

Guidance on the use of codes for this mark scheme	
M	Method mark
A	Accuracy mark
B	Mark awarded independent of method
C	Communication mark
P	Process, proof or justification mark
oe	Or equivalent
cao	Correct answer only
ft	Follow through

Question	Working	Answer	Mark	AO	Notes	Grade	
1	a	$1.75 \times 3.50 = 6.125$	£6.13 to nearest penny	M1	3	M1 for correct method A1 cao M1 for correct method, accept $2 \times 6.125 = £12.25$ A1 for £12.26 or £12.25 M1 for correct method, accept $6.125 \times 1.05 = 6.43125$ A1 for £6.44 or £6.43	B
	b	$6.13 \times 2 = 12.26$	£12.26	M1			
	c	$6.13 \times 1.05 = 6.4365$	£6.44 to nearest penny	A1			
			<b>6</b>				
2			995 ml	B1	3	B1 for 995	B
				<b>1</b>			
3	1 km = 1000 m = $1000 \times 100$ cm = 100 000 cm			C2	3	C1 for km to metres C1 for metres to centimetres	B
		1 km = 100 000 cm		<b>2</b>			
4			He has forgotten that there are 60 minutes in an hour, not 100. $1\frac{1}{4}$ hours is 75 minutes	B1 B1	2	B1 for stating he has used 1 hour as 100 minutes B1 for correct answer as 75 minutes	B
				<b>2</b>			
5	15 minutes = $\frac{15}{60} = \frac{1}{4}$ hour  Total time is $1\frac{3}{4}$ hours + $\frac{1}{4}$ hour = 2 hours  18:40 plus 2 hours gives 20:40. So the film will finish at 20:40. If Peter's Dad leaves at 9 p.m. and it is a 20 min drive he will get to the cinema at 9:20 p.m. or 21:20.			M1	2 3	M1 for calculating the time the boys will be leaving  A1 cao  B1 for dad's arrival time C1 for clear explanation of dad being late	B
				A1			
		No, Peter's dad is not correct as they will have been waiting for 40 min by the time he gets there.		B1 C1			

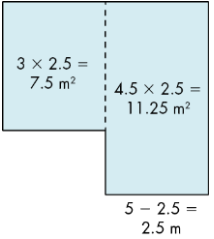
6		<p><math>\frac{1}{4}</math> could be odd one out as it's the only terminating decimal equivalent/the only one with 1 as the denominator/unit fraction.</p> <p><math>\frac{2}{6}</math> could be odd one out as it's the only one which is not in its simplest form.</p> <p><math>\frac{2}{3}</math> could be odd one out as after simplifying <math>\frac{2}{6}</math> it's the only one not having a numerator of 1/unit fraction.</p>	C1	2	C1 for a valid reason for $\frac{1}{4}$	B	
			C1				C1 for a valid reason for $\frac{2}{6}$
			C1				C1 for a valid reason for $\frac{2}{3}$
			3				
7	a	Look at the first decimal place of the decimal, put the numbers in order. If any have the same digit in this place, look to the second decimal place and put these in order. Keep going along the decimal places until all numbers are in order.	C1	2	C1 for explanation of what you look for when ordering decimals.	B	
	b	E.g. 0.24 Closest to 0.23 as it is smaller than 0.25 which is halfway between the two numbers.	B1 C1		B1 for a decimal between 0.23 and 0.27 (not 0.25) C1 for clear explanation		
			3				

8	a	$500 - (85 \times 5) = 500 = 75$	75p	B1	2 3	B1 cao	B
	b		$500 - (85 \times 5)$	C1		C1 for simple word problem that requires the calculation	
	c		e.g. for $500 \times (85 \times 5)$ Pip buys some nails in packs of five. Each pack is in a box containing 85 packs. He has ordered 500 boxes. How many nails has he ordered?  e.g. for $500 + (85 \times 5)$ Pip buys some nails in packs of five. He buys a box containing 85 packs. He already had 500 nails, so how many has he altogether now?  e.g. for $500 \div (85 \times 5)$ Pip needs 500 nails. The nails come in packs of 5 in boxes containing 85 packs. How many boxes does he need?	C1  C1		C1 for simple word problem that requires the calculation  C1 for simple word problem that requires the calculation	
				4			
9	a		She was overdrawn.	B1	2 3	B1 a correct answer	B
	b	Difference between $-123.67$ and $1428.62$ , which equals $1428.62 + 123.67 = 1552.29$		M1		M1 for correct method of finding the difference	
			£1552.29	A1		A1 cao	
				3			
10	a		$\times 100$ Because multiplying by 100 will have the effect of moving 72 two places to the left.	B1 C1	2	B1 for a correct operation C1 for clear explanation	B
	b		e.g. $100 \div 4$ $5 \times 5$	C2		C1 for a suitable question where the answer is 25. C1 for another suitable question where the answer is 25.	
	c		$25 \times 10$ E.g. I looked for a simple question with an answer of $10 \times 25$ , then realised this is the answer.	B1 C1		B1 for a correct question with answer of 250 C1 for a clear explanation	
				6			
11			A prime number has only two factors, one and itself. So 36 is not a prime number. The true statement is that 36 has 8 factors.	C1	2	C1 for clear explanation	B
				B1		B1 for correct true statement	
						2	

