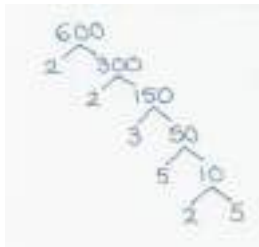**International GCSE Maths**

Apart from questions 1, 2, 4b, 5, 8, 12d, 19, 21, 23 (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	eg $2 \times 2 \times 150$ **or** $3 \times 5 \times 40$ **or** $2 \times 3 \times 100$ **or** $5^2 \times 24$ **or** **or** 	2	600		3	M1	for at least 2 correct stages in prime factorisation which give 2 prime factors – may be in a factor tree or a table or listed eg 2, 2, 150 (see LHS for examples of the amount of work needed for the award of this mark, allow no more than one mistake ft (eg one mistake with 2 prime factors ft: $600 = 200 \times 30 = 2 \times 100 \times 5 \times 6$))
	eg $2 \times 2 \times 2 \times 3 \times 5 \times 5$ oe				M1	for 2, 2, 2, 3, 5, 5 (ignore 1s) (may be a fully correct factor tree or ladder)
	Working required and note that the answer must be given as a product of powers of prime factors	$2^3 \times 3 \times 5^2$		A1	dep on M2 can be any order (allow $2^3 . 3 . 5^2$)
					Total 3 marks

First table:
2	600
2	300
	150

Second table:
2	600
2	300
2	150
3	75
5	25
5	5
	[1]

oe

Question	Working	Answer	Mark	Notes
2	eg $\dfrac{18}{7}$ **and** $\dfrac{9}{8}$ oe		3	M1 both fractions expressed as improper fractions, no need for $\div$ or $\times$ may be equivalent to those given eg $\dfrac{36}{14}$ or $\dfrac{27}{24}$ etc. A student could invert $\dfrac{9}{8}$ and show multiplication - as shown in the 2nd M1, this mark is then implied.
	eg $\dfrac{18}{7} \times \dfrac{8}{9}$ oe **or** oe $\dfrac{144}{56} \div \dfrac{63}{56}$			M1 **or** for both fractions expressed as equivalent fractions with denominators that are a common multiple of 7 and 8 eg $\dfrac{144}{56} \div \dfrac{63}{56}$
	eg $\dfrac{18}{7} \times \dfrac{8}{9} = \dfrac{144}{63} = \dfrac{16}{7} = 2\dfrac{2}{7}$ **or** $\dfrac{18}{7} \times \dfrac{8}{9} = \dfrac{144}{63} = 2\dfrac{18}{63} = 2\dfrac{2}{7}$ **or** $\dfrac{\cancel{18}^{\,2}}{7} \times \dfrac{8}{\cancel{9}^{\,1}} = \dfrac{16}{7} = 2\dfrac{2}{7}$ **or** $\dfrac{18}{7} \div \dfrac{9}{8} = \dfrac{144}{56} \div \dfrac{63}{56} = \dfrac{144}{63} = \dfrac{16}{7} = 2\dfrac{2}{7}$ **or** correct working to $\dfrac{16}{7}$ **and** writing $2\dfrac{2}{7} = \dfrac{16}{7}$	shown		A1 Dep on M2 for conclusion to $2\dfrac{2}{7}$ from correct working – either sight of the result of the multiplication or division eg $\dfrac{144}{63}$ must be seen and then cancelled or correct cancelling prior to the multiplication to $\dfrac{16}{7}$ **or** writing $2\dfrac{2}{7} = \dfrac{16}{7}$ (maybe on first line of working) and correct working as far as LHS $= \dfrac{16}{7}$ **NB: use of decimals scores no marks**
				Total 3 marks

Question	Working	Answer	Mark	Notes
3	$180 + 149$ **or** $360 − 31$		2	M1
	Working not required, so correct answer scores full marks	329		A1
				Total 2 marks

