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**GCSE**  
**MATHEMATICS**  
**8300/2H**

Paper 2 Calculator

Higher tier

Shadow paper based on June 2024 question paper

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Mark scheme

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Version: 1.0

Mark schemes are prepared by the Lead Assessment Writer and considered, together with the relevant questions, by a panel of subject teachers. This mark scheme includes any amendments made at the standardisation events which all associates participate in and is the scheme which was used by them in this examination. The standardisation process ensures that the mark scheme covers the students' responses to questions and that every associate understands and applies it in the same correct way. As preparation for standardisation each associate analyses a number of students' scripts. Alternative answers not already covered by the mark scheme are discussed and legislated for. If, after the standardisation process, associates encounter unusual answers which have not been raised they are required to refer these to the Lead Examiner.

It must be stressed that a mark scheme is a working document, in many cases further developed and expanded on the basis of students' reactions to a particular paper. Assumptions about future mark schemes on the basis of one year's document should be avoided; whilst the guiding principles of assessment remain constant, details will change, depending on the content of a particular examination paper.

No student should be disadvantaged on the basis of their gender identity and/or how they refer to the gender identity of others in their exam responses.

A consistent use of 'they/them' as a singular and pronouns beyond 'she/her' or 'he/him' will be credited in exam responses in line with existing mark scheme criteria.

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**Glossary for Mark Schemes**

GCSE examinations are marked in such a way as to award positive achievement wherever possible. Thus, for GCSE Mathematics papers, marks are awarded under various categories.

If a student uses a method which is not explicitly covered by the mark scheme the same principles of marking should be applied. Credit should be given to any valid methods. Examiners should seek advice from their senior examiner if in any doubt.

<b>M</b>	Method marks are awarded for a correct method which could lead to a correct answer.
<b>A</b>	Accuracy marks are awarded when following on from a correct method. It is not necessary to always see the method. This can be implied.
<b>B</b>	Marks awarded independent of method.
<b>ft</b>	Follow through marks. Marks awarded for correct working following a mistake in an earlier step.
<b>SC</b>	Special case. Marks awarded for a common misinterpretation which has some mathematical worth.
<b>M dep</b>	A method mark dependent on a previous method mark being awarded.
<b>B dep</b>	A mark that can only be awarded if a previous independent mark has been awarded.
<b>oe</b>	Or equivalent. Accept answers that are equivalent. e.g. accept 0.5 as well as $\frac{1}{2}$
<b>[a, b]</b>	Accept values between a and b inclusive.
<b>[a, b)</b>	Accept values $a \leq \text{value} < b$
<b>3.14 ...</b>	Accept answers which begin 3.14 e.g. 3.14, 3.142, 3.1416
<b>Use of brackets</b>	It is not necessary to see the bracketed work to award the marks.

Examiners should consistently apply the following principles.

### **Diagrams**

Diagrams that have working on them should be treated like normal responses. If a diagram has been written on but the correct response is within the answer space, the work within the answer space should be marked. Working on diagrams that contradicts work within the answer space is not to be considered as choice but as working, and is not, therefore, penalised.

### **Responses which appear to come from incorrect methods**

Whenever there is doubt as to whether a student has used an incorrect method to obtain an answer, as a general principle, the benefit of doubt must be given to the student. In cases where there is no doubt that the answer has come from incorrect working then the student should be penalised.

### **Questions which ask students to show working**

Instructions on marking will be given but usually marks are not awarded to students who show no working.

### **Questions which do not ask students to show working**

As a general principle, a correct response is awarded full marks.

### **Misread or miscopy**

Students often copy values from a question incorrectly. If the examiner thinks that the student has made a genuine misread, then only the accuracy marks (A or B marks), up to a maximum of 2 marks are penalised. The method marks can still be awarded.

### **Further work**

Once the correct answer has been seen, further working may be ignored unless it goes on to contradict the correct answer.

### **Choice**

When a choice of answers and/or methods is given, mark each attempt. If both methods are valid then M marks can be awarded but any incorrect answer or method would result in marks being lost.

### **Work not replaced**

Erased or crossed out work that is still legible should be marked.

### **Work replaced**

Erased or crossed out work that has been replaced is not awarded marks.

### **Premature approximation**

Rounding off too early can lead to inaccuracy in the final answer. This should be penalised by 1 mark unless instructed otherwise.

### **Continental notation**

Accept a comma used instead of a decimal point (for example, in measurements or currency), provided that it is clear to the examiner that the student intended it to be a decimal point.

