



# CORNERSTONE JUNIOR SCHOOL - MUKONO

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## P7 MATHEMATICS SELF- STUDY LESSON SET 5

### LESSON 1

#### TOPIC: NUMBER PATTERNS AND SEQUENCE

#### SUB -TOPIC: SQUARE ROOTS OF NUMBERS

#### Learning outcomes:

By the end of the lesson, you should be able to:

- Define the term square root.
- Find the square root of whole numbers and fractions.

#### Introduction

1. A square root is a number that is multiplied by self to get a square number.
2. To get a square root, you need to prime factorize the given numbers, pair the prime factors and pick one from each pair, the prime factors picked are the ones multiplied to get the square root.

#### Examples

1. Find the square root of 81.

#### **Solution**

From the prime factorization table, the bold numbers are the ones picked after pairing.

$$\sqrt{81} = \begin{array}{|c|c|} \hline \mathbf{3} & 81 \\ \hline 3 & 27 \\ \hline \mathbf{3} & 9 \\ \hline 3 & 3 \\ \hline & 1 \\ \hline \end{array}$$

$$\sqrt{81} = 3 \times 3$$

$$= 9.$$

2. Find the square root of  $\frac{1}{16}$ .

Solution

$$\sqrt{\frac{1}{16}} = \frac{1 \times 1}{4 \times 4}$$

$$= \frac{1}{4}$$

3. Find the square root of  $\frac{36}{81}$ .

Solution

- For such a fraction, you need to find the numerator and the denominator.
- However, the given number is not in its simplest form, so that your answer should not be reduced.

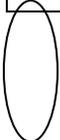
$$\sqrt{36} =$$

<b>2</b>	36
2	18
<b>3</b>	9
3	3
	1

$$\sqrt{36} = 2 \times 3$$

$$= 6$$

<b>3</b>	81
3	27



- For all unit fractions, find the number that should be multiplied by self for both the numerator and the denominator.
- Pick one fraction and that's the square root

$$\sqrt{81} = \sqrt{\begin{array}{|c|c|} \hline 3 & 9 \\ \hline 3 & 3 \\ \hline & 1 \\ \hline \end{array}}$$

$$= 3 \times 3$$

$$= 9$$

$$\sqrt{\frac{36}{81}} = \frac{6}{9}$$

Work to do.

1. Find the square root of the following.

a) 16

g) 0.64

b) 100

h) 0.81

c) 169

k) 0.144

d) 144

l)  $\frac{81}{144}$

e) 256

j)  $2\frac{7}{9}$

2. The area of a square is  $1.44\text{m}^2$ . Find the length of its side.

3. Calculate the perimeter of a square whose area is  $64\text{cm}^2$ .

4. Given that  $k^2 = 144$ . Find the value of k.

## LESSON 2

### TOPIC: NUMBER PATTERNS AND SEQUENCE

### SUB TOPIC: CUBE NUMBERS LEARNING OUTCOMES

By the end of the lesson, you should be able to

- Define a cube number.
- Define a cube root.
- Find the cube root of whole numbers

### Introduction

- A cube number is a number obtained by multiplying a counting number by self-three times.
- A cube root is a number that is multiplied by itself three times to get a cube number.
- For example,  $4 \times 4 \times 4 = 64$ . In such an expression, 4 is the cube root and 64 is the cube number.

### Examples

1. Find the 6<sup>th</sup> cube number

#### Solution

- To find a cube number in any given position, multiply the given position by itself three times.

$$\begin{aligned}6^{\text{th}} \text{ cube no.} &= n \times n \times n \\ &= (6 \times 6) \times 6 \\ &= 36 \times 6 \\ &= 216\end{aligned}$$

2. Find the cube root of 216.

#### Note

- To find the cube root of any given number, you need to prime factorize the given number and group the prime factors in threes.
- Pick one prime factor from each group, multiply them to find the cube root.
- The symbol for cube root is  $\sqrt[3]{\quad}$

