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# P.5 MATHEMATICS SELF- STUDY LESSONS SET 2

## LESSON 1

**TOPIC: OPERATIONS ON NUMBERS**
**SUBTOPIC : SUBTRACTION IN BASES**

**LEARNING OUTCOMES:**

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

- Identify the given base.
- Re-group in fives.
- Write the given number in the given base
- Subtract in base five.

### Introduction

- When subtracting numbers in any given base, you need to arrange the given numbers in their rightful place values.
- In case you are to regroup/borrow, remember that it's the base that we regroup.

### Subtracting numbers in base five

**Examples**

1. Subtract: $102_{five}$ - $22_{five}$

| | | | |
|---|---|---|---|
| $\cancel{1}^{0}$ | $\cancel{0}^{5}$ | $2_{five}$ | **2-2 = 0** |
| - | 2 | $2_{five}$ | **0+5 = 5** |
| | 3 | $0_{five}$ | |

2. Subtract : $200_{five}$ - $11_{five}$

| | | | |
|---|---|---|---|
| $\cancel{2}$ 1 | $\cancel{1}^{0\text{-}5}$ | $\cancel{0}^{5}_{five}$ | **0+5 = 5** |
| - | 1 | $1_{five}$ | **0+5 = 5** |
| 1 | 4 | $4_{five}$ | **1- 0 =1** |

3. Workout: 210 – 121

$\cancel{2}^{\,1}$ $\cancel{3}^{\,2}$ $^{7}$ $\cancel{0}^{\,5}_{five}$ 0+5 = 5

- Subtract beginning from ones 2-2=0
- Then subtract from the next place value ie, 0 -2. In this case, zeo is less than 2 and hence you have to regroup/ borrow the base( five) and add it to the small number which is 0. Ie, 0+5 =5.
- Cancel zero and replace it with 5 and then find the difference.
- Answer is $30_{five.}$
- Follow through examples 2 and 3 to guide you in the

- $\underline{1 \quad 4}\ 1_{five}$ $\quad 5 + 2 = 7$

  $\underline{\quad 3 \quad 4}_{five}$ $\quad 1-1 = 0$

**Exercise**
**Subtract**

1. $210_{five} - 22_{five}$
2. $40_{five} - 2_{five}$
3. $221_{five} - 12_{five}$
4. $101_{five} - 22_{five}$
5. $100_{five} - 22_{five}$

## LESSON 2

**TOPIC: OPERATIONS ON NUMBERS**
**SUBTOPIC : ADDITION IN FINITE SYSTEM**

**LEARNING OUTCOMES:**

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

- Identify the given finite.
- Group in fives and sevens
- Add correctly in a given finite or modular system.

## Introduction

- Addition means putting things together to get a single group.
- However, the result you get after addition depends on the system which you are dealing with.

**Adding in finite five and seven**

**Note:**

- Finite system is a system of counting that deals with the remainder.
- It is also called the modular system of counting.
- The basic digits in any given finite are all those whole numbers less than the given finite. E.g. the basic digits in finite 7 are 0, 1, 2, 3, 4, 5, and 6.
- The basic digits in finite 5 are 0, 1, 2, 3, and 4. There fore, if the sum or product you get is greater than the finite, divide the result by the given finite of which you take the remainder as your answer.

-To change a number in any given finite, draw tallies of the given number and group the tallies basing on the give finite i.e., in sevens.

-Unlike in bases where the groups and the remainder are used, in finite system we only focus on the **remainder.**

Examples

1. Express 25 in finite 7.

   ///////  ///////  ///////  ////

   3 groups of sevens remainder 4

   Therefore ; 25 = 4 (finite 7)

2. Add: 4 + 3 = ___ (finite 5)

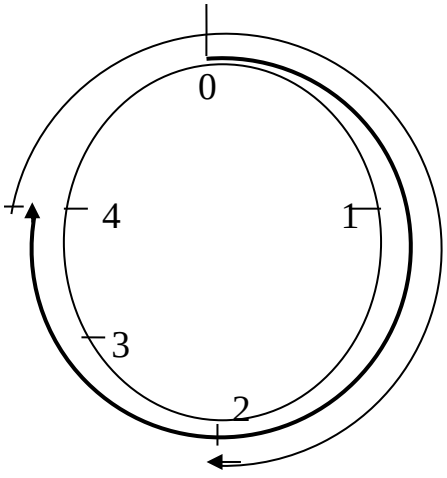
   Method 1

   4 + 3 = ___ (finite 5)

   7 ÷ 5 = 1 rem 2

   4 + 3 = 2 (finite 5)

