International GCSE Maths

Apart from question 11c, 12, 13, 16, 19, 20 (where the mark scheme states otherwise) the correct answer, unless clearly obtained from an incorrect method, should be taken to imply a correct method.

Q		Working	Answer	Mark	Notes	
1	a		g^{10}	1	B1	
	b		k^7	1	B1	
	c		$9c^2d^8$	2	B2	B1 for 2 out of 3 terms correct in a product
	d	$4x > 2 - 7$ oe			M1	accept as an equation or with wrong inequality sign.
			$x > -1.25$	2	A1	oe allow $(-1.25, (+)\infty)$ Note: award M1A0 for an answer on the answer line of -1.25 with no sign or the incorrect sign eg $x = -1.25$, $x < -1.25$
						Total 6 marks

2	a		$50 < L \leq 60$	1	B1	oe eg 50 - 60
	b	$25 \times 6 + 35 \times 26 + 45 \times 31 + 55 \times 40 + 65 \times 17$ $(150 + 910 + 1395 + 2200 + 1105)(= 5760)$			M2	For correct products using midpoints (allow one error) with intention to add. M1 for products using frequency and a consistent value within the range (allow one error) with intention to add or correct products using midpoints (allow one error) without addition
		"5760" ÷ "120"			M1	dep on M1
			48	4	A1	
						Total 5 marks

3	*ADC* = 180 – 58 (= 122) **or** *EDF* = 122 **or** *CDE* = 58 **or** *ADF* = 58			M1 may be seen marked on the diagram
	e.g. *DEF* = 58 ÷ 2 **or** *DEF* = (180 – 122) ÷ 2			M1 complete method to find angle *DEF*
		29		A1
			5	B2 dep on M2 for fully correct reasons for their method (B1 dep on M1 for one correct reason stated and used) e.g. Allied angles, co-interior angles, Alternate angles, Corresponding angles, Vertically opposite angles are equal (or Vertically opposite angles are equal), Angles on a straight line add up to 180°(or angles on a straight line add to 180°), Sum of two angles in a triangle are equal to opposite exterior angle, Angles in a triangle add up to 180°(or Angles in a triangle add up to 180°), Base angles in an isosceles triangle Angles in a quadrilateral add up to 360. (accept "4-sided shape"or parallelogram) Opposite angles of a parallelogram are equal
				Total 5 marks

4	eg 76 ÷ (5 + 2 – 3) oe (= 19) or 5*x* + 2*x* – 3*x* = 76 **and** *x* = 76 ÷ (5 + 2 – 3) (=19) oe			M1 For a correct method to find the value of 1 share
	3 × "19" (= 57)			M1
	"57" – 48.5(0)			M1
		8.5(0)	4	A1
				Total 4 marks

5	a	1.04 × 3 130 000 oe				M2	complete method to increase salary by 4% M1 for 0.04 × 3 130 000 oe (= 125 200)	
				3 255 200	3	A1		
	b	for 0.15 × 750 000 oe (=112 500) **or** 0.85 × 750 000 oe (=637 500)	**OR** 750 000 × 0.85^3			M1	For method to find depreciation for 1 year or value after 1 year	**or** M2 for 750 000 × 0.85^3 (= 460 593.75) **or** 750 000 × 0.85^4 (= 391 504.69) (M1 for 750 000 × 0.85^2 (= 541 875)
		0.85 × "637 500" oe (= 541 875) 0.85 × "541 875" oe(= 460 593.75)				M1	for completing method	
				460 594	3	A1	accept 460 593 – 460 594	
							SC: if no other marks gained award M1 for 0.55 × 750 000 oe **(**= 412 500) **or** 0.45 × 750 000 oe **(**= 337 500) accept (1 – 0.15) as equivalent to 0.85 throughout	
								Total 6 marks

6				M1	for $y = 3x + c$ oe **or** $y = mx - 2$ oe **or** $3x - 2$ **or** eg $L = 3x - 2$ **or** $y = 3(x \pm a)$
		$y = 3x - 2$	2	A1	oe eg $y - 4 = 3(x - 2)$ $y - 1 = 3(x - 1)$ $y - a = 3(x - b)$ where (a, b) is any coordinate on the line
					Total 2 marks

