

# TOPICAL PAST PAPER QUESTIONS WORKBOOK

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## Edexcel International GCSE Mathematics B (4MB1) Paper 1

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**Exam Series: Jan 2017 – Jan 2022**

**Format Type A:**

Answers to all questions are provided as an appendix



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# Introduction

Each Topical Past Paper Questions Workbook contains a comprehensive collection of hundreds of questions and corresponding answer schemes, presented in worksheet format. The questions are carefully arranged according to their respective chapters and topics, which align with the latest IGCSE or AS/A Level subject content. Here are the key features of these workbooks:

1. The workbook covers a wide range of topics, which are organized according to the latest syllabus content for Cambridge IGCSE or AS/A Level exams.
2. Each topic includes numerous questions, allowing students to practice and reinforce their understanding of key concepts and skills.
3. The questions are accompanied by detailed answer schemes, which provide clear explanations and guidance for students to improve their performance.
4. The workbook's format is user-friendly, with worksheets that are easy to read and navigate.
5. This workbook is an ideal resource for students who want to familiarize themselves with the types of questions that may appear in their exams and to develop their problem-solving and analytical skills.

Overall, Topical Past Paper Questions Workbooks are a valuable tool for students preparing for IGCSE or AS/A level exams, providing them with the opportunity to practice and refine their knowledge and skills in a structured and comprehensive manner. To provide a clearer description of this book's specifications, here are some key details:

- Title: Edexcel IGCSE Mathematics B (4MB1) Paper 1 Topical Past Paper Questions Workbook
- Subtitle: Exam Practice Worksheets With Answer Scheme
- Examination board: Pearson Edexcel
- Subject code: 4MB1
- Years covered: Jan 2017 – Jan 2022
- Paper: 1
- Number of pages: 660
- Number of questions: 557



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# Chapter 1

# Number

1. 4MB1\_01\_que\_20220111 Q: 24

The two digit number  $M$  has tens digit  $p$  and units digit  $q$

The two digit number  $N$  has tens digit  $q$  and units digit  $p$

Given that  $N - M = 9$  and that  $p + q = 13$

find the value of  $M$

Show clear algebraic working.

$M = \dots\dots\dots$

---

(Total for Question 24 is 5 marks)

---



2. 4MB1\_01\_que\_20220111 Q: 1

Find the Lowest Common Multiple (LCM) of 180 and 198  
Show your working clearly.

.....  
**(Total for Question 1 is 2 marks)**

---

3. 4MB1\_01R\_que\_20220111 Q: 7

$$A = 2^3 \times 3^2 \times 5^4$$

$$B = 2^2 \times 3^3 \times 5^n$$

Given that the Lowest Common Multiple (LCM) of  $A$  and  $B$  is 3 375 000

find the value of the integer  $n$ .

Show your working clearly.

$$n = \dots\dots\dots$$

---

**(Total for Question 7 is 2 marks)**

---

4. 4MB1\_01\_que\_20210421 Q: 10

The integer  $N$  is greater than 120

When  $N$  is divided by 28 the remainder is 3

When  $N$  is divided by 120 the remainder is 3

Find the least value of  $N$ .

You must show your working.

---

(Total for Question 10 is 3 marks)

---

5. 4MB1\_01R\_que\_20210304 Q: 2

Find the highest common factor (HCF) of 60, 126 and 648  
Show your working clearly.

.....  
**(Total for Question 2 is 2 marks)**

---

6. 4MB1\_01\_que\_20201104 Q: 4

$$A = 2^3 \times 3 \times 5^2$$

$$B = 2^2 \times 3^2 \times 5 \times 7$$

(i) Find the Lowest Common Multiple (LCM) of  $A$  and  $B$ .

.....  
(1)

(ii) Find the Highest Common Factor (HCF) of  $A$  and  $B$ .

.....  
(1)

.....  
**(Total for Question 4 is 2 marks)**

---

7. 4MB1\_01\_que\_20190522 Q: 2

Find the Lowest Common Multiple (LCM) of 18, 30 and 48  
Show your working clearly.

.....  
**(Total for Question 2 is 2 marks)**

---

8. 4MB1\_01R\_que\_20190522 Q: 1

Find the Lowest Common Multiple (LCM) of 60 and 135  
Show your working clearly.

---

.....

**(Total for Question 1 is 2 marks)**

---

9. 4MB0\_01\_que\_20180108 Q: 2

Find the Lowest Common Multiple (LCM) of 84 and 40  
Show your working clearly.

---

.....

**(Total for Question 2 is 2 marks)**

---

10. 4MB0\_01R\_que\_20180525 Q: 2

Find the Highest Common Factor (HCF) of 180 and 324

---

.....  
**(Total for Question 2 is 2 marks)**

---

11. 4MB0\_01\_que\_20170109 Q: 3

Find the Highest Common Factor (HCF) of 60, 84 and 120

---

.....  
**(Total for Question 3 is 2 marks)**

---



12. 4MB0\_01\_que\_20170525 Q: 17

(i) Find the Lowest Common Multiple (LCM) of 84, 126 and 294

LCM = .....

