MATHEMATICS
Secondary ONE
Year 2021

Name: ( ) **Class:**

Unit 1 Numbers and Their Operations Part 1

Enduring Understanding
Students will understand that:

- Index **notation** concisely represents the operation of 'multiplying by itself'.
- Representing numbers in its **equivalent** prime factorisation form enables us to find LCM and HCF of two (or more) numbers
- Negative numbers enables us to **measure** the opposite property of real-world objects and situations.
- **Notations** such as >, <, ≥, ≤ help to represent the relationship between two numbers concisely and precisely.
- A number line is a **diagram** that serves as an abstraction for real numbers

Essential Questions

- Why do we need negative numbers?
- Why do we express a number in terms of its prime factorisation?
- How do we represent the operation of 'multiplying by itself' concisely?
- How do we represent the set of real numbers in the form of a diagram?

Resources

- Textbook: *Think! Mathematics New Syllabus Mathematics 1B (8th edition)* **Chapter 1**
- SLS

Unit Checklist

Cognitive Level	Know, Understand, Demonstrate	Checklist
Level 0: Memorisation	Define and give examples of prime and composite numbers	
Level 1: Procedural tasks without connections	Carry out prime factorisation, leaving answer in index notation	
Level 2: Procedural tasks with connections	Evaluate square roots and cube roots using prime factorisation	
	Find HCF and LCM	
Level 3: Problem solving	Solve problems involving HCF and LCM	

Lesson 1: Prime Numbers

(I) Prime and Composite Numbers

<u>Activity 1</u>

1. Complete the following table.

Number	Working	Factors	Number of Factors
1	1 is divisible by 1 only		
2	2 =		
3	3 =		
4	4 = 1 x 4 = 2 x 2		
5	5 =		
6	6 =		
7			
8			
9			
10			
11			
12			
13			
14			

15			

2. Classify the numbers in the table above into 3 groups.

Group A contains a number with *exactly 1 factor*: ______________________________

Group B contains numbers with *exactly 2 factors*: ______________________________

Group C contains numbers with *more than 2 factors*: ______________________________

The numbers in Group B are known as **prime numbers** (or **primes**).

The numbers in Group C are called **composite numbers**.

- A **prime number** is a whole number that has exactly ____ different factors, 1 and ____________.
- A **composite number** is a whole number that has ____________ different factors.

Activity 2

Bob says that if a whole number is not prime, then it must be composite.
Do you agree? Explain your answer.

Extension Activity: Sieve of Erasthostene

Source: 1A Textbook p4

1. Follow the instructions below.
   a) Cross out 1.
   b) Circle 2. Cross out multiples of 2.
   c) The next number that is not crossed out, i.e. 3, is a prime. Circle 3. Cross out all other multiples of 3.
   d) The next number that is not crossed out, i.e. 5, is a prime. Circle 5. Cross out all other multiples of 5.
   e) Continue doing this until all numbers have either been circled or crossed out.

1	2	3	4	5	6	7	8	9	10
11	12	13	14	15	16	17	18	19	20
21	22	23	24	25	26	27	28	29	30
31	32	33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48	49	50
51	52	53	54	55	56	57	58	59	60
61	62	63	64	65	66	67	68	69	70
71	72	73	74	75	76	77	78	79	80
81	82	83	84	85	86	87	88	89	90
91	92	93	94	95	96	97	98	99	100

2. Answer the following questions.
   a) List all primes from 1-100.
   b) Is every odd number a prime number? Explain.
   c) Is every even number a composite number? Explain.
   d) For a prime number greater than 5, what can the last digit be? Explain.

(II) Index Notation

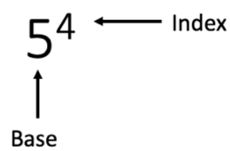
Index notation is a ‘shortcut’ method of writing repeated multiplication of the same number.

For example, we can express 5×5 as 5^2 (read as ‘5 squared’).