7	$\tan x = \frac{3.4}{4.7}$ oe eg $\cos x = \frac{4.7}{\sqrt{3.4^2 + 4.7^2}}$ oe			M1	or $\sin x = \frac{3.4 \sin 90}{\sqrt{3.4^2 + 4.7^2}}$ oe
	$(x =) \tan^{-1}\left(\frac{3.4}{4.7}\right)$ oe eg $(x =) \cos^{-1}\left(\frac{4.7}{\sqrt{3.4^2 + 4.7^2}}\right)$			M1	or $(x =) \sin^{-1}\left(\frac{3.4 \sin 90}{\sqrt{3.4^2 + 4.7^2}}\right)$ oe
		35.9	3	A1	accept 35.7 - 36.1
					Total 3 marks

8	$8.5^2 - (8 \div 2)^2$ (= 56.25) **or** $\cos x = \frac{4}{8.5}$ oe			M1	**or** eg $\cos A = \frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}$
	$\sqrt{"56.25"}$ (= 7.5) **or** $x = \cos^{-1}\left(\frac{4}{8.5}\right)$ (= 61.927...) oe			M1	**or** eg $(A =) \cos^{-1}\left(\frac{8^2 + 8.5^2 - 8.5^2}{2 \times 8 \times 8.5}\right)$ (61.927...) (other angle = 56.144...)
	8 × "7.5" ÷ 2 oe **or** 0.5 × 8 × 8.5 × sin "61.927..."			M1	**or** eg 0.5 × 8.5 × 8 × sin"61.927..." oe
		30	4	A1	
					Total 4 marks

9	$\pi \times 3^2 \times h = 72\pi$ oe			M1	Allow use of 3.14... or $\frac{22}{7}$ for π and use of 226... for 72π
	$h = 72\pi \div (\pi \times 3^2)$ oe **or** $h = 8$			M1	method to isolate h (may be seen in several stages)
	$2 \times \pi \times 3^2$ (= 18π or 56.54...) **or** $2 \times \pi \times 3 \times$ "8" oe (= 48π or 150 - 151)			M1	method to find the area of the two circles **or** curved surface area – use of their h, dep on 1st M1 (NB may get this mark for total area of 2 circles with no previous marks awarded)
	$2 \times \pi \times 3^2 + 2 \times \pi \times 3 \times$ "8" oe (= 66π)			M1	method to find total surface area ft their h dep on 1st M1, including intention to add, to find the total surface area
		207	5	A1	accept 207-208
					Total 5 marks

10	a		10, 26, 70, 99, 114, 120	1	B1	
	b		correct cumulative frequency graph	2	B2	fully correct cf graph – points at ends of intervals and joined with curve or line segments If not B2 then B1 for 5 or 6 (ft from a table with only one arithmetic error) of their points at ends of intervals and joined with curve or line segments **OR** for 5 or 6 points plotted correctly at ends of intervals not joined **OR** for 5 or 6 of their points from table plotted consistently within each interval (not at upper ends of intervals) at their correct heights and joined with smooth curve or line segments
	c				M1	For use of 30 and 90, or 30.25 and 90.75 (eg reading of 21 and 37 stated or indicated by marks on horizontal axis that correspond to 30 (or 30.25) and 90 (or 90.75) on the vertical axis or correct readings ft their cf graph provided method to show readings is shown)
			16	2	A1	accept 14 – 18, ft from their cf graph (ft provided method to show readings is shown)
	d				M1	For use of cf from number of minutes late being 48 (eg an indication by a mark on the vertical axis corresponding to 48 mins late or a correct reading ft their cf graph)
			9	2	A1	accept 7 – 10, ft from their cf graph
						Total 7 marks

