EXPERT TUITION

Maths Questions By Topic:

Number
Mark Scheme

Edexcel GCSE (Higher)

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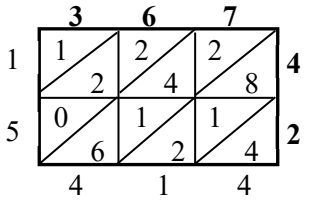
Question	Answer	Mark	Mark scheme	Additional guidance
1 (a)	15.414	M1	for a complete method with relative place value correct including intention to add all the appropriate elements of the calculation eg 2 lines of the 1st method, internal numbers of grids, or complete structure shown of partitioning methods.	14680 734 15414  | | 300 | 60 | 7 | | --- | --- | --- | --- | | 40 | 12000 | 2400 | 280 | | 2 | 600 | 120 | 14 | 12000 + 2400 + 280 + 600 + 120 + 14 = 15414
		A1	for digits 15414	
		A1	(ft) dep on M1 for correct placement of the decimal point into their final answer	
(b)	37.4	M1	for a start to a method, eg 598.4 ÷ 16 (or 59.84 ÷ 1.6) = 3 (as a first digit)	A start to a repeated subtraction method or build-up method is acceptable if a correct first digit of 3 is found
		A1	for digits 374	
		A1	(ft) dep on M1 for correct placement of the decimal point into their final answer	

Question	Answer	Mark	Mark scheme	Additional guidance
2	$1\frac{8}{15}$	M2	for a complete method, eg $4-2+\frac{3}{15}-\frac{10}{15}$ condoning error with one numerator **or** for $\frac{21}{5}-\frac{8}{3}=\frac{63}{15}-\frac{40}{15}\left(=\frac{23}{15}\right)$ with no more than one error	
		(M1	for finding two fractions with a correct common denominator, with at least one correct corresponding numerator, eg $\frac{3}{15}, \frac{10}{15}$ **or** for converting both to improper fractions, eg $\frac{21}{5}, \frac{8}{3}$)	At least one improper fraction must be correct
		A1	$1\frac{8}{15}$ oe	Any equivalents must be a mixed number

Question	Answer	Mark	Mark scheme	Additional guidance
3 (a)	1	B1	cao	
(b)	3	B1	cao	
(c)	$\frac{1}{16}$	B1	oe	
(d)	3	B1	cao	
4 (a)	30	P1	for a start to the process, eg 5406 ÷ 6 (= 901) **or** 5400 ÷ 6 (= 900) **or** 5000 ÷ 6 (= 833.33..) **or** 5410 ÷ 6 (= 901.66..)	
		P1	for a process to find the length of one side, eg $\sqrt{"901"}$ **or** $\sqrt{"900"}$ **or** $\sqrt{"833.33.."}$ **or** $\sqrt{"901.66.."}$	
		A1	for 30	
(b)	Explanation	C1	for a correct explanation based on their working in (a), eg underestimate because I rounded the total area down	Must be based on the use of a rounded value in a calculation

Question	Answer	Mark	Mark scheme	Additional guidance
5	Explanation	C1	explanation **Acceptable examples** he should have used 100(x) rather than 10(x) he should have used 1000x and 10x Ted's working does not eliminate the recurring decimals the recurring numbers after the decimal point have to be in the same sequence he should have multiplied by 100 to subtract easier after the decimal point he should have multiplied by 100 because two numbers are recurring **Not acceptable examples** it is not correct the method is not complete he should have used 1000x he should have multiplied by 100 he should have multiplied by 100 and then done 100x – 10x to give 43/90	

Question	Answer	Mark	Mark scheme	Additional guidance
6	Result shown	M1	(indep) for writing $\sqrt{12}$ as $2\sqrt{3}$	This mark can be awarded whenever this is seen, which might be later in the process.
		M1	for method to rationalise the denominator eg $\frac{8+\sqrt{12}}{5+\sqrt{3}}\times\frac{5-\sqrt{3}}{5-\sqrt{3}}$ **or** $\frac{8+2\sqrt{3}}{5+\sqrt{3}}\times\frac{5-\sqrt{3}}{5-\sqrt{3}}$ oe	
		M1	(dep on previous M1) for expanding terms, condone one error in numerator or denominator eg $\frac{40-8\sqrt{3}+5\sqrt{12}-\sqrt{12}\sqrt{3}}{25-5\sqrt{3}+5\sqrt{3}-\sqrt{3}\sqrt{3}}$ **or** $\frac{40-8\sqrt{3}+10\sqrt{3}-2\sqrt{3}\sqrt{3}}{25-5\sqrt{3}+5\sqrt{3}-\sqrt{3}\sqrt{3}}$ **or** $\frac{34+2\sqrt{3}}{22}$ oe	
		A1	for a complete chain of reasoning leading to $\frac{17+\sqrt{3}}{11}$	

Question	Answer	Mark	Mark scheme	Additional guidance
7	Shown	M1	for conversion to improper fractions eg. $\frac{7}{3}$ **or** $\frac{15}{4}$	Need not be shown with operators
		M1	(dep) for method to multiply fractions, eg. $\frac{7\times15}{3\times4}\left(=\frac{105}{12}\right)$ **or** $\frac{28\times45}{12\times12}\left(=\frac{1260}{144}\right)$ oe	
		C1	for complete working showing each stage as far as $\frac{35}{4}$ or $8\frac{9}{12}$	

Question	Answer	Mark	Mark scheme	Additional guidance
8	0.000 672, 67.2×10^{-4} 6.72×10^{5} 672×10^{4}	B2 (B1	cao for correct conversions to same format, condoning one error **or** for 3 numbers in the correct order (ignoring one) **or** for all 4 numbers listed in reverse order)	Accept correct numbers in any form

Question	Answer	Mark	Mark scheme	Additional guidance
9 (a)	300	M1	for working out $\sqrt[4]{81}$ as 3 **or** $\sqrt[4]{10^8}$ as 10^2 or 100	Mark may be awarded if operations are attempted on 8100000000 eg 300000000
		A1	for 300 **or** 3×10^2 or 3×100	
(b)	$\frac{1}{8}$	M1	for showing a square root of 64 as 8 **or** recognition of the reciprocal eg $\frac{1}{n}$ **or** shows expressions that show an understanding of the ½ index and the minus index eg $\frac{1}{\sqrt{64}}$ or other equivalent forms	
		A1	oe	Accept $\pm\frac{1}{8}$ oe
(c)	3^{2-n}	M1	for $3^{2(n-1)}$ **or** 3^{2n-2} **or** $\left(3^2\right)^{n-1}$	
		A1	for 3^{2-n} oe eg $3^{n-2(n-1)}$	

Question	Answer	Mark	Mark scheme	Additional guidance
10	$1+\frac{\sqrt{5}}{5}$	P1	for writing $\sqrt{180}$ as $6\sqrt{5}$	This process mark can be awarded whenever this is seen, which might be later in the process.
		P1	for process to rationalising the denominator eg $\frac{\sqrt{180}-2\sqrt{5}}{5\sqrt{5}-5}\times\frac{5\sqrt{5}+5}{5\sqrt{5}+5}$ **or** $\frac{4\sqrt{5}}{5\sqrt{5}-5}\times\frac{5\sqrt{5}+5}{5\sqrt{5}+5}$ oe	
		P1	(dep on previous P1) for expanding terms eg $\frac{5\sqrt{5}\sqrt{180}+5\sqrt{180}-50-10\sqrt{5}}{125-25}$ **or** $\frac{100+20\sqrt{5}}{100}$ oe	
		A1	for $1+\frac{\sqrt{5}}{5}$	Accept written as $a = 1$, $b = 5$

Question	Answer	Mark	Mark scheme	Additional guidance
11	1080	M1	for method to write one number as a product of prime factors (condone one division error in method chosen), eg. one complete factor tree or 2, 2, 3, 3, 3 or 2, 2 , 2, 3, 5 or for listing at least 5 multiples of either number (condone one error) or for any common multiple (≠ 1080), eg. 12960 (= 108 × 120)	Accept first 5 multiples if all correct or one error in the first 6 multiples
		M1	for method to write both numbers as a product of prime factors (condone a total of one division error) eg. two complete factor trees or 2, 2, 3, 3, 3 **and** 2, 2, 2, 3, 5 or lists of multiples of the two numbers, at least 5 of each, one of which includes 1080	For the list not containing 1080, accept first 5 correct multiples or one error in the first 6 multiples
		A1	cao SC: B2 for any product that would lead to 1080, eg. $2^3 \times 3^3 \times 5$ or $12 \times 9 \times 10$	

Question	Answer	Mark	Mark scheme	Additional guidance
12	$2\frac{1}{3}$	M1	for either $\frac{7}{4}$ oe or $\frac{4}{3}$ oe	
		M1	for method to find the product, eg. $\frac{7\times4}{4\times3}$ or $\frac{21\times16}{12\times12}$ oe or for $\frac{28}{12}$ or $\frac{7}{3}$ oe	
		A1	for $2\frac{1}{3}$ or an equivalent mixed number	

Question	Answer	Mark	Mark scheme	Additional guidance
13	$\frac{414}{990}$	M1	for (x =) 0.41818… or (10x =) $4.\dot{1}\dot{8}$ or 4.1818… or (100x =) $41.\dot{8}\dot{1}$ or 41.818… or (1000x =) $418.\dot{1}\dot{8}$ or 418.18…	
		M1	for using two recurring decimals with a terminating decimal difference, eg. (1000x – 10x =) $418.\dot{1}\dot{8} - 4.\dot{1}\dot{8}$ or 418.18… − 4.1818… (= 414)	Accept (100x – x =) $41.\dot{8}\dot{1} - 0.4\dot{1}\dot{8}$ or 41.818... – 0.41818... (= 41.4)
		A1	for $\frac{414}{990}$ oe, eg $\frac{23}{55}$	$\frac{41.4}{99}$ must be simplified to gain the accuracy mark
14 (a)	$2\sqrt{11}$	M1	for method to multiply numerator and denominator by $\sqrt{11}$ or a multiple of $\sqrt{11}$, eg $\frac{22}{\sqrt{11}} \times \frac{\sqrt{11}}{\sqrt{11}}$	
		A1	for $2\sqrt{11}$	
(b)	$\frac{6+\sqrt{3}}{11}$	M1	for method to multiply numerator and denominator by $2\sqrt{3} + 1$ or a multiple of $2\sqrt{3} + 1$, eg $\frac{\sqrt{3}}{2\sqrt{3}-1} \times \frac{2\sqrt{3}+1}{2\sqrt{3}+1}$	
		M1	(dep) for $\sqrt{3} \times 2\sqrt{3} = 6$ or $2\sqrt{3} \times 2\sqrt{3} = 12$	
		A1	for $\frac{6+\sqrt{3}}{11}$ (accept a = 6 and b = 11)	

