Mark scheme

Question			Answer/Indicative content	Marks	Guidance	
1			$\frac{1}{6}$ oe	4	B2 for $[-]\frac{14}{15}$ oe or M1 for $[-]\frac{2}{5}\times\frac{7}{3}$ oe or $[-]\frac{14}{35}\div\frac{15}{35}$ oe M1 for $\frac{33}{30}-\frac{28}{30}$ oe FT *their* $\frac{14}{15}$ or [1] $\frac{3}{30}-\frac{14}{15}$ oe FT *their* $\frac{14}{15}$ If **0** or **1** scored, award instead **SC2** for answer $\frac{49}{30}$ oe If **0** scored, **SC1** for $\frac{7}{10}$ **oe** in working	$\frac{5}{30}$ is awarded 4 marks Allow pairs of equivalent fractions for the product or division for **M1** Allow pairs of equivalent fractions both over a common denominator for **M1** From correct processing but wrong order
			Total	**4**		
2			$\sqrt{13}$ final answer	4	**B3** for answer 13 **nfww** OR **B1** for $\cos 30 = \frac{\sqrt{3}}{2}$ and	Do not accept work in decimals rounded to answers of $\sqrt{13}$ or 13 Award if seen as clear statement of fact or in use; once seen condone replacement by 0.866… or 0.87 in subsequent work

					M2 for $x^2 = (4\sqrt{3})^2 + 5^2 - 2 \times 4\sqrt{3} \times 5\cos 30$ or better or **M1** for other correct arrangements of cosine rule where x or x^2 are not the subject	Condone missing brackets Condone use of 6.92… or 6.9 and 0.866… or 0.87 in **M2** and **M1**
			Total	**4**		
3	a		28	2	**M1** for identification of 2 (or 2^2 or 4) and 7 as common factors, not spoilt	Venn diagram on its own scores **0** unless 2^2 and 7 selected
	b	i	They did not multiply by 5 **oe**	1		For additional information refer to '2024 November, J560/06, Alternative, Mark Scheme Appendix' within downloadable extra resource materials.
		ii	154028	2	**B1** for [LCM] 1540 **soi** by passcode or **M1** for $2^2 \times 5 \times 7 \times 11$ **oe**	**FT** *their* **(a)** e.g. **(a)** 46 **(b) 2** marks for 154028, 154026, 143026 or **B1** for **(a)** × 55
			Total	**5**		
4			$\sqrt{31}$final answer	4	**B3** for answer 31 nfww OR	Do not accept work in decimals rounded to answers of $\sqrt{31}$or 31

					B1 for cos30 = $\frac{\sqrt{3}}{2}$ and **M2** for x^2 = $(6\sqrt{3})^2 + 7^2 - 2 \times 6\sqrt{3} \times 7\cos 30$ or better or **M1** for other correct arrangements of cosine rule where x or x^2 are not the subject	Award if seen as clear statement of fact or in use; once seen condone replacement by 0.866... or 0.87 in subsequent work Condone missing brackets Condone use of 10.39... or 10.4 and 0.866... or 0.87 in **M2** and **M1**

Examiner's Comments

Many candidates used trigonometry or Pythagoras in a right-angled triangle, scoring zero or B1 if the exact form of cos 30 was seen. Correct substitution into the cosine rule, with x or x^2 as the subject, scored M2. Many of these cosine expressions were written accurately but not evaluated properly with answers to (($6\sqrt{3})^2 + 7^2 - 2 \times 6\sqrt{3} \times 7$) cos 30 or similar being very common. Other candidates used decimal approximations such as 0.866 for cos 30 and 10.39 for $6\sqrt{3}$when the question asks for the exact value.

Assessment for learning

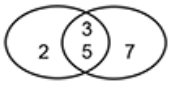
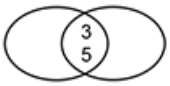
When presented with geometric diagrams, right angles will normally be indicated by notation and may also be referred to in the text, unless their identification is part of the assessment (e.g. angle in a semicircle).