We can express $5 \times 5 \times 5 \times 5$ as 5^4, where 5 is called the **base** and 4 is called the **index**.
We read 5^4 as ‘5 to the **power** of 4’.

In layman terms, we say that there are four copies of 5.

Big Idea:



Express the following in index notation.	
(a) $3 \times 3 \times 3 \times 3$	(b) $2 \times 5 \times 11 \times 11$
(c) $3 \times 5 \times 5 \times 35$	(d) $4 \times 8 \times 9$

(III) Prime Factorisation

The factors of 18 are 1, 2, 3, 6, 9, 18.
The *prime factors* of 18 are 2 and 3.

We can express 18 as a product of its prime factors as shown below:

$$\begin{aligned} 18 &= 2 \times 3 \times 3 \\ &= 2 \times 3^2 \end{aligned}$$

The process of expressing 18 as a product of its prime factors is called **prime factorisation**.
Prime factorisation can be done using factor tree or repeated division.

Example

Find the prime factorisation of 126, leaving your answer in index notation.

Method 1: Factor Tree	Method 2: Repeated Division
126 =	126 =

Practice

Express the following numbers as a product of its prime factors, leaving your answer in index notation.	
(a) 60	(b) 792
(c) 1911	(d) 2700

Classwork

1. If p and q are whole numbers such that $p \times q = 23$, find the value of $p + q$. Explain your answer.

2. If n is a whole number such that $n \times (n + 28)$ is a prime number, find the prime number. Explain your answer.

3. Vani uses 231 one-centimetre cubes to make a cuboid.
   Each side of the cuboid is longer than 1 cm. Find the dimensions of the cuboid.

   Extension: What if the length of any side of the cuboid can be 1 cm?

Extension: Fundamental Theorem of Arithmetic

The **Fundamental Theorem of Arithmetic** states that ‘every whole number greater than 1 is either a prime number or it can be expressed as a unique product of its prime factors’.

Read more: **https://tinyurl.com/fundtheorem**

Assignment 1A

Textbook: *Shinglee New Syllabus Mathematics (8th Edition) Textbook Secondary 1A*

Basic

- Textbook 1A Exercise 1A (page 9): Questions 2, 4, 6

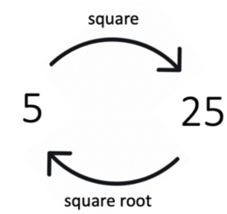
Intermediate

- Textbook 1A Exercise 1A (page 9): Questions 3, 9, 11

Advanced

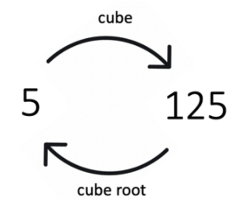
- Textbook 1A Exercise 1A (page 9): Questions 12

Lesson 2: Square roots and cube roots



$\mathbf{5^2 = 5 \times 5 = 25}$. We say that the square of 5, or 5 ***squared***, is 25.
The reverse is $\sqrt{25} = \sqrt{5^2} = 5$; we say that the ***square root*** of 25 is 5.

$\mathbf{5^3 = 5 \times 5 \times 5 = 125}$. We say that the cube of 5, or 5 ***cubed***, is 125.
The reverse is $\sqrt[3]{125} = \sqrt[3]{5^3} = 5$; we say that the ***cube root*** of 125 is 5.



Example

a) Find $\sqrt{324}$ using prime factorisation.

b) Find $\sqrt[3]{216}$ using prime factorisation.

Big Idea:

Practice

1. Given that the prime factorisation of 7056 is $2^4 \times 3^2 \times 7^2$, find $\sqrt{7026}$ without using a calculator.
2. Given that the prime factorisation of 125000 is $2^3 \times 5^6$, find $\sqrt[3]{125000}$ without using a calculator.