11	a		$4e^{10}$	2	B2	(B1 for $4e^{k}$ **or** ke^{10})
	b	A correct first step eg $\frac{y^{-4}}{2^{-4}}$ **or** $\left(\frac{y^4}{16}\right)^{-1}$ **or** $\frac{y^{-4}}{0.0625}$ **or** $\left(\frac{2}{y}\right)^4$ **or** $\frac{16}{y^4}$ **or** $\left(\frac{1}{y/2}\right)^4$ **or** $\frac{1}{\left(y/2\right)^4}$			M1	or for $16y^{p}$ where $p \neq -4$
			$16y^{-4}$	2	A1	
	c	eg $12\times\frac{4x-2}{3}-12\times\frac{5-3x}{4}=12\times6$ **or** eg $4(4x-2)-3(5-3x)=12\times6$ **or** eg $\frac{4(4x-2)}{12}-\frac{3(5-3x)}{12}(=6)$ **or** eg $\frac{4(4x-2)-3(5-3x)}{12}(=6)$ oe			M1	for clear intention to multiply **all** terms by 12 or a multiple of 12 **or** to express LHS as two fractions over 12 or a multiple of 12 or as a single fraction with a denominator of 12 or a multiple of 12 (if expanded numerator, allow one sign error)
		eg $16x-8-15+9x=6\times12$			M1	expanding brackets and multiplying both sides by denominator with no more than one sign error
		eg $16x + 9x = 72 + 8 + 15$			M1	for correct rearrangement of a correct equation with terms in x isolated
			3.8	4	A1	oe, award full marks for a correct answer if at least M1 scored
						Total 8 marks

12	$3^4 = \frac{3^x}{9^{3x}}$ **or** $81 = \frac{3^x}{(3^2)^{3x}}$	$9^2 = \frac{3^x}{9^{3x}}$ **or** $81 = \frac{(9^{0.5})^x}{9^{3x}}$			M1 replacing 81 with 3^4 **or** 9^{3x} with $(3^2)^{3x}$ (or 3^{6x}) **or** replacing 81 with 9^2 **or** 3^x with $(9^{0.5})^x$ (in an equation)
	eg $4 + 6x = x$ or $4 = x - 2(3x)$ oe	eg $2 = 0.5x - 3x$ oe			M1 a correct equation using powers
			−0.8	3	A1 oe, dep on at least M1
					Total 3 marks

13	e.g. $x = 0.6\dot{8}\dot{1}$ and $100x = 68.\dot{1}\dot{8}$ **or** $10x = 6.\dot{8}\dot{1}$ and $1000x = 681.\dot{8}\dot{1}$			M1 e.g. two decimals that when subtracted give a finite decimal (must show understanding of recurring figures by 'dot' or at least 2 lots of 18 or 81 after the decimal point). Algebra required, use of any letter.
	$99x = 67.5$, $x = \frac{67.5}{99} = \frac{15}{22}$ **or** $990x = 675$, $x = \frac{675}{990} = \frac{15}{22}$ oe	show	2	A1 dep for completing the 'show that' arriving at given answer from correct working.
				Total 2 marks

14	a		8	1	B1	
	b	$A = \{10, 11, 12, 13, 14\ 15, 16, 17\}$ $B = \{13, 14, 15, 16, 17, 18, 19, 20, 21\}$ **or** $A \cup B = \{10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, 21\}$			M1	may be seen in a Venn diagram (allow for example 10 – 17 for A and 13 – 21 for B or 10 – 21 for $A \cup B$) **or** for an answer with one missing element or one extra element
			22, 23, 24, 25	2	A1	
	c	$A' = \{18, 19, 20, 21, 22, 23, 24, 25\}$ $B = \{13, 14, 15, 16, 17, 18, 19, 20, 21\}$			M1	may be seen in a Venn diagram (allow 18 – 25 for A' and 13 – 21 for B) **or** for an answer with one missing element or one extra element
			18, 19, 20, 21	2	A1	
	d		13, 14, 15, 16, 17	1	B1	
						Total 6 marks

15	$xy + 3y = 5 - 2x$ oe			M1	multiplying both sides by $(x + 3)$ and expanding the brackets correctly
	e.g. $xy + 2x = 5 - 3y$			M1	ft dep on 2 terms on left and $(5 - 2x)$ on right, for collecting all x terms on one side and non-x terms on the other side
	eg $x(y + 2) = 5 - 3y$			M1	ft, dep on 2 terms in x, for factorising for x
		$x = \frac{5-3y}{2+y}$	4	A1	oe allow $\frac{5-3y}{2+y}$ as answer so long as previously seen $x = \frac{5-3y}{2+y}$
					Total 4 marks