<b>12</b>	<b>a</b>	No, a prime number cannot be a multiple of 4 because a prime number has only two factors, one and itself.	B1 C1	2	B1 for No C1 for clear explanation	B
	<b>b</b>	e.g. 501 the sum of its digits is divisible by 3	B1 C1			
	<b>c</b>	A number is divisible by 6 if it is divisible by 2 (even) and divisible by 3 (the sum of its digits is divisible by 3)	C1			
	<b>d</b>	e.g. 105 It ends in 5 and the sum of its digits is divisible by 3	B1 C1			
	<b>e</b>	A number is divisible by 25 if it ends with 00, 25, 50, or 75.	C1			
			<b>8</b>			
<b>13</b>	$\sqrt{16}$ = 4	4 tiles	M1 A1	3	M1 for finding square root of 16 A1 cao	B
			<b>2</b>			
<b>14</b>		720 Use multiplication as the inverse of division. $7.2 \times 10 \times 10 = 7.2 \times 100 = 720$	B1 C1	2	B1 for 720 C1 for clear explanation.	B
			<b>2</b>			
<b>15</b>	1 × 20p (2 × 20p = 40p > 34p) 14p left to find 2 × 5p (3 × 5p = 15p > 14p) 2 × 2p = 4p Total 34p as required 1 × 20p, 2 × 5p, 2 × 2p: 5 coins	5 coins	P1	3	P1 for the process of finding suitable coins	B
			A1			
			<b>2</b>	A1 cao		

16 a	1 cm = 10 mm So 300 cm = $300 \times 10 = 3000$ mm		P1	2	P1 for process of changing one unit to the other	B
	b	So 30 000 mm is longer. e.g. 500 cm, 5000 mm	B1 B1		B1 for correct statement B1 for a correct example	
			<b>3</b>			
17	$12 \times 15 = 180$ ice creams all together Cost of ice creams = $12 \times \text{£}4.50 = \text{£}54$ $105 \times 80\text{p} = 8400\text{p} = \text{£}84$ $180 - 105 = 75$ $75 \times 50\text{p} = 3750\text{p} = \text{£}37.50$ Total sales $\text{£}84 + \text{£}37.50 = \text{£}121.50$ Profit = $\text{£}121.50 - \text{£}54 = \text{£}67.50$	£67.50	B1 B1 B1  B1  B1 M1 A1	3	B1 for 180 B1 for 54 B1 for 84  B1 for 37.50  B1 for 121.50 M1 for finding difference A1 cao	B
			<b>7</b>			
18 a	$540 - 300 = 240$ $240 \times 5 = 1200\text{p} = \text{£}12$ Add £25 for the month	£37	M1 A1 A1	3	M1 for finding how many calls chargeable A1 for 12 A1 cao	B
	b	$240 \times 0.25 = 60$ So 180 calls @ 5p $= 180 \times 5\text{p} = 900\text{p} = \text{£}9$ 60 calls @ 3p $= 60 \times 3\text{p} = 180\text{p} = \text{£}1.80$ Total = $\text{£}9 + \text{£}1.80 = \text{£}10.80$ Difference = $\text{£}12 - \text{£}10.80 = \text{£}1.20$	M1  B1  B1  M1 A1		M1 for method of finding 25%  B1 for 9  B1 for 1.80  M1 for finding difference A1 cao	
		£1.20	<b>8</b>			

19 a	Change both fractions to 12ths $\frac{1}{3} = \frac{4}{12}$ $\frac{1}{2} = \frac{6}{12}$ Between these two is $\frac{5}{12}$	$\frac{5}{12}$	C1	2	C1 for suitable fraction alongside with explanation	M
	b Change each to a decimal and look at the difference to 1/3 $\frac{1}{3} \rightarrow 0.333\ 333$ $\frac{10}{31} \rightarrow 0.322\ 581$ , difference is 0.010 752 $\frac{20}{61} \rightarrow 0.327\ 869$ , difference is 0.054 644 $\frac{30}{91} \rightarrow 0.296\ 703$ , difference is 0.003 663 $\frac{50}{151} \rightarrow 0.331\ 126$ , difference is 0.002 208 So $\frac{50}{151}$ is the closest OR Make each fraction have a numerator of 1, so $\frac{10}{31} \rightarrow \frac{1}{3.1}$ $\frac{20}{61} \rightarrow \frac{1}{3.05}$ $\frac{30}{91} \rightarrow \frac{1}{3.033}$	$\frac{50}{151}$	B1  P1 C1       B1		B1 for any fraction between $\frac{1}{3}$ and $\frac{1}{2}$  P1 for a suitable process of comparing the fractions C1 for accuracy of results       B1 cao	
20	$\frac{10}{31} \rightarrow 3.033$	Compare the denominator but not take into consideration the numerator.	5 C1 1	2	C1 for clear explanation	M