Q	Answer	Mark	Comments
1	diameter	B1	line A
	chord	B1	line B

Q	Answer	Mark	Comments
2	72(%) or 0.72	M1	oe e.g. 1 – 0.28
	2088 000 ÷ 72 (× 100) or 29 000 (× 100)	M1dep	oe e.g. $2.088 \times 10^6 \div (100 - 28) (\times 100)$ or $2\,088\,000 \times [1.38, 1.39]$ or 2 900 000
	$2.9 \times 10^6$	A1	oe standard form e.g. $2.900\,000 \times 10^6$ SC1 $2.088 \times 10^6$ oe standard form seen SC1 any value seen converted to standard form
	<b>Additional Guidance</b>		
	M1 or SC1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	M1 may be seen in a trial or incorrect working e.g. $2\,000\,000 \times 0.72$ or 72% of 2 088 000		M1
	2088 000 ÷ 72% not recovered		M1M0
$2\,088\,000 \times 1.28 = 2\,672\,640$ $= 2.67264 \times 10^6$		SC1	

Q	Answer	Mark	Comments
3(a)	The number of seeds in the bag	B1	

Q	Answer	Mark	Comments						
3(b)	<table border="1"> <tr> <td>30</td> <td>120</td> <td>300</td> </tr> <tr> <td>20</td> <td>5</td> <td>2</td> </tr> </table>	30	120	300	20	5	2	B2	B1 5 or 300 in the correct position or $(k=)$ $30 \times 20$ or $(k=)$ 600 seen
	30	120	300						
	20	5	2						
	<b>Additional Guidance</b>								
$(k=)$ 600 or $(k=)$ $30 \times 20$ may be seen anywhere on the page									
600 may be seen embedded in the formula e.g. $20 = \frac{600}{30}$			B1						

Q	Answer	Mark	Comments
4(a)	The same number of 1s as even numbers	M1	any order may be in a list or on the spinner must be at least one 1
	1, 1, 2, 3, 3, 3, 3, 4	A1	any order may be in a list or on the spinner may be implied
	$\frac{4}{8}$	A1ft	oe fraction, decimal or percentage ft M1A0 with completed spinner or list of six numbers
	<b>Additional Guidance</b>		
	Ignore simplification or conversion attempt after correct answer seen		
	A list/spinner with blanks and/or using other numbers may still score M1 e.g. 1, 3, 3, 10 or 1, 1, 2, 2, 3, 3, 3, 3		M1
	$\frac{4}{8}$ oe with no incorrect working e.g. 1, 2, 3, 4 on spinner with 4 blanks answer $\frac{4}{8}$ (M1A1 is implied)		M1A1A1
	1, 1, 2, 2 with answer $\frac{4}{8}$		M1A0A1ft
	1, 2, 3, 3, 3, 3, 3, 3 with answer $\frac{6}{8}$		M1A0A1ft
	1, 1, 1, 2, 2, 2, 3, 3 with answer $\frac{4}{8}$		M1A0A0ft
3, 3, 3, 3, 3, 3, 3, 4 with answer $\frac{7}{8}$		M0A0A0ft	

Q	Answer	Mark	Comments
<b>4(b)</b>	Valid reason	B1	e.g. sum of probabilities is not 1
	<b>Additional Guidance</b>		
	Ignore irrelevant statements alongside a correct statement e.g. the sum of the probabilities is not 1 and the probabilities are not percentages	B1	
	Do not ignore incorrect statements alongside a correct statement e.g. the sum of the probabilities is 0.115 not 1	B0	
	They add up to 1.15	B1	
	They add up to 115%	B1	
	It is 0.15 too much	B1	
	One of the probabilities is 0.15 too much	B1	
	It should be something like 0.3, 0.1, 0.4, 0.2	B1	
	They don't add up correctly	B0	
	They add up to 0.115	B0	
	It's not a fair spinner	B0	

Q	Answer	Mark	Comments
5(a)	C (0, 12)	B1	if answer space is blank, accept (0, 12) written at C on the diagram
	D (4, 0)	B1	if answer space is blank, accept (4, 0) written at D on the diagram
	<b>Additional Guidance</b>		
	For each part mark the answer space unless blank		
	Allow $x$ and $y$ written above the coordinates but do not allow e.g. (0 $x$ , 12 $y$ )		

Q	Answer	Mark	Comments
5(b)	20	B1	
	– 6	B1	
	<b>Additional Guidance</b>		
	Mark the answer lines only		
	Do not allow e.g. (0, 20)		

Q	Answer	Mark	Comments
6	$6.4 \times 10^{-11}$	B1	oe standard form e.g. $6.40 \times 10^{-11}$