$\sqrt[3]{216} =$

2	216
2	108
2	54
3	27
3	9
3	3
	1

$\sqrt[3]{216} = 2 \times 3$   
 $= 6.$

3. The volume of a cube is  $125\text{cm}^3$ . Find the length of its side.

Solution

$S \times S \times S = \text{Volume.}$

$\sqrt[3]{S^3} = \sqrt[3]{125\text{cm}^3}$

$S = 5\text{cm}$

5	125
5	25
5	5
	1

Work to do

1. Set P = { the first 5 cube numbers}. List all elements of set P.
2. Find the 7<sup>th</sup> cube number.
3. Find the sum of the 5<sup>th</sup> cube number and the 10<sup>th</sup> even number.
4. Express the cube number in scientific notation.
5. Find the cube roots of the following numbers.
  - a) 1000
  - b) 373
  - c) 512
  - d) 8
6. Find the length of each side of a cube whose volume is given below.
  - a)  $512\text{cm}^3$

- b)  $1000\text{dm}^3$   
c)  $373\text{m}^3$
7. Given that  $m^3 = 64$ . Find the value of  $m$ .

## LESSON 3

### TOPIC: NUMBER PATTERNS AND SEQUENCE

#### SUB TOPIC: TOPICAL TEST

#### Learning outcome:

By the end of this mixed activity, you should be able to:

- Attempt all possible questions from the topic number patterns and sequence.
- Review the previously taught concepts through revision.
- Identify areas of difficulty in order to be addressed to the teacher.

#### Section A

1. Find the lowest common factor (LCF) of 12 and 15.
2. List all factors of 36.
3. Set  $P = \{\text{multiples of 7 between 21 and 63}\}$ . Find  $n(P)$
4. Without dividing, prove that 3216 is a multiple of 3.
5. Find the greatest common factor (GCF) of 18 and 24.
6. The LCM of two numbers is 72 and their GCF is 6. If the first number is 18, find the second number.
7. Find the least number of pens that can be shared by 12 boys and 18 girls leaving 3 pens remaining.
8. Express 144 as a product of its prime factors.
9. The area of a square is  $64\text{cm}^2$ . Find its perimeter.
10. Find the highest number that can divide 18 and 24 without leaving a remainder.
11. Find the next number in the sequence 1, 2, 6, 15, 31, \_\_\_\_\_
12. The ratio of two numbers is 4:5. If their GCF is 6, find the numbers.
13. Express 64 in powers of 4.

## **Section B**

14. Two guns are fired at an interval of 30min and 40mins respectively. If they were first fired at 11.20 am for the second time, at what time were they fired for the first time.
15. A team of engineers planted 450 electric poles along Mukono-Kayunga road in 3 consecutive days. If they planted 20 more poles than on the previous day,
  - a) How many poles were planted on the first day?
  - b) Express the total number of poles planted on the second and third day in scientific notation.
16. The sum of three consecutive even numbers is 54. If the largest is  $n$ . find the numbers.
17. The volume of a cube is  $512\text{cm}^3$ .
  - a) Find the length of each side.
  - b) Calculate its total surface area.

## **LESSON 4**

### **TOPIC: FRACTIONS (PROPORTION)**

### **SUB TOPIC: PROPORTIONS**

#### **Learning outcome:**

#### **By the end of this lesson, you should be able to:**

- Explain the term proportion.
- Identify three types of proportions
- Work out problems involving direct proportions.

## **Introduction**

- In our day to day life, we have always compared objects in relation to size, shape, colour and we all have a different preference.
- In some instances like shopping, items are priced differently and this leads us in paying different amounts of money depending on the quantities that we may want even when we are to buy the same kind of item.
- Therefore, the relationship of objects in terms of size, shape or colour is what we term as **proportion**.

## **TYPES OF PROPORTION**

- There are mainly four types of proportions. Namely;
  1. Simple / Direct proportion
  2. Inverse / Indirect proportion
  3. Constant proportion
  4. Compound proportion

### **DIRECT PROPORTION**

- In this proportion, an increase in one quantity causes an increase in the other quantity that is being compared.
- Take an example, if you go to the shop to buy a ruler at sh.1000, you discover that when you ask for more rulers, the shopkeeper will ask for more money.
- You need to note that an increase in one quantity causes an increase in another quantity while a decrease in one quantity causes a decrease in another quantity.