Question	Answer	Mark	Mark scheme	Additional guidance
15	$\frac{3}{4}$ oe	P1	for a first step to converting to a common base with one correct conversion, eg. $9^{-\frac{1}{2}} = 3^{-1}$ or $\frac{1}{3}$ or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe	$9^{-\frac{1}{2}} = 3^{-1}$ (or $\frac{1}{3}$) oe or $27^{\frac{1}{4}} = 3^{\frac{3}{4}}$ oe seen alone gets the P1
		P1	(dep) for $3^{-1} = 3^{\frac{3}{4}} \div 3^{x+1}$ oe	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
16	18	M1	for listing factors of 72 and 90, at least 4 correct for each (with no more than 1 incorrect in each list), could be in factor pairs **OR** for the prime factors of 72 (2, 2, 2, 3, 3) **or** 90 (2, 3, 3, 5)	Factors of 72: 1, 2, 3, 4, 6, 8, 9, 12, 18, 24, 36, 72 Factors of 90: 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90
		A1	for 18 or 2×3^2 oe SC B1 for answer of 6 or 9 if M0 scored	2, 3^2 is not enough, it must be a product

Question	Answer	Mark	Mark scheme	Additional guidance
17 (a)	75 to 81	B2	for answer in the range 75 to 81	
		(B1	for 60 **or** 100 **or** 6000 **or** 6400 **or** $\sqrt{64\times100}$)	
(b)	0.000 148	B1	for 0.000 148 oe	Can use standard form
(c)	$\frac{1}{25}$	B1	for $\frac{1}{25}$ or 0.04	
18	$5\frac{3}{5}$	M1	for writing as improper fractions with at least one correct, eg $\frac{7}{2}\times\frac{8}{5}$ oe	
		M1	(dep) for multiplying improper fractions, eg $\frac{"56"}{"10"}$ **or** $5\frac{6}{10}$ **or** $\frac{28}{5}$ oe	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
19 (a)	125	M1	for method to find the number of 3 digit combinations, eg 5^3 **or** $5^3 - 1$	
		A1	for 125 **or** 124	
(b)	60	M1	for method to find the number of combinations with 3 different digits eg $5 \times 4 \times 3$ **or** finds there are 65 combinations that do not have 3 different digits	
		A1	cao	
20 (a)	$3\sqrt{3}$	M1	for working unambiguously with $\sqrt{12}$, eg $\sqrt{4\times3}$ **or** $\sqrt{4}\times\sqrt{3}$ **or** $2\sqrt{3}$	
		A1	cao	
(b)	$\frac{\sqrt{3}}{81}$	M1	for simplifying the power eg $(\sqrt{3})^7 = 27\sqrt{3}$	
		M1	for method to rationalise the denominator eg multiplying by $\frac{\sqrt{3}}{\sqrt{3}}$	May be seen as the first step
		A1	for $\frac{\sqrt{3}}{81}$ **or** equivalent fraction in form $\frac{\sqrt{b}}{c}$, eg $\frac{\sqrt{2187}}{2187}$	

Question	Answer	Mark	Mark scheme	Additional guidance
21	9	M1	for a correct first step, using the laws of indices to simplify eg. 3^2 or 3^{7+-2} or 3^{7-3} or 3^{-2-3} OR for using exact values, eg. $2187 \times \frac{1}{9}$ (= 243) or $2187 \div 27$ (= 81) or $\frac{1}{27\times9}$ $(=\frac{1}{243})$	
		A1	cao	
22 (a)	16 to 20	P1	for using time = $\frac{\text{distance}}{\text{speed}}$, eg $\frac{1}{200}$ or $\frac{1}{213}$ **or** for 1 hour = 60 × 60 (= 3600) seconds	
		P1	complete process, eg $\frac{1}{200} \times 60 \times 60$ oe or $\frac{1}{213} \times 60 \times 60$ oe	Calculation could be done in stages.
		A1	for answer in range 16 to 20	
(b)	decision with reason	C1	(dep on correct use of time = $\frac{\text{distance}}{\text{speed}}$) for reason related to their response to part(a), eg overestimate as speed rounded down	

Question	Answer	Mark	Mark scheme	Additional guidance
23 (a)	$\frac{8}{27}$	M1	for showing the 4th root of 16 as 2 **and** the 4th root of 81 as 3 **or** $\frac{8}{n}$ $(n \neq 27)$ **or** $\frac{n}{27}$ $(n \neq 8)$ **or** an intention to find the 4th root and cube, eg. $\sqrt[4]{\left(\frac{16}{81}\right)^3}$ or $\left(\sqrt[4]{\frac{16}{81}}\right)^3$ oe	
		A1	cao	
(b)	0	M1	for writing $\frac{1}{9} = 3^{-2}$, $9\sqrt{3} = 3^{2.5}$, $\frac{1}{\sqrt{3}} = 3^{-0.5}$ as powers of 3, with at least 2 correct **or** for working out $\frac{1}{9} \times 9\sqrt{3} \times \frac{1}{\sqrt{3}} = 1$	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
24	Proof with $\frac{127}{495}$	M1	0.25656... **or** 0.2 + 0.05656.. or $(10 \times 0.2\dot{5}\dot{6} =)\ 2.\dot{5}\dot{6}$ or 2.5656… or $(100 \times 0.2\dot{5}\dot{6} =)\ 25.\dot{6}\dot{5}$ or 25.6565…or $(1000 \times 0.2\dot{5}\dot{6} =)\ 256.\dot{5}\dot{6}$ or 256.5656…	
		M1	for finding two correct recurring decimals that when subtracted would result in a terminating decimal or integer, eg. 256.5656….. – 2.5656….. or 25.6565….. – 0.25656….. or $256.\dot{5}\dot{6} - 2.\dot{5}\dot{6}$ or $25.\dot{6}\dot{5} - 0.2\dot{5}\dot{6}$ **or** for $\frac{254}{990}$ or $\frac{25.4}{99}$	
		C1	full proof seen with $\frac{127}{495}$	
25	fully correct working leading to $16\left(1+\sqrt{2}\right)$	C1	for expanding the numerator, eg $18 + 2\sqrt{2}\sqrt{18} + 2$ or $\sqrt{324} + \sqrt{36} + \sqrt{36} + \sqrt{4}$ (= 32) **or** for simplifying $\sqrt{18}$, eg. $\sqrt{18} = 3\sqrt{2}$ or $\sqrt{18} + \sqrt{2} = 4\sqrt{2}$	Expanded terms need not be simplified
		C1	(indep) for method to rationalise the denominator, eg. $\frac{\text{"numerator"}}{\sqrt{8}-2} \times \frac{\sqrt{8}+2}{\sqrt{8}+2}$	
		C1	for fully correct working leading to $16\left(1+\sqrt{2}\right)$	Accept $a = 16$, $b = 1$

Question	Answer	Mark	Mark scheme	Additional guidance
26 (a)	$\frac{95}{28}$	M1	for a method to add using common denominators with at least one fraction correct (matching numerator with common denominator) eg $\frac{60}{28}+\frac{35}{28}$ **or** $(2)\frac{4}{28}+(1)\frac{7}{28}$	Use of decimals gets no credit unless it leads to a correct fraction
		A1	$\frac{95}{28}$ oe eg $3\frac{11}{28}$	
(b)	$1\frac{3}{5}$	M1	for $\frac{6}{5}\times\frac{4}{3}$ **or** $\frac{24}{20}\div\frac{15}{20}$ **or** $\frac{8}{5}$ oe eg $1\frac{9}{15}$	Use of decimals gets no credit unless it leads to a correct fraction
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
27	30	P1	for full process to find the number of bags sold eg 5 × 1000 ÷ 250 (= 20) **OR** for process to find selling price of 1 kg of sweets eg 0.65 × 4 (= 2.60)	This could be by repeated addition Calculations can be in £ or pence
		P1	for [number of bags] × 0.65 **or** "20" × 0.65 (= 13) **or** "2.60" × 5 (= 13) **OR** for 10 ÷ "20" oe (= 0.50) **OR** for 0.65 × 4 (= 2.60) **and** 10 ÷ 5 (= 2)	[number of bags] can only come from 5 × 10 ÷ 250 (= 0.2) or 5 × 100 ÷ 250 (= 2) or 5 ÷ 250 (= 0.02)
		P1	(dep on previous P1) for a process to find the percentage profit eg ("13" – 10) ÷ 10 × 100 **or** (0.65 – "0.50") ÷ "0.50" × 100 **or** ("2.60" – "2") ÷ "2" × 100 **OR** "13" ÷ 10 ×100 (= 130) oe	3/10 or 0.3 is not enough but should be awarded 2 marks Award P3 for 130(%)
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
28 (a)	Estimated value	P1	for using a rounded value in a correct process eg 3000 ÷ 15 **or** 15 × 8 **or** 20 × 8	Their rounded value must be used in a calculation Rounding may appear after a correct process eg 15.12 × 8 = 120.96 ≈ 100 followed by eg 3069.25 ÷ 100
		P1	for a full process to find the number of days eg "3000" ÷ "15" ÷ "10" (= 20) **or** "3000" ÷ "15" ÷ 8 (= 25)	Accept 3069.25 ÷ 15.12 ÷ 8 oe
		A1	for a correct answer following through their rounded values	
(b)	Explanation	C1	eg less days required **or** it doesn't affect the answer because I would still round 16.27 down to 15 (or up to 20)	Refers to time taken

Question	Answer	Mark	Mark scheme	Additional guidance
29 (a)	6	B1	cao	Accept ±6
(b)	1	B1	cao	
(c)	$\frac{1}{9}$	M1	for evidence of working with a cube root eg $\sqrt[3]{27}$ or $\sqrt[3]{729}$ **OR** evidence of working with a reciprocal eg $\frac{1}{27^{2/3}}$ or $\left(\frac{1}{27}\right)^{\frac{2}{3}}$	
		A1	cao	
30	5	M1	for $\sqrt{40}$ **or** $\sqrt{90}$ **OR** $2\sqrt{2}$ **or** $3\sqrt{2}$	
		M1	for $2\sqrt{10}$ **or** $3\sqrt{10}$ **or** $\sqrt{4}\times\sqrt{10}$ **or** $\sqrt{9}\times\sqrt{10}$ **or** $\sqrt{4\times10}$ **or** $\sqrt{9\times10}$ **OR** $2\sqrt{2}+3\sqrt{2}$	
		A1	cao	Answer of $5\sqrt{10}$ from correct working gets M2 A0

Question	Working	Answer	Mark	Notes
31		2×2×3×3	M1 A1	for complete method to find prime factors; could be shown on a complete factor tree with no more than 1 arithmetic error **or** 2,2,3,3,(1) 2×2×3×3 oe
32		0.246, 0. $\dot{2}4\dot{6}$ 0.24$\dot{6}$, 0.24$\dot{6}$	M1 A1	for correct use of recurring symbol eg 0.2$\dot{4}\dot{6}$ = 0.24646… **or** 3 terms in the correct relative position cao
33 (a)		10	B1	accept ±10
(b)		25	M1 A1	for $(\sqrt[3]{125})^2$ **or** $\sqrt[3]{125} = 5$ **or** $125^2 = 15625$ **or** $\sqrt[3]{125^2}$ cao
34		Proof to reach $\frac{24}{55}$	M1 M1 A1	for 100x = 43.636… (43.6$\dot{3}$) **or** 10x = 4.3636… (4.3$\dot{6}$) and 1000x = 436.36….(436.3$\dot{6}$) (dep) for finding difference that would lead to a terminating decimal for completing algebra to reach $\frac{24}{55}$
35	$\frac{6-\sqrt{8}}{\sqrt{2}-1} \times \frac{\sqrt{2}+1}{\sqrt{2}+1}$ $=\frac{6\sqrt{2}+6-\sqrt{8}\sqrt{2}-\sqrt{8}}{2-1}$ $=6\sqrt{2}+6-4-2\sqrt{2}$	$2 + 4\sqrt{2}$	M1 M1 A1	for correct first step eg multiplies numerator and denominator by $\sqrt{2}$ +1 condone missing brackets (dep) for expansion of numerator with 4 terms correct with or without signs **or** 3 out of exactly 4 terms correct for $2 + 4\sqrt{2}$ oe **or** for stating $a = 2$ and $b = 4$