<p><b>21 a</b></p>  <p> <math>3 \times 2.5 = 7.5 \text{ m}^2</math>  <math>4.5 \times 2.5 = 11.25 \text{ m}^2</math>  <math>5 - 2.5 = 2.5 \text{ m}</math> </p> <p>Total area is <math>11.25 + 7.5 = 18.75 \text{ m}^2</math>  <math>18.75 \times 78 = 1462.5</math>  1463 to nearest whole brick</p> <p><b>b</b></p> <p> <math>1463 = 14 \times 100 + 63</math>  <math>= 1400 \times 1.08 + 63 \times 1.79</math>  <math>= \text{£}1512 + \text{£}112.77</math>  <math>= \text{£}1624.77</math>  Or <math>15 \times 100</math>  <math>= 1500 \times 1.08</math>  <math>= \text{£}1620</math>  Cheaper to buy <math>15 \times 100</math> </p> <p><b>c</b></p> <p> <math>1463 \div 11 = 133</math>  So buy 133 lots of 10, getting 133 free  Gives 1463 bricks  Would need to buy 1330 bricks at <math>\text{£}1.65</math> plus VAT.  <math>= \text{£}1.65 \times 1.20 \times 1330</math>  <math>= \text{£}2633.40</math>  About <math>\text{£}1000</math> more. </p>		<p>1463 bricks</p> <p><math>\text{£}1620</math></p> <p>No, because the cost is about <math>\text{£}1000</math> more.</p>	<p>P1</p> <p>M1 A1 M1 A1</p> <p>C1</p> <p>M1</p> <p>A1</p> <p>P1</p> <p>B1</p> <p>B1 C1</p> <p><b>12</b></p>	<p>3</p>	<p>P1 for process of splitting the shape into two rectangles</p> <p>M1 for method of finding total area of the shape A1 cao M1 for method of finding number of bricks A1 cao</p> <p>C1 for showing cheapest way to buy bricks</p> <p>M1 for method of calculation</p> <p>A1 cao</p> <p>P1 for process of finding out how many needed to buy</p> <p>B1 for 1330</p> <p>B1 for <math>\text{£}2633.40</math> C1 for stating no with clear explanation</p>	<p>M</p>
<p><b>22 a</b></p> <p><b>b</b></p> <p><b>c</b></p>		<p> <math>4.6 \times 40</math>  <math>= 4.6 \times 10 \times 4</math>  <math>= 46 \times 4</math>  <math>= 184</math> </p> <p>e.g. <math>4.6 \times 40</math>  Round to <math>5 \times 40 = 200</math>  So the answer in part a makes sense.</p> <p>e.g. Divide both by 10, or multiply both by 10 to give  <math>11.56 \div 0.34 = 34</math>  Or <math>1156 \div 34 = 34</math></p>	<p>P1</p> <p>B1</p> <p>C1</p> <p>C1</p> <p>B1 B1</p> <p><b>6</b></p>	<p>2</p>	<p>P1 for correct way of creating answer</p> <p>B1 for 184</p> <p>C1 for clear explanation</p> <p>C1 for clear explanation</p> <p>B1 for first example B1 for second example</p>	<p>M</p>



23	a	Story about the calculation	C2	2	C1 for a sensible story C1 for suitable involvement of figures C1 for story with calculation C1 for suitable mark scheme	M
	b	Own calculation story with mark scheme	C2 4			
24	a	$8 \times 100 = 8 \times 10 \times 10 = 80 \times 10$ as required $\frac{400}{100} = \frac{40 \times 10}{10 \times 10} = \frac{40}{10} \times 1$ as required	C1  C1	2	C1 for clear explanation  C1 for clear explanation  C1 for clear explanation  C1 for clear explanation  C1 for first suitable question C1 for second suitable question  C1 for creating and stating a link  C1 for first suitable question C1 for second suitable question  C1 for creating and stating a link	M
	b	$6 \div \frac{1}{3}$ is the same as asking how many times does $\frac{1}{3}$ go into 6 which is $6 \times 3 = 18$ $6 \div \frac{2}{3}$ will be less than 18 as $\frac{2}{3}$ will go into 6 less times as it is bigger than $\frac{1}{3}$	C1  C1			
	c	Use $3 \times 3 = 9$ and $3 \times 15 = 45$ to create, for example: $15 \times 3 = 45$ $45 \div 5 = 9$	C1 B1 B1			
	d	e.g. Bill and Ted's ages multiply together to make 64. What are their ages? The product of Bill's baby sister and his dad is 64. What are their ages? The link is Bill.	C2  C1			
	e	e.g. Three brothers win £15 between them. How much will each receive? Tom won £5 and bought some games that cost £1 each. How many games did he buy? The link is winning.	C2  C1			
25		4, 9, 25, 49 They are all the square of a prime number.	A1 C1 2	2	A1 cao C1 for clear explanation	M