Q	Answer	Mark	Comments
7	$\frac{3591}{10000}$	B1	oe fraction, decimal or percentage e.g. 0.35(9...) or 0.36 or 35.9(...)% or 36%
	Valid reason involving the number of trials	B1	e.g. it is from using the largest number of flips
	<b>Additional Guidance</b>		
	1st B1 Ignore simplification or conversion attempt after correct answer seen e.g. $\frac{3591}{10000} = 40\%$		1st B1
	3591 out of 10000 or 3591 : 10000		1st B0
	Probability from incorrect working e.g. $\frac{3 + 37 + 389 + 3591}{10 + 100 + 1000 + 10000} = \frac{4020}{10000}$		1st B0
	Ignore irrelevant statements alongside a correct statement e.g. Using most flips and they could have done more		2nd B1
	Do not ignore incorrect statements alongside a correct statement e.g. Uses all the flips but they could have used 1000 flips		2nd B0
	It uses all the flips		2nd B1
	More spins		2nd B1
	10000 is the largest amount of data		2nd B1
	10000 is the highest number		2nd B1
	10000 is the total number of flips		2nd B0
	10000 flips give 3591 heads		2nd B0
	10000 is the final result		2nd B0
	That is the highest number in the table		2nd B0
	The highest results are more accurate		2nd B0
	1000 flips is easier to work out		2nd B0
	He could use any of the results		2nd B0
	B0B1 is possible e.g. Answer 42% Reason Use the one from most spins		B0B1

Q	Answer	Mark	Comments
8	A change in distance for an integer time interval or a change in distance for a non-integer time interval with the corresponding time interval	M1	integer time intervals are [108, 112] [86, 90] [64, 68] [42, 46] [20, 24] may be seen on graph
	$\frac{\text{their change in distance}}{\text{corresponding time interval}}$	M1dep	oe e.g. $\frac{[108, 112]}{5}$ must see their change in distance and the corresponding time interval division by 1 may be implied
	22	A1	SC1 27
	<b>Additional Guidance</b>		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	110 × 5		M1M0
	(1 second) Answer [20, 24] is awarded at least M2		
	22 from incorrect working cannot score A1		
22 followed by further work e.g. $22 \div 5 = 4.4$		M1M0	

Q	Answer	Mark	Comments
9	Only union shaded	B1	mark intention

Q	Answer	Mark	Comments
10	<b>Alternative method 1: works year by year</b>		
	80 000 × 1.04 or 83 200 or 80 000 × 1.07 or 85 600	M1	oe e.g. 80 000 + 80 000 × 0.04
	80 000 × 1.04 × 1.07 or 89 024	M1dep	oe e.g. 83 200 × 1.07
	89 024 and No	A1	oe e.g. 89 024 > 90 000 SC1 88 800 seen
	<b>Alternative method 2: uses multipliers</b>		
	1.04 × 1.07 or 1.112(8) or 1.113	M1	oe
	$\frac{90\,000}{80\,000}$ or 1.125 or $\frac{90\,000}{1.04 \times 1.07}$ or [80 877, 80 900]	M1	oe $\frac{90\,000}{1.04 \times 1.07}$ or [80 877, 80 900] is M2
	1.112(8) and 1.125 and No or [80 877, 80 900] and No	A1	oe e.g. 1.112(8) and 1.125 so it is more SC1 88 800 seen
	<b>Additional Guidance</b>		
	M1 or SC1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	A correct value is sufficient for showing working eg1 Alt 1 89 024 eg2 Alt 1 89 024 and No		M2A0 M2A1
	Alt 1 80 000 × 104% not recovered		M0
	Alt 2 No cannot be implied only by an inequality		
	SC1 is from increasing 80 000 by 11%		

Q	Answer	Mark	Comments	
11	$12 \times 30\,000 \div 100 \div 1000$	M2	oe full method e.g. $360\,000 \div 100 \div 1000$ or $0.3 \times 12$ or $0.00012 \times 30\,000$ M1 one correct step e.g. $12 \times 30\,000$ or $360\,000$ or $30\,000 \div 100$ or $300$ or $30\,000 \div 1000$ or $30$ or $12 \div 100$ or $0.12$ or $12 \div 1000$ or $0.012$ or $100 \times 1000$ or $100\,000$	
	3.6	A1		
	<b>Additional Guidance</b>			
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts			
	M2 will usually be seen in stages e.g. $30\,000 \div 100 = 300$ $300 \times 12 = 3600$ $3600 \div 1000$			M2
	M1 may be seen embedded in more than one step (extra steps could be incorrect) e.g. $12 \times 30\,000 \div 100$ or $3600$ or $12 \times 30\,000 \div 1000$ or $360$ or $30\,000 \div 100 \div 1000$ or $0.3$ or $12 \div 100 \div 1000$ or $0.00012$			M1
Ignore their units for method marks				