   Method 2



Therefore; 4 + 4 = 2 (finite 5)

**Activity**
**Work out the following without a dial.**

1. 2 + 3 + 2 = ___ (finite 5)

2. 4 + 2 + 3 = ___ (finite 7)

3. 6 + 3 + 5 = ___ (finite 7)

4. 3 + 3 + 4 = ___ (finite 5)

**Work out the following using a dial**

5. 3 + 6 = ___ (finite 7)

6. 4 + 3 = ___ (finite 5)

7. 6 + 5 = ___ (mod 7)

8. 3 + 4 = ___ (mod 5)

## LESSON 3

**TOPIC : OPERATIONS ON NUMBERS**
**SUBTOPIC : SUBTRACTING IN FINITE 5 AND 7**

**LEARNING OUTCOMES:**

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

- Regroup to get equivalent finite.
- Use a dial to subtract in finite system.
- Subtract the number correctly in finite system.

**Introduction**

- When subtracting in bases, we learnt that when subtracting a small number from a bigger number, you have to regroup/borrow the base**.**
- Similarly in finite system, we regroup/borrow the finite in case you are subtracting a small number from a bigger number.

## Subtracting in finite 5 and 7

Examples

1. Workout : 2 – 4 = ____(finite 5)

   Method 1

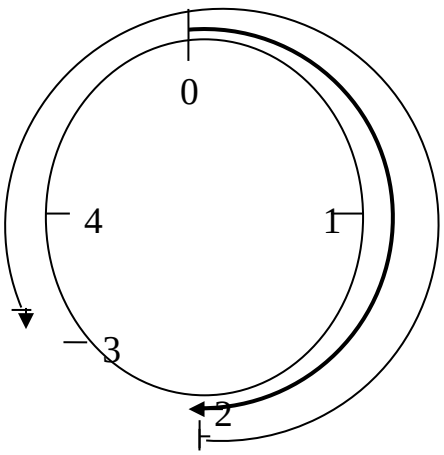
   (2 + 5) – 4 = ___ (finite 5)

   7 – 4 = 3 (finite 5)

   Therefore 2 – 4 = 3 (finite 5)

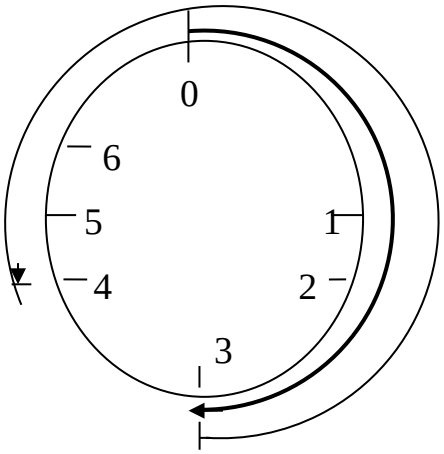
- Since 2 is less than 4, regroup the finite ie, borrow the finite and add it to 2 then subtract as shown in method one.
- Use a dial by moving 2 steps forward then 4 steps backwards.
- Where you stop is the answer.

Method 2



2 – 4 =3 (finite 5)

2. Subtract 3 – 5 = ___ (finite 7) using a dial.




3– 5 = 5(finite 7)

3. Work out. 4 – 6 = ___ (finite 7)

   4 + 7 – 6 = ___ (finite 7)

   11 – 6 = 5 (finite 7)

   4 – 6 = 5 (finite 7)

**Activity**

**Workout the following without a dial**

1. 2 – 3 = _____(finite 5)
2. 3 – 4 = _____(finite 5)
3. 3 – 6 = _____(finite 7)
4. 5 – 8 = _____(finite 7
5. 4 – 3 = _____(finite 5)

**Use a dial to work out the following**

6. 2 – 4 = _____(finite 5)

7. 3 – 5 = _____(finite 7)

8. 5 – 6 = _____(finite 7)

## LESSON 4

**TOPIC : NUMBER PATTERNS AND SEQUENCES**

**SUBTOPIC : DIVISIBILITY TEST FOR 2, 3 AND 5**

**LEARNING OUTCOMES:**

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

- Test divisibility of different numbers.
- Find when to divide a number by 2, 3, 5 without leaving a remainder.
- Apply the divisibility tests

**Introduction**

- Sometimes you wonder whether you can divide a number by another number without leaving a remainder.
- This can easily be done if you have the knowledge of divisibility tests.
- With divisibility tests, you study the number and draw a conclusion without making any division.

**Note:**

**<u>Divisibility tests for 2,3,5</u>**

- A number is exactly divisible by 2 when the last digit is either 0, 2,4,6,8.
- A number is exactly divisible by 3 when the sum of its digits is a multiple of 3.