### Study the table below

<u>Item (pens)</u>	<u>Quantity</u>	<u>Amount</u>
1 pen	costs	sh.1000
2 pens	cost	Sh. 2000
3 pens	cost	Sh. _____

- From the table above, the more number of pens that you want, the more money you will pay.

### **Points to note**

- We use the unitary method in direct proportion. This means that you need to get the equivalence of one item.
- Put the item that you want to find on the right-hand side.
- In moments when you need to get more within your calculation, you should **multiply**.
- However, when you need less, you are required to **divide**.

### Examples

1. Two books cost. Sh. 4000. What is the cost of 8 such books?

#### Solution

$$\begin{array}{l} \underline{\text{Books}} \qquad \qquad \underline{\text{cost}} \\ 2\text{bks} \qquad = \qquad \text{sh. } 400 \\ 1\text{bk} \qquad \qquad = \qquad \text{sh. } \underline{400} \\ \qquad \qquad \qquad \qquad \qquad 2 \\ \therefore 8\text{bks} \qquad = \qquad \text{sh. } \underline{400} \times 8 \end{array}$$

$$\begin{array}{r} \text{side work} \\ 400 \\ \underline{\quad} \times 4 \\ \underline{1600} \end{array}$$

$$\begin{aligned}
 & 2 \\
 & = \text{sh. } 400 \times 4 \\
 & \underline{\underline{= \text{sh. } 1600}}
 \end{aligned}$$

2. Six books cost shs. 3,600. How many books can one buy with sh.4800?

Soln

$$\text{Cost} = \text{Books}$$

$$\text{Sh. } 3600 = 6\text{bks}$$

$$\text{Sh. } 1 = \underline{6}$$

$$\text{Sh. } 3600$$

$$\therefore \text{Sh. } 600 = \frac{\underline{6-1}}{\text{Sh.}3600} \times \text{sh. } \cancel{42}^{800}$$

$$1$$

$$\underline{\underline{= 8 \text{ books}}}$$

## **EXERCISE**

1. The cost of 4 pens is sh. 800. What is the cost of 6 pens?
2. If 5kg of sugar cost sh. 11,000. What is the cost of 8kg of sugar?
3. A car uses 6 litres of petrol to travel 30km. How many litres does it need to travel 45km?
4. A dozen of pencils cost sh. 1800. Find the cost of 9 pencils.
5. 5 metres of cloth can make 2 shirts. How many metres of cloth are needed to make 8 shirts?
6. 3 shirts cost sh. 33,000, how many shirts will one buy with sh. 22000?
7. 9 plates can cost sh. 3600. How many plates can one buy with 8000?

## LESSON 5

### TOPIC: FRACTIONS (PROPORTION)

#### SUB TOPIC: MORE ON DIRECT PROPORTION

#### Learning outcomes:

#### By the end of the lesson, you should be able to:

- Relate fractions to whole numbers
- Use the unitary method to work out questions with direct proportion.

#### Introduction

- In the previous lesson, we learnt that direct proportion causes an increase in one quantity when the other quantity increases and reverse of decrease also applies.
- In this lesson, we are going to learn how to relate fractions with whole numbers using the unitary method.

#### Example:

1.  $\frac{2}{3}$  of the books in the book, the shop is school textbooks. How many books are in the bookshop altogether if there are 240 school textbooks?

#### Solution

$$\frac{2}{3} = 240 \text{ bks}$$

$$2 \text{ parts} = 240 \text{ bks}$$

$$1 \text{ part} = \frac{240}{2} \text{ bks}$$

$$\frac{2}{2} = 1$$

$$3 \text{ parts} = 120 \text{ bks}$$

$$\begin{array}{r} \underline{\times 3} \\ = \underline{\underline{360 \text{ bks}}} \end{array}$$

- From the given information, the text books in the book shop are only 240 which is  $\frac{2}{3}$  of the books altogether.
- This means that  $\frac{2}{3}$  is equivalent to 240 books.
- The numerator 2 is equated to the available books while the denominator 3 represents the total number of books in the shop altogether.
- However, you need to find out the equivalence of one part as shown in step 3 of example one.
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## Method 2

