Guidance on the use of codes for this mark scheme	
M	Method mark
A	Accuracy mark
B	Mark awarded independent of method
oe	Or equivalent
cao	Correct answer only
ft	Follow through

Question	Working	Answer	Mark	AO	Notes	Grade
1 a	1.75 × 3.50 = 6.125	£6.13 to nearest penny	M1 A1	3	M1 for correct method A1 cao	B
b	6.13 × 2 = 12.26	£12.26	M1 A1		M1 for correct method, accept 2 × 6.125 = £12.25 A1 for £12.26 or £12.25	
c	6.13 × 1.05 = 6.4365	£6.44 to nearest penny	M1 A1		M1 for correct method, accept 6.125 × 1.05 = 6.43125 A1 for £6.44 or £6.43	
			6			
2		995 ml	B1	3	B1 for 995	B
			1			
3	1 km = 1000 m = 1000 × 100 cm = 100 000 cm	1 km = 100 000 cm	B2	3	B1 for km to metres B1 for metres to centimetres	B
			2			
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
			2			
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.	No, Peter's dad is not correct as they will have been waiting for 40 min by the time he gets there.	M1 A1 B1 B1	2 3	M1 for calculating the time the boys will be leaving A1 cao B1 for dad's arrival time B1 for clear explanation of dad being late	B
			4			

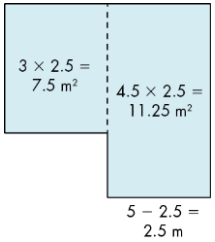
6		$\frac{1}{4}$ could be odd one out as it's the only terminating decimal equivalent/the only one with 1 as the denominator/unit fraction. $\frac{2}{6}$ could be odd one out as it's the only one which is not in its simplest form. $\frac{2}{3}$ could be odd one out as after simplifying $\frac{2}{6}$ it's the only one not having a numerator of 1/unit fraction.	B1 B1 B1 **3**	2	B1 for a valid reason for $\frac{1}{4}$ B1 for a valid reason for $\frac{2}{6}$ B1 for a valid reason for $\frac{2}{3}$	B
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.	B1	2	B1 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 B1 **3**		B1 for a decimal between 0 .23 and 0.27 (not 0.25) B1 for clear explanation	

8	**a**	500 – (85 × 5) = 500 = 75	75p	B1	2 3	B1 cao	B
	b		500 – (85 × 5)	B1		B1 cao	
	c		e.g. for 500 × (85 ×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?	B1		B1 for simple word problem that requires the calculation	
			e.g. for 500 + (85 × 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?	B1		B1 for simple word problem that requires the calculation	
			e.g. for 500 ÷ (85 × 5) Pip needs 500 nails. The nails come in packs of 5 in boxes containing 85 packs. How many boxes does he need?	B1 **4**		B1 for simple word problem that requires the calculation	
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 **3**		A1 cao	
10	**a**		× 100 Because multiplying by 100 will have the effect of moving 72 two places to the left.	B1 B1	2	B1 for a correct operation B1 for clear explanation	B
	b		e.g. 100 ÷ 4 5 × 5	B2		B1 for a suitable question where the answer is 25. B1 for another suitable question where the answer is 25.	
	c		25 × 10 E.g. I looked for a simple question with an answer of 10 × 25, then realised this is the answer.	B1 B1 **6**		B1 for a correct question with answer of 250 B1 for a clear explanation	
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.	B1 B1 **2**	2	B1 for clear explanation B1 for correct true statement	B

