Distinction in MATHEMATICS

Revision Guide Secondary 1

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Based on 2013 MOE syllabus

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Preface

Distinction in Mathematics – Revision Guide is written for students preparing for tests and examinations as well as the crucial GCE 'O' Level Examinations.

Each chapter begins with a set of 'Keynotes'. This is where concepts and various formulae are compiled for pupils' easy reference during revision. It also includes essential formulae from the GCE 'O' Level Mathematical Formulae List.

Every chapter has a variety of questions for practice and exposure. Emphasis is given to commonly asked questions in examinations to better equip pupils with the skills to answer effectively and efficiently.

I sincerely hope that pupils will benefit greatly from this book by maximizing their potential and scoring better grades for tests and examinations.

Ivan Lau Kim Soon

Contents

TOPIC 1

Factors and Multiples

Keynotes:

1 Prime factorization

***Definition*:** A method to express number as a **product of prime factors.**

***Example*:** Find the product of the prime factors for 72.

***Solution*:**

2	72
2	36
3	18
3	6
2	2
	1

$\therefore 72 = 2^3 \times 3^2$

2 Lowest Common Multiple (LCM) and Highest Common Factor (HCF)

***Definition*:** (1) The smallest common multiple of a two or more numbers is called **Lowest Common Multiple (LCM).**

(2) The largest common factor of two or more numbers is **Highest Common Factors (HCF).**

Student must know how to find LCM and HCF of a number in the form of **ordinary notation** and **index notation**.

(a) Ordinary notation

***Example*:** Find the HCF and LCM for 72 and 84.

***Solution*:**

HCF	LCM
2 | 72, 84 2 | 36, 42 3 | 18, 21 6, 7 HCF = $2 \times 2 \times 3 = 12$	2 | 72, 84 2 | 36, 42 3 | 18, 21 6 | 6, 7 7 | 1, 7 1, 1 LCM = $2 \times 2 \times 3 \times 6 \times 7 = 504$

(b) Index notation

HCF	Consider the smaller power for each of the base
LCM	Consider the bigger power for each of the base

***Example*:** Find the HCF and LCM for $2^4 \times 7^5 \times 11^4$ and $2^8 \times 3^3 \times 7^9$. Express your answer in index notation.

***Solution*:**

HCF	LCM
$\therefore$ HCF $= 2^4 \times 7^5$	$\therefore$ LCM $= 2^8 \times 3^3 \times 7^9 \times 11^4$

3 Square and square root

***Definition*:** Since $4^2 = 16$ and $(-4)^2 = 16$, then 16 is known as the **square** of 4 and -4. Alternatively, 4 and -4 are known as the **square root** of 16.

(a) Square

Number	Square Number
1	1
2	4
3	9
4	16
5	25
6	36
7	49
8	64
9	81
10	100
11	121
12	144
13	169
14	196
15	225
$2^2 \times 7 \times 11^3$	$2^4 \times 7^2 \times 11^6$
2×3^3	$2^2 \times 3^6$

Exam Tips

1. Use the function x^2 on a calculator to find the square of a number.
2. All the numbers in the 2nd column are called **perfect square numbers**.

(b) Square root

Number	Positive Square Root	Negative Square Root
1	1	–1
4	2	–2
9	3	–3
16	4	–4
25	5	–5
36	6	–6
49	7	–7
64	8	–8
81	9	–9
100	10	–10
121	11	–11
144	12	–12
169	13	–13
196	14	–14
225	15	–15

Exam Tips

1. Use the function $\sqrt{\ }$ on a calculator to find the square root of a number.
2. If the given number is in index notation, divide the power by **two** in order to find the square root.

4 Cube and cube root

***Definition*:** Since $4^3 = 64$, then 64 is called as the **cube** of 4. Alternatively, 4 is known as the **cube root** of 16.

(a) Cube

Number	Cube Number
1	1
2	8
3	27
4	64
5	125
6	216
$2^2 \times 7 \times 11^3$	$2^6 \times 7^3 \times 11^9$
2×3^3	$2^3 \times 3^9$

1. Use the function x^3 on a calculator to find the cube of a number.
2. All the numbers in the 2nd column are called **perfect cube numbers**.

(b) Cube root

Number	Cube Root
1	1
8	2
27	3
64	4
125	5
216	6
–1	–1
–8	–2
–27	–3
–64	–4
–125	–5
–216	–6
$2^6 \times 7^3 \times 11^9$	$2^2 \times 7 \times 11^3$
$2^3 \times 3^9$	2×3^3

1. Use the function $\sqrt[3]{\square}$ on a calculator to find the cube root of a number.
2. If the given number is in index notation, divide the power by **three** in order to find the cube root.

5 Prime number

***Definition*:** A number is called a prime number if it is divisible only by 1 or itself.
***Example*:** 2, 3, 5, 7, 11, 13, 17, ….

1. All prime numbers are positive numbers.
2. The smallest prime number is 2.

Quiz:

1 Find the product of the prime factors for the following:

(a) 75

(b) 702

(c) 585

(d) 1540

(e) 4862

(f) 5202

(a)	(b)	(c)
(d)	(e)	(f)

2 Find the (i) HCF and (ii) LCM for

(a) 150 and 360,

(b) 15, 36 and 66,

(c) 80 and 150.