26		<p>True when: 4 is a factor of each of the numbers or 4 is a factor of just two of the numbers. False when: either only one or three of the numbers has a factor of 4</p>	<p>C1 C1 <b>2</b></p>	2	<p>C1 for clear explanation C1 for clear explanation</p>	M
27 a i  ii  iii  b  c	<p>629 = <math>x \times 17</math> Using inverse operations and rearranging: <math>629 \div 17 = 37</math></p>	<p>e.g. 101, 103, 107, 109  <math>10^3 = 1000</math> So <math>9^3 = 729</math>  <math>89 + 11</math>  2484: even so 2 is a factor 17625: ends in 5 so 5 is a factor 3426: even so 2 is a factor  37</p>	<p>B1 P1 B1  B1  C1 C1  P1  B1 <b>8</b></p>	2	<p>B1 for any prime number greater than 100 with justification P1 for process of looking for <math>9^3</math> B1 cao  B1 for correct pair  C1 for explanation about both even numbers C1 for explanation about multiple of 5  P1 for process of using inverse operation  B1 cao</p>	M
28	<p>Try first as 2 Second is 6 Third is 11 Sum is 19, out of range  Try first as 3 Second is 9 Third is 14 Sum is 26, possible  Try first as 5 Second is 15 Third is 20 Sum is 40 out of range</p>	<p>There is only one possible first number and that is 3.</p>	<p>P1  C1  P1  C1  P1  C1 C1 <b>7</b></p>	3	<p>P1 for starting with smallest prime of 2  C1 for clearly stating out of range  P1 for trying next prime of 3  C1 for clearly stating it's a possible one.  P1 for continuing with the next prime 5  C1 for clearly stating out of range C1 for final solution of only one possible answer</p>	M

29	a	Sometimes True when the cube of a number is greater than 1. Not true for numbers 1 or less.	B1 C1	2	B1 for sometimes C1 for clear explanation	M
	b	Always The square of a positive number is positive. The square of a negative number is positive.	B1 C1			
			<b>4</b>			
30	b	$2^6$ or $4^3$	B1		B1 for either	M
	c	$3^3$	B1			
	d	$6^2$	B1			
			<b>3</b>			
31	a	$10 \times 2$ or $2 \times 10$	B1	2 3	B1 for 10 and 2 either way round	M
	b	$20 \times 10 \times 2$ $= 2 \times 10 \times 10 \times 2$ $= 2 \times 2 \times 5 \times 2 \times 5 \times 2$ $= 2 \times 2 \times 2 \times 2 \times 5 \times 5$ $= 2^4 \times 5^2$ as required.	P1			
	c	He has treated $2^N$ and $N \times 2$ as the same calculation.	C1			
			<b>3</b>			
32	a	1	B1	2	B1 cao	M
	b	$6^2 \div 6^2 = 6^{2-2}$  $6^0$	M1 A1			
	c	$6^0 = 1$ When you divide a number by the same number you always get 1.	B1 C1			
	d	Any combination of $a$ and $b$ such that the sum is equal to 9 E.g. $a = 8, b = 1$	B1			
			<b>6</b>			

33	a	i	Sometimes True when the digits are to the left of the decimal point.	B1 C1	2	B1 for sometimes C1 for clear explanation	M	
		ii	Sometimes True when both are positive, false when one is negative.	B1 C1				
		iii	Sometimes true for positive numbers, false for negative numbers	B1 C1				
		b	e.g. $-\frac{1}{2} \times -\frac{1}{3} = \frac{1}{6}$	B1				
		c	This works because multiplying two negative numbers gives a positive one. Positive numbers are always larger than negative numbers.	C1				
		d	False because 0.1 is smaller than 0.9	C1				
				<b>9</b>				
34	a		42 – 15	27 °C	M1 A1	2 3	M1 for subtracting A1 cao	M
		b		Easy, e.g. 1 – 8 Harder, e.g. –3 + –4	B1 B1			
				<b>4</b>				
35				Larger Dividing a positive number by a positive number less than 1 will always result in a larger number than you started with	B1 C1	2	B1 for larger C1 for clear explanation	M
				<b>2</b>				
36				I left home at 10 past 2 and walked for 50 minutes. The temperature was 13 °C. I could see an aeroplane overhead at 3000 feet. Altogether I had walked 3 miles.	C2	2	C1 for rounding the times and temperature sensibly. C1 for rounding distances sensibly	M
				Own question similar to the one in part a together with an answer and mark scheme.	C2			
				<b>4</b>				