12	**a**		No, a prime number cannot be a multiple of 4 because a prime number has only two factors, one and itself.	B1 B1	2	B1 for No B1 for clear explanation	B
	b		e.g. 501 the sum of its digits is divisible by 3	B1 B1		B1 for a suitable number B1 for clear explanation	
	c		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)	B1		B1 for clear explanation	
	d		e.g. 105 It ends in 5 and the sum of its digits is divisible by 3	B1 B1		B1 for suitable number B1 for clear explanation	
	e		A number is divisible by 25 if it ends with 00, 25, 50, or 75.	B1 **8**		B1 for clear explanation	
13		$\sqrt{16}$ = 4	4 tiles	M1 A1 **2**	3	M1 for finding square root of 16 A1 cao	**B**
14			720 Use multiplication as the inverse of division. 7.2 × 10 × 10 = 7.2 × 100 = 720	B1 B1 **2**	2	B1 for 720 B1 for clear explanation.	B
15		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	M1 A1 **2**	3	M1 for the process of finding suitable coins A1 cao	B
16	**a**	1 cm = 10 mm So 300 cm = 300 × 10 = 3000 mm	So 30 000 mm is longer.	M1 B1	2	M1 for method of changing one unit to the other B1 for correct statement	B
	b		e.g. 500 cm, 5000 mm	B1 **3**		B1 for a correct example	

17	12 × 15 = 180 ice creams all together Cost of ice creams = 12 × £4.50 = £54 105 × 80p = 8400p = £84 180 – 105 = 75 75 × 50p = 3750p = £37.50 Total sales £84 + £37.50 = £121.50 Profit = £121.50 – £54 = £67.50	 £67.50	B1 B1 B1 B1 B1 M1 A1 **7**	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
18 a	540 – 300 = 240 240 × 5= 1200p = £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 × 0.25 = 60 So 180 calls @ 5p = 180 × 5p = 900p = £9 60 calls @ 3p = 60 × 3p = 180p = £1.80 Total = £9 + £1.80 = £10.80 Difference = £12 – £10.80 = £1.20	 £1.20	M1 B1 B1 M1 A1 **8**		M1 for method of finding 25% B1 for 9 B1 for 1.80 M1 for finding difference A1 cao	

19 a	Change both fractions to 12ths $\frac{1}{3} = \frac{4}{12}$ $\frac{1}{2} = \frac{6}{12}$		B1	2	B1 for suitable fraction alongside with explanation	M
	Between these two is $\frac{5}{12}$	$\frac{5}{12}$	B1		B1 for any fraction between $\frac{1}{3}$ and $\frac{1}{2}$	
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 $\frac{10}{31} \rightarrow \frac{1}{3.1}$ $\frac{20}{61} \rightarrow \frac{1}{305}$ $\frac{30}{91} \rightarrow \frac{1}{3.033}$	$\frac{50}{151}$	M1 B1 B1 **5**		M1 for a suitable process of comparing the fractions B1 for accuracy of results B1 cao	
20		Compare the denominator but not take into consideration the numerator.	B1 **1**	2	B1 for clear explanation	M

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

23	**a**		Story about the calculation	B2	2	B1 for a sensible story B1 for suitable involvement of figures	M
	b		Own calculation story with mark scheme	B2 **4**		B1 for story with calculation B1 for suitable mark scheme	
24	**a**		$8 \times 100 = 8 \times 10 \times 10 = 80 \times 10$ as required	B1	2	B1 for clear explanation	M
			$\frac{400}{100} = \frac{40 \times 10}{10 \times 10} = \frac{40}{10} \times 1$ as required	B1		B1 for clear explanation	
	b		$6 \div \frac{1}{3}$ is the same as asking how many times does $\frac{1}{3}$ go into 6 which is $6 \times 3 = 18$	B1		B1 for clear explanation	
			$6 \div \frac{2}{3}$ will be less than 18 as $\frac{2}{3}$ will go into 6 less times as it is bigger than $\frac{1}{3}$	B1		B1 for clear explanation	
	c		Use $3 \times 3 = 9$ and $3 \times 15 = 45$ to create, for example: $15 \times 3 = 45$ $45 \div 5 = 9$	B1 B1 B1		B1 for clear explanation B1 for first example B1 for second example	
	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.	B2 B1		B1 for first suitable question B1 for second suitable question B1 for creating and stating a link	
	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.	B2 B1 **13**		B1 for first suitable question B1 for second suitable question B1 for creating and stating a link	
25			4, 9, 25, 49 They are all the square of a prime number.	A1 B1 **2**	2	A1 cao B1 for clear explanation	M