(ii) Find the Highest Common Factor (HCF) of 84, 126 and 294

HCF = .....

**(Total for Question 17 is 3 marks)**

---

13. 4MB0\_01R\_que\_20180525 Q: 10

Given that  $m$  and  $n$  are positive integers, and  $m$  is odd, express  $\frac{2^{20} + 2^{25}}{2^{-15}}$  in the form  $m \times 2^n$

Show your working clearly.

.....  
**(Total for Question 10 is 2 marks)**

---

14. 4MB0\_01\_que\_20170109 Q: 22

(a) Given that  $m$  is an integer, express  $2^{101} + 2^{103}$  in the form  $m \times 2^{100}$

.....  
(1)

(b) Without using a calculator, express  $2^{101} + 2^{103}$  in the form  $n \times 4^{48}$  where  $n$  is an integer.

Show all your working.

.....  
(4)

**(Total for Question 22 is 5 marks)**

15. 4MB0\_01R\_que\_20170109 Q: 9

Showing all your working, evaluate  $\frac{3^{-2} + 5^3}{3^{-2}}$

.....  
**(Total for Question 9 is 2 marks)**

16. 4MB1\_01\_que\_20220111 Q: 13

Without using a calculator and showing your working clearly, express

$$\sqrt{432} - \sqrt{147}$$

in the form  $\sqrt{n}$  where  $n$  is an integer.

.....  
**(Total for Question 13 is 3 marks)**

---

17. 4MB1\_01\_que\_20201104 Q: 10

Without using a calculator and showing your working clearly, find the value of the integer  $a$  so that

$$\sqrt{180} - \sqrt{27} - \sqrt{20} + \sqrt{147} = a(\sqrt{5} + \sqrt{3})$$

$a =$  .....

**(Total for Question 10 is 3 marks)**

---

18. 4MB1\_01R\_que\_20190110 Q: 13

Without using a calculator and showing all your working, express

$$\sqrt{605} - \sqrt{80}$$

in the form  $\sqrt{n}$  where  $n$  is an integer.

---

(Total for Question 13 is 3 marks)

---

19. 4MB1\_01\_que\_20180525 Q: 9

Showing all your working, express  $3\sqrt{180} - 2\sqrt{80}$  in the form  $a\sqrt{b}$  where  $a$  is an integer and  $b$  is a prime number.

.....  
**(Total for Question 9 is 3 marks)**

---

20. 4MB0\_01\_que\_20170109 Q: 12

Without using a calculator, evaluate  $\frac{\sqrt{72} + \sqrt{32}}{\sqrt{8}}$

Show all your working.

.....  
**(Total for Question 12 is 3 marks)**

---

21. 4MB0\_01\_que\_20170525 Q: 10

Without using a calculator, and showing all your working, express

$$\sqrt{432} - \sqrt{243}$$

in the form  $\sqrt{n}$ , where  $n$  is an integer.

.....  
**(Total for Question 10 is 3 marks)**

---

22. 4MB0\_01R\_que\_20170525 Q: 8

Show that  $(2 + \sqrt{6})(\sqrt{3} - \sqrt{2}) = \sqrt{2}$

You must show all your working.

---

(Total for Question 8 is 3 marks)

23. 4MB1\_01R\_que\_20220111 Q: 15

Given that  $m$  and  $n$  are integers, write  $\frac{4 + \sqrt{20}}{\sqrt{5} - 2}$  in the form  $m + n\sqrt{5}$

Show each stage of your working clearly.

.....  
**(Total for Question 15 is 3 marks)**

---



24. 4MB1\_01\_que\_20210304 Q: 13

Without using your calculator and showing all your working, express

$$\frac{\sqrt{13} + \sqrt{11}}{\sqrt{13} - \sqrt{11}}$$

in the form  $a + \sqrt{b}$  where  $a$  and  $b$  are integers.

.....  

---

**(Total for Question 13 is 3 marks)**

---

25. 4MB1\_01\_que\_20210421 Q: 15

Without using a calculator and showing all your working, express

$$\frac{4 - \sqrt{12}}{4 + \sqrt{12}}$$

in the form  $a - \sqrt{b}$  where  $a$  and  $b$  are integers.

.....  
**(Total for Question 15 is 3 marks)**

---

26. 4MB1\_01R\_que\_20210304 Q: 20

$\frac{2 - \sqrt{2}}{(1 + \sqrt{2})^2}$  can be written in the form  $a + b\sqrt{2}$  where  $a$  and  $b$  are integers.

Find the value of  $a$  and the value of  $b$ .  
Show your working clearly.

$a =$  .....

$b =$  .....

---

**(Total for Question 20 is 4 marks)**

27. 4MB1\_01R\_que\_20201104 Q: 10

Without using a calculator and showing all your working, express  $\frac{6 - \sqrt{8}}{2 + \sqrt{8}}$   
in the form  $a + \sqrt{b}$  where  $a$  and  $b$  are integers.

.....  