Question	Working	Answer	Mark	Notes
4 (a)(i)	other seen orders of letters: a, b, d, e, i, l, n, r, z b, r, I, a, e, z, l, n, d	b, r, a, z, i, l, e, n, d	1	B1 no repeats, letters can be in any order. Condone capital letters rather than lower case letters. (no need for commas)
(ii)		b, z	1	B1 No repeats, letters can be in any order. Condone capital letters. (no need for a comma)
(b)		correct explanation that shows they know the meaning of intersection and empty set	1	B1 eg letter 'a' is in both sets $B \cap K = \{a\}$ Set B and set K have an element (or letter) in common. There is a letter that is in set B and in set K There is an intersection so it isn't the null set There is a letter in common (do **not** allow 'letters' or 'elements' (plural) in common) (If students mention the letter that is in common, it must be the correct one (ie a))
				Total 3 marks

Question	Working	Answer	Mark		Notes
5	Angle *EBC* or *ECB* = (180 – 44) ÷ 2 (= 68)		5	M1	Could be seen on diagram
	Angle *GBC* = 180 – "68" (= 112) **or** Angle *GBC* = "68" + 44 (= 112) **or** Angle *BGH* = "68" (same as *EBC*) Angle *ABE* = 180 – "68" (= 112) **and** Angle *BGF* = "112" **or** Angle *ABG* = "68" **and** Angle *BGH* = "68" or Angle *FGJ* = "68" **or** Angle *BGF* = 180 – "68"(=112)			M1	for a method to as far as one step away from working out Angle *JGH* (an angle corresponding or vertically opposite to *JGH* or at the same point on a straight line with *JGH*) Could be seen on diagram. (the award of this mark also implies the previous M1)
	Working not required, so correct angle scores 3 marks *(unless from obvious incorrect working)*	112		A1	Could be seen in correct place on diagram
	NB: reasons must include the underlined words *Accept ∠ for angle(s) and ▱ for triangle* **For all angles**: They must be clearly stated as the correct angle or shown on the diagram in the correct position. (eg just seeing 68 in working without a label is not sufficient for the award of a mark for angle *EBC*)			B2	for correct answer with full reasons for their method eg <u>isosceles</u> triangle (or <u>2 equal sides</u>, <u>2 equal angles</u>) Angles in a <u>triangle</u> sum to <u>180º</u> or angles in a <u>triangle</u> Angles on a straight <u>line</u> sum to <u>180º</u> Angles on a straight <u>line</u> sum to 180º <u>Exterior</u> angle in a <u>triangle</u> is <u>equal</u> to the two <u>opposite interior</u> angles. <u>Vertically</u> <u>opposite</u> angles are equal. Vertically <u>opposite angles</u> are equal. <u>Corresponding</u> angles are equal. <u>Alternate</u> angles are equal <u>Allied</u> angles sum to 180° (or <u>co-interior</u> angles) Angles at a <u>point</u> (or <u>full turn)</u> add up to <u>360º</u> (or <u>angles</u> at a <u>point</u>) (B1 for one correct reason appropriate to their method, dep on M1)
					Total 5 marks

Question	Working	Answer	Mark	Notes	
6	$19.35 \div (4 + 5) \ (= 2.15)$		4	M1	M2 for $\dfrac{5}{9} \times 19.35 \, (= 10.75)$
	"2.15" $\times 5 \ (= 10.75)$			M1	
	$\dfrac{12 - "10.75"}{12} \times 100$ oe **or** $100 - \dfrac{10.75 \times 100}{12}$ oe			M1	
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	10.4		A1 accept 10.4 – 10.42 SCB1 for $\dfrac{5}{9} \times 12 \, (= 6.66...)$oe	
				Total 4 marks	

Question	Working	Answer	Mark	Notes
7	$\sin 42 = \dfrac{6.5}{x}$ **or** $\dfrac{x}{\sin 90} = \dfrac{6.5}{\sin 42}$ or $\cos 48 = \dfrac{6.5}{x}$ [where $48 = 180 - 90 - 42$]		3	M1 **or** use of tan to find the horizontal side **and** then a correct first step in Pythagoras' theorem ie [base =] $\dfrac{6.5}{\tan 42}\ (= 7.21...)$ and $[x^2 =]\ 6.5^2 + "7.21..."^2$
	$[x =]\ \dfrac{6.5}{\sin 42}$ **or** $\dfrac{6.5\sin 90}{\sin 42}$ **or** $[x =]\ \dfrac{6.5}{\cos 48}$ [where $48 = 180 - 90 - 42$]			M1 **or** complete method using Pythagoras $[x =]\sqrt{6.5^2 + "7.21..."^2}$ (If students give this statement with nothing before it they gain M2)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	9.7		A1 accept $9.7 - 9.72$
				Total 3 marks