Question	Working	Answer	Mark	Notes
36		$2\times2\times2\times7$	M1 A1	for complete method to find prime factors; could be shown on a complete factor tree with no more than 1 arithmetic error accept $2^3 \times 7$
37	21840 1638 23478 **5 4 6** 2 | 2 0 | 1 6 | 2 4 | **4** 3 | 1 5 | 1 2 | 1 8 | **3** 4 7 8 | | 500 | 40 | 6 | | 40 | 20000 | 1600 | 240 | | 3 | 1500 | 120 | 18 | 20000 + 1600 + 240 + 1500 + 120 + 18 = 23478	234.78	M1 A1 A1	for complete method with relative place value correct including addition of all the appropriate elements of the calculation e.g. two lines of 1st method, internal numbers of grids, or complete structure shown of partitioning methods for digits 23478 (ft dep M1) for correct placement of the decimal point into their final answer
38 (a)		0.00000797	B1	cao
(b)		6.3×10^7	M1 A1	for partial calculation involving powers of 10 e.g. $0.63 \times 10^{5--3}$ or 6.3×10^n where $n \neq 7$ or for $n \times 10^8$ or for 63000000 cao
39 (a)		$\frac{1}{9}$	M1 A1	for showing a method using either reciprocal or square root e.g. $\frac{1}{n}$ or 9 seen cao Accept $\pm\frac{1}{9}$ or 0.1 recurring
(b)		$\frac{16}{25}$	M1 A1	for showing cube root of 64 as 4 and the cube root of 125 as 5 or $\frac{16}{n}$ $(n \neq 25)$ or $\frac{n}{25}$ $(n \neq 16)$ or an intention to find the cube root and square. cao Accept 0.64

Question	Working	Answer	Mark	Notes
40 (a)		3.5 to 4.5	M1	substitution into formula $\frac{1}{3}\pi r^2 h$ of chosen values for r and V (accept $r = 5.13$ and $V = 98$) and starts rearrangement e.g. multiplies by 3, divides by π or divides by r^2 (both sides)
			M1	uses estimates in calculation e.g. $\frac{3\times100}{3\times25}$ (or in rearranged formula) or $\frac{12}{\pi}$
			A1	arrives at a single value from estimate in the range 3.5 to 4.5
(b)		more	C1	ft e.g. more since number in numerator goes up; numbers in denominator go down.

Question	Working	Answer	Notes
41		32.968	M1 for correct method (condone one error) A1 for digits 32968 A1 ft (dep M1) for correct placement of decimal pt
42		2.7×10^4	M1 For evidence of a correct method eg. $27 \times 10^{-4+7}$ A1
43 (a)		8	B1
(b)		$\frac{25}{4}$ oe	M1 for correct first step A1
44 (a)		2.5×10^{24}	P1 process to estimate or divide P1 a complete process eg. $(1 \times 10^3) \div (4 \times 10^{-22})$ A1
(b)		Under-estimate	C1 ft from (i) Eg. under estimate as number rounded up but in denominator of fraction
45		Given result	C1 Correct first step towards simplifying expression eg. $\frac{\sqrt{2}}{\sqrt{2}+1}$ C1 Correct step to rationalise denominator C1 Conclusion to given result

Question	Working	Answer	Notes
46 (a)		5.7×10^{26} to 6×10^{26}	B1 uses estimates eg 1.9 or 2 M1 process of multiplication eg 0.57×10^{27} or 2×0.3 A1 between 5.7×10^{26} and 6×10^{26}
(b)		explanation	C1 eg overestimate a number is rounded up
47		25	B1 cao
48		$\sqrt{31}$	M1 expands brackets eg $36 + 6\sqrt{5} - 6\sqrt{5} - \sqrt{25}$ (=31) M1 rationalises the denominator eg using $\sqrt{31}$ with numerator & denominator A1 for $\sqrt{31}$

Question	Working	Answer	Notes
49 a		$7\frac{1}{2}$	M1 $\frac{9}{4}\times\frac{10}{3}$ oe M1 $\frac{90}{12}$ oe A1 $7\frac{1}{2}$
b		$5\frac{1}{4}+6\frac{2}{3}$ or $5\frac{2}{3}+6\frac{1}{4}$	B1 $5\frac{1}{4}+6\frac{2}{3}$ or $5\frac{2}{3}+6\frac{1}{4}$
50		4 - 4.5	B1 Rounds appropriately using two of 5, 2 or 7 M1 $\sqrt{19}$ A1 4 - 4.5
51		Completes reasoning	M1 Expansion of $(4-\sqrt{3})(4+\sqrt{3})$ with at least 3 terms out of 4 correct or $4^2-\sqrt{3}\times\sqrt{3}$ C1 for $\sqrt{13}$ from correct working
52 a		200	B1 200 or 2×10^2
b		3	B1 12 and $\frac{1}{4}$ A1 3 cao
c		-2	M1 $81=3^4$ or $\frac{1}{81}=3^{-4}$ A1 cao

Question	Answer	Mark	Mark scheme	Additional guidance
53 (a)	12	M1	for a correct factor tree for either 60 **or** 84 with no more than one arithmetic error **or** for listing factors of 60 **or** 84, at least 4 correct for either (with no more than 1 incorrect in either list), could be in factor pairs **or** for the prime factors of 60 (2, 2, 3, 5) **or** 84 (2, 2, 3, 7)	Condone the use of 1 in any factor tree 60: 1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60 84: 1, 2, 3, 4, 6, 7, 12, 14, 21, 28, 42, 84
		A1	for 12 or 2×2×3 oe SC B1 for answer of 4 or 6, if M0 scored	2,2,3 is not enough, it must be a product
(b)	120	M1	for a correct factor tree for either 24 **or** 40 with no more than one arithmetic error **or** for at least 3 multiples of both 24 and 40 (can include 24 and 40) **or** for the prime factors of either 24 (2, 2, 2, 3) **or** 40 (2, 2, 2, 5) **or** for a common multiple from their lists (≠ 120)	Condone the use of 1 in any factor tree 24: 24, 48, 72, 96, 120, … 40: 40, 80, 120, … For the list not containing 120, accept the first 3 correct multiples or one error in the first 4 multiples
		A1	for 120 or 2×2×2×3×5 oe	
54	192 000	M1	for 16 × 120 × 100 oe	
		A1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
55	984.(3677853) and 969.(0181643)	B1	stating bound of 51.95 or 52.05 or 1.445 or 1.455	Accept $52.04\dot{9}$ or 52.0499… for 52.05 Accept $1.45\dot{4}\dot{9}$ or 1.4549… for 1.455
		P1	for process to rearrange formula to give g as the subject, eg $g=\frac{4\pi^2 l}{T^2}$ oe	Rearrangement may occur after substitution, in this case correct bounds are not needed for this mark
		P1	for process to use LB of l **and** UB of T in formula for g or T **or** process to use UB of l **and** LB of T in formula for g or T eg $\frac{4\pi^2[\text{LB of } l]}{[\text{UB of } T]^2}$ or $\frac{4\pi^2[\text{UB of } l]}{[\text{LB of } T]^2}$	$51.95 \leq$ [LB of l] < 52.0 $1.45 <$ [UB of T] ≤ 1.455 $52.0 <$ [UB of l] ≤ 52.05 $1.445 \leq$ [LB of T] < 1.45 Rearrangement may not be correct
		A1	for upper bound = 984.(3677853) or 984.(1125639..) **and** lower bound = 969.(0181643) or 968.(7669227..)	NB: correct answer without supportive working gets 0 marks Accept answers rounded or truncated to 3sf or better

Question	Answer	Mark	Mark scheme	Additional guidance
56 (a)	2×2×3×7	M1	for a complete method to find prime factors, could be shown on a factor tree, with no more than one arithmetic error **or** for 2, 2, 3, 7	Condone the use of 1
		A1	for 2 × 2 × 3 × 7 oe	Accept $2^2 \times 3 \times 7$
(b)	420	M1	for at least 3 multiples of both 60 and 84 (can include 60 and 84) **or** finds the prime factors of both 84 (may be seen in (a)) and 60, may be seen in factor trees	60, 120, 180, 240, 300, 360, 420 84, 168, 252, 336, 420 60 = 2 × 2 × 3 × 5 or $2^2 \times 3 \times 5$ If factor tree in (a) is incorrect ft this factor tree in part3 (b) for M1 only
		A1	420 **or** 2 × 2 × 3 × 5 × 7 oe	
57	Yes (supported)	P1	for process to find number of combinations, eg 5 × 8 oe (= 40) **or** for 240 ÷ 5 (= 48) **or** 240 ÷ 8 (= 30) **or** for 240 ÷ 5 ÷ 8 (= 6) **or** 5 × 8 × x = 240	
		C1	Yes **and** 6	

Question	Answer	Mark	Mark scheme	Additional guidance
58	127.5 and 128.5	B1 B1	for 127.5 in the correct position for 128.5 in the correct position	 Accept $128.4\dot{9}$ or 128.499...
59	4.56×10^{-2}	M1 A1	for 0.000000342 ÷ 0.0000075 **OR** for 0.0456 oe eg 0.456×10^{-1} **or** 45.6×10^{-3} **or** $\frac{57}{1250}$ **OR** for an answer of 4.56×10^{n} cao	
60	7	M1 A1	method to find number of combinations, eg 19 × 25 oe (= 475) **or** for 3325 ÷ 19 (= 175) **or** 3325 ÷ 25 (= 133) cao	
61	160 (supported)	B1 M1 A1 C1	stating bound of 10.85 or 10.95 using both UB **and** LB to work out value of *d* eg [UB of *c*]^3 ÷ 8 **and** [LB of *c*]^3 ÷ 8 **or** gives a bound of 159.66... from correct working **or** gives a bound of 164.11... from correct working for 159.66... **and** 164.11... from correct working for 160 from 159.66... and 164.11... with a supporting reason eg "since both UB and LB round to 160"	Accept $10.94\dot{9}$ or 10.9499... for 10.95 $10.9 < \text{UB} \leq 10.98$ $10.85 \leq \text{LB} < 10.9$ Accept bounds rounded or truncated to at least 4 sig fig