Let the total number of books be n.

$$\frac{2}{3} \text{ of } n = 240 \text{ bks}$$

$$\frac{2}{3} \times n = 240 \text{ bks}$$

$$\cancel{3} \times \frac{2}{\cancel{3}} \times n = 240 \text{ bks} \times 3$$

$$2n = 240 \times 3 \text{ bks}$$

$$\cancel{2} n = \frac{240}{\cancel{2}} \times 3 \text{ bks}$$

$$\cancel{2}_1 \quad \cancel{2}_1$$

$$n = 120 \times 3 \text{ bks}$$

$$\therefore n = \underline{\underline{360 \text{ bks}}}$$

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- In this approach, we let the total number of be any unknown ie, let the total be n.
  - After forming the equation, find the lowest common denominator (LCD) which is 3 and multiply it on both sides.
  - Follow through by division by dividing 2 on both sides to find the value of n.

## EXERCISE

1.  $\frac{1}{3}$  my salary is sh. 90,000. What is my salary?
2.  $\frac{3}{4}$  of the pupils in the class passed the exams. If 60 pupils passed, how many pupils are in the class?
3.  $\frac{1}{4}$  of the man's salary is spent on drinks, he drinks sh. 12000
  - a) How much is the man's salary?
  - b) What is  $\frac{1}{12}$  of the man's salary?
4.  $\frac{2}{3}$  of the pupils in the class are absent, 15 pupils are present, how many pupils are in the class?

5. In a school, 18000/= is paid for lunch. This is  $\frac{5}{12}$  of the total school fees in a school. What is the total school fee in a school? What is the total school fees that the school charges?

## **LESSON 6**

**TOPIC : FRACTIONS (PROPORTION)**

**SUBTOPIC: INVERSE / INDIRECT PROPORTION**

**Learning outcomes:**

**By the end of this lesson, you should be able to:**

- Work out problems involving in direct proportion.

### **Introduction**

- In inverse or indirect proportion, when one item increases, the other decreases but when one item decreases, the other increases.
- It is so different with direct proportion in a way items relate.
- However, in both proportions, what you are looking for must be put on the right.

### **Examples**

12 men can build a classroom in 5 days. How many men are needed to do the work for 4 days?

### Solution

$$\underline{\text{Day}} = \underline{\text{Men}}$$

$$5 \text{ days} = 12 \text{ men}$$

$$1 \text{ day} = (12 \times 5) \text{ men} \\ = 60 \text{ men}$$

$$\therefore 4 \text{ days} = \cancel{60}^{15} \text{ men} \\ \cancel{4} \\ = \underline{15 \text{ men}}$$

Step 1.

- State the proportion by writing the items you are relating. Remember to write what you are finding on the left.
- Where you need many, you should multiply and where you need an item to decrease, you must divide.
- For example, in order to get the men who can do work in 1 day, you should multiply since you need many men.

a) How many days will 10 men take to do the same job?

Soln

$$\text{Men} = \text{days}$$

$$12 \text{ men} = 5 \text{ days}$$

$$1 \text{ man} = (5 \times 12) \text{ days}$$

$$\therefore 10 \text{ men} = \underline{5 \times 12} \text{ days} \\ 10 \\ = (1 \times 6) \text{ days} \\ = \underline{\underline{6 \text{ days}}}$$

-Follow through example  
one to guide with example  
2.

### EXERCISE

1. 4 men take 9 days to complete a job. How long will 12 men take to finish the job at the same rate?

2. It takes 12 women to dig a shamba in 4 days. How many more days will 8 women take?
3. 25 girls can construct a road in 8 days. How many girls will construct a road in 10 days?
4. A car which travels at a speed of 20km/hr covers a journey in 4 hrs. How long will it take to cover the journey at 16km/hr?
5. 5 men take 6 days to dig a trench. How many more days will 3 men take?  
A Taylor makes 8 shirts a day. How long does he take to make 2 shirts

## **LESSON 7**

**TOPIC: FRACTIONS (PROPORTION)**

**SUBTOPIC: CONSTANT AND COMPOUND PROPORTION**

## Learning outcomes:

### By the end of this lesson, you should be able to:

- Work out problems involving constant proportion.