---

**(Total for Question 10 is 3 marks)**

---

28. 4MB1\_01R\_que\_20190522 Q: 20

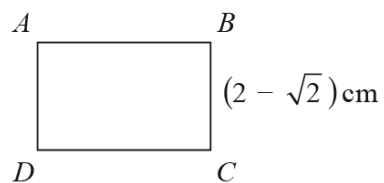


Diagram **NOT**  
accurately drawn

The diagram shows rectangle  $ABCD$ .

$$AD = BC = (2 - \sqrt{2}) \text{ cm}$$

$$\text{Area of } ABCD = 3(5\sqrt{2} - 2) \text{ cm}^2$$

Show that the length of  $AB$  can be written in the form  $(a + b\sqrt{2})$  cm  
where  $a$  and  $b$  are integers to be found.

Show your working clearly.

---

(Total for Question 20 is 3 marks)

29. 4MB1\_01R\_que\_20180525 Q: 5

Without using your calculator, and showing all your working,

express  $\frac{12}{3 - \sqrt{5}}$  in the form  $a + b\sqrt{5}$  where  $a$  and  $b$  are integers.

.....  
**(Total for Question 5 is 2 marks)**

---

30. 4MB0\_01R\_que\_20180525 Q: 5

Here is a list of 5 numbers

$$(\sqrt{2} + 3) \quad 2\frac{1}{4} \quad 1.23 \times 10^2 \quad \frac{9\pi}{3\pi} \quad (\sqrt{3} \times \sqrt{27})$$

Write down all the numbers in the list that are natural numbers.

.....  
**(Total for Question 5 is 2 marks)**

---

31. 4MB1\_01\_que\_20180525 Q: 6

Write down which two of the following six numbers are equivalent to irrational numbers.

$$\frac{7}{12} \quad \frac{\sqrt{27}}{\sqrt{3}} \quad 2\pi \quad 16^{\frac{1}{4}} \quad 4\sqrt{2} \quad 0.3$$

.....  
**(Total for Question 6 is 2 marks)**

---

32. 4MB1\_01\_que\_20201104 Q: 15

Akash drove from his home to his friend's house.

The distance Akash drove was 190 km, to the nearest 5 km.

His average speed for the journey was 62 km/h, to the nearest km/h.

Calculate the upper bound for the time taken by Akash to drive from his home to his friend's house.

Give your answer in hours and minutes, to the nearest minute.

..... hours ..... minutes

**(Total for Question 15 is 4 marks)**

---



# Appendix A

## Answers

1. 4MB1\_01\_rms\_20220111 Q: 24

Question	Working	Answer	Mark	Notes
	$[M =]10p + q$ or $[N =]10q + p$ stated or used		5	M1 Allow $M$ and $N$ interchanged as long as one is $10p + q$ and one is $10q + p$ or $M + N = 10p + 10q + p + q$ oe
	" $10q + p$ " - (" $10p + q$ ") = 9 or $q - p = 1$ oe			M1 dep or $M + N = 11 \times 13$
	$p = 6$ or $q = 7$			A1 $M + N = 143$
	e.g. $q - 6 = 1$			M1 dep on first two M marks. Method to find second unknown or $M$ eg. $2M = 143 + 9$ If $p$ or $q$ is not an integer between 0 and 9 inclusive do not award this mark if used to find the other digit. Can be implied by a correct answer if all other marks awarded
		67		A1 dep on all marks gained
				<b>Total 5 marks</b>

2. 4MB1\_01\_rms\_20220111 Q: 1

Question	Working	Answer	Mark	Notes																					
	$180 = 2 \times 2 \times 3 \times 3 \times 5$ $198 = 2 \times 3 \times 3 \times 11$ or <table border="1" style="display: inline-table; vertical-align: middle;"> <tr><td>2</td><td>180</td><td>198</td></tr> <tr><td>3</td><td>90</td><td>99</td></tr> <tr><td>3</td><td>30</td><td>33</td></tr> <tr><td>2</td><td>10</td><td>11</td></tr> <tr><td>5</td><td>5</td><td>11</td></tr> <tr><td>11</td><td>1</td><td>11</td></tr> <tr><td></td><td>1</td><td>1</td></tr> </table>	2	180	198	3	90	99	3	30	33	2	10	11	5	5	11	11	1	11		1	1		2	M1 A correct method to enable the LCM to be found. Correct factorisation of 180 and 198 allow on factor trees. For the table they must divide both numbers by those shaded (or other combination with a product of 18) in grey at some point. All other lines are optional but must be correct if seen (2 and 5 could be combined to give 10). Division could be in a different order. Allow list of multiples – at least 5 correct for each number, excluding 180 and 198 eg. 360, 540, 720, 900, 1080 and 396, 594, 792, 990, 1188
2	180	198																							
3	90	99																							
3	30	33																							
2	10	11																							
5	5	11																							
11	1	11																							
	1	1																							
		1980	A1 Allow $2^2 \times 3^2 \times 5 \times 11$																						
				<b>Total 2 marks</b>																					

3. 4MB1\_01R\_rms\_20220111 Q: 7

Question	Working	Answer	Mark	Notes	Total
	$3\,375\,000 \div (2^3 \times 3^3) (= 15625)$ oe or $3\,375\,000 = 2^3 \times 3^3 \times 5^6$		2	M1	
		6		A1 dep on M1	
					2