37	$1 \text{ mile} = \frac{8}{5} \text{ km}$ $5.5 \text{ miles} = \frac{8}{5} \times 5.5 \text{ km}$ $= 8.8 \text{ km}$	Her usual supermarket is closer.	B1 M1 A1 C1 <b>4</b>	3	B1 for conversion stated  M1 for multiplying distance by conversion factor A1 for a correct answer C1 for clearly stating correct solution.	M
38	$79\,298 - 78\,987 = 311 \text{ kWh used.}$ $80 \text{ kWh @ } \pounds 20.95 = 1676\text{p}$ $= \pounds 16.76$  $311 - 80 = 231$ $231 \text{ kWh @ } \pounds 10.80 = 2494.80$ $= \pounds 24.948$ $\text{Total bill} = \pounds 16.76 + \pounds 24.948 = \pounds 41.708$  Assumptions that if you average consumption over the year April will be representative.	$\pounds 41.71$ Yes	M1 B1 B1 B1 A1 C1  <b>6</b>	2	M1 for subtracting the given readings to find the amount of electricity used. B1 multiplying 80 by 20.95 or for writing down $\pounds 16.76$ .  B1 for subtracting 80 from 311 and then finding the cost of the remainder used by multiplying by 10.80 or for writing down $\pounds 24.948$ B1 for adding the two amounts found together or writing down $\pounds 41.708$ A1 for conversion to pounds correctly C1 for assumption made such as that given or showing that the standing order is higher than the cost of electricity used in April. oe assumptions stated	M

39	<p>Assuming inclusive and not a leap year  27 August to 30 December  = 4 + 30 + 31 + 30 + 30 = 125 days  31 December to 9 April  = 1 + 31 + 28 + 31 + 9  = 100  Total number of days = 225 days  Total amount of electricity used  = 55916 – 53480 = 2436 kWh</p> <p><b>Current supplier</b>  225 × 13.99 = 3147.75  = £31.4775  15.09 × 2436 = 36759.24  =£367.5924  Total = £399.07</p> <p><b>New supplier</b>  225 × 23.818 = 5359.05  = £53.5905  14.37 × 2436 = 35005.38  = 350.0538  Total = £403.64</p>	<p>He should stay with his current supplier assuming that electricity use continues at the same level. The summary does not include the summer months when use is likely to be less. The difference is likely to be greater for the summer months.</p>	M1	2	<p>M1 for showing how many days from each month are used and added together.  C1 For stating the assumptions about inclusive days, that this is not a leap year and for calculating number of days correctly.</p> <p>M1 for showing how to find the difference of the readings  B2 for showing how to calculate each part of the total cost. B1 if the conversion to pounds and correct rounding has not been done.</p> <p>M1 for showing how the cost is derived for the new supplier with same data as before.  B2 for the finding the total cost and correctly rounding into money units. B1 if the correct amount has been calculated but not rounded or changed to correct monetary units.  A1 for correctly stating he should stay with current supplier.  C2 for clarity of answer, including any assumptions given.</p>	M
			C1			
			M1			
			B2			
			M1			
			B2			
			A1			
C2						
			11			

40	a i	$175 \div 8 = 21.875$ Round up to the nearest integer, 22, as tables are needed for everybody and you can't have part of a table.	M1 A1 C1	2 3	M1 for dividing guests by number at a table. A1 for the rounded, correct integer. C1 for explaining the need to round up to the nearest integer.	M
	ii	$175 \div 8 = \pounds 21.875$ If all the guests pay the same amount of $\pounds 21.88$ or more there is enough to cover the bill.	B1 A1 C1			
	iii	$175 \div 8 = 21.875$ Cannot have a fraction of a box, so only 21 boxes can be filled. $21 \times 8 = 168$ rolls hence 7 rolls left over	B1 P1 A1 P1 A1			
	iv	Average speed = distance $\div$ time $165 \div 8 = 21.875$ km/h You do not need to round this figure off as the speed can be given with this accuracy.	M1 A1 C1			
	b		C2			
			<b>16</b>			
41	a	$24 \times 72 = 1728$ $1728 \div 100 = 17.28$	B2 B2	3	B1 for each correct statement B1 for each correct explanation of the relationships between the calculations.	M
	b	Suitable question using concepts introduced in part <b>a</b>	B2 B2			

42	$4.75 \leq \text{space} < 4.85$ $4.25 \leq \text{car} < 4.75$	<p>A: Yes, the car is always smaller than the smallest possible space</p> <p>B: No, the smallest space is the same size as the largest car length.</p> <p>C: No, because the car is always smaller than the minimum size of the space you can always say it will fit.</p>	B1 B1  C1  C1  C1  <b>5</b>	3	B1 for stating upper and lower bounds of space. B1 for stating upper and lower bounds of car  C1 for correct explanation of why this is definitely true oe C1 for correct explanation of why this is definitely not true oe C1 for correct explanation of why this is definitely not true oe	M
43	$14.5 \text{ cm} \leq \text{brick} < 15.5 \text{ cm}$	So maximum length for 20 identical bricks is: $20 \times 15.5 = 310 \text{ cm}$	M1  A1 <b>2</b>	3	M1 for identifying the upper bound of the length of one brick and multiplying this by 20 A1 cao	M
44	<p><b>a</b></p> <p><b>b</b></p> <p><b>c</b></p>	<p>How long will it take Barry to recover the money it cost him to convert the car?</p> <p>Cost of 1 litre of LPG (<math>l</math>)</p> <p>Cost of 1 litre petrol (<math>p</math>)</p> <p>The distance he can travel per litre of each fuel (<math>d_l</math> and <math>d_p</math>)</p> <p>How far does he travel in one month (<math>d</math>)</p> <p>Cost of using LPG per month (<math>c_l</math>) is:  <math>c_l = l \times (d \div d_l)</math></p> <p>Cost of using Petrol per month (<math>c_p</math>) is:  <math>c_p = p \times (d \div d_p)</math></p> <p>The saving is <math>c_p - c_l</math></p>	C1  C4  P1 B1 P1 B1 B1 C2 <b>13</b>	3	C1 for suitable question oe  C1 for each piece of information oe  P1 for trying to find first cost B1 for correct method of finding this cost P1 for trying to find second cost B1 for correct method of finding this cost B1 for finding this difference correctly C2 for clarity of explanation throughout part <b>c</b>	H