Q	Answer	Mark	Comments
12	ASA	B1	

Q	Answer	Mark	Comments
13	$30 \times 12.4$ or 372 <b>and</b> $15 \times 13.2$ or 198 <b>and</b> $5 \times 14$ or 70	M1	oe implied by 640 allow one product or $\bar{f}x$ value to be incorrect
	$(372 + 198 + 70) \div 50$ or $640 \div 50$ or $\frac{64}{5}$	M1dep	oe do not allow if any exact $\bar{f}x$ or $\Sigma\bar{f}x$ value is approximated
	12.8	A1	accept 13 if 12.8 in working lines with no incorrect method
	<b>Additional Guidance</b>		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$30 \times 12.4$ $15 \times 13.2$ $5 \times 14$ $(372 + 200 + 70) \div 50$ ( $\bar{f}x$ value 200 is approximated)	M1	M0
	$108 + 136.8 + 56 = 640$ $600 \div 50$ ( $\Sigma\bar{f}x$ value 600 is approximated)	M1	M0
	M1dep Missing brackets must be recovered e.g. $372 + 198 + 70 \div 50$ not recovered		M1M0
	12.8 in working with answer $12.8 \leq d < 13.6$		M2A0

Q	Answer	Mark	Comments
14(a)	$9 = 2^2 + c$ or $(c =) 5$	M1	oe
	$5^2 +$ their 5	M1dep	oe
	30	A1	

Q	Answer	Mark	Comments
14(b)	It must be different to the value in part (a)	B1	

Q	Answer	Mark	Comments
15	<b>Alternative method 1: works out water pumped in 45 minutes</b>		
	$19.5 \times 45 \times 60 \div 1000$ or 52.6(5) or 52.7  <b>or</b>  $19.5 \times 45 \times 60$ or 52 650 and $50 \times 1000$ or 50 000	M3	oe full method e.g. $19.5 \times 2700 \div 1000$ or $45 \times 1170 \div 1000$ or $52650 \div 1000$  M2 two correct steps e.g. $19.5 \times 45 \times 60$ or 52 650 or $19.5 \times 45 \div 1000$ or 0.8775 or $19.5 \times 60 \div 1000$ or 1.17 or $45 \times 60 \div 1000$ or 2.7  M1 one correct step e.g. $19.5 \times 45$ or 877.5 or $19.5 \times 60$ or 1170 or $19.5 \div 1000$ or 0.0195 or $45 \times 60$ or 2700 or $45 \div 1000$ or 0.045 or $60 \div 1000$ or 0.06 or $50 \times 1000$ or 50 000
	52.6(5) or 52.7 and Yes  <b>or</b> 52 650 and 50 000 and Yes		A1

**Question 15 continues on the next page**

<b>15 cont.</b>	<b>Alternative method 2: works out time for 50 cubic metres at given rate</b>		
	$50 \times 1000 \div 19.5 \div 60$ or [42.7, 42.8]  <b>or</b>  $50 \times 1000 \div 19.5$ or [2564, 2565] and $45 \times 60$ or 2700	M3	oe full method e.g. $50\,000 \div 19.5 \div 60$ or $50 \times [51.2, 51.28206] \div 60$ or [2564, 2565] $\div 60$ M2 two correct steps e.g. $50 \times 1000 \div 19.5$ or [2564, 2565] or $50 \times 1000 \div 60$ or 833.(...) or $50 \div 19.5 \div 60$ or [0.0427, 0.043] or $1000 \div 19.5 \div 60$ or [0.85, 0.86] M1 one correct step e.g. $50 \times 1000$ or 50 000 or $50 \div 19.5$ or [2.56, 2.565] or $50 \div 60$ or 0.83(...) or $1000 \div 19.5$ or [51.2, 51.28206] or $1000 \div 60$ or [16.6, 16.7] or $19.5 \times 60$ or 1170 or $45 \times 60$ or 2700
	[42.7, 42.8] and Yes or [2564, 2565] and 2700 and Yes	A1	oe e.g. 42.8 so it is
	<b>Additional Guidance</b>		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	M3 or M2 will usually be seen in stages e.g. Alt 1 $19.5 \times 45 = 877.5$ $877.5 \times 60 = 52\,650$ $52\,650 \div 1000$		M3
	M2 or M1 may be seen embedded in more than one step (extra steps could be incorrect)		
	No may be indicated by selecting the box or a statement in the working lines		
	No cannot be implied only by an inequality		
	A correct value is sufficient for showing working e.g. Alt 1 52.6 and Yes		M3A1
Ignore their units throughout			
Other approaches are possible e.g. works out rate in litres per s for 50 cubic metres in 45 minutes and compares to 19.5			