4. 4MB1\_01\_rms\_20210421 Q: 10

Question	Working	Answer	Mark	Notes									
	$28 = 2 \times 2 \times 7$ or $4 \times 7$ $120 = 2 \times 2 \times 2 \times 3 \times 5$ or $4 \times 30$ oe Or factor trees <table style="margin-left: 40px;"> <tr> <td></td> <td>28</td> <td>120</td> </tr> <tr> <td>2</td> <td>14</td> <td>60</td> </tr> <tr> <td>2</td> <td>7</td> <td>30</td> </tr> </table>		28	120	2	14	60	2	7	30			M1 For prime factorisation of 28 and 120 (may be at ends of a factor tree), must have $2 \times 2 \dots$ or $4 \times \dots$  or for multiples of 120 up to at least 840 or for multiples of 28 up to at least 840
	28	120											
2	14	60											
2	7	30											
	LCM (28, 120) = 840			A1 Allow $2 \times 2 \times 2 \times 3 \times 5 \times 7$									
		843	3	A1ft For adding 3 to their LCM. The M1 must be awarded. An answer with no working gains no marks									
<i>Total 3 marks</i>													

5. 4MB1\_01R\_rms\_20210304 Q: 2

Question	Working	Answer	Mark	Notes												
	$60 = 2^2 \times 3 \times 5$ $126 = 2 \times 3^2 \times 7$ $648 = 2^3 \times 3^4$			M1 for prime factors of two of 60, 126, 648 (or equivalent e.g. factor ladder/trees  <table style="margin-left: 40px;"> <tr> <td></td> <td>60</td> <td>126</td> <td>648</td> </tr> <tr> <td>2:</td> <td>30</td> <td>63</td> <td>324</td> </tr> <tr> <td>3:</td> <td>10</td> <td>21</td> <td>108</td> </tr> </table> or listing at least 6 factors of each of the 3 numbers		60	126	648	2:	30	63	324	3:	10	21	108
	60	126	648													
2:	30	63	324													
3:	10	21	108													
	HCF(60,126,648) = $2 \times 3$	6	2	A1												
<i>Total 2 marks</i>																

6. 4MB1\_01\_rms\_20201104 Q: 4

Question	Working	Answer	Mark	Notes	Total	
(i)		$2^3 \times 3^2 \times 5^2 \times 7$ or 12 600	1	B1	SC (i) 60 or $2^2 \times 3 \times 5$ and (ii) 12 600 or $2^3 \times 3^2 \times 5^2 \times 7$ scores B0B1	
(ii)		$2^2 \times 3 \times 5$ or 60	1	B1		
<b>2</b>						

7. 4MB1\_01\_rms\_20190522 Q: 2

Question	Working	Answer	Mark	Notes																																												
	$18 = 2 \times 3^2$ or $18 = 6 \times 3$ or $30 = 2 \times 3 \times 5$ or $30 = 6 \times 5$ $48 = 2^4 \times 3$ or $48 = 6 \times 8$  or <table style="margin-left: 40px;"> <tr> <td>2</td> <td>18</td> <td>30</td> <td>48</td> </tr> <tr> <td>3</td> <td>9</td> <td>15</td> <td>24</td> </tr> <tr> <td></td> <td>3</td> <td>5</td> <td>8</td> </tr> </table> oe <table style="margin-left: 40px;"> <tr> <td>2</td> <td>18</td> <td>30</td> <td>48</td> </tr> <tr> <td>2</td> <td>9</td> <td>15</td> <td>24</td> </tr> <tr> <td>2</td> <td>9</td> <td>15</td> <td>12</td> </tr> <tr> <td>2</td> <td>9</td> <td>15</td> <td>6</td> </tr> <tr> <td>3</td> <td>9</td> <td>15</td> <td>3</td> </tr> <tr> <td>3</td> <td>3</td> <td>5</td> <td>1</td> </tr> <tr> <td>5</td> <td>1</td> <td>5</td> <td>1</td> </tr> <tr> <td></td> <td>1</td> <td>1</td> <td>1</td> </tr> </table>	2	18	30	48	3	9	15	24		3	5	8	2	18	30	48	2	9	15	24	2	9	15	12	2	9	15	6	3	9	15	3	3	3	5	1	5	1	5	1		1	1	1			M1 Prime factors for two of 18, 30, 48 (or equivalent) or  lists multiples of 18, 30 and 48 (at least 2 multiples, not inc number itself for all three of the numbers, ie (18),36,54, ... (30),60,90, ... (48),96,144,...) or  table method
2	18	30	48																																													
3	9	15	24																																													
	3	5	8																																													
2	18	30	48																																													
2	9	15	24																																													
2	9	15	12																																													
2	9	15	6																																													
3	9	15	3																																													
3	3	5	1																																													
5	1	5	1																																													
	1	1	1																																													
		720	2	A1																																												
<i>Total 2 marks</i>																																																