16	$3y(2y+1)-y^2=8$ **or** $x=\frac{8+y^2}{3y} \rightarrow \frac{8+y^2}{3y}-2y=1$ **or** $\_\ 3xy-y^2=8$ $3xy-3y\times 2y=3y\times 1$ oe	$3x\left(\frac{x-1}{2}\right)-\left(\frac{x-1}{2}\right)^2=8$ oe			M1	correct first step eg substitution by eg $x=1+2y$ or $y=\frac{x-1}{2}$ to get an equation in a single variable **or** writing 2nd equation with x the subject and substituting into 1st **or** multiplying 2nd equation by $3y$ and subtracting from 1st oe
	eg $5y^2+3y-8\ (=0)$	eg $5x^2-4x-33\ (=0)$			A1	for a correct simplified quadratic
	$(5y+8)(y-1)\ (=0)$ or $\frac{-3\pm\sqrt{3^2-4\times 5\times(-8)}}{2\times 5}$	$(5x+11)(x-3)\ (=0)$ or $\frac{4\pm\sqrt{(-4)^2-4\times 5\times(-33)}}{2\times 5}$			M1ft	dep on M1 for solving their 3 term quadratic equation using any correct method (allow one sign error and some simplification – allow as far as $\frac{-3\pm\sqrt{9+160}}{10}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$y=-\frac{8}{5}$ and $y=1$ (both)	$x=-\frac{11}{5}$ and $x=3$ (both)			A1	dep on first M1
			$x=-\frac{11}{5}, y=-\frac{8}{5}$ $x=3, y=1$	5	A1	oe dep on first M1 Must be paired correctly
						Total 5 marks

17	$(3x + 2)(2x - 4) < 3x + 27$oe eg $6x^2 - 8x - 8 < 3x + 27$			M1	condone incorrect symbol
	eg $6x^2 - 11x - 35 < 0$			M1	expanding and rearranging to get a correct 3 term quadratic, condone incorrect symbol
	$(2x - 7)(3x + 5)$ $(= 0)$ or $\frac{11 \pm \sqrt{(-11)^2 - 4 \times 6 \times (-35)}}{2 \times 6}$			M1	first step to find the critical values dep on M1 for solving their 3 term quadratic using any correct method (allow one sign error and some simplification – allow as far as the equivalent of $\frac{11 \pm \sqrt{121 + 840}}{12}$) or if factorising, allow brackets which expanded give 2 out of 3 terms correct)
	$-\frac{5}{3}, \frac{7}{2}$			A1	oe the positive critical value only or both critical values (if both they must be correct)
		$2 < x < \frac{7}{2}$	5	A1	accept $2 \leq x < \frac{7}{2}$ may be seen as two separate inequalities $x > 2$ $(x \leq 2)$ **and** $x < \frac{7}{2}$
					Total 5 marks

18	eg $\frac{4}{AC} = \tan 35$ oe **or** $\frac{AC}{4} = \tan 55$ oe **or** $\frac{AC}{\sin 55} = \frac{4}{\sin 35}$ oe **or** $CH = \frac{4}{\sin 35}$ oe (= 6.97...) **and** $\frac{AC}{"6.97"} = \cos 35$ oe **or** $CH = \frac{4}{\sin 35}$ oe (=6.97...) **and** $AC^2 = 6.97^2 - 4^2$ oe			M1 A correct trig statement involving AC **or** trig and then Pythagoras involving AC
	$(AC =) \frac{4}{\tan 35}$ oe eg $(AC =)$ 4tan55 (= 5.71...) **or** $(AC =) \frac{4\sin 55}{\sin 35}$ **or** "6.97" × cos35 oe **or** $(AC =) \sqrt{"6.97"^2 - 4^2}$			M1 complete method to find AC
	$(BC =) \sqrt{"5.71"^2 - 5^2}$ (= 2.76...)			M1 complete method to find BC
	4 × 5 × "2.76..."			M1 method to find volume
		55.3	5	A1 accept 55.1 – 55.5
				Total 5 marks