Question	Answer	Mark	Mark scheme	Additional guidance
62	8.3 and 8.4	B1 B1	for 8.3 in the correct position for 8.4 in the correct position	 Accept 8.3$\dot{9}$ or 8.399…
63 (a)	5.62×10^{-3}	B1	cao	
(b)	1452	B1	cao	

Question	Answer	Mark	Mark scheme	Additional guidance
64 (a)	8.623×10^{-5}	B1	cao	
(b)	7.44×10^{6}	M1	for $\frac{3200 + 0.051}{0.00043}$ or $\frac{3200.051}{0.00043}$ **or** performs an operation eg shows 163.2, 7441860.5, 118.6(…) **or** an answer or $7.44(\ldots.) \times 10^{n}$ where $n \neq 6$ or 7441979(….) **or** an answer of 7.4×10^{6}	7441979.0689…
		A1	for $7.44(1979\ldots) \times 10^{6}$	If a correct answer is shown in working and then rounded incorrectly, award full marks. Answer need only be given correctly to 3 sig fig; if following digits are incorrect ignore them.
65	$7 \leq N < 8$	M1	for identifying the key numbers 7 and 8	Ignore any inequality symbols used at this stage Accept 7.9 (recurring) for 8 as shown by 7.999 or 7.9… or recurring notation (or words)
		A1	cao	
66	1335	M1	for one correct procedure eg 9×15 (=135) **or** 15×8 (=120) **or** $9 \times 15 \times 8$ (=1080)	Ignore additional products.
		M1	for all three correct products eg “135”, “120”, “1080” **or** 9×15, 15×8, $9 \times 15 \times 8$ oe	Only these three products must be identified. There is no need to indicate summing at this stage.
		C1	for showing the three correct products added eg 135 + 120 + 1080	There is no need to show the three products sum to 1335

Question	Answer	Mark	Mark scheme	Additional guidance
67 (a)	280	M1	for listing at least 3 multiples of both 40 and 56 **OR** finds the prime factors of both 40 and 56	40, 80, 120, … 56, 112, 168, … **OR** 2,2,2,5 and 2,2,2,7
		A1	cao	
(b)	60	B1	60 **or** $2^2 \times 3 \times 5$ oe	2^2, 3, 5 not enough ie must be a product
68 (a)	explanation	C1	for a correct explanation, eg $\sqrt{3} \times -\sqrt{3} = -3$, not 3	
(b)	explanation	C1	for correct explanation, eg $\sqrt{12} = 2\sqrt{3}$, not $3\sqrt{2}$	
69	0.43	B1	for one correct bound for mass or length eg 1967.5 **or** 1972.5 **or** 13.15 **or** 15.95 **or** 21.65 **or** 13.25 **or** 16.05 **or** 21.75	Can work in any units
		P1	for a correct process to find a bound for the volume, eg 13.15 × 15.95 × 21.65 (=454(0.925125)) **or** 13.25 × 16.05 × 21.75 (=462(5.409375))	Accept volumes truncated or rounded to at least 3 sig fig
		P1	for a correct process to find a bound for density, eg [mass LB] ÷ "462(5.409375)" (=0.425(367755)) where 1965 ≤ mass LB < 1970 **or** [mass UB] ÷ "454(0.925125)" (=0.434(3828506)) where 1970 < mass UB ≤ 1975	Accept densities truncated or rounded to at least 3 sig fig
		A1	for both correct bounds, 0.425(367755) **and** 0.434(3828506)	Accept bounds truncated or rounded to at least 3 sig fig At this point correct units must be used
		C1	(dep on A1) for a correct statement on degree of accuracy e.g. UB and LB both round to 0.43 to 2 decimal places or 2 significant figures	Must be 0.43 not 0.4

Question	Working	Answer	Mark	Notes
70 (a)		2.7560…	M1	for 1.0654(059…), 0.1402(633…), 7.5957(541…), 2.756 truncated or rounded to no less than 2dp
			A1	for 2.7560(….)
(b)		2.76	B1	for 2.76 ft from (a)
71 (a)		No with reason	C1	for "no" with reason, eg Tracey should multiply 8 and 7
(b)		66	M1	for starting a method to find number of games played, eg 12 × 11 (= 132) or sum of integers from 1 to 11
			A1	cao

Question	Working	Answer	Mark	Notes
72		$4.755 \leq n < 4.765$	B2 [B1	for $4.755 \leq n < 4.765$ for 4.755 or 4.765 or $4.764\dot{9}$]
73 (a)		Jupiter	B1	for Jupiter (accept 1.898×10^{27})
(b)		4.5388×10^{24}	B1	for 4.5388×10^{24} oe (e.g. 45.388×10^{23})
(c)		Yes (supported)	M1 A1	for $(4.35 \times 10^9) \div (4.14 \times 10^7)$ (= 105(.07..)) or $(4.14 \times 10^7) \times 100$ $(= 4.14 \times 10^9)$ or $(4.35 \times 10^9) \div 100$ $(= 4.35 \times 10^7)$ for Yes with correct supporting evidence
74			M1 M1 C1 M1 M1 C1	for the start of a method to convert 0.22.. to a fraction, eg$10y = 2.22..$ or $(y=) \frac{2}{9}$ for the start of a method to convert 0.13636... to a fraction, $10x = 1.3636..$ or $100x = 13.6363\ldots$ or $1000x = 136.3636..$ or $(x=)\_ \frac{13.5}{99}$ or $(x=) \frac{135}{990}$ for correct arithmetic and concluding the proof OR for $0.1\dot{3}\dot{6} \times 0.\dot{2} = 0.\dot{0}\dot{3}$ $(= z)$ for complete method to find two appropriate recurring decimals the difference of which is a rational number, eg. $100z = 3.0303\ldots$,$(z =) 0.0303\ldots$ or $\frac{3}{99}$ for correct arithmetic and concluding the proof

Question	Working	Answer	Notes	
75		$\frac{23}{90}$	M1	For a fully complete method as far as finding two correct decimals that, when subtracted, give a terminating decimal (or integer) and showing intention to subtract eg $x = 0.2\dot{5}$ so $10x = 2.5\dot{5}$ then $9x = 2.3$ leading to…
			A1	correct working to conclusion
76		0.229 With Explanation	B1	Finding bound of s: 3.465 or 3.475 or 3.474999… or Finding bound of t: 8.1315 or 8.1325 or 8.132499…
			P1	Use of "upper bound" and "lower bound" in equation
			P1	Process of choosing correct bounds eg $\frac{\sqrt{3.475}}{8.1315}$ or $\frac{\sqrt{3.465}}{8.1325}$
			A1	For 0.2292… and 0.2288.. from correct working
			C1	For 0.229 from 0.2292.. and 0.2288.. since both LB and UB round to 0.229

Question	Working	Answer	Notes
77 (a)		0.4	B1 For 0.4 oe
(b)		0.586	M1 for "3.48207....." ÷ 17.34 or 3.48207..... ÷ "17.34" or 0.200811... A1 for 0.585 to 0.586
78		1.5	B1 for any correct bound clearly identified, eg. 99.65 →x → 99.75 or 66.5 → y→ 67.5 M1 (dep on B1) for method to find UB, eg. "99.75" ÷ "66.5" A1 for 1.5

Question	Working	Answer	Notes
79 (a)	25 × 24	600	P1 for process to find number of ways A1 cao
(b)	12 × 10 × 11 10 × 12 × 9 1320 + 1080	2400	P1 for process to find number of lists with boy then girl then boy or the number of lists with girl then boy then girl P1 for complete process to find the total number of lists A1 cao
80 (i)		200	B1 cao
(ii)		5.6	B1 For 5.6(2...)
81	$\sqrt{8.35^2 - 6.05^2}$	5.754997828	B1 for finding bounds of one measurement,8.25 8.35, 6.05 or 6.15 P1 for process of choosing and using correct bounds P1 for process of Pythagoras' rule with correct bounds A1 for 5.754(997…)

Question	Answer	Mark	Mark scheme	Additional guidance
82 (a)	450 000	B1	cao	
(b)	7×10^{-3}	B1	cao	
(c)	4.73×10^{3}	M1	for 4730 oe **or** for 4.73×10^{n} where $n \neq 3$	
		A1	cao	
83 (a)	4	P1 A1	$12 \times 5 \div 15$ cao	
(b)	Statement	C1	**Acceptable examples** it could take more time it could take less time it could take more or less time it would take longer if they worked at a slower rate **Not acceptable examples** the time will be less as there are more people if the rate at which the 15 people work changes it would have taken longer it would take less time	
84	6.35, 6.45	B1	for 6.35 in the correct position	
		B1	for 6.45 in the correct position	Accept 6.44$\dot{9}$ oe or 6.4499… oe

Question	Answer	Mark	Mark scheme	Additional guidance
85	9.35, 9.45	B1 B1	for 9.35 in the correct position for 9.45 in the correct position	 Accept $9.44\dot{9}$ oe or 9.4499…oe
86	Proof	M1 A1	for $10x = 7.333\ldots$ $(7.\dot{3})$ and for finding difference that would lead to a terminating decimal for completing algebra to reach $\frac{11}{15}$	$100x$ and $1000x$, etc could also be used
87 (a)	3.0×10^9	P1 A1	for correct process, eg $10^5 \times 365 \times 81$ or for a correct answer not written in standard form, eg 2956500000 or $2.9(565) \times 10^n$ where $n \neq 9$ oe for an answer in the range 2.8×10^9 to 4.0×10^9	Values may be rounded. Allow 350, 360, 366, 370, 400 and 80, 100
(b)	4.5×10^{-11}	P1 A1	for correct process, eg $\frac{90}{2\times10^{12}}$ **or** for correct answer not written in standard form, eg 45×10^{-12} or 0.45×10^{-10} **or** 4.5×10^n where $n \neq -11$ cao	Allow $90 \div 2 \times 10^{12}$

Question	Answer	Mark	Mark scheme	Additional guidance
88	6.495190528	B1	for 11.25 or 11.35	
		M1	use $a^2 + a^2 + a^2$ oe for the square of the length of a diagonal	
		M1	for writing an equation to find the length of a side, eg $a^2 + a^2 + a^2 = [LB]^2$ where $11.25 \leq LB < 11.3$ oe	
		A1	for an answer in the range 6.49 to 6.50	If the answer is given in the range 6.49 to 6.5 without supportive evidence award 0 marks.
89	98^{91}	B1	cao	Must be clear and unambiguous

Question	Answer	Mark	Mark scheme	Additional guidance
90 (a)	157.668(255)	M1	for 836.4 **or** 5.304(809139) **or** 28.141 **or** a truncated or rounded version of 157.668255 to no less than 3 sf	
		A1	for 157.668(255)	Answer must be given to at least 3 decimal places rounded or truncated Accept a clear indication of the decimal point. Check first 3 decimal places only
(b)	157.7	B1	ft from part (a) provided answer to (a) has at least 5 sf	
91 (a)	3.246×10^7	B1	cao	
(b)	0.00496	B1	cao	
(c)	No with explanation	C1	No and explanation that B is bigger as the power of 10 is bigger. **Acceptable examples** She is incorrect as 10^8 is smaller than 10^9 No, because B has more digits than A No, A is millions but B is billions No, if you subtract A from B the answer is positive (but if you subtract B from A the answer is negative) A= 621200000, B=4730000000, B is bigger No because she did not take into account standard form No as when you find the ordinary number B is greater than A **Not acceptable examples** Yes… A = 5 zeros after the number where as B = 7 zeros after the number No as 4.73×10^9 is one more than 6.212×10^8 6.212 is to the power of 8 and 4.73 is to the power of 9 so there is an extra digit Asma is wrong because she has more numbers behind the decimal point which means that it will be bigger than A No B has more zeros	Decision eg "No" may be seen by the question. "She is incorrect" is equivalent to "no"