Q	Answer	Mark	Comments	
16	Fully correct box plot with shortest at 3 metres LQ at 3.6 metres median at 6 metres UQ at 9 metres longest at 12 metres	B3	mark intention B2 box plot with four correct plots and one incorrect/omitted plot or box plot with five correct plots and at most one extra plot B1 at least three correct plots	
	<b>Additional Guidance</b>			
	A box plot must be a rectangle with 'whiskers'			
	Accept 'whiskers' ending in points rather than vertical lines			
	For B2 condone the median given as a point in the rectangle			

Q	Answer	Mark	Comments
17	$\frac{1}{2}x + 10 + \frac{3}{4}x - 15 = 180$	M1	oe equation
	$\frac{1}{2}x + \frac{3}{4}x = 180 + 15 - 10$ or $2x + 40 + 3x - 60 = 720$	M1dep	oe equation with terms collected e.g. $\frac{5}{4}x = 185$ or oe equation with fractions eliminated e.g. $5x = 740$
	$(x =) 185 \div \frac{5}{4}$ or $(x =) 148$		M1dep
	84 : 96	A1	oe ratio e.g. 7 : 8 or $1 : \frac{8}{7}$ or $\frac{7}{8} : 1$
	<b>Additional Guidance</b>		
	Ignore simplification attempt after correct ratio seen e.g. 84 : 96 in working with answer 42 : 36		

Q	Answer	Mark	Comments
18	<b>Alternative method 1: only uses trigonometry</b>		
	$\cos 48 = \frac{x}{31.2}$	M1	oe e.g. $\sin(90 - 48) = \frac{x}{31.2}$ or $\frac{x}{\sin 42} = \frac{31.2}{\sin 90}$ accept [0.66, 0.67] for $\cos 48$ or $\sin 42$
	$31.2 \times \cos 48$	M1dep	oe e.g. $31.2 \times \sin 42 \div \sin 90$ accept [0.66, 0.67] for $\cos 48$ or $\sin 42$
	[20.87, 20.9]	A1	SC1 [23, 23.4]
	<b>Alternative method 2: uses trigonometry and Pythagoras</b>		
	$31.2^2$ and $(31.2 \times \sin 48)^2$ or [973.4, 973.5] and [525, 548]	M1	oe accept [0.74, 0.75] for $\sin 48$ accept [23, 23.4] for $31.2 \times \sin 48$
	$\sqrt{31.2^2 - (31.2 \times \sin 48)^2}$ or $\sqrt{[425.8, 440.3]}$	M1dep	oe accept [0.74, 0.75] for $\sin 48$ accept [23, 23.4] for $31.2 \times \sin 48$
	[20.87, 20.9]	A1	SC1 [23, 23.4]
	<b>Additional Guidance</b>		
	M1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
SC1 is from a diagonal making an angle of $42^\circ$ with $x$			

Q	Answer	Mark	Comments
19(a)	One of $18x^2 + 27x$ $-18x^2 + 36x$ $-63x - 35$	M1	may be seen in a grid
	Two of $18x^2 + 27x$ $-18x^2 + 36x$ $-63x - 35$	M1dep	may be seen in a grid
	$18x^2 + 27x$ and $-18x^2 + 36x$ and $-63x - 35$ and $-35$	A1	must see 6 correct terms and a final simplification to $-35$
	<b>Additional Guidance</b>		
	For terms seen in a grid accept e.g. $27x$ for $+27x$		
	Accept multiplication signs between coefficients and algebra e.g. $18 \times x^2 + 27 \times x$		1st M1
	Accept e.g. $+ -18x^2$ for $-18x^2$		
	Do not accept unprocessed brackets e.g. do not accept $-(63x + 35)$		
	Crossed out terms are likely to be their working rather than deleted work		

Q	Answer	Mark	Comments
19(b)	$(12x + 5)(x - 2)$	B2	oe factorisation e.g. $(-12x - 5)(-x + 2)$ B1 $(ax + b)(cx + d)$ where $ac = 12$ and $bd = -10$ or $(ax + b)(cx + d)$ where $ac = 12$ and $ad + bc = -19$ allow multiplication signs for B2 or B1
	<b>Additional Guidance</b>		
	B1 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
	$(4x - 2)(3x + 5)$ $(ac = 12$ and $bd = -10)$		B1
	$(4x - 5)(3x - 1)$ $(ac = 12$ and $ad + bc = -19)$		B1
	For B1 allow use of fractions or decimals e.g. $(12x + 20)(x - 0.5)$		B1
	For B1 allow e.g. $8(3x + 1.25)(0.5x - 1)$		B1
	Condone missing final bracket for B2 or B1		
	Ignore any attempt to 'solve' e.g. $(12x + 5)(x - 2)$ in working lines with 2 and $-\frac{5}{12}$ on answer lines		B2