8. 4MB1\_01R\_rms\_20190522 Q: 1

Question	Working	Answer	Mark	Notes																								
	60, 120, 180, 240, 300, 360, 420, 480, 540, ... 135, 270, 405, 540, ...  <b>or</b>  $60 = 2 \times 2 \times 3 \times 5$ or $15 \times 2 \times 2$ $135 = 3 \times 3 \times 3 \times 5$ or $15 \times 3 \times 3$  <b>or</b> <table border="1" style="display: inline-table; vertical-align: middle;"> <tr> <td>5</td> <td>60</td> <td>135</td> </tr> <tr> <td>3</td> <td>12</td> <td>27</td> </tr> <tr> <td></td> <td>4</td> <td>9</td> </tr> </table>	5	60	135	3	12	27		4	9			M1 for a correct list of multiples up to 540 or 60 and 135 written as a correct product of primes - factors may be on ends of trees or in ladder diagrams (so expect to see 3, 3, 3, 4 and 5 or equivalent e.g. 3, 4, 5, 9) or correct factor grid  The following is common:  <table style="display: inline-table; vertical-align: middle;"> <tr> <td>5</td> <td style="border-left: 1px solid black; border-right: 1px solid black;">60</td> <td>135</td> </tr> <tr> <td>3</td> <td style="border-left: 1px solid black; border-right: 1px solid black;">12</td> <td>27</td> </tr> <tr> <td>4</td> <td style="border-left: 1px solid black; border-right: 1px solid black;">4</td> <td>9</td> </tr> <tr> <td>9</td> <td style="border-left: 1px solid black; border-right: 1px solid black;">1</td> <td>9</td> </tr> <tr> <td></td> <td style="border-left: 1px solid black; border-right: 1px solid black;">1</td> <td>1</td> </tr> </table>	5	60	135	3	12	27	4	4	9	9	1	9		1	1
5	60	135																										
3	12	27																										
	4	9																										
5	60	135																										
3	12	27																										
4	4	9																										
9	1	9																										
	1	1																										
		540	2	A1																								
<b>Total 2 marks</b>																												

9. 4MB0\_01\_rms\_20180108 Q: 2

Question	Working	Answer	Mark	Notes
	Prime factorisation of either 84 <b>or</b> 40 $84 = 2^2 \times 3 \times 7$ $40 = 2^3 \times 5$ $(LCM = 3 \times 7 \times (2 \times 2) \times 2 \times 5)$  <b>OR</b> $84 = 4 \times 21$ <b>and</b> $40 = 4 \times 10$ oe (as 21 and 10 have no common factors) (so $LCM = 4 \times 21 \times 10 = 840$ )  <b>OR</b> At least 5 multiples of 84 <b>and</b> 40 84, 168, 252, 336, 420, ... 40, 80, 120, 160, 200, ...	840	2	M1 factors may be on the end of factor trees or on factor 'ladders' cao  A1
		840	{2}	{M1} {A1}
		840	{2}	{M1} {A1}

10. 4MB0\_01R\_rms\_20180525 Q: 2

Question	Working Answer	Mark	Notes
	One of 180 and 324 factored as  $180 = 2^2 \times 3^2 \times 5$ OR $180 = 36 \times 5$ OR $180 = 5 \times 3 \times 12$ $324 = 2^2 \times 3^4$ OR $324 = 36 \times 9$ OR $324 = 9 \times 3 \times 12$ OR one correct Factor Tree	2	M1
	HCF = 36		A1

11. 4MB0\_01\_rms\_20170109 Q: 3

Question	Working	Answer	Mark	Notes
	Prime factors (or factor ladders/trees) of any two of 60, 84 and 120 $(60 = 2^2 \times 3 \times 5, 120 = 2^3 \times 3 \times 5, 84 = 2^2 \times 3 \times 7)$		2	M1 Allow 4 for $2^2$ in the factorisations
		12		A1 SC: any multiple of 12 scores M1A0
<b>Total 2 marks</b>				

12. 4MB0\_01\_rms\_20170525 Q: 17

$$(i) \left. \begin{array}{l} 84 = 2^2 \times 3 \times 7 \\ 126 = 2 \times 3^2 \times 7 \\ 294 = 2 \times 3 \times 7^2 \end{array} \right\} \text{(prime factors of at least 2 of 84, 126 and 294)}$$

OR

$$\begin{array}{l} 84 = 42 \times 2 \\ 126 = 42 \times 3 \\ 294 = 42 \times 7 \end{array} \quad \text{M1}$$

OR  $2^2 \times 3^2 \times 7^2$  or  $2 \times 3 \times 7$

LCM = 1764 A1 2

(ii) HCF = 42 B1 1 3

**NB:** The M mark can be awarded in either (i) or (ii), so if one is correct M1A1B0 or M1A0B1

**Special Case:** If LCM & HCF are correct but wrong way round award M1A0B1.

One correct in wrong place is M1A0B0

**Total 3 marks**

13. 4MB0\_01R\_rms\_20180525 Q: 10

Question	Working Answer	Mark	Notes
	$(1+2^5) \times 2^n$ (ie odd number $\times$ even number)	2	M1
	$33 \times 2^{35}$ OR $m = 33$ or $1 + 2^5$ and $n = 35$		A1
	<b>NB:</b> No working seen scores M0 A0		