Question	Answer	Mark	Mark scheme	Additional guidance
92	0.319	M1	for partial method eg 1.70(499…) or 16.74 or $\frac{837}{50}$ or 0.101(8516...) or 0.102 or 0.32	
		A1	for 0.319(1419…)	Accept 0.319 or better. Condone incorrect digits after the 0.319; isw incorrect rounding if 0.319(1419…) is shown in working.
93 (a)	130	P1	for process to divide eg $(3.9 \times 10^7) \div (3 \times 10^5)$	Condone missing brackets
		A1	cao	Accept 1.3×10^2
(b)	Explanation	C1	Explanation referring to the time **Acceptable examples** The time will be more It will take longer The answer will be bigger **Not acceptable examples** The answer will be wrong The answer will be different	
94	Explanation	C1	for explanation eg needs to find 4th root or gives the correct answer of 2.828… **Acceptable examples:** He needs to find $\sqrt[4]{64}$ It should be 2.8..(or $2\sqrt{2}$) It is not asking for 64 ÷ 4, it is asking what number to the power of 4 = 64 $64^{\frac{1}{4}}$ means the fourth root not a quarter of 64 $64^{\frac{1}{4}}$ means square root and square root again, not divide by 4 **Not acceptable examples:** It should be 2 The expression is 64 to the power of $\frac{1}{4}$ $64^{\frac{1}{4}}$ is not a $\frac{1}{4}$ of 64	

Question	Answer	Mark	Mark scheme	Additional guidance
95 (a)	81.0662	M1	for one of 26.15 or 26.25 or 4.25 or 4.35	Accept $26.24\dot{9}$ for 26.25 and $4.34\dot{9}$ for 4.35
		M1	for a correct process to find the upper bound for D [UB of u]^2 ÷ [2 × LB of a] eg $\frac{26.25^2}{2\times4.25}$ where 26.2 < UB of $u \leq 26.25$ and $4.25 \leq$ LB of $a < 4.3$	Award for $\frac{26.25^2}{4.25}$
		A1	for answer given in the range 81.0661 to 81.0662 from correct working	
(b)	80	B1	for 80 ft answer to (a) with 78.6003	
	explanation	C1	for explanation relating to the upper bound found in (a) **Acceptable examples** bounds agree when rounded to 80 bounds agree to nearest 10 **Not acceptable examples** 80 79.83325 rounded to nearest tenth	

Question	Answer	Mark	Mark scheme	Additional guidance
96 (a)	7360	B1	cao	
(b)	0.1077981356	B2	for 0.1077(981…)	Answer must be given to at least 4 decimal places rounded or truncated
		(B1	for 5.74(45626…) **or** 53.29 **or** 0.11 **or** 0.107 **or** 0.108)	Accept a clear indication of the decimal point. Check first four decimal places only
97	2.7 with statement	B1	for 179.5 or 180.5 or 180.4999...	
		B1	for 486.5 or 487.5 or 487.4999...	
		P1	for a correct process to find a bound for average speed, eg [upper bound of distance] ÷ [lower bound of time] where 487 < [UB of distance] ≤ 487.5 and 179.5 ≤ [LB of time] < 180 **or** for [lower bound of distance] ÷ [upper bound of time] where 486.5 ≤ [LB of distance] < 487 and 180 < [UB of time] ≤ 180.5	
		A1	(dep on all previous marks) for 2.695(2…) **and** 2.715(8 …) with both values clearly coming from working with correct values	Accept bounds truncated or rounded to at least 4 sig fig
		C1	for 2.7 from 2.695… and 2.715… **and** statement that both LB and UB round to 2.7	

Question	Answer	Mark	Mark scheme	Additional guidance
98	4.52×10^3	M1	for $2.04.... \times 10^7$ oe eg $2.04....\times 10^{-5} \div 10^{-12}$ or $20.4... \times 10^6$ or 204(08163.27) **or** for correct value of *T*, 4517.(53....), not written in standard form, eg 4520	May be given correct to 3 sig figs or more
		A1	for answer in the range 4.51×10^3 to 4.52×10^3 (SC B1 for $6.32\ldots\times 10^{-1}$)	
99	10	P1	for start to a process to find the LCM of 20, 45 and 120 (= 360), eg $45 = 3 \times 3 \times 5$ or $20 = 2 \times 2 \times 5$ or $120 = 2 \times 2 \times 2 \times 3 \times 5$ or writes down at least 3 multiples of 45 and 120	Could be presented as complete prime factor trees for 45 or 120
		P1	(dep) for a process to find number of times/hour using their LCM, eg $3600 \div 360$ or $3600 \div 720$	Must use a common multiple. Working may be in minutes.
		A1	for 10 or 11	
100	240	M1	for start to method to find total number of matches, eg 16×15 or $16^2 - 16$ or $16 \times 15 \times 2$ (= 480) or $\frac{16 \times 15}{2}$ (= 120)	Credit complete listing strategies
		A1	cao	

Question	Working	Answer	Mark	Notes
101 (a)		0.625	B1	cao
(b)		$9.75 \leq x < 9.85$	B2	for $9.75 \leq x < 9.85$
			[B1	for 9.75 or 9.85 (or $9.84\dot{9}$)]
102		0.000 745 2	M1	digits 7452 seen
			A1	cao
103		Yes and correct working	B1	for 147.5 or 148.5 or 148.4999... or 11.75 or 11.85 or 11.84999...
			P1	substitutes $11.8 < UB \leq 11.85$ and $147.5 \leq LB < 148$ in the formula to work out petrol consumption
			A1	for 'Yes' and 8.03(3898305...) from correct working

Question	Working	Answer	Mark	Notes
104		No (supported)	P1	Process to find number of rose trees e.g. 215 ÷17 (=12.647...) or show number of choices with 12 and 13 eg 17 × 12 = 204 and 17 × 13 = 221
			C1	No with interpretation that 12.6.. is not a whole number or a whole number of plants must be bought or number of plants would have to be between 12 and 13 which is not possible
105 (a)		No (supported)	P1	for 265 or 275 or 274.999... or 107.5 or 112.5 or 112.4999...
			P1	process to find $\frac{d}{t}$ where $270 < d \leq 275$ and $107.5 \leq t < 110$ oe
			P1	for process to work in consistent units of time eg $\frac{d}{t} \times 60$ or $t \div 60$ where $265 \leq d \leq 275$ and $107.5 \leq t < 110$ oe or 160 ÷ 60 (= 2.666..)
			C1	Conclusion supported with correct figure(s) given eg No and 153(.488..) or No and 2.66 to 2.7 and 2.5(581..) from correct working
(b)		Statement	C1	e.g. Less distance in the same time so (max) speed would drop

Question	Working	Answer	Notes
106		6.8×10^{-5}	B1
107 (a)	Number of men possible is 17 Number of women possible is 26 Each man can be paired with 26 different women 17×26	442	P1 Process to find number of combinations A1
(b)		Ben with reason	C1 Convincing reason e.g. correct calculation is $17 \times 16 \div 2$

Question	Working	Answer	Notes
108		$12.5 \leq L < 13.5$	B1 12.5 B1 13.5 or 13.4
109		168	M1 product of 14 and 12 A1 cao
110 (a)		Number of errors	P1 1000 000 ÷ 256 oe A1 3906 or 3907 or 3900 or 3910 or 4000 from correct working
(b)		Decision	C1 Decision and supporting statement Eg no 'model' never zero or yes cannot have a part error Note just yes or no will score zero
111 (a)		4.23×10^{-4}	B1
(b)		45000	B1

Question	Working	Answer	Notes
112		$7.15 \leq x < 7.25$	B1 for 7.15 and 7.25 B1 cao
113		proof leading to $\frac{7}{22}$	M1 for finding two correct recurring decimals that when subtracted would result in a terminating decimal or integer with intention to subtract eg $x = 0.31818...$, $100x = 31.81818...$ A1 fully correct proof

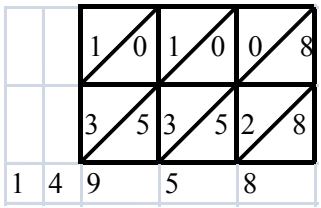
Question	Working	Answer	Mark	Notes
114 (a)		5.4×10^6	1	B1 cao
(b)		0.00032	1	B1 cao
(c)		6.3×10^{32}	2	M1 for 630×10^{30} oe or figures 63 **with** $\times 10^n$ A1 for 6.3×10^{32} or 6.30×10^{32}
115		17.6(0)	4	M1 18×6.45 (= 116.1(0)) or 18×645 = (11610) M1 for $18 \times 6.45 - 98.50$ in the correct order but units may not be consistent A1 for digits 1760 A1 (dep on M2) for correct placement of decimal point after subtraction (of appropriate values)
116		44 - 56	2	B2 for 44 - 56 (B1 for 1000 or 900 or 20 or 18 or 19, unless it is clear these have not come from estimation)
117		7×10^8	2	M1 for 7×10^n, $n \neq 8$ or $a \times 10^8$, $a \neq 7$ or 700 000 000 or 0.7×10^9 A1 cao

Question	Working	Answer	Mark	Notes
118 (a)		$2\frac{4}{5}$	3	M1 for writing as improper fractions eg $\frac{6}{5}$ or $\frac{7}{3}$ M1 (dep) for multiplying improper fractions eg $\frac{6\times7}{5\times3}$ or $\frac{14}{5}$ oe A1 cao
(b)		$\frac{4}{5}$	3	M1 for finding two correct fractions with a common denominator eg $\frac{7}{15}-\frac{10}{15}$ or $\frac{21-30}{45}$ M1 (dep) for complete and correct method eg $1-\frac{3}{15}$ or $\frac{37}{15}-\frac{25}{15}$ or $\frac{111-75}{45}$ oe A1 for $\frac{4}{5}$ oe

Question	Working	Answer	Mark	Notes
119 (i)		19.44	2	B1 cao
(ii)		19 440		B1 cao
120		$2\sqrt{5}$	2	M1 for multiplication of denominator and numerator by $\sqrt{5}$ A1 cao

Question	Working	Answer	Mark	Notes
121	40, 80, 120 15, 30, 45, 60, 75, 90, 105, 120	3 and 8 or any multiple of 3, 8	3	M1 for multiples of both 40 and 15 (at least 2 of each shown but condone errors if intention is clear) or for 40 × 15 M1 (dep on M1) for a complete method to find a common multiple of 40 and 15, eg. 120, 240, 600 condoning one arithmetic error in any lists of multiples shown A1 for 3, 8 or any multiple of 3, 8 OR M1 for factors 2,2,2,5 and factors 3,5 M1 (dep on M1) for a complete method to find a common multiple of 40 and 15 A1 for 3, 8 or any multiple of 3, 8
	$40 = 2 \times 2 \times 2 \times 5$ $15 = 3 \times 5$			