Q	Answer	Mark	Comments
20	$x^2 + 3x - 6x - 18$ or $x^2 - 3x - 18$	M1	oe implied by e.g. $\frac{1}{2}x^2 + \frac{3}{2}x - 3x - 9$ may be seen in a grid
	their $(x^2 + 3x - 6x - 18) = 60 - 5x^2$	M1dep	oe equation with brackets expanded e.g. their $\left(\frac{1}{2}x^2 + \frac{3}{2}x - 3x - 9\right) = 60 - 5x^2$
	$6x^2 - 3x - 78 (= 0)$ or $6x^2 - 3x = 78$	M1dep	oe $ax^2 + bx + c (= 0)$ or $px^2 + qx = r$ e.g. $2x^2 - x - 26 (= 0)$ or $3x^2 - \frac{3}{2}x - \frac{78}{2} (= 0)$ implied by e.g. $\frac{1 \pm \sqrt{209}}{4}$
	$d = k$ $e = 209k^2$ $f = 4k$ where $k$ is a non-zero constant	A1	e.g. $d = 1$ $e = 209$ $f = 4$ or $d = 3$ $e = 1881$ $f = 12$
	<b>Additional Guidance</b>		
Take the values on the answer lines as the final answer e.g. $\frac{1 \pm \sqrt{209}}{4}$ in working with $d = 1$ $e = \sqrt{209}$ $f = 4$ on answer lines			M3A0
For terms seen in a grid accept e.g. $3x$ for $+3x$			
For up to M2 accept algebraic fractions but do not allow 3rd M1 unless recovered e.g. $\frac{x^2 + 3x - 6x - 18}{x + 3} = \frac{60 - 5x^2}{x + 3}$			M1M1

Q	Answer	Mark	Comments
21	<b>Alternative method 1: uses total and proportion in Rest with Main Stage</b>		
	$2400 \times \frac{7}{4}$ or 4200	M1	oe total in Rest with Main Stage e.g. $600 \times 7$
	$1 - \frac{1}{6} - \frac{3}{10}$ or $\frac{8}{15}$	M1	oe proportion in Rest with Main Stage e.g. 0.53(...) or 53(...)%
	their 4200 $\div$ their $\frac{8}{15}$	M1dep	oe full method dep on M2
	7875	A1	
	<b>Alternative method 2: uses total in Rest with Main Stage and total in Food Court with Merchandise</b>		
	$2400 \times \frac{7}{4}$ or 4200	M1	oe total in Rest with Main Stage e.g. $600 \times 7$
	$2400 \times \frac{49}{32}$ or 3675	M1	oe total in Food Court with Merchandise e.g. $75 \times 49$
	their 4200 + their 3675	M1dep	oe full method e.g. $75 \times 105$ dep on M2
	7875	A1	
	<b>Alternative method 3: sets up an equation</b>		
	$2400 \times \frac{7}{4}$ or 4200	M1	oe total in Rest with Main Stage e.g. $600 \times 7$
	$\frac{1}{6}x + \frac{3}{10}x + \text{their } 4200 = x$	M1dep	oe equation in any variable e.g. $5x + 9x + 126\,000 = 30x$
	their 4200 $\div \left(1 - \frac{1}{6} - \frac{3}{10}\right)$	M1dep	oe full method e.g. $126\,000 \div 16$
	7875	A1	

Question 21 continues on the next page

<b>21 cont.</b>	<b>Alternative method 4: works out proportion in Main Stage or proportion in Rest</b>		
	$1 - \frac{1}{6} - \frac{3}{10}$ or $\frac{8}{15}$	M1	oe proportion in Rest with Main Stage e.g. 0.53(...) or 53.(...)%
	$\frac{4}{7} \times$ their $\frac{8}{15}$ or $\frac{32}{105}$  or  $\frac{3}{7} \times$ their $\frac{8}{15}$ or $\frac{8}{35}$	M1dep	oe proportion in Main Stage e.g. 0.30(4...) or 30.4(...)%  e.g. $\frac{4}{3+4} \times$ their $\frac{8}{15}$  or oe proportion in Rest e.g. 0.228(5...) or 0.23 or 22.8(5...)% or 22.9%  e.g. $\frac{3}{3+4} \times$ their $\frac{8}{15}$
	2400 $\div$ their $\frac{32}{105}$  or  2400 $\times \frac{3}{4} \div$ their $\frac{8}{35}$	M1dep	oe full method e.g. 225 $\times$ 35
	7875	A1	
	<b>Additional Guidance</b>		
	Up to M2 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts		
Proportions can be percentages but in calculations values must be used e.g. Alt 1 4200 $\div$ 53.(...)% is awarded M2 but cannot be awarded the 3rd M1 unless $\frac{8}{15}$ or 0.53(...) is subsequently used correctly			