Classwork

1. (i) Use prime factors to explain why 6×24 is a perfect square.
   (ii) *k* is a non-zero whole number. Given that $6 \times 24 \times k$ is a perfect cube, write down the smallest value of k.
   (iii) *p* and *q* are both prime numbers. Find the values of p and q such that $6 \times 24 \times \frac{p}{q}$ is a perfect cube.

2. Use a calculator to evaluate $\frac{8^2+\sqrt{50}}{7^3-\sqrt[3]{63}}$, leaving your answer correct to 4 decimal places.

Assignment 1B

Textbook: *Shinglee New Syllabus Mathematics (8th Edition) Textbook Secondary 1A*

Basic

- Textbook 1A Exercise 1B (page 15): Questions 1(a), 1(c), 2(a), 2(c), 3(a), 3(c),
- Textbook 1A Exercise 1B (page 15): Questions 4(a), 4(c), 5(a), 5(c), 6

Intermediate

- Textbook 1A Exercise 1B (page 15): Questions 7, 9, 10

Advanced

- Textbook 1A Exercise 1B (page 15): Questions 12, 13

Lesson 3: Highest Common Factor (HCF) and Lowest Common Multiple (LCM)

(I) Highest Common Factor (HCF)

Example 1

Find the Highest Common Factor (HCF) of 30 and 48.

The factors of 30 are ____.

The factors of 48 are ____.

The common factors of 30 and 48 are ___________________________.

Hence, the HCF of 30 and 48 is __________.

Example 2

Find the HCF of 504 and 588.

Should you use the above method? Why?

Classwork

1. Find the HCF of 1080 and 336 using prime factorisation.

2. Find the HCF of 162 and 225. Leave your answer in index notation.

3. Find the HCF of 63, 84 and 231.

(II) Lowest Common Multiple (LCM)

Example 1

Find the Lowest Common Multiple (LCM) of 6 and 10.

The multiples of 6 are ____.

The multiples of 10 are ____.

The common multiples of 6 and 10 are ____________________________.

Hence, the LCM of 6 and 10 is __________.

Example 2

Find the LCM of 1080 and 336.

Should you use the above method? Why?

Classwork

Tier A

1. a) Find the lowest common multiple of 30 and 36.
   b) Find the lowest common multiple of 12, 18, 56.

2. Find the smallest value of n such that the LCM of n and 6 is 24.

Tier B

3. Three different train services arrived at a City Hall MRT interchange at intervals of 4 minutes, 5 minutes and 12 minutes respectively.
   If they arrived together at 1 pm, when will they arrive together again?

4. The highest common factor of two numbers is 56.
The lowest common multiple of these two numbers is 2520. Both numbers are greater than 56. Find the two numbers.

5. It is given that $648 = 2^3 \times 3^4$.
(a) Express 84 as a product of its prime factors.
(b) Hence find smallest value of $\boldsymbol{x}$ such that $648\boldsymbol{x}$ is a multiple of 84.

Tier C

6. A school plans to donate 1400 packs of instant noodles, 350 packets of rice and $700 in cash to the elderly in the neighbourhood. All items to be distributed are packed in gift bags such that there are equal amount of cash in each gift bag.

   (a) How many gift bags are needed?
   (b) Hence, write down the number of packets of rice and the amount of cash in each gift bag.

7. The living room of a 5-room HDB flat measures 620 cm by 540 cm. Find

   (a) the area of the **largest square** tile that can be used to **completely** cover the floor without cutting the tile,
   (b) the total number of such tiles required to cover the floor of the living room.

Assignment 1C

Textbook: *Shinglee New Syllabus Mathematics (8th Edition) Textbook Secondary 1A*

Basic

- Textbook 1A Exercise 1C (page 25): Questions 1(b), 1(d), 3(b), 3(d), 5(b), 5(d), 7(b),
- Textbook 1A Exercise 1C (page 25): Questions 7(d), 8, 10

Intermediate

- Textbook 1A Exercise 1C (page 25): Questions 13, 15, 18, 21, 23

Advanced

- Textbook 1A Exercise 1C (page 25): Questions 26, 27