Mistakes were made and marks lost by

					finding $b^2 + c^2 - 2bc$, an unnecessary and incorrect step in the evaluation. Instead, candidates should type the whole expression for a 2 into their calculator, write down that answer, and then show the square root step.
			Total	**4**	
5	a		99	1	**M1** for identification of 3 (or 3^2 or 9) and 11 as common factors, not spoilt Venn diagram on its own scores **0** unless 3^2 and 11 selected **Examiner's Comments** Candidates often put the prime factors onto a Venn diagram. Most were then successful in finding the HCF. A few candidates gave answers of 990 (the LCM) or 10 (the product of the prime factors not in the overlap region of the Venn diagram).
	b	i	They did not multiply by 2 oe	1	For additional information refer to '2024 November, J560/05, Mark Scheme Appendix: item 2' within downloadable extra resource materials. **Examiner's Comments** Very few candidates answered the question asked, which was to 'write down the omission'. Having multiplied 3^2 and 11 to obtain the HCF, the hacker then multiplies only by 5. The omission in the method is that the hacker still needs to multiply by 2 to find the LCM.
		ii	99099	2	

					B1 for [LCM] 990 soi by passcode or **M1** for $2 \times 3^2 \times 5 \times 11$ oe	**FT** *their* **(a)** eg (**a**) 46 **(b) 2** marks for 99099, 99046, 46046 or **B1** for **(a)** × 10
					Examiner's Comments About a quarter of candidates scored full marks and another quarter scored 1 mark, usually for finding the LCM. The correct answer was 99099 but follow through of the HCF from part (a) was also allowed. However, many of the wrong answers seemed to be chosen randomly and made no use of part (a).	
			Total	**5**		
6			$\frac{17}{18}$ oe	4	**B2** for $[-]\frac{8}{9}$ oe or **M1** for $[-]\ \frac{2}{3}\times\frac{4}{3}$ oe or $[-]\frac{8}{12}\div\frac{9}{12}$ oe **M1** for $\frac{33}{18}-\frac{16}{18}$ oe FT *their* $\frac{8}{9}$ or $[1]\frac{15}{18}-\frac{16}{18}$ oe FT *their* $\frac{8}{9}$ If 0 or 1 scored, award instead **SC2** for answer $\frac{14}{9}$ oe If 0 scored, **SC1** for $\frac{7}{6}$ oe in working	Allow pairs of equivalent fractions for the product or division for M1 Allow pairs of equivalent fractions both over a common denominator for M1 From correct processing but wrong order
					Examiner's Comments A number of candidates answered this well. The most common error was to carry out the calculation in the wrong order, subtracting $\frac{2}{3}$ from $1\frac{5}{6}$ first before dividing by	

					$\frac{3}{4}$. A few candidates approached the problem in the correct order but made arithmetic mistakes when dividing by $\frac{3}{4}$ and when subtracting the answer from $1\frac{5}{6}$. A few candidates attempted to convert fractions into decimals. **Assessment for learning** When working with calculations involving fractions, candidates should not write a fraction with a decimal in the numerator or denominator.
			Total	**4**	
7			$2 \times 3^2 \times 5$ or $2 \times 3 \times 3 \times 5$	2	**B1** for only 2, 3 and 5 or **M1** for any correct factor pair of 90 Condone inclusion of 1 for **B1** Not 1 and 90
			Total	**2**	
8			$(9 + 10 + 11 + 12) - (5 + 6 + 7 + 8) = 16$	1	May be shown in stages Accept $42 - 26 = 16$ May be explained via sum of differences of paired cells eg 4×4 from $(9 - 5)$, $(10 - 6)$ etc **Examiner's Comments** The vast majority of candidates scored the mark here, but a few did not write the subtraction that was required for this 'Show that….' mark.
			Total	**1**	
9			30 and 105	3	