Question	Working		Answer	Mark		Notes
8	eg $10a + 4c = 20$ $\;\;\;\; + \;\; 2a - 4c = 7$ eg $[\, c = \dfrac{10 - 5a}{2} \,]$ oe $2a - 4\left(\dfrac{10 - 5a}{2}\right) = 7$ oe	eg $10a + \;\; 4c = 20$ $\;\;\;\; - \;\; 10a - 20c = 35$ eg $[\, a = \dfrac{7 + 4c}{2} \,]$ oe $5\left(\dfrac{7 + 4c}{2}\right) + 2c = 10$ oe		3	M1	multiplication of one or both equation(s) with correct operation selected (allow one arithmetic error) (if $+$ or $-$ is not shown then assume it is the operation that at least 2 of the 3 terms have been calculated for) **or** correct rearrangement of one equation with substitution into second
	eg 5 × "2.25" + 2c = 10 **or** 2 × "2.25" − 4c = 7	eg 5a + 2 × "−0.625" = 10 **or** 2a − 4 × "−0.625" = 7			M1	(dep on previous M1 but not on a correct first value) correct method to find second unknown – this could be a correct substitution into one of the equations given or calculated or starting again with the same style of working as for the first method mark
	Working required		$a = 2.25$ $c = -0.625$		A1	oe eg $a = \dfrac{9}{4}$, $c = -\dfrac{5}{8}$ for both solutions dependent on first M1
						Total 3 marks

Question		Working	Answer	Mark	Notes
9	(i)	$(x \pm 6)(x \pm 4)$		2	M1 or $(x + a)(x + b)$ where $ab = -24$ **or** $a + b = 2$
		Working not required, so correct answer scores full marks	$(x + 6)(x - 4)$		A1
	(ii)	*Answer must come from the factors in (i) as the questions says 'Hence solve…'*	$-6, 4$	1	B1ft **Must** follow through from their factors in (i), so even if the answers 4 and –6 are given the mark can only be awarded if it follows from the factorisation in (i) (dep on 2 factors)
					Total 3 marks
					NB: Some students may show the whole of their working in the space for (i) or (ii). Please award the marks for (i) and (ii) so long as there is no ambiguity.

Question	Working	Answer	Mark	Notes
10	$11.2^2 - 7.4^2$ $(= 70.68)$ or $[x =] \cos^{-1}\left(\dfrac{7.4}{11.2}\right) (= 48.64...)$ or $[y =] \sin^{-1}\left(\dfrac{7.4}{11.2}\right) (= 41.35...)$ or $\sin^{-1}\left(\dfrac{7.4 \sin 90}{11.2}\right)$		5	M1 A correct first stage to finding the perpendicular height of the triangular cross section
	eg $\sqrt{11.2^2 - 7.4^2}$ $(= 8.407...)$ **or** $[h =]\sin"48.64..."\times 11.2$ **or** $\tan"48.64..."\times 7.4 (= 8.407...)$ **or** $[h =]\cos"41.35..."\times 11.2$ **or** $\dfrac{7.4}{\tan"41.35..."}$ $(=8.407...)$			M1 oe eg $h = \dfrac{11.2 \sin"48.64..."}{\sin 90}$
	eg $7.4 \times "8.407" \div 2 (= 31.10....)$ **or** $7.4 \times "8.407" \times 15 (= 933.19...)$			M1 for method to find area of cross section **or** volume of cuboid
	eg $"31.10" \times 15 (= 466.59...)$ **or** $"933.19" \div 2 (= 466.59...)$			M1 complete method to find volume of the prism
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	467		A1 accept $466 - 467$ SCB2 (if M0 awarded) for $0.5 \times 7.4 \times \sqrt{11.2^2 + 7.4^2} \times 15 (= 745)$ **or** SCB1 (if M0 awarded) for $7.4 \times \sqrt{11.2^2 + 7.4^2} \times 15 (= 1490)$ or $0.5 \times 7.4 \times \sqrt{11.2^2 + 7.4^2} (=49.6...)$ or $0.5 \times 7.4 \times 11.2 \times 15 (= 621.6)$ or 622
				Total 5 marks