26		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	 B1 B1 **2**	2	 B1 for clear explanation B1 for clear explanation	M
27 a i **ii** **iii** **b** **c**	 $629 = x \times 17$ Using inverse operations and rearranging: $629 \div 17 = 37$	e.g. 101, 103, 107, 109 $10^3 = 1000$ So $9^3 = 729$ 89 + 11 2484: even so 2 is a factor 17625: ends in 5 so 5 is a factor 3426: even so 2 is a factor 37	B1 M1 B1 B1 B1 B1 M1 B1 **8**	2	B1 for any prime number greater than 100 with justification M1 for process of looking for 9^3 B1 cao B1 for correct pair B1 for explanation about both even numbers B1 for explanation about multiple of 5 M1 for process of using inverse operation B1 cao	M
28	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	 There is only one possible first number and that is 3.	M1 B1 M1 B1 M1 B1 B1 **7**	3	M1 for starting with smallest prime of 2 B1 for clearly stating out of range M1 for trying next prime of 3 B1 for clearly stating it's a possible one. M1 for continuing with the next prime 5 B1 for clearly stating out of range B1 for final solution of only one possible answer	M

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

33	**a i**		Sometimes True when the digits are to the left of the decimal point.	B1 B1	2	B1 for sometimes B1 for clear explanation	M
	ii		Sometimes True when both are positive, false when one is negative.	B1 B1		B1 for sometimes B1 for clear explanation	
	iii		Sometimes true for positive numbers, false for negative numbers	B1 B1		B1 for sometimes B1 for clear explanation	
	b		e.g. $-\frac{1}{2} \times -\frac{1}{3} = \frac{1}{6}$	B1		B1 for a correct example	
	c		This works because multiplying two negative numbers gives a positive one. Positive numbers are always larger than negative numbers.	B1		B1 for clear explanation	
	d		False because 0.1 is smaller than 0.9	B1		B1 for false with a clear explanation	
				9			
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		B1 for a correct example B1 for a correct, harder example	
				4			
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 B1	2	B1 for larger B1 for clear explanation	M
				2			
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.	B2	2	B1 for rounding the times and temperature sensibly. B1 for rounding distances sensibly	M
			Own question similar to the one in part a together with an answer and mark scheme.	B2		B1 for suitable question B1 for the mark scheme	
				4			

37	1 mile = $\frac{8}{5}$ km 5.5 miles = $\frac{8}{5}$ × 5.5 km = 8.8 km	 Her usual supermarket is closer.	B1 M1 A1 B1 **4**	3	B1 for conversion stated M1 for multiplying distance by conversion factor A1 for a correct answer B1 for clearly stating correct solution.	M
38	79 298 – 78 987 = 311 kWh used. 80 kWh @ £20.95= 1676p = £16.76 311 – 80 = 231 231 kWh@ £10.80 = 2494.80 = £24.948 Total bill = £16.76 + £ 24.948 = £41. 708 Assumptions that if you average consumption over the year April will be representative.	 £41.71 Yes	M1 B1 B1 B1 A1 B1 **6**	2	M1 for subtracting the given readings to find the amount of electricity used. B1 multiplying 80 by 20.95 or for writing down £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 £24.948 B1 for adding the two amounts found together or writing down £41.708 A1 for conversion to pounds correctly B1 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	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 **Current supplier** 225 × 13.99 = 3147.75 = £31.4775 15.09 × 2436 = 36759.24 =£367.5924 Total = £399.07 **New supplier** 225 × 23.818 = 5359.05 = £53.5905 14.37 × 2436 = 35005.38 = 350.0538 Total = £403.64	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.	M1 A1 B1 B2 B1 B2 A1 B2 **11**	2	M1 for showing how many days from each month are used and added together. B1 For stating the assumptions about inclusive days, that this is not a leap year and for calculating number of days correctly. B1 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. B1 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. B2 for clarity of answer, including any assumptions given.	M