Example

1. Without dividing, prove that 321 is exactly divisible by 3.

   Solution

   321 = 3 + 2 + 1

   = 6.

   There fore, 321 is exactly divisible by 3 since the sum of its digits is a multiple of 3.

- A number is exactly divisible by 5 when its last digit is either 0 or 5.
- A number is exactly divisible by 10 when the last digit of that number is zero.

**Activity**

A: circle the numbers that are divisible by 2

1. 20, 55, 66, 73, 84, 41
2. 63, 74, 55, 65, 63, 80

B: Circle the number that is divisible by 3.

3. 147, 99, 67. 14, 190, 20
4. 20, 40, 56, 72, 42, 10

C: Circle the numbers that are divisible by 5.

5. 61, 60, 25, 43, 75, 17, 12, 20, 13
6. 120, 123, 142, 165, 183

## LESSON 5

**TOPIC: NUMBER PATTERNS AND SEQUENCES**
**SUBTOPIC: FINDING PRIME NUMBERS**

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

- Use prime factors
- List prime numbers
- Complete sequences that need usage of prime numbers.

**Introduction**

- In this lesson, we are learning about the different types of numbers and specifically prime numbers.
- Numbers are grouped into types basing the common properties they contain.

**Finding prime numbers**

- Prime numbers are numbers that have got two factors one and itself. Study the table below.

| **Number** | **Factors** | **Type.** |
|---|---|---|
| 1 | { 1} | Not prime |
| 2 | { 1, 2} | Prime no. |
| 3 | { 1, 3 } | Prime no. |
| 4 | { 1, 2, 4} | Composite no. |
| 5 | { 1, 5} | Prime no. |
| 6 | { 1, 2, 3, 6 } | Composite no. |
| 7 | { 1, 7 } | Prime no. |

- Therefore prime numbers include 2, 3, 5, 7, 11, 13, 17, 19.. etc.
- One is not a prime number since it has only one factor.

Examples

1. Write elements in a set of prime numbers between 10 and 40
   Steps
- Write the counting numbers between 10 and 40.
- Cancel all multiples of 2, 3, 5, 7 and 11 except the numbers themselves.
- All numbers cancelled are composite numbers since they have more than one factor while the remaining numbers are the prime numbers.

~~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~~ ~~29~~

11, 13, 17, 19, 23, 29, 31, 37

2. Given that set T = {prime numbers less than 20}
   List all elements of set T.
   Solution

~~0~~ ~~1~~ ~~2~~ 3 ~~4~~ 5 ~~6~~ ~~7~~ ~~8~~ ~~9~~ ~~10~~

11 ~~12~~ 13 ~~14~~ ~~15~~ ~~16~~ 17 ~~18~~ 19 ~~20~~

T = { 2, 3, 5, 7, 11, 13, 17, 19}

If set Y = {Prime numbers between 90 and 100}.

a) List all elements of set Y.

b) Find n(Y)

Y = ~~90~~, ~~91~~, ~~92~~, ~~94~~, ~~95~~, 96, ~~97~~, ~~98~~, ~~99~~, 100

Y = {97}

n(Y) = 1

**Activity**

1. Given that Y = {prime numbers between 30 and 40}. Find n(Y).
2. How many prime numbers are there between 20 and 30?
3. Given that set N = {prime numbers less than 20}
    a. List all elements of set N.
    b. Find n(N)
4. Set T is a set of prime numbers between 10 and 20. List them.

## LESSON 6

**TOPIC : NUMBER PATTERNS AND SEQUENCES**

**SUBTOPIC : PRIME FACTORIZATION**

**LEARNING OUTCOMES:**

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

- Use prime numbers to factorize given numbers.
- Uses prime factors to break down big numbers.

**Introduction**

- In mathematics, division of numbers can be instructed in a particular way.
- You can be instructed to divide numbers using prime numbers and this is known as prime factorization.

**Prime factorization**

- Prime factorization is a way of dividing numbers using prime factors.
- There are two methods used to prime factorize numbers i.e.
    - Ladder method

- Factor tree method.

- The prime factors used can be expressed in three ways i.e.
  - Set notation or subscript form
  - Power/ exponent/ index form
  - Multiplication form.

