= 8) **or** $5(7\times 2-6)^2-10(7\times 2-6)+7$		2	M1
		Working not required, so correct answer scores full marks	247		A1
	(b)	eg $y=5(x^2-2x)+7$ **or** $y=5(x^2-2x+\frac{7}{5})$ oe	eg $x=5(y^2-2y)+7$ **or** $x=5(y^2-2y+\frac{7}{5})$	4	M1 **or** eg $\frac{y-7}{5}=x^2-2x$
		eg $y=5[(x-1)^2-1^2]+7$ **or** $y=5\left((x-1)^2-1^2+\frac{7}{5}\right)$ oe	eg $x=5\left((y-1)^2-1^2\right)+7$ **or** $x=5\left((y-1)^2-1^2+\frac{7}{5}\right)$ oe		M1 **or** eg $\frac{y-7}{5}=(x-1)^2-1^2$
		$(x-1)^2=\frac{y-2}{5}$ oe	$(y-1)^2=\frac{x-2}{5}$ oe		M1 **or** eg $(x-1)^2=\frac{y-7}{5}+1$
		Working not required, so correct answer scores full marks(unless from obvious incorrect working)	$1+\sqrt{\frac{x-2}{5}}$		A1 Must be in terms of x, oe eg $1+\sqrt{\frac{x-7}{5}+1}$ (NB: $f^{-1}(x)=1\pm\sqrt{\frac{x-2}{5}}$ is 3 marks)
		Alternative for (b)			**Total 6 marks**
		Let $x=5y^2-10y+7$ [⇔] $5y^2-10y+(7-x)=0$ oe		4	M1
		$[y=]\frac{10\pm\sqrt{100-20(7-x)}}{10}$			M1
		$1\pm\sqrt{\frac{x-2}{5}}$			M1
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$1+\sqrt{\frac{x-2}{5}}$		A1 Must be in terms of x
					Total 6 marks

25	[chord AB =] $\sqrt{5^2+5^2-2\times5\times5\times\cos 50}$ **or** $2 \times 5 \times \sin 25$ (= 10sin25 or 4.226...)		6	M1 oe
	[$\angle APB$ =] $\cos^{-1}\left(\frac{4^2+4^2-"4.226..."^2}{2\times4\times4}\right)$ (=63.77...) **or** [$\angle OPA$ =] $\sin^{-1}\left(\frac{0.5\times"4.226..."}{4}\right)$ (= 31.88...)			M1 oe may use other methods but must be a complete method for $\angle APB$ **or** $\angle OPA$ (see below for sine rule)
	[Area sector AOB =] $\frac{50}{360}\times\pi\times5^2$ $\left(=\frac{125}{36}\pi \text{ or } 10.9...\right)$			M1 oe independent
	[Area sector APB =] $\frac{"63.77..."}{360}\times\pi\times4^2$ (= 8.90...)			M1 oe NB: 2 × "31.88…" = "63.77…"
	$\left(\frac{50}{360}\pi\times5^2-\frac{1}{2}\times5^2\times\sin 50\right)+\left(\frac{"63.77..."}{360}\times\pi\times4^2-\frac{1}{2}\times4^2\times\sin"63.77..."\right)$			M1 oe (10.9…– 9.57…) + (8.90… – 7.17…)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	3.06		A1 allow 3 – 3.1
	Alternative version (using line of symmetry OP in quadrilateral $OAPB$)			**Total 6 marks**
	$[\angle OPA] = \sin^{-1}\left(\frac{5\sin 25}{4}\right)$ (= 31.88..)		6	M1 oe (see above for cosine rule & trig)
	[Area sector APB =] $\frac{2\times"31.88..."}{360}\times\pi\times4^2$ (= 8.90...)			M1 oe
	[Area $OAPB$ =] 2 × ½ × 5 × 4 × sin(180 – "31.88.." – 25) (=16.75...)			M1 oe
	[Area sector AOB =] $\frac{50}{360}\times\pi\times5^2$ $\left(=\frac{125}{36}\pi=10.9...\right)$			M1 oe independent
	[Area **R** =] "10.9..." + "8.90..." – "16.75..."			M1 oe
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	3.06		A1 allow 3 – 3.1
				Total 6 marks

26		eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$ **or** $\overrightarrow{OP} = 2\mathbf{a} + m(5\mathbf{b} - 2\mathbf{a})$ **or** $\overrightarrow{OP} = 5\mathbf{b} + x(2\mathbf{a} - 5\mathbf{b})$		5	M1	for a vector equation for $\overrightarrow{OP}$
		eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$ **and** $\overrightarrow{OP} = 2\mathbf{a} + m(5\mathbf{b} - 2\mathbf{a})$ **or** eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$ **and** $\overrightarrow{OP} = 5\mathbf{b} + x(2\mathbf{a} - 5\mathbf{b})$ oe			M1	2 vector equations for $\overrightarrow{OP}$ that can be used to find $\overrightarrow{OP}$ - must be in terms of **a** and **b** and a scalar
		eg $5m = 3n$ or $m = \frac{3}{5}n$ or $2n = 2 - 2m$ or $n = 1 - m$ oe **and** $2 - 2 \times \frac{3}{5}n = 2n$ or $2 \times \frac{5}{3}m = 2 - 2m$ oe **or** eg $2n = 2x$ or $n = x$ or $3n = 5 - 5x$ oe **and** $3x = 5 - 5x$ or $3n = 5 - 5n$ oe			M1	Writing one equation in terms of only one scalar eg one of n or m or x etc
		eg $m = \frac{3}{8}$ or $n = \frac{5}{8}$ or $x = \frac{5}{8}$ oe			M1	for a correct value for one scalar
		Working is required	$\frac{5}{4}\mathbf{a} + \frac{15}{8}\mathbf{b}$		A1	oe (dep on M1) but terms in **a** and terms in **b** should be simplified. eg $\frac{1}{8}(10\mathbf{a} + 15\mathbf{b})$ or $\frac{5}{8}(2\mathbf{a} + 3\mathbf{b})$ etc
						Total 5 marks
		Alternative method as a vector method not requested				
		eg $\overrightarrow{OP} = n(2\mathbf{a} + 3\mathbf{b})$		5	M1	for a vector equation for $\overrightarrow{OP}$

		eg $CP : OP = 3 : 5$ or $CP : CO = 3 : 8$ or $\frac{CP}{OP} = \frac{3}{5}$ or $\frac{CP}{CO} = \frac{3}{8}$ oe			M2	for a correct ratio for two sides in triangle ACP and triangle BOP that help to find $\overrightarrow{OP}$ as a fraction of $\overrightarrow{OC}$ (could be seen on the diagram)
		$\overrightarrow{OP} = \frac{5}{8}\overrightarrow{OC}$ or $n = \frac{5}{8}$			M1	
		Working is required	$\frac{5}{4}\mathbf{a} + \frac{15}{8}\mathbf{b}$		A1	oe (dep on M1) but terms in **a** and terms in **b** should be simplified. eg $\frac{1}{8}(10\mathbf{a} + 15\mathbf{b})$ or $\frac{5}{8}(2\mathbf{a} + 3\mathbf{b})$ etc
						Total 5 marks