Question	Working	Answer	Mark	Notes
11(a)	eg 100 + 24 (=124 [%]) **or** 1 + 0.24 (= 1.24) **or** $\frac{180000}{124}(=1451.6...)$		3	M1
	eg 180 000 ÷ 1.24 180 000 ÷ 124 × 100 or 180 000 × 100 ÷ 124 oe			M1 for a complete method
	Working not required, so correct answer scores full marks (unless from obvious incorrect working) *NB: this question is one where students could misread the number of zeros(eg one too many or one too few) in the question, up to M2 could be awarded if a correct method is seen with this misread*	145 000		A1 accept 145 000 − 145 200 (if a correct answer is seen in working and then rounded incorrectly, award full marks) (if no marks awarded, SCB1 for 223 200 or 223 000)
(b)	for 0.018 × 120 000 oe **or** 2160 **or** 1.018 × 120 000 oe **or** 122 160		3	M1 For finding 1.8% or 101.8% of the value **OR** M2 for 120 000 × 1.018^3 **or** 120 000 × 1.018^4 **or** 128 876.09
	1.018 × "122 160" (= 124 358.88) oe **and** 1.018 × "124 358.88" (= 126 597.34) oe			M1 for completing the method (M1 for 120 000 × 1.018^2 **or** 124 358.88)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working) *NB: this question is one where students could misread the number of zeros in 120 000 (eg one too many or one too few) in the question, up to M2 could be awarded if a correct method is seen with this misread*	127 000		A1 or 126 597 – 126 600 (if a correct answer is seen in working and then rounded incorrectly, award full marks) **SC:** if no other marks gained award M1 for 1.054 × 120 000 oe **or** 126 480 **or** 6 480 (accept (1 + 0.018) as equivalent to 1.018 throughout)
				Total 6 marks

Question	Working	Answer	Mark	Notes
12 (a)			2	M1 for at least 4 points plotted correctly at end of interval **or** for all points plotted consistently within each interval of the associated frequency table (eg at 2.5, 7.5, 12.5, 17.5, 22.5, 27.5 or 0, 5, 10, 15, 20, 25) at the correct height
	(NB: a 'bar chart' type graph scores zero marks)	correct cf graph		A1 All points plotted correctly at end of interval (tolerance 1 small square) and joined with a curve or line segments accept curve that is not joined at (0, 0).
(b)	If answer is in the given range, then award the mark – unless from obvious incorrect working	10.5 to 12	1	B1ft accept answer in range 10.5 – 12 or ft *their* cumulative frequency graph (must be an ascending graph) (allow 1 small square tolerance)
(c)	NB: readings are 5.5 – 7 and 15.5- 17 (but for this M1 these do not have to be correct if correct working is shown – eg lines or marks indicating use of CF 20 (or 20.25)and CF 60 (or 60.75) with an indication on the Distance axis at the correct points (or they can just show the correct readings))		2	M1ft For correct use of LQ and UQ, ft from a cum freq graph provided method is shown – eg a line horizontally to the graph from readings of CF 20 and CF 60 to meet the graph and then a vertical line to the Distance axis(even if wrongly read scale) **or** clear marks on the graph and Distance axis that correspond to the correct readings **or** correct values from the Distance axis
	If answer is in the given range, then award the marks – unless from obvious incorrect working	8.5 to 11.5		A1ft Accept a single value in range 8.5 to 11.5 or ft from their cumulative frequency graph provided method is shown
(d)	**not in context**: office *B* workers have a higher median than office *A* workers oe **in context**: office *B* workers [tend to] travel further oe		2	B1 ft comparison of medians e.g. Office *B* workers travel further [but if they have a wrong median then correct comparison of this with the 15 km] (Must compare to median in (b))
	not in context: the IQR for office *A* workers is bigger than the IQR for office *B* workers oe **in context**: The distances for the office *A* workers are more spread out/more varied oe			B1 ft comparison of IQR eg Office *A* distances are more spread (must compare to IQR in (c)) **NB: To award both marks at least one comparison must be in context**
				Total 7 marks