40	**a i**		175 ÷ 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 B1	2 3	M1 for dividing guests by number at a table. A1 for the rounded, correct integer. B1 for explaining the need to round up to the nearest integer.	M
	ii		175 ÷ 8 = £21.875 If all the guests pay the same amount of £21.88 or more there is enough to cover the bill.	M1 A1 B1		M1 for dividing bill by the number at the table. A1 for a correct monetary amount higher than 21.875 and **less** than 22 unless a tip is mentioned B1 for stating the need to round up in order to create a total higher than the bill if they all pay the same.	
	iii		175 ÷ 8 = 21.875 Cannot have a fraction of a box, so only 21 boxes can be filled. 21 × 8 = 168 rolls hence 7 rolls left over	M1 M1 A1 M1 A1		M1 for correctly dividing number of bread rolls by number in each box or the number 21.875 M1 for stating the need to truncated amount as you can't have a fraction of a box A1 for the correct truncation M1 for dividing number of boxes by 8 or the total 168 A1 for the answer of 7 rolls left over.	
	iv		Average speed = distance ÷ time 165 ÷ 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 B1		M1 for stating formula for calculating speed A1 for the correct answer with correct units. B1 for stating no need to round off answer	
	b			B2		In each case for part **b** 1 mark for answer and an extra mark for describing what is the same and different about each context. B2 Extra communication marks available for quality of questions and explanations in mark scheme	
				16			
41	**a**	24 × 72 = 1728 1728 ÷100 = 17.28	Dividing both by ten Correct calculation e.g. 2.4 × 7.2 = 17.28 Divide both by 10 24 × 0.72 = 17.28 Divide one of the numbers by 100	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 **a**	B2 B2		B1 for each set of questions, but the second must be harder than the first. B2 marks for correct explanation of the relationships between the calculations and identification of progression in difficulty.	
				8			

42	4.75 ≤ space < 4.85 4.25 ≤ car < 4.75	 A: Yes, the car is always smaller than the smallest possible space B: No, the smallest space is the same size as the largest car length. C: No, because the car is always smaller than the minimum size of the space you can always say it will fit.	B1 B1 B1 B1 B1 **5**	3	B1 for stating upper and lower bounds of space. B1 for stating upper and lower bounds of car B1 for correct explanation of why this is definitely true oe B1 for correct explanation of why this is definitely not true oe B1 for correct explanation of why this is definitely not true oe	M
43	14.5 cm ≤ brick < 15.5 cm	So maximum length for 20 identical bricks is: 20 × 15.5 = 310 cm	M1 A1 **2**	3	M1 for identifying the upper bound of the length of one brick and multiplying this by 20 A1 cao	M
44 **a**		How long will it take Barry to recover the money it cost him to convert the car?	B1	3	B1 for suitable question oe	H
b		Cost of 1 litre of LPG (l) Cost of 1 litre petrol (p) The distance he can travel per litre of each fuel (d_l and d_p) How far does he travel in one month (d)	B4		B1 for each piece of information oe	
c		Cost of using LPG per month (c_l) is: $c_l = l \times (d \div d_l)$ Cost of using Petrol per month (c_p) is: $c_p = p \times (d \div d_p)$ The saving is $c_p - c_l$	M1 B1 M1 B1 B1 B2 **13**		M1 for trying to find first cost B1 for correct method of finding this cost M1 for trying to find second cost B1 for correct method of finding this cost B1 for finding this difference correctly B2 for clarity of explanation throughout part **c**	