					M2 for  or **M1** for  or for 3 with 5 and 3 with 2, 5, 7 <u>Alternative method:</u> **M1** for at least four correct multiples of 15 apart from 15 **M1** for at least four correct factor pairs of 210 apart from 1 & 210	For **M2** or **M1** allow 15 for 3 and 5 in the overlap As lists, products or factor trees etc Ignore errors when counting four correct <u>30</u>, 45, 60, 75, 90. <u>105</u>, … 2 & <u>105</u>, 3 & 70, 4 & 55, 5 & 42, 6 & 35, 7 & <u>30</u>, 10 & 21, 14 & 15
			Total	**3**		
10	a		Divisible by 5 or divisible by 17 or 85 ÷ 5 = 17 or 85 ÷ 17 = 5 or 5 × 17	1		Accept factor tree showing 85, 5 and 17 Accept 5 and 17 are factors of 85 Do not accept 5 and 17 are multiples of 85
	b	i	250	2	**B1** for 2 [×] 5^3	Venn diagram on its own scores 0 unless 2 and 5^3 selected
		ii	$2^{10} \times 5^9$	2	**M1** for $10^k = 2^k \times 5^k$ where k is a positive integer implied by final answer of the	e.g. 10 = 2 × 5

					form $2^{k+1} \times 5^k$ or **SC1** for $2^9 \times 5^9$	
			Total	**5**		
11	a		10 is not a prime number oe	1	**Reason Judgement Mark** 10 is not a prime number **1** 10 is not a prime factor **1** 10 can be written as 2 × 5 **1** 10 is not allowed **0**	
	b		$2^{11} \times 3^4 \times 5^5$	2	**M1** for [10^5 =] $2^5 \times 5^5$ seen, expanded or used or for answer including 2^{11}	Correct answer in expanded form implies $2^5 \times 5^5$ used for **M1**
	c		16000	2	**B1** for $2^7 \times 5^3$	
			Total	**5**		
12			20.375	2	**M1** for 32 or 11.625 or $\frac{93}{8}$ oe	Condone for **2** marks $\frac{163}{8}$ or $20\frac{3}{8}$
			Total	**2**		
13			No **oe** and 1 is not a prime [factor] **oe**	1		e.g. it should be $2^2 \times 3 \times 5$
			Total	**1**		
14	a		17 161	1		
	b		5.82	3	**B2** for 5.81[5…] OR **B1** for 81.17 or 9.0 or 9.00[9…] **B1** for *their* answer written to more than 3	

					figures correctly rounded to 3 sf	
			Total	**4**		
15			$2^2 \times 3 \times 5$ or $2 \times 2 \times 3 \times 5$	2	**B1** for only 2, 3 and 5 or **M1** for any correct factor pair of 60	Condone inclusion of 1 for **B1** Not 1 and 60
			Total	**2**		
16	a		Divisible by 5 or divisible by 19 or $95 \div 5 = 19$ or $95 \div 19 = 5$ or 5×19	1		Accept factor tree showing 95, 5 and 19 Accept 5 and 19 are factors of 95 Do not accept 5 and 19 are multiples of 95
	b	i	250	2	**B1** for 2 [×] 5^3	Venn diagram on its own scores 0

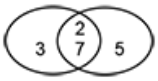
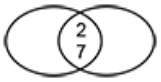
Examiner's Comments

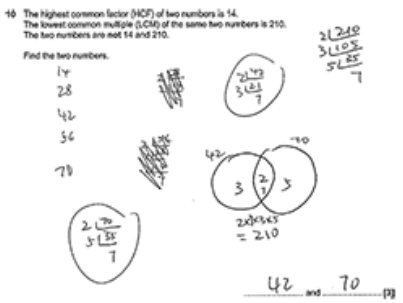
This was answered well by almost all candidates. Most used a factor tree to obtain the prime factors.
Few candidates did not give their responses as a product or made an error with one pair of factors.