Q	Answer	Mark	Comments
<b>22</b>	8.772	B3	B2 [8.771, 8.7714] B1 8 or 8.75
	<b>Additional Guidance</b>		
	Ignore values written as fractions		
	Ignore the suffixes		
Q	Answer	Mark	Comments

23	One correct expression e.g. $(\overrightarrow{DE} =) 5a - 2b - 3a - b$ or $(\overrightarrow{DF} =) 5a - 2b + 3a - 10b$ or $(\overrightarrow{EF} =) 3a + b + 3a - 10b$	M1	oe e.g. $(\overrightarrow{ED} =) -5a + 2b + 3a + b$ or $(\overrightarrow{FD} =) -5a + 2b - 3a + 10b$ or $(\overrightarrow{FE} =) -3a - b - 3a + 10b$ accept unprocessed brackets e.g. $(\overrightarrow{EF} =) 5a - 2b - (3a + b)$
	Two correct expressions from $\overrightarrow{DE}$ $\overrightarrow{DF}$ $\overrightarrow{EF}$	M1dep	oe e.g. $\overrightarrow{DE}$ and $\overrightarrow{FD}$ accept unprocessed brackets
	Two fully simplified expressions from $(\overrightarrow{DE} =) 2a - 3b$ $(\overrightarrow{DF} =) 8a - 12b$ $(\overrightarrow{EF} =) 6a - 9b$	A1	oe e.g. $(\overrightarrow{DE} =) 2a - 3b$ and $(\overrightarrow{FD} =) -8a + 12b$
	Two fully simplified expressions from $(\overrightarrow{DE} =) 2a - 3b$ $(\overrightarrow{DF} =) 8a - 12b$ $(\overrightarrow{EF} =) 6a - 9b$ and valid indication that the vectors are parallel	A1	e.g. $(\overrightarrow{DE} =) 2a - 3b$ and $(\overrightarrow{FE} =) -6a + 9b$ and $2a - 3b = -\frac{1}{3}(-6a + 9b)$ or $(\overrightarrow{DF} =) 8a - 12b$ and $(\overrightarrow{EF} =) 6a - 9b$ and $\overrightarrow{DF} = \frac{4}{3}\overrightarrow{EF}$
	<b>Additional Guidance</b>		
	Condone absence of vector notation		
	Condone e.g. $\overrightarrow{DCE}$ or $D$ to $E$ for $\overrightarrow{DE}$		
	If the only two correct expressions are e.g. $\overrightarrow{DE}$ and $\overrightarrow{ED}$ the maximum possible mark is M1		
Only combining the three given vectors		Zero	
$\overrightarrow{DF} = \overrightarrow{DE} + \overrightarrow{EF}$ is not a valid indication			
Stating e.g. $\overrightarrow{DF}$ is a (scalar) multiple of $\overrightarrow{EF}$ is not enough for the final A1			

Q	Answer	Mark	Comments
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<b>24(a)</b>	$(k =) (4 - 1) \div 25$ or $(k =) \frac{3}{25}$	M1	oe may be implied e.g. $y = \frac{3}{25}x^2 + 1$
	13	A1	oe value e.g. $\frac{130}{10}$ ignore units
	<b>Additional Guidance</b>		
	Ignore simplification or conversion attempt after correct answer seen		
	13 only seen embedded e.g. $13 \times 10 = 130$		M1A0

Q	Answer	Mark	Comments
<b>24(b)</b>	$4 = A \times \frac{4}{3}$ or $(A =) 4 \times \frac{3}{4}$ or $(A =) 3$	M1	oe e.g. $4 = A \times \left(\frac{4}{3}\right)^{\frac{1}{5} \times 5}$ implied by $(y =) 5.3(3\dots)$
	$(y =) 5.3(3\dots)$ and middle box ticked	A1ft	ft decision using their 13 in (a) must have $(y =) 5.3(3\dots)$
	<b>Additional Guidance</b>		
	A correct value is sufficient for showing working		
	Decision may be indicated by selecting a box or a statement in the working lines		
Decision cannot be implied only by an inequality			