14. 4MB0\_01\_rms\_20170109 Q: 22

Question	Working	Answer	Mark	Notes
a		$10 \times 2^{100}$	1	B1 Accept $m = 10$
b	$4^{48} (= 2^{48} \times 2^{48}) = 2^{96}$		4	M1
	$\therefore "10" \times 2^{100} = "10" \times 2^4 \times 2^{96}$			M1(DEP)
	$= "10" \times 2^4 \times 4^{48}$ (OR $\frac{"10 \times 2^{100}"}{2^{96}}$ $10 \times 2^4$ (oe eg (32 + 128)))			M1(DEP) <b>NB:</b> 0 marks if no correct working seen (M1(DEP)) (M1(DEP))
		$160 \times 4^{48}$ (cao)		A1ft
				<b>Total 5 marks</b>

Note: 2<sup>nd</sup> Alternative

$$2^{100} = 4^{50} \text{ (M1)}$$

$$"10 \times 2^{100}" = 10 \times 4^{50} \text{ (M1 (DEP))}$$

$$= 10 \times 4^2 \times 4^{48} \text{ (M1(DEP))}$$

Answers of (a) 10 and (b) 160 earns at most (B0)((M1)(M1)(M1)(A1)

15. 4MB0\_01R\_rms\_20170109 Q: 9

Question	Working	Answer	Mark	Notes
	$\frac{1}{9} + 125$ $\frac{1}{9}$ or $1 + \frac{125}{9}$		2	M1
		1126		A1
<b>Total 2 marks</b>				

Notes: 1. Accept  $\left(\frac{1}{9} + 125\right) \times 9$  or  $1 + 5 \times 15^2$  for (M1)2. Where decimals are used for 1/9, **must** see 0.11 (or better) written down for (M1).

16. 4MB1\_01\_rms\_20220111 Q: 13

Question	Working	Answer	Mark	Notes
	$\sqrt{144 \times 3} - \sqrt{49 \times 3}$		3	M1 Must see 432 and 147 decomposed into at least $144 \times 3$ and $49 \times 3$
	$5\sqrt{3}$			A1 Must gain the method mark to award this allow for $\sqrt{75}$ gained without $5\sqrt{3}$ stated
		$\sqrt{75}$		A1 dep on M mark gained allow $n = 75$
<b>Total 3 marks</b>				

17. 4MB1\_01\_rms\_20201104 Q: 10

Question	Working	Answer	Mark	Notes	Total
	$(\sqrt{180} =) \sqrt{36 \times 5}$ or $(\sqrt{180} =) 2\sqrt{45}$ or $(\sqrt{180} =) 3\sqrt{20}$ or $(180 =) 2^2 \times 3^2 \times 5$ or $(\sqrt{147} =) \sqrt{49 \times 3}$ or $(147 =) 3 \times 7^2$		3	M1 for clearly showing understanding of surd form must include a decomposition of either 180 or 147	
	$6\sqrt{5} - 3\sqrt{3} - 2\sqrt{5} + 7\sqrt{3}$			M1 dep at least 3 terms correct	
	$4(\sqrt{5} + \sqrt{3})$	4		A1 dep on both M marks	
					3

18. 4MB1\_01R\_rms\_20190110 Q: 13

Question	Working	Answer	Mark	Notes
	$\sqrt{121 \times 5} - \sqrt{16 \times 5}$ or $605 = 11 \times 11 \times 5$ and $80 = 4 \times 4 \times 5$ or $2 \times 2 \times 2 \times 2 \times 5$ $11\sqrt{5} - 4\sqrt{5} (= 7\sqrt{5})$		3	M1
	<b>SC B1</b> $\sqrt{605} - \sqrt{80} = 11\sqrt{5} - 4\sqrt{5} = 7\sqrt{5} = \sqrt{245}$	$\sqrt{245}$		M1dep A1dep on first M1 [allow $n = 245$ ]

19. 4MB1\_01\_rms\_20180525 Q: 9

Question	Working	Answer	Notes	Mark	Sub-Total	Total
	$\sqrt{80} = (\sqrt{16 \times 5}) = 4\sqrt{5}$		M1 for one term simplified correctly M2 for both terms simplified correctly (with one step of working for $\sqrt{180}$ )	M1		3
	$\sqrt{180} = \sqrt{36 \times 5} = 6\sqrt{5}$			M1		
	$3\sqrt{180} - 2\sqrt{80} = 3(6\sqrt{5}) - 2(4\sqrt{5})$	$10\sqrt{5}$		A1		

20. 4MB0\_01\_rms\_20170109 Q: 12

Question	Working	Answer	Mark	Notes
	Two of $6\sqrt{2}$ , $4\sqrt{2}$ and $2\sqrt{2}$		3	B1
	$\frac{6\sqrt{2}+4\sqrt{2}}{2\sqrt{2}}$ oe			M1
	(OR $\frac{\sqrt{8}}{\sqrt{8}} \times \frac{\sqrt{72}+\sqrt{32}}{\sqrt{8}}$			(B1)
	$\frac{\sqrt{576}+\sqrt{256}}{8}$			(M1)
	OR $\frac{\sqrt{2}}{\sqrt{2}} \times \frac{\sqrt{72}+\sqrt{32}}{\sqrt{8}}$			(B1)
	$\frac{\sqrt{144}+\sqrt{64}}{\sqrt{16}}$			(M1)
	OR Dividing numerator by $\sqrt{8}$ producing one of $\sqrt{9}$ or $\sqrt{4}$			(B1)
	$\sqrt{9} + \sqrt{4}$			(M1)
		5		A1
				<b>Total 3 marks</b>