45	<p>Assume the dolphin starts from the bottom. A complete cycle from top to bottom, back to top, takes 7 minutes. Therefore in 90 mins completed the following cycles:  <math>90 \div 7 = 12.857\ 142\ 8</math> cycles.  It has therefore completed 12 cycles but is NOT back at the back at the bottom. To work out which of the other options is correct calculate:  <math>0.857\ 142\ 8 \times 7 = 6</math> minutes  Therefore if we assume that the time started by observing the dolphin at the surface, the 6 minutes of the cycle will be towards the end of the cycle, it is on its way up.</p>	On its way up.	M2	2 3	M1 for adding the times to create a 7 minute cycle M1 for dividing 90 by the time of one cycle	H																											
			C1				C1 for stating that the dolphin has completed 12 cycles																										
46	26 letters $\times$ 25 numbers So $26 \times 25 = 650$	650	M1	2 3	B1 for knowing to use 26 and 25 M1 for $26 \times 25$ A1 cao	H																											
			A1				A1 cao																										
47 a	<table border="1"> <thead> <tr> <th>Planet</th> <th>Distance from the sun (million km)</th> <th>Diameter (km)</th> </tr> </thead> <tbody> <tr> <td>Mercury</td> <td><math>5.8 \times 10^1</math></td> <td><math>4.878 \times 10^3</math></td> </tr> <tr> <td>Venus</td> <td><math>1.08 \times 10^2</math></td> <td><math>1.2104 \times 10^4</math></td> </tr> <tr> <td>Earth</td> <td><math>1.5 \times 10^2</math></td> <td><math>1.2756 \times 10^4</math></td> </tr> <tr> <td>Mars</td> <td><math>2.28 \times 10^2</math></td> <td><math>6.787 \times 10^3</math></td> </tr> <tr> <td>Jupiter</td> <td><math>7.78 \times 10^2</math></td> <td><math>1.42796 \times 10^5</math></td> </tr> <tr> <td>Saturn</td> <td><math>1.427 \times 10^3</math></td> <td><math>1.20660 \times 10^5</math></td> </tr> <tr> <td>Uranus</td> <td><math>2.871 \times 10^3</math></td> <td><math>5.1118 \times 10^4</math></td> </tr> <tr> <td>Neptune</td> <td><math>4.497 \times 10^3</math></td> <td><math>4.8600 \times 10^4</math></td> </tr> </tbody> </table>		Planet	Distance from the sun (million km)	Diameter (km)	Mercury	$5.8 \times 10^1$	$4.878 \times 10^3$	Venus	$1.08 \times 10^2$	$1.2104 \times 10^4$	Earth	$1.5 \times 10^2$	$1.2756 \times 10^4$	Mars	$2.28 \times 10^2$	$6.787 \times 10^3$	Jupiter	$7.78 \times 10^2$	$1.42796 \times 10^5$	Saturn	$1.427 \times 10^3$	$1.20660 \times 10^5$	Uranus	$2.871 \times 10^3$	$5.1118 \times 10^4$	Neptune	$4.497 \times 10^3$	$4.8600 \times 10^4$	B2	2	B1 for correct distance column B1 for correct diameter column	H
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b	<p>i Jupiter  ii Mercury  iii Mercury  iv Jupiter  v Uranus  vi Earth and Venus</p>	B6	B1 cao B1 cao B1 cao B1 cao B1 cao B1 cao																														
		8																															