(a) (i)	(b) (i)	(c) (i)
(a) (ii)	(b) (ii)	(c) (ii)

3 Consider the numbers 198 and 456. Find

(a) the product of the prime factors for each number,

(b) the HCF of both numbers, leaving your answers in ordinary notation,

(c) the LCM of both numbers, leaving your answers in index notation.

(a)	(b)	(c)

Answer

Factors and Multiples

TOPIC 1

1. (a)
$$\begin{array}{r|l} 5 & 75 \\ 3 & 15 \\ 5 & 5 \\ \hline & 1 \end{array}$$
$\therefore 75 = 3 \times 5^2$

(b)
$$\begin{array}{r|l} 2 & 702 \\ 3 & 351 \\ 3 & 117 \\ 3 & 39 \\ 13 & 39 \\ \hline & 1 \end{array}$$
$\therefore 702 = 2 \times 3^3 \times 13$

(c)
$$\begin{array}{r|l} 5 & 585 \\ 3 & 117 \\ 3 & 39 \\ 13 & 13 \\ \hline & 1 \end{array}$$
$\therefore 585 = 3^2 \times 5 \times 13$

(d)
$$\begin{array}{r|l} 2 & 1540 \\ 2 & 770 \\ 5 & 385 \\ 7 & 77 \\ 11 & 11 \\ \hline & 1 \end{array}$$
$\therefore 1540 = 2^2 \times 5 \times 7 \times 11$

(e)
$$\begin{array}{r|l} 2 & 4862 \\ 11 & 2431 \\ 13 & 221 \\ 17 & 17 \\ \hline & 1 \end{array}$$
$\therefore 4862 = 2 \times 11 \times 13 \times 17$

(f)
$$\begin{array}{r|l} 2 & 5202 \\ 3 & 2601 \\ 3 & 867 \\ 17 & 289 \\ 17 & 17 \\ \hline & 1 \end{array}$$
$\therefore 5202 = 2 \times 3^2 \times 17^2$

2. (a) (i)
$$\begin{array}{r|l} 5 & 150, 360 \\ 3 & 30, 72 \\ 2 & 10, 24 \\ \hline & 5, 12 \end{array}$$
$\therefore$ HCF $= 2 \times 3 \times 5 = 30$

(ii)
$$\begin{array}{r|l} 5 & 150, 360 \\ 3 & 30, 72 \\ 2 & 10, 24 \\ 5 & 5, 12 \\ 2 & 1, 12 \\ 2 & 1, 6 \\ 3 & 1, 3 \\ \hline & 1, 1 \end{array}$$
$\therefore$ LCM $= 2^3 \times 3^2 \times 5^2 = 1800$

(b) (i)
$$\begin{array}{r|l} 3 & 15, 36, 66 \\ \hline & 5, 12, 22 \end{array}$$
$\therefore$ HCF $= 3$

(ii)
$$\begin{array}{r|l} 3 & 15, 36, 66 \\ 2 & 5, 12, 22 \\ 5 & 5, 6, 11 \\ 2 & 1, 6, 11 \\ 3 & 1, 3, 11 \\ 11 & 1, 1, 11 \\ \hline & 1, 1, 1 \end{array}$$
$\therefore$ LCM $= 2^2 \times 3^2 \times 5 \times 11 = 1980$

(c) (i)
$$\begin{array}{r|l} 2 & 80, 150 \\ 5 & 40, 75 \\ \hline & 8, 15 \end{array}$$
$\therefore$ HCF $= 2 \times 5 = 10$

(ii)
$$\begin{array}{r|l} 2 & 80, 150 \\ 5 & 40, 75 \\ 2 & 8, 15 \\ 2 & 4, 15 \\ 2 & 2, 15 \\ 3 & 1, 15 \\ 5 & 1, 5 \\ \hline & 1, 1 \end{array}$$
$\therefore$ LCM $= 2^4 \times 3 \times 5^2 = 1200$

3. (a)

2	198
3	99
3	33
11	11
	1

$\therefore 198 = 2 \times 3^2 \times 11$

2	456
2	228
2	114
3	57
19	19
	1

$\therefore 456 = 2^3 \times 3 \times 19$

(b)

3	198, 456
2	66, 152
	33, 76

$\therefore$ HCF $= 2 \times 3 = 6$

(c)

3	198, 456
2	66, 152
3	33, 76
11	11, 76
2	1, 76
2	1, 38
19	1, 19
	1, 1

LCM $= 2^3 \times 3^2 \times 11 \times 19$

4. (a)

3	1089
3	363
11	121
11	11
	1

$\therefore 1089 = 3^2 \times 11^2$

2	4312
2	2156
2	1078
11	539
7	49
7	7
	1

$\therefore 4312 = 2^3 \times 7^2 \times 11$

(b)

11	1089, 4312
	99, 392

$\therefore$ HCF $= 11$

(c)

11	1089, 4312
11	99, 392
7	9, 392
7	9, 56
3	9, 8
3	3, 8
2	1, 8
2	1, 4
2	1, 2
	1, 1

$\therefore$ LCM $= 2^3 \times 3^2 \times 7^2 \times 11^2$

5. (a)

2	5624
2	2812
2	1406
19	703
37	37
	1

$\therefore 5624 = 2^3 \times 19 \times 37$

2	7326
3	3663
3	1221
11	407
37	37
	1

$\therefore 7326 = 2 \times 3^2 \times 11 \times 37$