Q	Answer	Mark	Comments
<b>25</b>	<b>Alternative method 1: works out a scale factor</b>		
	$\frac{1}{2} \times 8(L) \times 15(L) \times 12(L)$ or $720(L^3)$ where $L$ is any variable or any positive value	M1	oe volume e.g. ( $L = 2$ ) $\frac{1}{2} \times 16 \times 15 \times 24$ or 5760
	2430 $\div$ their 720 or $\frac{27}{8}$ or 3.375	M1dep	oe e.g. $2430 \times 2 \div (8 \times 15 \times 12)$ e.g. ( $L = 2$ ) 2430 $\div$ their 5760 or $\frac{27}{64}$
	$\sqrt[3]{\text{their } \frac{27}{8}}$ or $\frac{3}{2}$ or 1.5	M1dep	Oe e.g. ( $L = 2$ ) $\sqrt[3]{\text{their } \frac{27}{64}}$ or $\frac{3}{4}$ or 0.75
	2 $\times$ 8 $\times$ their 1.5 + 2 $\times$ 15 $\times$ their 1.5 + 2 $\times$ 17 $\times$ their 1.5 + 3 $\times$ 12 $\times$ their 1.5	M1dep	oe e.g. ( $L = 2$ ) 2 $\times$ 16 $\times$ their 0.75 + 2 $\times$ 30 $\times$ their 0.75 + 2 $\times$ 34 $\times$ their 0.75 + 3 $\times$ 24 $\times$ their 0.75
	174	A1	SC4 [138.1, 138.2]

**Question 25 continues on the next page**

<b>25 cont.</b>	<b>Alternative method 2: works out a value of <math>a</math>, <math>b</math>, <math>c</math> or <math>d</math></b>		
	<p>Correct expression for volume in terms of <math>a</math> or <math>b</math></p> <p>e.g. <math>\frac{1}{2} \times a \times \frac{15a}{8} \times \frac{12a}{8}</math> or <math>\frac{45a^3}{32}</math></p> <p>or</p> <p><math>\frac{1}{2} \times \frac{8b}{15} \times b \times \frac{12b}{15}</math> or <math>\frac{16b^3}{75}</math></p>	M1	<p>oe in terms of <math>c</math> or <math>d</math></p> <p>e.g. <math>\frac{1}{2} \times \frac{8c}{17} \times \frac{15c}{17} \times \frac{12c}{17}</math> or <math>\frac{720c^3}{4913}</math></p> <p>or</p> <p><math>\frac{1}{2} \times \frac{8d}{12} \times \frac{15d}{12} \times d</math> or <math>\frac{5d^3}{12}</math></p> <p>may be implied by an equation</p> <p>e.g. <math>a \times \frac{15a}{8} \times \frac{12a}{8} = 2430 \times 2</math></p>
	<p><math>a^3 = 2430 \div</math> their <math>\frac{45}{32}</math> or <math>a^3 = 1728</math></p> <p>or <math>b^3 = 2430 \div</math> their <math>\frac{16}{75}</math></p> <p>or <math>b^3 = \frac{91125}{8}</math></p>	M1dep	<p>oe e.g. <math>c^3 = 2430 \div</math> their <math>\frac{720}{4913}</math></p> <p>or <math>c^3 = \frac{132651}{8}</math></p> <p>or <math>d^3 = 2430 \div</math> their <math>\frac{5}{12}</math> or <math>d^3 = 5832</math></p>
	<p><math>a = \sqrt[3]{\text{their } 1728}</math> or <math>a = 12</math></p> <p>or</p> <p><math>b = \sqrt[3]{\frac{91125}{8}}</math> or <math>b = \frac{45}{2}</math> or 22.5</p>	M1dep	<p>oe e.g. <math>c = \sqrt[3]{\text{their } \frac{132651}{8}}</math></p> <p>or <math>c = \frac{51}{2}</math> or 25.5</p> <p>or <math>d = \sqrt[3]{5832}</math> or <math>d = 18</math></p>
	<p><math>2 \times</math> their <math>a + 2 \times \frac{15}{8} \times</math> their <math>a</math></p> <p><math>+ 2 \times \frac{17}{8} \times</math> their <math>a + 3 \times \frac{12}{8} \times</math> their <math>a</math></p> <p>or</p> <p><math>2 \times \frac{8}{15} \times</math> their <math>b + 2 \times</math> their <math>b</math></p> <p><math>+ 2 \times \frac{17}{15} \times</math> their <math>b + 3 \times \frac{12}{15} \times</math> their <math>b</math></p>	M1dep	oe correct method using their $c$ or their $d$
174	A1	SC4 [138.1, 138.2]	
<b>Additional Guidance</b>			

	Up to M3 may be awarded for correct work with no answer or incorrect answer, even if this is seen amongst multiple attempts	
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