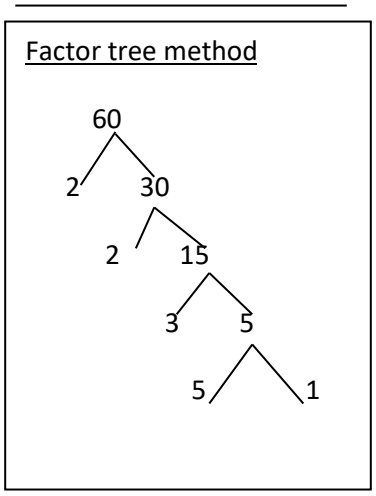
Examples

1. Find the prime factors of 60 and represent your answers in
   a. Subscript / set notation
   b. Multiplication form
   c. Power form

   Solution.

   Ladder method.

| | |
|---|---|
| 2 | 60 |
| 2 | 30 |
| 3 | 15 |
| 5 | 5 |
| | 1 |




**Set notation/subscript form**

- Inset notation, small numbers called subscripts are written at the base of the prime factors to show the position of the prime factors during prime factorization

  $F_{60} = \{2_1, 2_2, 3_1, 5_1\}$

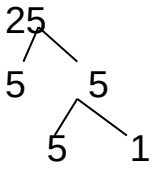
**Multiplication form**

- In multiplication form, prime factors are simply multiplied after prime factorization.
- To express numbers in multiplication form is the same as expressing the given number as a product of its prime factors.
  $F_{60} = 2 \times 2 \times 3 \times 5$

**Power/ exponent/ index form.**

- In this form, small numbers are written on the top right-hand corner of the prime factors.
- Powers indicate the number of times the prime factor has been used during prime factorization.
  $F_{60} = 2^2 \times 3^1 \times 5^1$

2. Prime factorize 25




Set notation

$F_{25} = \{5_1, 5_2\}$

Multiplication form

$F_{25} = 5 \times 5$

Power form

$F_{25} = 5^2$

**Activity**

Prime factorize the numbers and answer as instructed in the brackets

1. 4 (in set notation)
2. 6 (in multiplication form)
3. 9 ( in subscript form)
4. 15 ( in multiplication form)
5. 27 ( in multiplication form)
6. 40 ( in set notation)
7. 72 ( in subscript form)

## LESSON 7

**TOPIC: NUMBER PATTERNS AND SEQUENCES**
**SUBTOPIC: FINDING FACTORS OF NUMBERS**
**LEARNING OUTCOMES:**

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

- Find the factors of the given numbers.
- Divide the given numbers to get factors of a number
- Find the number of factors.

## Finding factors of numbers

- A factor is a number that divides another number an exact number of times.
- Factors are numbers multiplied to get a multiple. i.e., 3 x 4 = 12: in such an expression, 3 and 4 are factors while 12 is a multiple or product.
- The lowest common factor (L. C. F) of all numbers is one.
- The greatest common factor (G.C.F) of numbers is obtained by comparing the set of factors of two or more numbers.
- The greatest common factor is also known as the highest common factor (H.C.F) or the greatest common divisor (G.C.D).
- Common factors are obtained by comparing a set of factors that appear in two or more sets of factors.

Examples

1. List all factors of 12?

1 x 12 = 12

2 x 6 = 12

3 x 4 = 12

$F_{12}$ = {1, 2, 3, 4, 6, 12}

- To find factors by multiplication, you need to identify all numbers that should be multiplied to get the given number as shown in example one.

2. Find all the factors 144

**Method 1**

**Here we …….**

$\frac{144}{2}$ = 72

$\frac{144}{3}$ = 48

$\frac{144}{4}$ = 36

$\frac{144}{6}$ = 24

$\frac{144}{8}$ = 18

$\frac{144}{12}$ = 12

**Method 2**

1 x 144 = 144

2 x 72 = 144

1 x 48 = 144

4 x 36 = 144

6 x 24 = 144

8 x 18 = 144

12 x 12 = 144

$F_{144}$

={1,2,3,4,6,8,12,18,24,36,48,72,144}

**Activity**

**A**: List all factors of the following

1. 4
2. 9
3. 16
4. 36
5. 64

**B**: Find the number of factors of the following

6. 13
7. 19
8. 67

9. 3

10. 7

## LESSON 8

**TOPIC: NUMBER PATTERNS AND SEQUENCES**
**SUBTOPIC: FINDING THE GREATEST COMMON FACTOR (G C F) AND LOWEST COMMON FACTOR (L. C .F)**

**LEARNING OUTCOMES**

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

- Lists the factors of given numbers
- Identify the common factors
- List the GCF and LCF from the common factors.

## Introduction

- In the previous lesson, we learnt how to find factors of numbers.
- When comparing factors of two numbers, we can identify the common factors, lowest common factors and the greatest common factor.

## Finding GCF & LCF

- GCF is Greatest Common Factor
- LCF is Lowest Common Factor

- In order to conclude correctly, compare the two sets of factors to find the common factors, lowest common factors and the greatest common factor.