<table>
<tr><td>45</td><td>Assume the dolphin starts from the bottom.
A complete cycle from top to bottom, back to top, takes 7 minutes.
Therefore in 90 mins competed the following cycles:
$90 \div 7 = 12.857\ 142\ 8$ 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:
$0.857\ 142\ 8 \times 7 = 6$ 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.</td><td>On its way up.</td><td>M2
B1
M1
B1
A1
6</td><td>2
3</td><td>M1 for adding the times to create a 7 minute cycle
M1 for dividing 90 by the time of one cycle
B1 for stating that the dolphin has completed 12 cycles
M1 for multiplying the fraction part of 12.8… by 7
B1 for finding this time and relating it to a part of the cycle
A1 cao</td><td>H</td></tr>
<tr><td>46</td><td>26 letters × 25 numbers
So $26 \times 25 = 650$</td><td>650</td><td>B1
M1
A1
6</td><td>2
3</td><td>B1 for knowing to use 26 and 25
M1 for 26×25
A1 cao</td><td>H</td></tr>
<tr><td>47 a</td><td colspan="2"><table>
<tr><th>Planet</th><th>Distance from the sun (million km)</th><th>Diameter (km)</th></tr>
<tr><td>Mercury</td><td>5.8×10^1</td><td>4.878×10^3</td></tr>
<tr><td>Venus</td><td>1.08×10^2</td><td>1.2104×10^4</td></tr>
<tr><td>Earth</td><td>1.5×10^2</td><td>1.2756×10^4</td></tr>
<tr><td>Mars</td><td>2.28×10^2</td><td>6.787×10^3</td></tr>
<tr><td>Jupiter</td><td>7.78×10^2</td><td>1.42796×10^5</td></tr>
<tr><td>Saturn</td><td>1.427×10^3</td><td>1.20660×10^5</td></tr>
<tr><td>Uranus</td><td>2.871×10^3</td><td>5.1118×10^4</td></tr>
<tr><td>Neptune</td><td>4.497×10^3</td><td>4.8600×10^4</td></tr>
</table></td><td>B2</td><td>2</td><td>B1 for correct distance column
B1 for correct diameter column</td><td>H</td></tr>
<tr><td>b i
ii
iii
iv
v
vi</td><td colspan="2">Jupiter
Mercury
Mercury
Jupiter
Uranus
Earth and Venus</td><td>B6
8</td><td></td><td>B1 cao
B1 cao
B1 cao
B1 cao
B1 cao
B1 cao</td><td></td></tr>
</table>

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 **4**		B1 for always true B1 for correct explanation	
49	**a i**	$5^6 \div 5^{-3} = 5^{(6--3)} = 5^9$ OR $\frac{5\times5\times5\times5\times5\times5}{\frac{1}{5\times5\times5}}$ = $= \frac{5\times5\times5\times5\times5\times5\times5\times5\times5}{1} = 5^9$		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 $\frac{5\times5\times5\times5\times5\times5}{5\times5\times5} = 5\times5\times5 = 5^3$		M2		M1 for showing the indices are added 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 5's as numerators.	
	b		$\frac{1}{2}$ as a power represents the reciprocal of square so the square root.	B2 **6**		B1 for showing square root B1 for clear explanation.	
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	$8.298 \times 10^2 \div 10^3 = 0.8298$ km	0.8298 km	M1 A1		M1 for dividing skyscraper height by 100 A1 cao	
	c	$20 \div 1\,000\,000\,000 = 2 \times 10^{-8}$	2×10^{-8}	M1 A1 **6**		M1 for finding reciprocal of 1 000 000 000 A1 cao	
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 M1 A1 M1 A1 **5**	2	M1 for adding given fractions M1 for use of common denominator 63 A1 cao M1 for subtracting fraction sum from 1 A1 ft from their $\frac{25}{63}$	H