48	a	False You can't find the square root of a negative number that is a real number.	B1 B1	2	B1 for false B1 for correct explanation	H	
	b	Always true The cube root of a positive number is positive and the cube root of a negative number is negative.	B1 B1				
			<b>8</b>				
49	a i	$5^6 \div 5^{-3} = 5^{(6 - -3)} = 5^9$ OR $\frac{5 \times 5 \times 5 \times 5 \times 5 \times 5}{\frac{1}{5 \times 5 \times 5}} = \frac{5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5 \times 5}{1} = 5^9$	M2	2	M1 for showing subtraction of indices M1 for recognising $6 - -3 = 6 + 3$ Or M1 for showing each number as a product of factors M1 for combining them to give all the 5s as numerators.	H	
	ii	$5^6 \times 5^{-3} = 5^{(6 + -3)} = 5^3$ OR $\frac{5 \times 5 \times 5 \times 5 \times 5 \times 5}{5 \times 5 \times 5} = 5 \times 5 \times 5 = 5^3$	M2				
	b	$\frac{1}{2}$ as a power represents the reciprocal of square so the square root.	C2				
			<b>6</b>				
50	a	$8.848 \times 10^3 \div 8.298 \times 10^2 = 10.66$	10.66	M1 A1	2	M1 for dividing mountain by skyscraper A1 accept 10.66... or 10.7	H
	b	$8.298 \times 10^2 \div 10^3 = 0.8298 \text{ km}$	0.8298 km	M1 A1			
	c	$20 \div 1\,000\,000\,000 = 2 \times 10^{-8}$	$2 \times 10^{-8}$	M1 A1			
			<b>6</b>				
51	Fractions unshaded are $\frac{1}{9}$ and $\frac{2}{7}$ $\frac{1}{9} + \frac{2}{7} = \frac{7}{63} + \frac{18}{63} = \frac{25}{63}$ $1 - \frac{25}{63} = \frac{38}{63}$		$\frac{38}{63}$	M1 B1 A1	2	M1 for adding given fractions B1 for use of common denominator 63 A1 cao  M1 for subtracting fraction sum from 1 A1 ft from their $\frac{25}{63}$	H
				M1 A1			
			<b>5</b>				

52	<p>So <math>\frac{3}{8}</math> of the residential land is used for services.</p> $\frac{3}{8} \times 5\frac{1}{2} = \frac{33}{16} \text{ m}^2$ $\left(\frac{33}{16} \div 15\right) \times 100$ $= 13.75\%$	<p>13.75% of the total area is used for services.</p>	<p>C1 M1 A1 M1 A1 <b>5</b></p>	<p>3</p>	<p>C1 for recognising and stating <math>\frac{3}{8}</math> of residential development is used for the services M1 for multiplying <math>\frac{3}{8}</math> by <math>5\frac{1}{2}</math> A1 oe M1 for finding above fraction of 15 and multiplying by 100 A1 accept 14 or 13.8</p>	H
53		<p>The volume of the 2 cm dice is <math>2 \times 2 \times 2 = 8 \text{ cm}^3</math>. The volume of the 4 cm dice is <math>4 \times 4 \times 4 = 64 \text{ cm}^3</math> This is 8 times as much plastic as the 2 cm cube.</p> <p>The 4 cm cube will use <math>64 - 8 = 56 \text{ cm}^3</math> more plastic Or could say 8 times as much</p>	<p>E2  B1 <b>3</b></p>	<p>3</p>	<p>E1 for clear explanation showing how to find volumes of each cube. E1 for clear indication that the volume of the 4 cm dice is not twice as much as the 2 cm Or E2 for stating twice as large in dimensions will be <math>2^3</math> as large in volume. B1 For correctly stating <math>56 \text{ cm}^3</math> more plastic Or for stating 8 times as much</p>	H
54	<p><b>a</b></p> <p><b>b</b></p>	<p><math>75 \times 20 = 1500</math> oe The approximation will be smaller because each term has been rounded down</p> <p><math>\frac{25}{5} = 5</math> oe The approximation will be smaller because the numerator has been rounded up and the denominator rounded down. Dividing a smaller number by a larger number will result in a smaller answer.</p>	<p>M1 A1 B1  M1 A1 B1  <b>6</b></p>	<p>3</p>	<p>M1 for a suitable rounding of each number A1 for correctly multiplying the rounded numbers. B1 for a correct justification</p> <p>M1 for a suitable rounding of each number A1 for correctly dividing the rounded numbers. B1 for a correct justification In each case answer marks only if the estimation is one that could be done in your head. Explanation marks only for a valid explanation but allow ft for a given approximation</p>	H
55		<p>Three calculations that approximate to 75 e.g. <math>1.1 \times 75.1</math> based on <math>1 \times 75</math> <math>24.7 \times 3.2</math> based on <math>25 \times 3</math> <math>147 \div 1.9</math> based on <math>150 \div 2</math></p>	<p>B3 B2  B2 <b>7</b></p>	<p>2 3</p>	<p>B1 for each example that approximates to 75 B1 for use of multiplication and division. B1 for evidence of progression of complexity B2 for use of mathematical language and possibly connectives in answer</p>	H