Examples

1. a) List all the factors of 12 and 15

$F_{12}$ = 1 x 12

2 x 6

3 x 4

$F_{12}$ = {**1**, 2, **3**, 4, 6, 12}

$F_{15}$ = 1 x 15

= 3 x 15

$F_{15}$ ={1**, 3**, 15}

Find the common factors of 12 and 15.

Solution

$F_{12}$ = {(1), 2 ,(3), 4, 6, 12}

$F_{15}$ = {(1), (3) , 15}

C.F = { 1, 3}

c) Find the lowest common factor of 12 and 15.

F12 = {(1) , 2, (3), 4, 6, 12}

F15 = {(1) , (3), 15}

C.F = { 1, 3}

L. C. F = 1

e) Find the highest common factor (H.C.F) OF 12 and 15

F12 = { (1), 2, (3), 4, 6, 12}

F15 = { (1), (3), 15}

C.F = { 1, 3}

H. C. F = 3

**Activity**

Find the factors, Common factors, GCF and LCF of the following

1. 6 and 9
2. 12 and 18
3. 12 and 24
4. 18 and 28
5. 30 and 45
6. 72 and 60

## LESSON 9

**TOPIC: NUMBER PATTERNS AND SEQUENCES**

**SUBTOPIC : FINDING GCF / HCF BY PRIME FACTORIZING**

**LEARNING OUTCOMES**

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

- Prime factorize the given numbers
- Multiply the common prime factors
- Identify the GCF/HCF after prime factorization

**Introduction**

- In order to find the H.CF by prime factorizing, you need to find the prime factor that can divide the given numbers at the same time.
- In case you reach a step where you don't have a common factor, stop at that level and multiply the prime actors used.

**Finding GCF / HCF by prime factorizing**

Examples

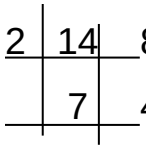
1. Find GCF of 12 and 18

| | | |
|---|---|---|
| 2 | 12 | 18 |
| 3 | 6 | 9 |
| | 2 | 3 |

G.C.F = 2 x 3

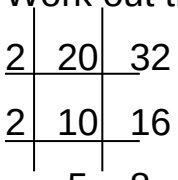
= 6

2. Find the GCF of 14 and 8




GCF = 2

3. Work out the HCF of 20 and 32




GCF =2 x 2

=4

**Activity**

Find the GCF of the following by prime factorizing

1. 4 and 12
2. 20 and 25
3. 20 and 30
4. 30 and 40
5. 36 and 48
6. 40 and 45
7. 15 and 18
8. 15 and 30

## LESSON 10

**TOPIC: NUMBER PATTERNS AND SEQUENCES**

**SUBTOPIC : FINDING LCM USING MULTIPLES**

**LEARNING OUTCOMES**

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

- Find the multiples of given numbers
- State the common multiples
- Identify the Lowest Common multiples

### Introduction

- A multiple is a result obtained by multiplying two numbers.
- The lowest common multiple is obtained by comparing a set of multiples of two or more numbers.
- Let's remind ourselves by reciting table 5, 6, 7, 8, and 9.
- The tables you have recited have many common multiples but the least common multiple is the L.C.M

### Finding LCM using multiples

### Steps

- List at least the first 8 multiples of the given numbers.
- Identify the common multiples.
- Find the lowest common multiple and that will be the .L.C.M

Examples

1. Find the least common multiple of 4 and 3

   $M_4$ = ( 4, 8, (12), 16, 20, (24), 28, 32, ___)

   $M_3$ = (3, 6, 9, (12), 15, 18, 21, (24), ____)

   Common factors = (12, 24, )

   Therefore LCM of 4 and 3 = 12

2. Find the LCM of 12 and 18

   $M_{12}$ = ( 12, 24, (36), 48, 60, 72, 84, ___ )

   $M_{18}$ = ((36), 54, 72, 90, 108, 126, ____)

   Com= (36, ___)

   Therefore LCM of 12 and 18= 36

3. Find the LCM of 8 and 16

   $M_8$ = ( 8, (16), 24, (32), 40, (48), 56, (64), ___)

   $M_{16}$ = ((16), (32), (48), (64), 80, ____)

   Common factors= (16, 32, 48, 64, ___)

   Therefore LCM of 8 and 16 = 16

**Activity**

Find the lowest common multiples of the following numbers

1. 10 and 20
2. 5 and 10
3. 15 and 30
4. 12 and 36
5. 12 and 15

6. 16 and 20
7. 60 and 45