52	So $\frac{3}{8}$ of the residential land is used for services. $\frac{3}{8} \times 5\frac{1}{2} = \frac{33}{16}$ m^2 $(\frac{33}{16} \div 15) \times 100$ = 13.75% 13.75% of the total area is used for services.		B1 M1 A1 M1 A1 **5**	3	B1 for recognising and stating $\frac{3}{8}$ of residential development is used for the services M1 for multiplying $\frac{3}{8}$ by $5\frac{1}{2}$ A1 oe M1 for finding above fraction of 15 and multiplying by 100 A1 accept 14 or 13.8	H
53		The volume of the 2 cm dice is 2 × 2 × 2 = 8 cm^3. The volume of the 4 cm dice is 4 × 4 × 4 = 64 cm^3 This is 8 times as much plastic as the 2 cm cube. The 4 cm cube will use 64 – 8 = 56 cm^3 more plastic Or could say 8 times as much	B2 B1 **3**	3	B1 for clear explanation showing how to find volumes of each cube. B1 for clear indication that the volume of the 4 cm dice is not twice as much as the 2 cm Or B2 for stating twice as large in dimensions will be 2^3 as large in volume. B1 For correctly stating 56 cm^3 more plastic Or for stating 8 times as much	H
54 **a**		75 × 20 = 1500 oe The approximation will be smaller because each term has been rounded down	M1 A1 B1	3	M1 for a suitable rounding of each number A1 for correctly multiplying the rounded numbers. B1 for a correct justification	H
b		$\frac{25}{5}$ = 5 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.	M1 A1 B1 **6**		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	
55		Three calculations that approximate to 75 e.g. 1.1 × 75.1 based on 1 × 75 24.7 × 3.2 based on 25 × 3 147 ÷ 1.9 based on 150 ÷ 2	B3 B2 B2 **7**	2 3	B1 for each example that approximates to 75 B1 for use of multiplication and division. B1 for evidence of progression of complexity in the questions oe B2 for use of mathematical language and possibly connectives in answer	H

56	The minimum area is: 14.5 × 18.5 = 268.25 The maximum area is less than: 15.5 × 19.5 = 302.25 Given lengths are 2 sf, so it would be sensible to give area to 2 sf as well. Where area = 15 × 19 = 285 The sensible answer for the area is 290 m^2	 268.25 302.25 268.25 ≤ floor area < 302.25 290 m^2	M1 A1 M1 A1 A1 B1 B1 **7**	2	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 B1 cao	H
57	Assume pallets are at maximum of 525 kg. A 6-axle lorry can carry up to 44 ÷ 0.525 = 83.8 So a maximum of 83 pallets per trip. A 5-axle lorry can carry up to 40 ÷ 0.525 = 76.2 So a maximum of 76 pallets per trip.	 6 axle max of 83 pallets 5 axle max of 76 pallets	B1 M1 A1 A1	2 3	B1 for stating maximum possible mass of pallet M1 for dividing both load limits by maximum pallet A1 cao A1 cao	H
a		80 is less than 83 but more than 76, so choose the 6-axle lorry, as this can do it in one trip.	B2		B2 for clear explanation of correct choice	
b		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.	B2		B2 for clear explanation of correct choice	
c		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.	B2 **10**		B2 for clear explanation of correct choice	

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	B2	2 3	B1 for clear explanation B1 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.	B1		B1 for clear explanation	
	b		425 cm ≤ length < 435 cm	B1		B1 for communicating clearly this information	
	c	13.25 ≤ runner 1 < 13.35 13.295 ≤ runner 2 < 13.305	Tenth of a metre or 10 cm.	B1		B1 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 B2		B1 for runner 1 limits B1 for runner 2 limits B2 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 × 100.4 > 700 kg.	B1 B2		B1 for a given example B2 for clear and concise explanation	
				12			
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 × 280 = 14 Hence assume 266 seats already taken. 365 – 266 = 99 free seats		B1 B1 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	H
			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 B2		B1 for finding assumed number of free seats B2 for clear explanation using all the calculated data	
				6			

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