56	<p>The minimum area is:  <math>14.5 \times 18.5 = 268.25</math>  The maximum area is less than:  <math>15.5 \times 19.5 = 302.25</math></p> <p>Given lengths are 2 sf, so it would be sensible to give area to 2 sf as well.  Where area = <math>15 \times 19 = 285</math>  The sensible answer for the area is <math>290 \text{ m}^2</math></p>	<p>268.25</p> <p>302.25  <math>268.25 \leq \text{floor area} &lt; 302.25</math></p> <p>290 m<sup>2</sup></p>	<p>M1  A1  M1  A1  A1  B1</p> <p>B1</p> <p><b>7</b></p>	<p>2</p>	<p>M1 for multiplying the lower bounds  A1 cao  M1 for multiplying the upper bounds  A1 cao  A1 cao  B1 for explanation of why 2 sf should be used</p> <p>B1 cao</p>	H
57	<p>Assume pallets are at maximum of 525 kg.  A 6-axle lorry can carry up to  <math>44 \div 0.525 = 83.8</math>  So a maximum of 83 pallets per trip.  A 5-axle lorry can carry up to  <math>40 \div 0.525 = 76.2</math>  So a maximum of 76 pallets per trip.</p> <p><b>a</b></p> <p><b>b</b></p> <p><b>c</b></p>	<p>6 axle max of 83 pallets</p> <p>5 axle max of 76 pallets</p> <p>80 is less than 83 but more than 76, so choose the 6-axle lorry, as this can do it in one trip.</p> <p>150 pallets can be split into two loads of 75, this is less than 76, so choose 5-axle lorry to make two trips, as this works out cheaper per trip.</p> <p>159 can be split into two loads, 76 + 83. So choose the 5-axle lorry to make one trip, as this is cheaper per trip, and 6-axle lorry to make one trip as this avoids the need for a third trip.</p>	<p>B1  P1</p> <p>A1</p> <p>A1</p> <p>C2</p> <p>C2</p> <p>C2</p> <p><b>10</b></p>	<p>2</p> <p>3</p>	<p>B1 for stating maximum possible mass of pallet  P1 for dividing both load limits by maximum pallet</p> <p>A1 cao</p> <p>A1 cao</p> <p>C2 for clear explanation of correct choice</p> <p>C2 for clear explanation of correct choice</p> <p>C2 for clear explanation of correct choice</p>	H

58	a	0.4 m is written to 1 dp and could have a value between 0.35 m and 0.449999 m 0.400 m is written to 3 dp and could have a value between 0.3995 m and 0.4004999 m	C2	2 3	C1 for clear explanation C1 for showing the range of possible values each could have	H	
		If the answer is required to 3 dp to provide all the information required you need to include 3 dp even if the digits are 0.	C1				
	b	$425 \text{ cm} \leq \text{length} < 435 \text{ cm}$	C1				C1 for communicating clearly this information
	c	$13.25 \leq \text{runner 1} < 13.35$ $13.295 \leq \text{runner 2} < 13.305$	C1				C1 for communicating clearly this information
	d	Therefore Runner 1 fastest time could be faster than Runner 2. But also true is that the slowest time for runner 1 is slower than the slowest of runner 2.	B1 B1 C2				B1 for runner 1 limits B1 for runner 2 limits C2 for clear explanation showing both possibilities
e	If each person is measured to the nearest kg, they could each for example have a mass 100.4 kg and $7 \times 100.4 > 700$ kg.	B1 C2	B1 for a given example C2 for clear and concise explanation				
			<b>12</b>				
59		Maximum number of people turning up will be 104 (as 105 will round to 110) Assume 5% of the 280 do not turn up. $0.05 \times 280 = 14$ Hence assume 266 seats already taken. $365 - 266 = 99$ free seats	B1	3	B1 for stating maximum number of people that could turn up. B1 for finding the assumed number not turning up B1 for finding assumed seats taken B1 for finding assumed number of free seats C2 for clear explanation using all the calculated data	H	
			B1				
			B1				
		If the estimate of how many will fail to turn up is correct, 266 seats will be taken with advance sales. This leaves 99 seats free. If up to 99 extra people turn up, they all get seats. If 100–104 turn up, some will not get a seat.	B1 C2				
							<b>6</b>

60	<p>12.25 seconds <math>\leq</math> time &lt; 12.35 seconds            99.995 m <math>\leq</math> distance &lt; 100.005 m            Speed = distance <math>\div</math> time            Fastest speed is longest distance divided by shortest time            = 100.005 <math>\div</math> 12.25 = 8.164 m/s</p>	8.164 m/s	B1 B1  M1 C1  M1  A1 <b>6</b>	2	B1 for time range B1 for distance range  M1 for correct formula used for speed C1 for explanation of longest distance used with shortest time M1 for division  A1 for suitably rounded speed (4 or 5 sf)	H
61	<p>124.5 <math>\leq</math> volume &lt; 125.5            Take cube root for lengths of sides giving            4.9933244 <math>\leq</math> length &lt; 5.0066578            Area of side will be square of lengths, giving            24.933289 <math>\leq</math> area &lt; 25.066622</p>	24.93 cm <sup>2</sup> $\leq$ area < 25.07cm <sup>2</sup>	B1 P1  A1  P1  A1 <b>5</b>	2	B1 for stating limits of accuracy for volume P1 for finding cube root to find length  A1 for unrounded limits to length  P1 for squaring unrounded length limits  A1 for rounded limits to 3 or 4 sf	H