Question		Working	Answer	Mark	Notes
122			Proof	3	M1 for (x =) 0.04545(...) or 1000x = 45.4545(...), accept 1000x = $45.\dot{4}\dot{5}$ or 100x = 4.54545(...), accept 100x = $4.\dot{5}\dot{4}$ or 10x = 0.4545(...) ,accept 10x = $0.\dot{4}\dot{5}$ M1 for finding the difference between two correct, relevant recurring decimals for which the answer is a terminating decimal A1 (dep on M2) for completing the proof by subtracting and cancelling to give a correct fraction eg $\frac{45}{990} = \frac{1}{22}$ or $\frac{4.5}{99} = \frac{1}{22}$
123	(a)		$\frac{1}{8}$	1	B1 for $\frac{1}{8}$ oe
	(b)		1.5	1	B1 for 1.5 oe
	(c)		3	2	M1 for √12×√12 – √12×√3 – √3×√12 + √3×√3 or √144 – √36 – √36 + √9 oe. with no more than one sign error A1 cao OR M1 for writing (√12 – √3) as (2√3 – √3) (= √3) A1cao

Question		Working	Answer	Mark	Notes
124	(i)		3484	1	B1 cao
	(ii)		34.84	1	B1 cao
	(iii)		670	1	B1 cao
***125**			Maths with correct comparative figure(s)	2	M1 for correct method to find figure(s) to compare, eg $\frac{32}{80}\times100$ (=40) oe **or** 0.38×80 oe (=30.4) C1 for maths with 40% or 30.4 or $\frac{40}{100}$ and $\frac{38}{100}$ oe
***126**		554 ×27 3878 11080 14958  	Yes with correct working	4	M1 for a complete method with relative place value correct. Condone 1 multiplication error, addition not necessary. M1 (dep) for addition of all the appropriate elements of the calculation. A1 for £149.58 or 42p (spare) C1 ft (dep on M1) for correct decision for their total cost **OR** M1 for a complete grid with not more than 1 multiplication error, addition not necessary M1 (dep) for addition of all the appropriate elements of the calculation A1 for £149.58 or 42p (spare) C1 ft (dep on M1) for correct decision for their total cost **PTO**

		<table><tr><th>500</th><th>50</th><th>4</th><th>×</th></tr><tr><td>10 000</td><td>1000</td><td>80</td><td>2 0</td></tr><tr><td>3500</td><td>350</td><td>28</td><td>7</td></tr></table> 10000 1000 3500 350 80 28 14958			**OR** M1 for sight of a complete partitioning method, condone 1 multiplication error, addition not necessary. M1 (dep) for addition of all the appropriate elements of the calculation. A1 for £149.58 or 42p (spare) C1 ft (dep on M1) for correct decision for their total cost **OR** M1 for 150.0... ÷ 27 at least 5 seen and 15 carried or $\frac{50}{9}$ M1 (dep) for full correct process to divide 150 by 27 or $5\frac{5}{9}$ A1 for £5.55 or £5.56 o**r** £5.55... C1 ft (dep on M1) for correct decision for their plant cost **OR** M1 for 150.0…÷ 5.54 at least 2 seen and 392 carried M1 (dep) for full correct process to divide 150 by 5.54 A1 for 27 (.07…) C1 ft (dep on M1) for correct decision for their number of plants

Question		Working	Answer	Mark	Notes
127	(a)		$2\times2\times3\times3\times5$	3	M1 for a continual prime factorisation (at least two consecutive steps correct) or at least two stages of a factor tree correct M1 for a fully correct factor tree or list 2,2,3,3,5 A1 for $2\times2\times3\times3\times5$ or $2^2\times3^2\times5$
	(b)		Eg 6, 30	2	M1 for two numbers with an HCF of 6 **or** for two numbers with a LCM a multiple of 15 A1 for two numbers with an HCF of 6 **and** a LCM a multiple of 15 (eg (6, 30), (12, 30), …) **OR** M1 for 2×3 **and** 3×5 **or** for $2\times3\times5$ A1 for two numbers with an HCF of 6 **and** a LCM a multiple of 15 eg (6, 30) (12, 30) …
128		$3-\sqrt{2}+3\sqrt{2}-\sqrt{2}\sqrt{2}$	$1+2\sqrt{2}$	2	M1 for 4 terms correct ignoring signs or 3 out of no more than 4 terms correct A1 cao

Question		Working	Answer	Mark	Notes
129	(a)		$\frac{2}{21}$	1	B1 for $\frac{2}{21}$
	(b)		$\frac{4}{15}$	2	M1 for attempting to use a suitable common denominator with at least one of the two fractions correct A1 for $\frac{4}{15}$ oe
***130**		1.18 ÷ 4 = 0.295 (118 ÷ 4 = 29.5) 1.74 ÷ 6 = 0.29 (174 ÷ 6 = 29) 1.18 ÷ 2 = 0.59 1.74 ÷ 3 = 0.58 1.74 × 4 = 6.96 1.18 × 6 = 7.08 1.74 × 2 = 3.48 1.18 × 3 = 3.54 1.18÷2×3=1.77 1.74÷3×2=1.16 4÷1.18=3.3(…) 6÷1.74=3.4(…)	6 pints	3	M1 for division of price by quantity for both bottles or division of quantity by price for both bottles or complete method to find price of same quantity of milk A1 for two correct values that could be used for a comparison C1 ft (dep on M1) for comparison of their values with a correct conclusion.
***131**			Answer in range 35 – 50	4	M1 for a method to either find the exact or approximate number of seconds in one day, e.g. 24 × 60 × 60 (=86400) or the number of minutes in 2014 seconds, e.g. 2014 ÷ 60 or 2000 ÷ 60 (≈30) M1 for a correct method to find the number of prizes; eg. '24 × 60 × 60' ÷ 2014 oe or 60 ÷ "30" × 24 oe B1 for rounding at least one appropriate value in the working to 1 sf, e.g. 24 rounded to 20 or 2014 rounded to 2000 or 86400 rounded to 90000 C1 (dep on M2) for answer in 35 – 50 clearly identified

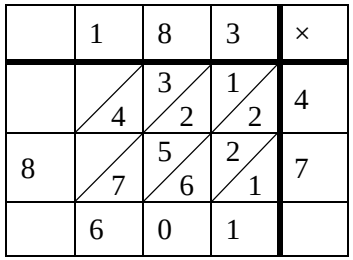
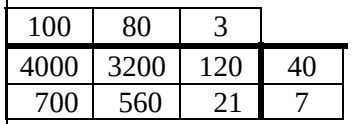
Question		Working	Answer	Mark	Notes
132	(a)		1	1	B1 cao
	(b)		$\frac{1}{100}$	1	B1 for $\frac{1}{100}$ or 0.01
	(c)		0.00273 27.3×10^{-3} 2.73×10^{3} 273×10^{2}	2	M1 for converting all numbers to same form with at least one conversion correct A1 for fully correct order with correct numbers in any correct form (SC B1 if one number incorrectly placed or all 4 numbers listed in reverse order)
133	(a)		$4\sqrt{3}$	2	M1 for $\frac{12}{\sqrt{3}} \times \frac{\sqrt{3}}{\sqrt{3}}$ A1 for $\frac{12\sqrt{3}}{3}$ oe with a rational denominator
	(b)		18	2	M1 for $\sqrt{2}\times\sqrt{2} + \sqrt{2}\times\sqrt{8} + \sqrt{8}\times\sqrt{2} + \sqrt{8}\times\sqrt{8}$ oe A1 cao OR M1 for $(\sqrt{2} + 2\sqrt{2})^2$ A1cao

Question		Working	Answer	Mark	Notes
134	(i)	20, 40, 60 12, 24, 36, 48, 60	3 and 5 or any multiple of 3, 5	4	M1 attempts multiples of both 20 and 12 (at least 3 of each shown but condone errors if intention is clear) or identifies 60 or a multiple of 60 M1 (dep on M1) for a division by 20 or 12 or counts up 'multiples' or identifies a common multiple (implied if one answer is correct or answers reversed) A1 cheese slices (packets) 3, burgers (boxes) 5 or any multiple of 3, 5 OR M1 for expansion of either 20 or 12 into factors M1 for demonstration that both expansions include 4 (or 2 × 2) A1 cao for cheese slices (packets) 3, burgers (boxes) 5
		$20 = 4\times5 = 2\times2\times5$ $12 = 4\times3 = 2\times2\times3$			
	(ii)		60		B1 for 60 or ft from their correct answer in (i) or ft 'common multiple'
135	(a)		$\frac{1}{5}$	1	B1 oe
	(b)		$\frac{1}{9}$	1	B1 cao
	(c)	$9\times10^4\times3\times10^3$	2.7×10^8	2	M1 27×10^7 oe or $9\times3\times10^{4+3}$ A1 cao

Question		Working	Answer	Mark	Notes
136	(a)		331.705	1	B1 cao
	(b)		179300	1	B1 cao
137		5|525 5|105 3|21 7	3 × 5 × 5 × 7	3	M1 for continual prime factorisation (at least first 2 steps correct) or first two stages of a factor tree correct M1 for fully correct factor tree or list 3, 5, 5, 7 A1 3 × 5 × 5 × 7 or $3 \times 5^2 \times 7$

Question		Working	Answer	Mark	Notes
138		$\frac{20 \times 300}{0.5}$	12000	3	B1 for 20 or 300 used M1 for "20" × "300" or $\frac{"20"}{0.5}$ or $\frac{"300"}{0.5}$, values do not need to be rounded A1 for answer in the range 11200 –13200 SC B3 for 12000 with or without working
139		LCM (80, 50) = 400 Matt 400 ÷ 50 = 8 Dan 400 ÷80 = 5 **OR** 50 = 2 × 5 (× 5) 80 = 2 × 5 (× 2 × 2 × 2)	Matt 8 Dan 5	3	M1 lists multiples of both 80 (seconds) and 50 (seconds) (at least 3 of each but condone errors if intention is clear, can be in minutes and seconds) or use of 400 seconds oe. M1 (dep on M1) for a division of "LCM" by 80 or 50 or counts up "multiples" (implied if one answer is correct or answers reversed) A1 Matt 8 and Dan 5 SC B1 for Matt 7, Dan 4 **OR** M1 for expansion of both 80 and 50 into prime factors. M1 demonstrates that both expansions include 10 oe A1 Matt 8 and Dan 5 SC B1 for Matt 7, Dan 4