Examiner's Comments

Almost all candidates answered this question successfully, either by showing a relevant calculation or factor tree, or by explaining that numbers that end in 5 are always divisible by 5.

					unless 2 and 5^3 selected **Examiner's Comments** Candidates often put the prime factors onto a Venn diagram. Most were then successful in finding the HCF. A few candidates gave answers of 70 000 (the LCM) or 280 (the product of the prime factors not in the overlap region of the Venn diagram).
		ii	$2^{13} \times 5^{12}$	2	**M1** for $10^k = 2^k \times 5^k$ where k is a positive integer implied by final answer of the form $2^{k+1} \times 5^k$ or **SC1** for $2^{12} \times 5^{12}$ e.g. $10 = 2 \times 5$ **Examiner's Comments** This type of question has appeared several times in the past and the limited working space is intentional. Candidates should also notice there were only 2 marks allocated. Still, there were many candidates who produced very large factor trees starting from 2×10^{12} written in ordinary form, almost always with errors. Instead, candidates should know that $10 = 2 \times 5$, so $10^{12} = 2^{12} \times 5^{12}$, from which the answer is just a short step away. **Assessment for learning** This is another example of where candidates should consider the number of marks and amount of answer space being

					allocated. This may help them identify more appropriate and efficient methods.
			Total	**5**	
17			42 and 70	3	**M2** for  or **M1** for  or for 2 with 7 and 2 with 3, 5, 7 Alternative method: **M1** for at least four correct multiples of 14 apart from 14 **M1** for at least four correct factor pairs of 210 apart from 1 & 210 **Examiner's Comments** Methods used were often difficult to follow, with a lot of processing and unstructured jottings. A good number of candidates did find the two correct numbers though. The clearest, and perhaps easiest, method was to find the prime factors of 14 and 210, scoring 1 mark, and then to use a Venn diagram. Exemplar 1
					For **M2** or **M1** allow 14 for 2 and 7 in the overlap As lists, products or factor trees etc Ignore errors when counting four correct 28, 42, 56, 70, 84, 98, … 2 & 105, 3 & 70, 4 & 55, 5 & 42, 6 & 35, 7 & 30, 10 & 21, 14 & 15

					 This was one of the clearer responses although it is not logically structured. In the top left of the script, the candidate has listed four correct multiples of 14 and so could score M1 by the mark scheme's alternative method if this has been used to reach their final answer. They have also found the prime factors of 210 in the top-right but, in the absence of the prime factors of 14 being explicitly shown, this would not have scored M1. It is difficult to know exactly how the candidate has reached 42 and 70 but there is no wrong working so full marks are given. They may have trialled 42 and 70 and the rest of the working is a check, or they may have found the prime factors of 14 but did not show them. The prime factors of 210 and 14 are then seen in a Venn diagram. Without the final answers, the Venn diagram on its own scored M2; a Venn diagram with just 2 and 7 correctly placed scored M1.
			Total	**3**	
18			29.575	2	**M1** for 43.2 or $\frac{216}{5}$ or 13. 625 or $\frac{109}{8}$ oe | Condone for **2** marks $\frac{1183}{40}$ or $29\frac{23}{40}$ **<u>Examiner's Comments</u>** A common response was $\frac{1183}{40}$, which is correct but an unusual form given that the question is framed in terms of decimals. The most consistently successful method was to calculate each fraction separately and then subtract the results. Early

					rounding or truncation did cause inaccurate responses. **Assessment for learning** Know how to use your calculator, and where to find the functions and inverse functions. Learn how to estimate the answer to check that you have not made an error. Know how to change the modes, for example so that you can get the answer as a fraction or as a decimal.
			Total	**2**	
19	a		6 is not a prime number oe	1	**Exemplar Responses** **Reason. Judgement. Mark** 6 is not a prime number. **1** **6 is not a prime factor. 1** **6 can be written as 2 × 3. 1** **6 is not allowed. 0** **Examiner's Comments** Although most realised that the mistake was that 6 was not a prime number, many other candidates thought that index form referred to using standard index form numbers. There were also often comments that the numbers were in an inappropriate order – and these were re-sorted to $6^5 \times 5^6 \times 2^7$ as the order of powers had been deemed essential. There were also a few candidates who decided that the correct form had actually been given and that there was no mistake.
	b		$2^{12} \times 3^5 \times 5^6$	2	**M1** for $[6^5 =] 2^5 \times 3^5$ seen, expanded or used or for answer including 2^{12} or 3^5 | Correct answer in expanded form implies $2^5 \times 3^5$ used for **M1** **Examiner's Comments** Some candidates efficiently changed 6^5 into $2^5 \times 3^5$, and were then usually