Question		Working	Answer	Mark		Notes
13	(a)		0.3		B1	oe first race branch correct
			0.6, 0.4, 0.6	2	B1	oe second race branches correct
	(b)	0.7 × "0.6" (= 0.42) oe **or** "0.3" × "0.4" (= 0.12) oe **or** 0.7 × 0.4 (= 0.28) oe **or** "0.3" × "0.6" (= 0.18) oe			M1	ft their tree diagram dep on probabilities being less than 1
		"0.42" + "0.12" oe **or** 1 – "0.28" – "0.18"oe			M1	ft complete method to find probability that Emilie wins exactly one of the races
		Working not required, so correct answer scores full marks (unless from obvious incorrect working)	0.54	3	A1	oe, eg $\frac{27}{50}$ ft from their tree diagram on M marks only
	(c)	0.7 × 0.4 × (1 – 0.6) (= 0.112) oe **or** "0.54" × 0.3 (= 0.162) oe **or** 0.7×"0.6"×0.3+"0.3"×"0.4"×0.3(= 0.162)			M1	ft
		eg "0.112" + "0.162"			M1	ft For a fully correct method
		Working not required, so correct answer scores full marks (unless from obvious incorrect working) *NB: allow decimals, fractions or percentages with % as oe for probability*	0.274	3	A1	oe, eg $\frac{137}{500}$ ft from (a) and (b) on M marks only
						Total 8 marks

Question	Working	Answer	Mark	Notes
14		$\dfrac{4y^5}{3x^2}$	3	**B3** Accept $\dfrac{4}{3}x^{-2}y^5$ or $\dfrac{4x^{-2}y^5}{3}$ or $1.\dot{3}x^{-2}y^5$ oe NB: Must see 4 and 3 and not $16^{\frac{1}{2}}$ or $9^{\frac{1}{2}}$ or $16^{-\frac{1}{2}}$ or $9^{-\frac{1}{2}}$ (allow use of 1.3[33..])
				If not B3 then B2 for 2 of: correct fraction ($\dfrac{4}{3}$ or $1.\dot{3}$)(allow use of 1.3[33..]) **or** x term correct (x^2 on denominator or x^{-2} on numerator) **or** y term correct (y^5 on numerator or y^{-5} on denominator)
				If not B2 then **B1** for 1 of : correct fraction **or** x term correct **or** y term correct **or** for one of applying negative power to at least 3 out of 4 of 9, x^4, 16, y^{10} **or** applying square root to at least 3 out of 4 of 9, x^4, 16, y^{10} eg at least 3 of the 4 parts of $\dfrac{16y^{10}}{9x^4}$ **or** $\dfrac{16x^{-4}}{9y^{-10}}$ **or** $\dfrac{\frac{1}{9}x^{-4}}{\frac{1}{16}y^{-10}}$ **or** $\dfrac{3x^2}{4y^5}$ oe
				Total 3 marks

Question	Working	Answer	Mark	Notes	
15 (a)		8.5, 5, 4, 5	2	B2	all 4 correct (allow eg 5.0 for 5) (B1 for 2 or 3 correct)
(b)				M1	ft their table dep on B1 scored in (a) for 5 or 6 points plotted correctly (tolerance 1 small square)
		fully correct graph	2	A1	A fully correct graph – correct points plotted correctly (within tolerance of 1 small square) and intention to join with a smooth curve (be generous if intention is clearly a smooth curve through all points)
					NB: If a student has nothing in the table for part (a) but draws a fully correct graph in part (b) award the marks in part (a)
					Total 4 marks