Question		Working	Answer	Mark	Notes
***140 QWC**			No + explanation	3	M1 for $500 \times 9 \times 10^{-3}$ oe A1 for 4.5 C1 (dep M1) for correct decision based on comparison of their paper height with 4 **OR** M1 for $4 \div 500$ oe A1 for 0.008 C1 (dep M1) for correct decision based on comparison of their paper thickness with 0.009 **OR** M1 for $4 \div (9 \times 10^{-3})$ oe A1 for 444(.4...) C1 (dep M1) for correct decision based on comparison of their number of sheets of paper with 500
141		– 5, 0.2, 0.5, 1	$-5, 5^{-1}, 0.5, 5^{0}$	2	M1 for either 5^{-1} or 5^{0} evaluated correctly A1 for a fully correct list from correct working, accept original numbers or evaluated (SC B1 for one error in position or correct list in reverse order)

Question		Working	Answer	Mark	Notes
142		183 × 47 1281 7320 8601 **or**  **or**  4000 + 3200 +120 + 700 + 560 + 21 = 8601 **or** 183 × 100 = 18 300 183 × 50 = 18 300 ÷ 2 =9150 183 × 3 = 549 9150 – 549 = 8601	86.01	3	M1 for a complete method to multiply 183 by 47 and attempt at addition (condone one multiplication error) A1 for digits 8601 given as the answer B1 (dep on M1) for correctly writing their answer to 2 decimal places

Question		Working	Answer	Mark	Notes
143			09 36	3	M1 for listing 9, 18, 27, 36, 45, ...(at least 3 correct multiples with at most one incorrect) M1 for listing 12, 24, 36, 48, ... (at least 3 correct multiples with at most one incorrect) A1 for 09 36 or 9 36 (am) **OR** M1 for listing 9.09 9.18 9.27 9.36 ...(at least 3correct times with at most one incorrect) M1 for listing 9.12 9.24 9.36 ... (at least 3 correct times with at most one incorrect) A1 for 09 36 or 9 36 (am) **OR** M1 for 9 = 3 × 3 **or** 12 = 2 × 2 × 3 (could be in factor tree) M1 for 9 = 3 × 3 **and** 12 = 2 × 2 × 3 (could be in a factor tree) A1 for 09 36 or 9 36 (am) **SC B2** for 9 36 pm or (after) 36 (minutes) on the answer line
144	(a)		820 000	1	B1 cao
	(b)		3.76×10^{-4}	1	B1 cao
	(c)		5×10^{8}	2	M1 for $2.3 \div 4.6 \times 10^{12-3}$ oe or 500 000 000 or 0.5×10^{9} A1 cao (accept 5.0×10^{8}

Question		Working	Answer	Mark	Notes
145*			9	4	M1 for 7155 – 7095 or 60 seen or 7155×15 (or .15) or 7095×15 (or .15) or 107325 or 106425 or 1073.25 or 1064.25 M1 for '60' ×15 or 7155 ×15 – 7095 × 15 [or .15 instead of 15] A1 for 9 or 9.00 or 900 C1 (ft) for answer with correct units (money notation) identified as the answer.
146			600	3	(M2 for 300 ÷ 0.5 or 60 × 10 or 30 × 20) M1 for at least two of 30, 10 and 0.5 or sight of 300 or 60 or 20 A1 for 600 – 620 but not 601.1(198428…) **OR** (M2 for 310 ÷ 0.5 or 62 × 10 or 31 × 20) M1 for at least two of 31, 10 and 0.5 or sight of 310 or 62 or 20 A1 for 600 – 620 but not 601.1(198428…)
147		0.38×10^{-1}, 3800×10^{-4}, 0.038×10^{2}, 380	Correct order	2	M1 changing any one correctly or at least 3 in the correct order (ignoring one) or reverse order A1 for correct order (accept any form)

Question		Working	Answer	Mark	Notes
148	(a)		$\frac{5\sqrt{2}}{2}$	2	M1 for $\frac{5}{\sqrt{2}}\times\frac{\sqrt{2}}{\sqrt{2}}$ oe A1 for $\frac{5\sqrt{2}}{2}$ oe
	(b)		$8\sqrt{3}$	2	M1 for $2\times2+2\sqrt{3}+2\sqrt{3}+\sqrt{3}\times\sqrt{3}$ or $\left(4+4\sqrt{3}+3\right)-\left(4-4\sqrt{3}+3\right)$ or $2\times2-2\sqrt{3}-2\sqrt{3}+\sqrt{3}\times\sqrt{3}$ at least three terms in either correct; could be in a grid. A1 cao **OR** Difference of two squares M1 for $\left(\left(2+\sqrt{3}\right)-\left(2-\sqrt{3}\right)\right)\left(\left(2+\sqrt{3}\right)+\left(2-\sqrt{3}\right)\right)$ A1 cao

Question		Working	Answer	Mark	Notes
149		Acton after 24, 48, 72, 96, 120 Barton after 20, 40, 60, 80, 100, 120 LCM of 20 and 24 is 120 9:00 am + 120 minutes **OR** Acton after 24, 48, 1h 12 m, 1h 36m, 2h Barton after 20, 40, 1 h, 1h 20m, 1h 40m, 2h LCM is 2 hours 9:00 am + 2 hours **OR** Times from 9:00 am when each bus leaves the bus station Acton at 9:24, 9:48, 10:12, 10:36, 11:00 Barton at 9:20, 9:40, 10:00, 10:20, 10:40, 11:00 **OR** 20 = 2 × 2 × 5 24 = 2 × 2 × 2 × 3 2 × 2 × 2 × 3 × 5 = 120	11:00 am	3	M1 for listing multiples of 20 and 24 with at least 3 numbers in each list ; multiples could be given in minutes or in hours and minutes (condone one addition error in total in first 3 numbers in lists) A1 identify 120 (mins) **or** 2 (hours) as LCM A1 for 11:00 (am) **or** 11(am) **or** 11 o'clock **OR** M1 for listing times after 9am when each bus leaves the bus station, with at least 3 times in each list (condone one addition error in total in first 3 times after 9am in lists) A1 for correct times in each list up to and including 11:00 A1 for 11:00 (am) **or** 11(am) **or** 11 o'clock **OR** M1 for correct method to write 20 and 24 in terms of their prime factors 2, 2, 5 and 2, 2, 2, 3 (condone one error) A1 identify 120 as LCM A1 for 11:00 (am) **or** 11(am) **or** 11 o'clock
150	(a)		1	1	B1 cao
	(b)		0.000067	1	B1 cao
	(c)		2.7×10^{14}	2	M1 for $27 \times 10^{7+6}$ **or** 27×10^{13} oe **or** an answer of 2.7×10^{n} where n is an integer **or** an answer of $a \times 10^{14}$ where $1 \leq a < 10$ A1 cao

Question		Working	Answer	Mark	Notes
151		eg. $x = 0.28181...$ $100x = 28.181...$ $99x = 27.9$	$\frac{31}{110}$	3	M1 for 0.28181(...) **or** 0.2 + 0.08181(...) **or** evidence of correct recurring decimal eg. 281.81(...) M1 for two correct recurring decimals that, when subtracted, would result in a terminating decimal, and attempting the subtraction eg. $100x = 28.1818\ldots$, $x = 0.28181\ldots$ and subtracting eg. $1000x = 281.8181\ldots$, $10x = 2.8181\ldots$ and subtracting **OR** $\frac{27.9}{99}$ **or** $\frac{279}{990}$ oe A1 cao

Question		Working	Answer	Mark	Additional Guidance
152	(a)	$66 = 2 \times 33 = 2 \times 3 \times 11$	$2 \times 3 \times 11$	2	M1 Successive division by 2 and 3 either by a factor tree or by repeated division A1 cao
	(b)	$132^2 = 4 \times 66^2$ $= 2^2 \times (2 \times 3 \times 11)^2$ **OR** $132^2 = 17424 = 2 \times 8712$ $= 2 \times 2 \times 4356 =$ $2^3 \times 2178 = 2^4 \times 1089$ $=2^4 \times 3 \times 363 =...$	$2^4 \times 3^2 \times 11^2$	2	M1 $(2 \times 3 \times 11)^2$ A1 $2^2 \times 3^2 \times 11^2$ oe **OR** M1 $132^2 = 17424$ and at least 3 correct steps in for example the factor tree
					Total for Question: 4 marks
153.	(a)		3.4×10^7	1	B1 cao
	(b)	$2.4 \times 10^{12} \times \frac{5}{100} (\div 10^6)$	1.2×10^5	2	M1 $2.4 \times 10^{12} \times \frac{5}{100}$ oe $(\div 10^6)$ A1 cao
					Total for Question: 3 marks
154.	(a)		$\frac{1}{2}$	1	B1
	(b)	$(2 + \sqrt{3}) \times (1 + \sqrt{3})$ $= 2 + 2\sqrt{3} + \sqrt{3} + \sqrt{9}$	$5 + 3\sqrt{3}$	2	M1 4 term expansion with 3, 4 terms correct and sight of 3 or $\sqrt{9}$ A1 cao
					Total for Question: 3 marks

Question	Working	Answer	Mark	Notes
155		$\frac{528}{167}$	3	B1 for 37.55 or 37.65 or 11.25 or 11.35 or 8.35 or 8.45 M1 for $\frac{37.65-11.25}{8.35}$ for $\frac{v_{ub}-u_{lb}}{t_{lb}}$ where $37.6 < v_{ub} \leq 37.65$ and $11.25 \leq u_{lb} < 11.3$ and $8.35 \leq t_{ub} < 8.4$ A1 for answer in range 3.16 to 3.162 from correct working

Question	Working	Answer	Mark	Notes
156		1.4091(…)	2	B2 for 1.4091(…) (B1 for 2.1025 or 1.492 or 2.397…or 2.398)
***157**		large carton with correct calculations	3	M1 for 1.60 ÷ 125 (= 0.0128) or 2.8 ÷ 225 (= 0.0124(4…)) or 125 ÷ 1.60 (= 78(.125(g)) or 225 ÷ 2.80 (= 80(.35…g)) or any other calculation that could lead to a comparative figure M1 for 1.60 ÷ 125 (= 0.0128) **and** 2.8 ÷ 225 (= 0.0124(4…)) or for 125 ÷ 1.60 (= 78(.125(g)) **and** 225 ÷ 2.80 (= 80(.35…g)) or for calculations that could lead to comparative figures for the cartons 2 C1 for correct comparative figures for both cartons leading to a correctly stated comparison. Accept any other method considered equivalent. Figures may be truncated or rounded as long as their method is clear.
158		17.7(014…)	3	B1 for 7.75 or7.85 or 5.15 or 5.25 or 62.5 or 63.5 M1 for $\frac{1}{2}$ × 7.7 × 5.15 × in 62.5 A1 for 17.7(0140994…)
159	400 ÷ 18 = 22(.2) 499 ÷ 20 = 24(.95) or 25 600 ÷ 26 = 23(.07…)(or equivalent in £) 18 ÷ 4 = 4.5 20 ÷ 4.99 = 4(.008…) 26 ÷ 6 = 4.3(333…)	18 pack with supporting working	4	M1 for a method that would result in at least two values that could be used to compare two packs M1 for a complete method that would result in values that could be used to compare all three packs A1 for all fully correct figures suitable for comparison C1 ft (dep on M2) for comparison of their values with a correct conclusion from their figures
160		29.25	3	B1 for one of 14.5, 13.5, 8.75, 8.65 M1 for "v_{UB}" − "u_{LB}" where 14 < "v_{UB}" ≤ 14.5 and 8.65 ≤ "u_{LB}" < 8.7 A1 for 29.25 from correct working