					successful in writing the correct final answer. Other candidates often adopted an inefficient approach by 're-starting' a full prime factor decomposition. This resulted in extensive working for the 2 marks available and a lack of space, which did not seem to be questioned. Some did reach 3^5 or 2^{12} in their final answer, either of which scored 1 mark. Those candidates that could not answer part (a) correctly would invariably not get very far in this part of the question. These candidates would attempt to make the correction that they had stated in part (a), e.g. trying to write an answer in standard index form or restating the given answer in a different order or different form such as 128 × 15625 × 7776.  In part (a), the candidate had correctly identified that 6 was not a prime number. They efficiently take the given $2^7 \times 5^6 \times 6^5$ and re-write 6^5 as $(2 \times 3)^5$ and then as $2^5 \times 3^5$. Finally, they simplify $2^7 \times 2^5$.
	c		20 000	2	**B1** for $2^5 \times 5^4$ **<u>Examiner's Comments</u>** Many candidates did not appear familiar with finding the HCF with numbers in index form. Attempts at finding the LCM or random selections of values chosen from the 2 sets of factors were often seen. A small number of candidates used a Venn diagram approach. More common was simply listing factors and identifying common terms. There were occasional inaccurate evaluations of identified HCFs and omission of zeros but it was rare to award the method mark in this part.

			Total	**5**		
20			No oe and he has not written the answer in index form **oe**	1		e.g. it should be $2^3 \times 5$
			Total	**1**		
21	a		18 07 [pm] or 6 07 pm	4	**B3** for 18 07 am or 6 07 [am] OR **B2** for listing the next three correct times of both fountains, i.e. 15 43, 16 07, 16 31 and 16 01, 16 43, 17 25 OR **B1** for listing the next three correct times of one fountain, i.e. 15 43, 16 07, 16 31 or 16 01, 16 43, 17 25. <u>Alternative method</u> **B3** for 2[h] 48[m] OR **B2** for [LCM=] 168 OR **B1** for listing the next three multiples of 24 and 42, i.e. 48, 72, 96 and 84, 126, 168 OR **M1** for [24 =] 2 × 2 × 2 × 3 or [42 =] 2 × 3 × 7 allow in a factor tree or table or [LCM=] 168k ($k \neq 1$) and **M1** for correctly converting *their* time(mins) to hours and mins	Condone use of 12 hour clock e.g. [0]3 43 and 3 43 am for **B1** and **B2** *their* time must be over 60
	b		[size] 15 [number] 11	4	**B3** for 15 and 11 OR	accept any correct method [60]

					B2 for [HCF or group size =] 15 or **M2** for [60] = 2× 2 × 3 × 5 and [105] = 3 × 5 × 7 or for listing complete factors of both numbers allow in a factor tree or table OR **M1** for one of 2 × 2 × 3 × 5 or 3 × 5 × 7 allow in a factor tree or table or for common factors 3 or 5 AND **B1** for [size] 3 [number] 55 or [size] 5 [number] 33	1,2,3,4,5,6,10,12,15,20,30,60 [105] 1,3,5,7,15,21,35,105
			Total	**8**		
22	a		68 921	1		
	b		2.86	3	**B2** for 2.85[7…] OR **B1** for 66.95 or 8.2 or 8.16[4…]	

					and **B1** for *their* answer written to more than 3 figures correctly rounded to 3 sf	
			Total	**4**		