## Introduction

- While direct proportion involves an increase in both quantities, the constant proportion does not relate in the same way.
- In this proportion, however much you increase one quantity, the other quantity doesn't change.

## Constant Proportion

- The change in one item doesn't affect the other item ie all remain the same.

### Example

20 eggs take 10 minutes to boil. How long will I need to boil 25 eggs?

Take common sense,

25 eggs will take the same time as 20 eggs to boil which is 10 minutes.

$$\begin{aligned}\therefore 48\text{hrs} &= \frac{5 \times 48}{40} \text{ days} \\ &= 1 \times 6 \text{ days}\end{aligned}$$

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$$= \underline{\underline{6 \text{ days}}}$$

## **EXERCISE**

1. 5 people can sing a song in 10 minutes, how long will 15 men take to sing the same song?
2. 25 choir members can sing the National Anthem in 8 minutes, how many minutes will 30 members take to sing the same anthem?
3. 25 girls can construct a road in 8 days. How many girls will construct a road in 10 days?
4. In a school, 18000/= is paid for lunch. This is  $\frac{5}{12}$  of the total school fees in a school. What is the total school fee in a school? What is the total school fees that the school charges?

## **LESSON 8**

**TOPIC:                    FRACTIONS (RATIOS)**

**SUB TOPIC:        QUANTITIES AS RATIOS**

**Learning outcomes:**

**By the end of the lesson you should be able to:**

- Define a ratio
- Express given quantities as ratios
- Simplify given quantities

## Introduction

- A ratio is a comparison of two or more numbers by division. ie divide the first number by the second number.
- Quantities to be compared in ratios must have the same units.
- Ratios are written in their lowest terms without units.

## Examples

1. What is the ratio of 20 minutes to 1 hour?

Soln

$$\begin{aligned} 1 \text{ hr} &= 60 \text{ minutes} \\ &= 20 \text{ min to } 1 \text{ hr} \end{aligned}$$

Since you have different units, first convert the hours to minutes and then divide.

$$\begin{aligned} \text{Fraction} &= \frac{20 \text{ min}}{1 \text{ hr}} \\ &= \frac{20 \text{ min}}{60 \text{ min}} \end{aligned}$$

$$\begin{aligned} &= \frac{2}{6} \\ &= \frac{1}{3} \end{aligned}$$

∴ Ratio = 1:3

Method II

$$1 \text{ hr} = 60 \text{ min}$$

$$\text{Ration} = 20 \text{ min} : 60 \text{ min}$$

$$\frac{20}{60} = \frac{2}{6}$$

$$= \underline{1:3}$$

2. What is ratio of 20cm to 2m?

Soln

$$1\text{m} = 100\text{cm}$$

$$\therefore 2\text{m} = (2 \times 100) \text{ cm}$$

$$= \underline{200\text{cm}}$$

Change the metres to cm in order to have the same units.

$$\text{Fraction} = \frac{20\text{cm}}{2\text{m}}$$

$$= \frac{20\text{cm}}{200\text{cm}}$$

$$= \frac{20}{200}$$

$$= \frac{2}{20}$$

$$= \frac{1}{10}$$

$$= \frac{1}{10}$$

$$= \frac{1}{10}$$

$$= \frac{1}{10}$$

$$= \frac{1}{10}$$

$$= \frac{1}{10}$$

$$\therefore \underline{\text{Ratio} = 1:10}$$

### Activity

1. Find the ratio of the following:

a)  $\frac{1}{2}$  to  $\frac{3}{5}$

b) 20cm to 30cm

c) 40m to 80m

- d) 240 boys to 360 girls
  - e) Sh. 12,000 to sh. 10,000
2. a) 30cm to 2m
- b) 240gm to 15kg
  - c) 14 days to 1 week
  - d) 40 minutes to 1hr.
3. Mary has 60 sweets and James has 20 sweets, what is the ratio of Jame's sweets tp Mary's sweets?