21. 4MB0\_01\_rms\_20170525 Q: 10

Breaking 432 into  $(144) \times 3$  or  $(16) \times 27$  AND 243 into  $(81) \times 3$  or  $(9) \times 27$  where bracketed number may be written as a product

OR 432 AND 243 as a product of prime factors ( $432 = 2^4 \times 3^3$ ,  $243 = 3^5$ ) M1

$$\sqrt{(3 \times 2^2)^2 \times 3} - \sqrt{9^2 \times 3} \text{ or } (3 \times 2^2)\sqrt{3} - 9\sqrt{3} \text{ or } 4\sqrt{27} - 3\sqrt{27}$$

oe, e.g. (from working)  $12\sqrt{3} - 9\sqrt{3} (= 3\sqrt{3})$  [manipulating both surds correctly]

**NB:**  $12\sqrt{3} - 9\sqrt{3}$  or  $3\sqrt{3}$  with no working gains M0M0A0

M1 (DEP)

$$\sqrt{27} \text{ or } n = 27$$

A1

3

**Total 3 marks**

22. 4MB0\_01R\_rms\_20170525 Q: 8

Q	Working	Answer	Mark	Notes
	$2\sqrt{3} - 2\sqrt{2} + \sqrt{6} \times \sqrt{3} - \sqrt{6} \times \sqrt{2}$ or $2\sqrt{3} - 2\sqrt{2} + \sqrt{18} - \sqrt{12}$		3	M1 Correctly expand brackets. Allow one sign error.
	$\sqrt{18} = 3\sqrt{2}$ and $\sqrt{12} = 2\sqrt{3}$ or $\sqrt{6} \times \sqrt{3} = 3\sqrt{2}$ and $\sqrt{6} \times \sqrt{2} = 2\sqrt{3}$			M1 (DEP) May be embedded within working
	$2\sqrt{3} - 2\sqrt{2} + 3\sqrt{2} - 2\sqrt{3}$	$\sqrt{2}$		A1 dep on M2 cso
NB Answers derived from decimal expansions score M0M0A0				<b>Total 3 marks</b>

23. 4MB1\_01R\_rms\_20220111 Q: 15

Question	Working	Answer	Mark	Notes	Total
	$\frac{4+\sqrt{20}}{\sqrt{5}-2} \times \frac{\sqrt{5}+2}{\sqrt{5}+2}$ oe		3	M1 multiply numerator and denominator by $\sqrt{5}+2$	
	$\frac{4\sqrt{5}+8+\sqrt{100}+2\sqrt{20}}{5-4}$ oe			M1 dep on first M1 expand numerator with three terms correct – allow $(\sqrt{5}-2)(\sqrt{5}+2)=1$	
		$18+8\sqrt{5}$		A1 dep on first M1	
					3

24. 4MB1\_01\_rms\_20210304 Q: 13

Question	Working	Answer	Mark	Notes
	$\frac{\sqrt{13}+\sqrt{11}}{\sqrt{13}-\sqrt{11}} \times \frac{\sqrt{13}+\sqrt{11}}{\sqrt{13}+\sqrt{11}}$		3	M1 multiplying numerator and denominator by $\sqrt{13}+\sqrt{11}$
	$\frac{13+\sqrt{143}+\sqrt{143}+11}{13+\sqrt{143}-\sqrt{143}-11}$			M1 dep attempt to expand top and bottom, condone a maximum of one error – condone $\frac{(\sqrt{13}+\sqrt{11})^2}{(\sqrt{13})^2 - (\sqrt{11})^2} = \frac{24+2\sqrt{143}}{2}$

Question	Working	Answer	Mark	Notes
	$\frac{24+2\sqrt{143}}{2}$	$12+\sqrt{143}$		A1 cao sufficient working must be seen. Correct answer with no working scores no marks
				<b>Total 3 marks</b>

25. 4MB1\_01\_rms\_20210421 Q: 15

Question	Working	Answer	Mark	Notes
	$\frac{4-\sqrt{12}}{4+\sqrt{12}} \times \frac{4-\sqrt{12}}{4-\sqrt{12}}$ oe			M1 multiplying by $\frac{4-\sqrt{12}}{4-\sqrt{12}}$ or $\frac{2-\sqrt{3}}{2+\sqrt{3}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$ or $\frac{4-\sqrt{12}}{4-\sqrt{12}} \times \frac{2-\sqrt{3}}{2-\sqrt{3}}$ oe
	$\frac{16+12-8\sqrt{12}}{16-12}$ or $\frac{28-8\sqrt{12}}{4}$ oe			M1 multiplies out correctly but need not be simplified. Allow $\frac{4+3-4\sqrt{3}}{4-3}$ or $\frac{7-4\sqrt{3}}{1}$ or $7-4\sqrt{3}$ or $\frac{14-2\sqrt{12}-4\sqrt{3}}{2+2\sqrt{12}-4\sqrt{3}}$ oe
		$7-\sqrt{48}$	3	A1 dep on both the previous method marks being awarded. Correct answer with no working is no marks. Allow $a=7$ and $b=48$ ISW once $7-\sqrt{48}$ seen <b>NB</b> Do not allow for $7-4\sqrt{3}$ unless $7-\sqrt{48}$ seen in working
				<b>Total 3 marks</b>