Question		Working	Answer	Mark	Notes
***161**			125m*l*	4	M1 for a complete method to find the cost per m*l* or the number of m*l* per £1 for one tube or for a method that results in at least 2 values that can be used to compare 2 tubes M1 for a complete method to find all three equivalent figures A1 3 correct figures suitable for comparison C1(dep on M2) for stating the correct tube size from their calculations
162	(a)		6.4×10^8	1	B1 cao
	(b)		5×10^2	2	M1 for $3 \div 6 \times 10^{7-4}$ or 0.5×10^3 or 500 or 30 000 000÷60 000 A1 cao
163	(a)		4.25	1	B1 cao
	(b)		7.20-7.21	3	B1 4.35 or 0.35 M1 for $4.35 + \frac{1}{0.35}$ A1 7.2(0)-7.21 or $\frac{1009}{140}$ from a correct method seen

Question		Working	Answer	Mark	Notes
164	(a)		4.58006(9567)	2	M1 for 1.83 or 8.381(527307) or 4.6 or 4.58 or 4.580 or 4.5801 A1 for 4.58006(9567)
	(b)		4.5801	1	B1 ft provided at least 5 decimal places in (a)
***165**			Large box	4	M1 for a complete method to find the cost per sachet or the number of sachets per £1 for one size of box M1 for a complete method to find all three comparable figures A1 for 0.47(08. .), 0.46, 0.45 or 2.12(3...), 2.17(..), 2.22 (2..) oe C1(dep on M2) for a comparison of their answers leading to a correct deduction OR M1 for 3 multiples of each of 12, 20 and 35 or a common multiple of 12, 20 and 35, eg 420 or multipliers to compare the same number of sachets from each box, eg $\times\frac{35}{12}$ and $\times\frac{35}{20}$ M1 for a complete method to find three comparable costs A1 for three correct costs, eg 197.75 and 193.20 and 189.00 C1(dep on M2) for a comparison of their answers leading to a correct deduction
166	(a)		0.000064	1	B1 for 0.000064 or $\frac{1}{15625}$ or 6.4×10^{-5} oe
	(b)		4.2875×10^{7}	2	B2 cao (B1 for digits 42875 or 4.3×10^{7} or 4.29×10^{7} or 4.288×10^{7})

Question		Working	Answer	Mark	Notes
167		$\frac{232.5}{202.5} \times 60$	68.9	4	M1 for 232.5 or 237.5 or 197.5(=3.29… hours) or 202.5 (= 3.375 hours) M1 for correct conversion of "upper bound of time" from minutes to hours, (202.5 to 205) ÷ 60 M1 for "lower bound of distance" ÷ "upper bound of time" (230 to 232.5) ÷ (3.375 to 3.41(6…)) A1 for 68.8 to 69 from correct working OR M1 for 232.5 or 237.5 or 197.5(=3.29… hours) or 202.5 (= 3.375 hours) M1 for "lower bound of distance" ÷ "upper bound of time" (230 to 232.5) ÷ (202.5 to 205) M1 for correct conversion of "lower bound of speed" from miles per minute to miles per hour, ((1.12(1...) to 1.14(8...)) × 60 A1 for 68.8 to 69 from correct working
***168**			Yes, average speed could have been as high as 80.622...	5	B1 for 4535 or 4534.999... or 202.5 M1 for 4535 (oe) ÷ 202.5 M1 for ×3600 and ÷1000 A1 for 80.622... C1 (dep on first M1) for correct conclusion from their calculations

Question		Working	Answer	Mark	Notes
169			2.15 pm	3	M1 for 240 ÷ 60 (=4) M1 for adding at least 3 of the 4 periods of time eg 20 (mins) + "4 (hrs)" + 25 (mins) + 30 (mins) (=5 h 15 min) oe or 2.15 without units A1 for 2.15 pm 14 15 (h or pm) oe
170		12, 24, 36, 48, 60, 72, …. 8, 16, 24, 32, 40, 48, 56, 64, 72,…	25.80	5	M1 for listing at least 3 multiples of each of 12 and 8 or 24 in two lists of multiples or from factor trees M1 (dep) for attempt to find a common multiple of 12 and 8 above 60 (=72) M1 (dep M2) for method to find the number of boxes **and** the number of packs 72 ÷12 (=6) and 72 ÷ 8 (=9) M1 for finding the total cost by multiplying numbers by cost and adding eg "6" × 2.50 + "9" × 1.20 A1 for 25.8(0)
171			1.875×10^8	2	M1 for digits 1875 A1 cao

Question	Working	Answer	Mark	Notes
172 (a)		18.75	2	M1 for 84 **or** 4.48 **or** $\frac{112}{25}$ **or** 18.7 **or** 18.8 **or** 19 **or** 20 **or** $\frac{75}{4}$ A1 cao
(b)		20	1	B1 for 20 **or** ft from their answer to (a) provided (a) is written to 2 or more significant figures
173		19	4	M1 for 130 − 96 (=34) M1 for 73 − 55 (=18) M1 for '34' − 9 − '18' + 12 A1 cao **OR** M1 for 96 − 55 − 12 (=29) M1 for 9 + '29' (=38) M1 for 130 − 73 − '38' A1 cao

Question	Working	Answer	Mark	Notes
***174**		Small with correct figures for comparison	4	M1 for one calculation eg 6.5 ÷ 30 (=0.216...) **or** 8.95 ÷ 40 (=0.22375) **or** 10.99 ÷ 50 (=0.2198) M1 for all three calculations eg 6.5 ÷ 30 (=0.216...) **and** 8.95 ÷ 40 (=0.22375) **and** 10.99 ÷ 50 (=0.2198) A1 for 0.216(6...) **and** 0.223(75) **and** 0.219(8...); can be rounded or truncated as long as they remain different C1 (dep on M1) for conclusion ft from three comparable figures [could use different figures relating to 30, 40, 50] **OR** M1 for one calculation eg 6.5 × 20 (=130) **or** 8.95 × 15 (=134.25) **or** 10.99 × 12 (=131.88) M1 for three calculations eg 6.5 × 20 (=130) **and** 8.95 × 15 (=134.25) **and** 10.99 × 12 (=131.88) A1 for 130 **and** 134(.25) **and** 131(.88); can be rounded or truncated as long as they remain different C1 (dep on M1) for conclusion ft from three comparable figures eg cost of 600 plants or comparing small and medium and small and large e.g. 120 plants and 150 plants separately] **OR** M1 for one calculation e.g 30 ÷ 6.5 (= 4.615…) **or** 40 ÷ 8.95 (= 4.469…) **or** 50 ÷ 10.99 (= 4.549…) M1 for three calculations e.g. 30 ÷ 6.5 (= 4.615…) **and** 40 ÷ 8.95 (= 4.469…) **and** 50 ÷ 10.99 (= 4.549…) A1 for 4.6(15…) **and** 4.4(69…) **and** 4.5(49…) can be rounded or truncated as long as they remain different C1 (dep on M1) for conclusion ft from three comparable figures [or any other calculations leading to comparable figures]
175 (a)		0.00078	1	B1 cao
(b)		9.56×10^7	1	B1 cao

Question	Working	Answer	Mark	Notes
176		4.8	4	M1 for 60 × 60 (=3600) M1 for 15000÷ 20 (=750) or 20÷15000 (=0.00133..) or "3600"÷15000 (=0.24) or 15000÷"3600" (=4.16..) M1 for "3600" ÷ (15000÷20) or "3600"×20÷15000 oe A1 cao
177	*d*: UB = 54.5 (or 54.499), LB = 53.5 *C:* UB = 170.5 (or 170.499), LB = 169.5 170.5 ÷ 53.5 169.5 ÷ 54.5	3.19 3.11..	4	B1 for any one correct bound quoted M1 for 170.5 ÷ 53.5 or 169.5 ÷ 54.5 A1 for UB = answer in range 3.18 to 3.19 from correct working A1 for LB = 3.11.. from correct working

Question		Working	Answer	Mark	Notes
178		$\sqrt{\frac{2.73\ldots}{0.732\ldots}}$	1.931851…	2	M1 for 2.73… or 0.732…or 3.73…or 1.931 or 1.932 or 1.93 or $(1+\sqrt{3})$ or $(\sqrt{3}-1)$ or $(2+\sqrt{3})$ **or** 1.65... **or** 0.855... A1 for 1.9318(5…) SC: B1 for 2.5127(17...)
***179**			0.229 because the LB and UB agree to that number of figures	5	B1 for 3.465 or 3.475 or 3.474999… B1 for 8.1315 or 8.1325 or 8.132499… M1 for $\frac{\sqrt{3.475}}{8.1315}$ as UB **OR** $\frac{\sqrt{3.465}}{8.1325}$ as LB C1 (dep on all previous marks) for 0.2292… and 0.2288… both values must clearly come from working with correct values C1 for 0.229 from 0.2292… and 0.2288… **and** 'both LB and UB round to 0.229'

Question		Working	Answer	Mark	Notes
180		$\frac{\sqrt{20.4}}{6.2\times0.48}=\frac{4.5166359}{2.976}$	1.5176(868)	2	B2 for 1.5176… (B1 for sight of 4.51(66359..) **or** 4.52 **or** 2.97(6) **or** 2.98 **or** 1.51 **or** 1.52 **or** 1.518 **or** 1.517 **or** 1.5177**or** $\frac{\sqrt{510}}{5}$)

Question		Working	Answer	Mark	Notes
181	(a)	$\frac{546.7}{12.5} =$	43.736	2	B2 for 43.736 (B1 for 546.7 **or** $\frac{5467}{10}$ **or** $\frac{5467}{125}$ **or** 12.5 **or** $\frac{25}{2}$ or 43.7 **or** 43.8 **or** 43.73 **or** 43.74 **or** 40 **or** 44)
	(b)		40	1	B1 for 40 **or** ft from their answer to (a) provided (a) is written to 2 or more significant figures
182			Farm shop	4	M1 for 12.5 ÷ 2.5 (=5) M1 for '5'×1.83 or '5' × 183 A1 for (£)9.15 or 915(p) C1 (dep on at least M1) for decision ft working shown **OR** M1 for 12.5 ÷ 2.5 (=5) M1 for 9 ÷ '5' or 900 ÷ '5' A1 for (£)1.8(0) or 180(p) C1 (dep on at least M1) for decision ft working shown **OR** M1 for 9 ÷ 12.5 (=0.72) **or** 1.83 ÷ 2.5 (=0.732) M1 for 9 ÷ 12.5 (=0.72) **and** 1.83 ÷ 2.5 (=0.732) A1 for 72(p) **and** 73.(2)(p) or (£)0.72 **and** (£)0.73(2) C1 (dep on at least M1) for decision ft working shown **OR** M1 for 12.5 ÷ 9 (= 1.388...) M1 for 2.5 ÷ 1.83 (= 1.366...) A1 for 1.38.... **and** 1.36... truncated or rounded C1 (dep on at least M1) for decision ft working shown