## **LESSON 9**

### **TOPIC: FRACTIONS (RATIOS)**

#### **SUB TOPIC: INCREASE AND DECREASE IN RATIOS**

#### **Learning outcomes:**

**By the end of the lesson you should be able to:**

- Describe the term increase and decrease.
- Increase given quantities
- Decrease given quantities

## 1. INCREASE IN RATIOS

- Increase is the same as add on, rise.
- To increase in a given ratio, change the given ratio to a fraction and multiply by the given quantity.

Example;

Increase 80kg in the ratio 5:4

Solution

$$= \frac{5}{4} \times 80 \text{ kg}$$

$$= 5 \times 20 \text{ kg}$$

$$= \underline{\underline{100 \text{ kg}}}$$

## 2. DECREASE:

Concepts

- The decrease is the same as reduce on, subtract, deduct.
- To decrease in a given ratio, change the given ratio to a fraction and multiply by the given quantity

Example

1. Decrease sh. 20,000 in the ratio 3:5

### Solution

$$= \frac{3}{5} \times \text{sh. } 20,000$$

$$= 3 \times \text{sh. } 4,000$$

$$= \text{sh. } 12,000$$

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### **Activity**

- Increase the following:
  - Sh. 1500 in the ratio 6:5
  - 630 pupils in the ratio 9:7
  - 12cm in the ratio of 4:3
- The price of a ratio was increased in the ratio of 7:5. What is the new price of the ratio if the old price is sh. 20,000.
- My salary was increased in the ratio of 3:2. What is my salary if the old one was sh. 240,000?
- Decrease the following:
  - 2999 goats in the ratio of 3:5
  - Sh. 3600 in the ratio of 5:9
  - Sh. 30,000 in the ratio of 1:2
- Mukasa had 20 oranges if 4 of them were eaten. Find his new number of oranges if a decrease in the ratio of 3:4.
- A woman's salary was decreased in ratio 7:12. If her old salary was sh. 480,000. Find her new salary.

## **LESSON 10**

### **TOPIC: FRACTIONS (RATIOS)**

## SUB TOPIC: FINDING RATIO OF INCREASE AND DECREASE

### Learning outcomes:

By the end of the lesson you should be able to:-

- Find the ratio increase
- Find the ratio decrease
- Use the operations carefully

### FINDING THE RATIO OF INCREASE

#### Concepts

- To get the ratio of increase, divided new quantity by the old quantity since ratios are arranged in the order of new to old.

#### Examples

1. The number of pupils in a school increased from 600 to 800. In what ratio did the number increase?

Soln

New part = 800

Old part = 600

$$\text{Fraction of increase} = \frac{800}{600}$$

$$= \frac{8}{6}$$

$$= \frac{4}{3}$$

∴ Ratio of increase = 4:3

### FINDING THE RATIO OF DECREASE

#### Note

- To get the ratio of decrease, divide the new quantity by the old quantity.

#### Example:

1. A man's salary was decreased from sh. 15000 to sh. 12000. In what ratio did it decrease.

**Soln**

$$\begin{aligned}
 \text{New salary} &= \text{sh. } 12000 \\
 \text{Old salary} &= \text{sh. } 15000 \\
 \text{Fraction of} &= \frac{\text{sh. } 12000}{\text{Sh. } 15000} \\
 &= \frac{\text{sh. } 12000}{\text{Sh. } 15000} \\
 &= \frac{12}{15} \\
 &= \frac{4}{5} \\
 \therefore \text{Ratio of decrease} &= 4:5
 \end{aligned}$$

### Activity

1. Asekenye's earnings now is sh. 300,000, she was earning sh. 250,000. In what ratio has her salary increased?
2. Sh. 108,000 increased to 360,000/=. Find the ratio of increase.
3. In what ratio has the number of pupils increased from 24 pupils to 36 pupils?
4. Mukasa had 20 oranges if 4 of them were eaten, in what ratio were the oranges decreased?
5. In what ratio must 24 be decreased to 20?
6. In what ratio must 30 be decreased to become 24?