26. 4MB1\_01R\_rms\_20210304 Q: 20

Question	Working	Answer	Mark	Notes
	$\frac{2-\sqrt{2}}{(1+\sqrt{2})^2} = \frac{2-\sqrt{2}}{1+2\sqrt{2}+2}$			M1 for expanding denominator correctly (2, 3 or 4 terms)
	$\left(\frac{2-\sqrt{2}}{3+2\sqrt{2}}\right)\left(\frac{3-2\sqrt{2}}{3-2\sqrt{2}}\right)$			M1ft for a correct method to rationalise their denominator (dep on a surd in the form $a \pm b\sqrt{c}$ )
	$\frac{6-4\sqrt{2}-3\sqrt{2}+4}{9-8}$			M1 (dependent on previous M mark) for expanding numerator (3 or 4 terms) allow one error with a denominator of 1 or an implied 1
		$a=10$ $b=-7$	4	A1 (dependent on M3)
				<b>Total 4 marks</b>

27. 4MB1\_01R\_rms\_20201104 Q: 10

Question	Working	Answer	Mark	Notes
	$\frac{6-\sqrt{8}}{2+\sqrt{8}} \times \frac{2-\sqrt{8}}{2-\sqrt{8}}$ or $\frac{3-\sqrt{2}}{1+\sqrt{2}} \times \frac{1-\sqrt{2}}{1-\sqrt{2}}$		M1	Or equivalent, for example, $\frac{6-\sqrt{8}}{2+\sqrt{8}} \times \frac{-2+\sqrt{8}}{-2+\sqrt{8}}$
	$\frac{20-8\sqrt{8}}{-4}$ or $-5+2\sqrt{8}$ or $-5+4\sqrt{2}$		M1dep	For multiplying out correctly and simplifying
		$-5+\sqrt{32}$	A1	If $-5+4\sqrt{2}$ with no working, then no marks If $-5+\sqrt{32}$ seen, then SC B1 only
<b>Total 3 marks</b>				

28. 4MB1\_01R\_rms\_20190522 Q: 20

Question	Working	Answer	Mark	Notes
	$\frac{3(5\sqrt{2}-2)}{2-\sqrt{2}}$ oe			M1
	$\frac{3(5\sqrt{2}-2)}{2-\sqrt{2}} \times \frac{2+\sqrt{2}}{2+\sqrt{2}}$ oe			M1
		$9+12\sqrt{2}$	3	A1 dep on M2
<b>Total 3 marks</b>				

29. 4MB1\_01R\_rms\_20180525 Q: 5

Question	Working	Answer	Mark	Notes	Sub-Total	Total
	$\frac{12}{3-\sqrt{5}} \times \frac{3+\sqrt{5}}{3+\sqrt{5}}$ or $12 = 3a + 3b\sqrt{5} - a\sqrt{5} - 5b$ and $3a - 5b = 12, 3b - a = 0$ oe		M1			
	$\frac{36+12\sqrt{5}}{9-5}$ or $4b=12$ or $4a=36$	$9+3\sqrt{5}$	A1	Correct expansion/correct method for solving simultaneous equations <b>with</b> a correct answer and no errors. <b>NB</b> no marks for answer without any working.		2

30. 4MB0\_01R\_rms\_20180525 Q: 5

Question	Working	Answer	Mark	Notes
	$1.23 \times 10^2$ (OR 123), $\frac{9\pi}{3\pi}$ (OR $\frac{9}{3}$ or 3), $(\sqrt{3} \times \sqrt{27})$ (OR +9 or $\sqrt{81}$ )		2	B2(-1eeoo)
<b>NB:</b> Deduct marks starting with the <b>second</b> ePEN mark box If <b>one</b> error then B1 B0, if <b>two</b> errors B0 B0				

31. 4MB1\_01\_rms\_20180525 Q: 6

Question	Working	Answer	Notes	Mark	Sub-Total	Total
		$2\pi$ $4\sqrt{2}$	-1 for each error or omission	B2		2

32. 4MB1\_01\_rms\_20201104 Q: 15

Question	Working	Answer	Mark	Notes	Total
	For 192.5 or 187.5		3	M1	
	For 61.5 or 62.5			M1	
	"192.5" $\div$ "61.5" (=3.13...)			M1 where $190 < \text{"192.5"} \leq 195$ and $61 \leq \text{"61.5"} < 62$	
		3hrs 8 mins		A1 cao	4