19	$\overrightarrow{AB} = -\mathbf{a} + \mathbf{b}$ or $\overrightarrow{BA} = \mathbf{a} - \mathbf{b}$			M1	Correct diagram (condone missing vector labels or arrows – with C on line segment OA and D on line segment OB) **OR** for finding $\overrightarrow{AB}$ or $\overrightarrow{BA}$ - may be seen as part of later working
	$\overrightarrow{CD} = \frac{1}{3}(-\mathbf{a} + \mathbf{b})$ or $\overrightarrow{DC} = \frac{1}{3}(\mathbf{a} - \mathbf{b})$oe			M1	Method to find $\overrightarrow{CD}$ or $\overrightarrow{DC}$
		Correct vectors and conclusion including <u>parallel</u> and <u>trapezium</u>	3	A1	eg $\overrightarrow{AB}$ (AB) and $\overrightarrow{CD}$ (CD) are parallel therefore $ABDC$ is a trapezium
					Total 3 marks

20	$\frac{\left(\frac{X+4}{2}\right)}{X}\left(=\frac{X+4}{2X}\right)$ **or** $\frac{\left(\frac{X+4}{2}\right)-1}{X-1}\left(=\frac{X+2}{2X-2}\right)$	eg, where b = number of blue counters $\frac{b}{2b-4}$ **or** $\frac{b-1}{2b-5}$	eg, where r = number of red counters $\frac{r+4}{2r+4}$ **or** $\frac{r+3}{2r+3}$			M1	for making a correct start by finding the probability of the first counter being blue for their method
	eg $\frac{X+4}{2X}\times\frac{X+2}{2X-2}$	eg $\frac{b}{2b-4}\times\frac{b-1}{2b-5}$	eg $\frac{r+4}{2r+4}\times\frac{r+3}{2r+3}$			M1	oe correct calculation for 2 blue (using one variable)
	eg $8(X^2+6X+8)=3(4X^2-4X)$	eg $8b(b-1)=3(2b-4)(2b-5)$	eg $8(r+4)(r+3)=3(2r+4)(2r+3)$			M1	dep for a correct equation with no algebraic fractions eg could have $X^2+6X+8=\frac{3}{8}(4X^2-4X)$
	Eg $4X^2-60X-64\ (=0)$ **or** $X^2-15X-16\ (=0)$ oe	eg $4b^2-46b+60\ (=0)$ **or** $2b^2-23b+30\ (=0)$ oe	eg $4r^2-14r-60\ (=0)$ **or** $2r^2-7r-30\ (=0)$ oe			M1	for rearranging their equation to a correct 3 term quadratic
				16	5	A1	cao dep on M4
							Total 5 marks

21	a	$5-(x \pm q)^2+9$ oe **or** $p-(x-3)^2$ oe **or** $p-q^2+2qx-x^2$ and one of $2q=6$ **or** $p-q^2=5$			M1	may be seen in working eg $-[(x-3)^2-9-5]$ **or** expanding $p-(x-q)^2$ correctly and equating one of the coefficient of x or the constant term
			$14-(x-3)^2$	2	A1	fully correct SCB1 for $(x-3)^2-14$
	b	e.g. $(x-3)^2=14-y$ [or $(y-3)^2=14-x$]			M1	correct steps to isolate their bracket ft from (a) dep on expression in form $\pm p \pm (x-q)^2$
		$x=3\pm\sqrt{14-y}$ [or $y=3\pm\sqrt{14-x}$]			M1	complete method to find y in terms of x or x in terms of y. Condone + for ± ft from (a) dep on expression in form $\pm p \pm (x-q)^2$
		$(f^{-1}(x)=)\ 3-\sqrt{14-x}$			M1	for the correct inverse
					M1	method to solve $0<3-\sqrt{14-x}$ or a lower bound of 5 clearly shown, eg $x>5$ as part of the answer
			$5<x\leq 14$	5	A1	cao
						Total 7 marks