Question	Working	Answer	Mark	Notes
16 (a)	$A = \dfrac{k}{r^2}$		3	**M1** oe k can be any letter (must be a letter and not 1)
	$5 = \dfrac{k}{0.3^2}$ oe **or** $k = 0.45$ oe			**M1** implies first M1 if you see this stage
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	$A = \dfrac{0.45}{r^2}$		**A1** oe with A as the subject eg $A = \dfrac{9}{20r^2}$ (allow $A = \dfrac{k}{r^2}$ where $k = 0.45$ oe) (SC if M0 scored then award B2 for $A \propto \dfrac{0.45}{r^2}$ oe)
(b)	$[A =] \dfrac{"0.45"}{(7.5A)^2}$ oe **or** $\dfrac{"0.45"}{56.25A^2}$ **or** $\dfrac{9}{20(7.5A)^2}$ oe		3	**M1** ft from (a) dep on M2 in (a) ($[A =]\dfrac{"0.45"}{7.5A^2}$ is zero marks unless recovered later)
	$A^3 = \dfrac{"0.45"}{56.25}$ $\left(A^3 = \dfrac{1}{125}\right.$ or 0.008 oe$)$ or $125\,A^3 = 1$ oe			**M1** ft their 0.45 dep on M2 in (a) Must include A^3
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	0.2		**A1** oe
				Total 6 marks

Question	Working	Answer	Mark	Notes
17	eg $\dfrac{4-(-1)}{6-4}$ $(=\dfrac{5}{2}=2.5)$		4	M1 for a method to find the gradient of **L**
	eg $\dfrac{-1}{"2.5"}$ $(=-\dfrac{2}{5}=-0.4)$ or $\dfrac{-1}{\textit{their} \text{ gradient}}$ oe			M1 ft for a method to find the gradient of **M** if *their* gradient of **L** clearly stated (even if no method shown for gradient of **L**)
	$y=$ "−0.4"$x+8$ oe eg $y-8=-\dfrac{2}{5}(x-0)$ **or** $(8\div2)\times5\;(=20)$ oe **or** $8\div(-\text{'}\textit{their gradient of }\textbf{M}\text{'})$			M1 dep on previous M1 for substitution of (0, 8) into equation for a line **or** use of $(8\div2)\times5\;(=20)$ (maybe on diagram) NB: 20 gains M3 if clearly intended as *x* coordinate (stated or on a diagram)
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	(20, 0)		A1
				Total 4 marks

Question	Working	Answer	Mark	Notes
18	$[ADC =]$ $180 - 98$ $(= 82)$		6	M1 may be seen on diagram
	$[AC^2 =] 8^2 + 7.5^2 - 2 \times 8 \times 7.5 \times \cos(98) (= 136.95...)$			M1 correct equation for AC or AC^2
	$[AC =] \sqrt{"136.95"}$ **or** $\sqrt{64 + 56.25 + 16.7....}(= 11.7...)$ oe			M1 complete method to find AC showing correct order of operations
	eg $[[AD =] \dfrac{"11.7" \sin 35}{\sin"82"} (= 6.77..)$ **or** $[DC =] \dfrac{"11.7" \times \sin"63"}{\sin"82"} (=10.5..)$oe (where **"82" = 180 – 98** , "63" = 180 – "82" – 35)			M1 correct calculation for AD **or** DC dep on 1st M1 and 2nd M1
	eg $[AD =] \dfrac{"11.7" \sin 35}{\sin"82"}$ **and** $[DC =] \dfrac{"11.7" \sin"63"}{\sin"82"}$ oe **or** $[AD =] \dfrac{"11.7" \sin 35}{\sin"82"}$ and $[DC =]\sqrt{"11.7"^2 + "6.77"^2 - 2 \times "11.7" \times "6.77" \times \cos"63"}$ $[DC =] \dfrac{"11.7" \sin"63"}{\sin"82"}$ **and** $[AD =]\sqrt{"11.7"^2 + "10.5"^2 - 2 \times "11.7" \times "10.5" \times \cos 35}$ Where "63" = 180 – "82" – 35			M1 correct calculations for AD **and** DC ($AD = 6.77...$ $DC = 10.5...$) dep on 1st M1 and 2nd M1
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	32.8		A1 accept 32.7 – 32.9
				Total 6 marks

Question	Working		Answer	Mark	Notes	
19	$x^2 + (3-2x)^2 = 18$	$\left(\dfrac{3-y}{2}\right)^2 + y^2 = 18$		5	M1	substitution of linear equation into quadratic
	$5x^2 - 12x - 9[=0]$ oe	$5y^2 - 6y - 63[=0]$ oe			M1	simplified to a correct 3 term quadratic
	$(5x+3)(x-3)\ [=0]$ $\dfrac{-(-12)\pm\sqrt{(-12)^2 - 4\times5\times(-9)}}{2\times5}$ $5[(x-\dfrac{12}{10})^2 - \dfrac{144}{100}] - 9 = 0$ oe	$(5y-21)(y+3)\ [=0]$ $\dfrac{-(-6)\pm\sqrt{(-6)^2 - 4\times5\times(-63)}}{2\times5}$ $5[(y-\dfrac{6}{10})^2 - \dfrac{36}{100}] - 63 = 0$ oe			M1ft	dep on M1 for solving *their* 3 term quadratic equation using any correct method (if factorising, allow brackets which expanded give 2 out of 3 terms correct) (if using formula allow one sign error and some simplification – allow as far as $\dfrac{12\pm\sqrt{144+180}}{10}$ or $\dfrac{6\pm\sqrt{36+1260}}{10}$)(if completing the square allow as far as shown)
			$x = -0.6$ **and** $x = 3$ **OR** $y = 4.2$ **and** $y = -3$		A1	oe dep on M2 for both *x*-values **OR** both *y*-values
	Working must be shown		$x = -0.6$, $y = 4.2$ $x = 3$, $y = -3$		A1	oe dep on M2 (must be clearly shown as correct pairs), accept answers given as coordinates
						Total 5 marks

Question	Working	Answer	Mark	Notes
20	eg $\sqrt{\dfrac{36}{25}}\left(=\dfrac{6}{5}\right)$ **or** $\sqrt{\dfrac{25}{36}}\left(=\dfrac{5}{6}\right)$ **or** $\sqrt{36}:\sqrt{25}\ (6{:}5)$ **or** $\sqrt{25}:\sqrt{36}\ (5{:}6)$ **or** $\dfrac{(\sqrt{25})^3}{(\sqrt{36})^3}=\left(\dfrac{125}{216}\right)$ oe **or** $\dfrac{36^3}{25^3}=\dfrac{(\text{vol of large})^2}{300^2}$ **or** $\dfrac{36}{25}=\dfrac{(\text{vol of large})^{\frac{2}{3}}}{300^{\frac{2}{3}}}$ oe		3	M1 for a correct scale factor for length – may be given as a fraction or ratio **or** a correct scale factor for volume given as a fraction or ratio **or** a correct equation for the volume of each large block
	eg $300\times\left("\dfrac{6}{5}"\right)^3$ **or** $300\div\left("\dfrac{5}{6}"\right)^3$ oe **or** $\sqrt{\dfrac{300^2\times36^3}{25^3}}$ **or** $\left(\dfrac{36\times300^{\frac{2}{3}}}{25}\right)^{\frac{3}{2}}$ oe			M1 for a complete method to find the volume of a large block
	Working not required, so correct answer scores full marks (unless from obvious incorrect working)	518.4		A1 allow 518
				Total 3 marks

Question	Working	Answer	Mark	Notes
21	$\left[\dfrac{dy}{dx}=\right]2\times kx-16x^{-2}$ **or** $2kx-\dfrac{16}{x^{2}}$ oe		5	M2 for both terms differentiated correctly (M1) for one term differentiated correctly
	$"2kx-16x^{-2}"=0$ oe			M1 ft dep on M1
	eg $\dfrac{8}{27}k=8$ or $\dfrac{4}{3}k=36$ or $k=27$ oe			M1 (not ft) for substituting $x=\dfrac{2}{3}$ into their correct equation for k and getting as far as one step from the value of k or the correct value of k
	Working must be seen	36		A1 dep on M4
				Total 5 marks

Qu	Working	Answer	Mark	Notes	
22	[g(x) =] $2(x-3)^2 - 5$		4	B2	for $a = 2$, $b = 3$ and $c = 5$ correct (stated or shown) (B1 for one of $a = 2$, $b = 3$ and $c = 5$ correct)
	stretch y direction scale factor 2 oe [ft their a] **or** translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ (ft correct use of their b and c) oe			M1	**Stretch** and a correct description of the stretch **or translation** and a correct description of the translation NB: must include the word translation (or translate) and stretch
		Correct transformations in correct order		A1	Stretch y direction scale factor 2 **followed by** translation $\begin{pmatrix} 3 \\ -5 \end{pmatrix}$ oe eg translation $\begin{pmatrix} 3 \\ 0 \end{pmatrix}$, stretch SF2 in y direction followed by translation $\begin{pmatrix} 0 \\ -5 \end{pmatrix}$
					Total 4 marks
22 Alt	[g(x) =] $2(x-3)^2 - 5$		4	B2	for $a = 2$, $b = 3$ and $c = 5$ correct (stated or shown) (B1 for one of $a = 2$, $b = 3$ and $c = 5$ correct)
	translation $\begin{pmatrix} 3 \\ -2.5 \end{pmatrix}$ (ft correct use of their b and $0.5c$) oe **or** stretch y direction scale factor 2 (ft their a)			M1	A correct description of the stretch **or** the translation
		Correct transformations in correct order		A1	Translation $\begin{pmatrix} 3 \\ -2.5 \end{pmatrix}$ oe **followed by** stretch y direction scale factor 2
					Total 4 marks

23	$\dfrac{\left(\dfrac{N+3}{2}\right)}{N}\left(=\dfrac{N+3}{2N}\right)$ eg	eg where b = number of black pens $\dfrac{b}{2b-3}$ **or** $\dfrac{b}{N}$ **and** $N = 2b-3\left(\text{or } b = \dfrac{N+3}{2}\right)$	eg where r = number of red pens $\dfrac{r+3}{2r+3}$ **or** $\dfrac{r+3}{N}$ **and** $N = 2r+3\left(\text{or } r = \dfrac{N-3}{2}\right)$		5	M1	for making a correct start by finding the probability of the first pen being black for their method. If in 2 variables, one must also be defined in terms of the other. (any letter may be used for the variable)
	eg $\dfrac{N+3}{2N}\times\dfrac{N-3}{2(N-1)}=\dfrac{9}{35}$	eg $\dfrac{b}{2b-3}\times\dfrac{b-3}{2b-4}=\dfrac{9}{35}$ **or** $\dfrac{b}{N}\times\dfrac{b-3}{N-1}=\dfrac{9}{35}$	eg $\dfrac{r+3}{2r+3}\times\dfrac{r}{2r+2}=\dfrac{9}{35}$ **or** $\dfrac{r+3}{N}\times\dfrac{r}{N-1}=\dfrac{9}{35}$ **and** $N = 2r+3$			M1	oe dep on previous M1 for a correct equation for black, red – must be in one variable or if 2 variables, one must be defined in terms of other.
	eg $35(N+3)(N-3)$ $=9(2N(2N-2))$ **or** $35(N^2-9)=$ $9(4N^2-4N)$	eg $35(b^2-3b)=$ $9(4b^2-14b+12)$	eg $35(r^2+3r)=$ $9(4r^2+10r+6)$			M1	dep on previous marks for a correct equation in one variable with no algebraic fractions – brackets may or may not be expanded
	eg $N^2-36N+315(=0)$	eg $b^2-21b+108(=0)$	eg $r^2-15r+54(=0)$			M1	For correctly rearranging their equation to a 3 term quadratic
	Working must be seen			21, 15		A1	cao dep on M4
							Total 5 marks