Free Quality School Education

Ministry of Basic and Senior Secondary Education

Pupils' handbook for

JSS Mathematics

JSS 1

Term 1

STRICTLY NOT FOR SALE

FOREWORD

The production of Teachers' Guides and Pupils' handbooks in respect of English and Mathematics for Junior Secondary Schools (JSSs) in Sierra Leone is an innovation. This would undoubtedly lead to improvement in the performance of pupils in the Basic Education Certificate Examination in these subjects. As Minister of Basic and Senior Secondary Education, I am pleased with this development in the educational sector.

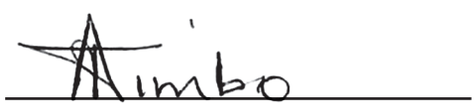
The Teachers' Guides give teachers the support they need to utilize appropriate pedagogical skills to teach; and the Pupils' Handbooks are designed to support self-study by the pupils, and to give them additional opportunities to learn independently.

These Teachers' Guides and Pupils' Handbooks had been written by experienced Sierra Leonean and international educators. They have been reviewed by officials of my Ministry to ensure that they meet specific needs of the Sierra Leonean population.

I call on the teachers and pupils across the country to make the best use of these educational resources.

This is just the start of educational transformation in Sierra Leone as pronounced by His Excellency, the President of the Republic of Sierra Leone, Brigadier Rtd. Julius Maada Bio. I am committed to continue to strive for the changes that will make our country stronger and better.

I do thank the Department for International Development (DFID) for their continued support. Finally, I also thank the teachers of our country - for their hard work in securing our future.



Mr. Alpha Osman Timbo
Minister of Basic and Senior Secondary Education

The Ministry of Basic and Senior Secondary Education, Sierra Leone, policy stipulates that every printed book should have a lifespan of 3 years.

To achieve this DO NOT WRITE IN THE BOOKS.

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Introduction

to the Pupils' Handbook

These practice activities are aligned to the lesson plans in the Teachers' Guide, and are based on the National Curriculum and the West Africa Examination Council syllabus guidelines. They meet the requirements established by the Ministry of Education, Science and Technology.

1. The practice activities will not take the whole term, so use any extra time to revise material or re-do activities where you made mistakes.
2. Use other textbooks or resources to help you learn better and practise what you have learned in the lessons.
3. Read the questions carefully before answering them. After completing the practice activities, check your answers using the answer key at the end of the book.
4. Make sure you understand the learning outcomes for the practice activities and check to see that you have achieved them. Each lesson plan shows these using the symbol to the right.
5. Organise yourself so that you have enough time to complete all of the practice activities. If there is time, quickly revise what you learned in the lesson before starting the practice activities. If it is taking you too long to complete the activities, you may need more practice on that particular topic.
6. Seek help from your teacher or your peers if you are having trouble completing the practice activities independently.
7. Make sure you write the answers in your exercise book in a clear and systematic way so that your teacher can check your work and you can refer back to it when you prepare for examinations.
8. Congratulate yourself when you get questions right! Do not worry if you do not get the right answer – ask for help and continue practising!

Learning Outcomes

Lesson Title: Concept and Vocabulary of Factors	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-001	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify factors of given numbers.

Overview

Factors are the numbers that divide another number. In other words, they go into another number without a remainder. A number can have many factors.

For example, the factors of 50 are 1, 2, 5, 10, 25, 50. The factors of 50 can be multiplied to get 50:

$1 \times 50 = 50$ $2 \times 25 = 50$ $5 \times 10 = 50$

When 50 is divided by any of its factors, the result is a whole number answer. For example:

$50 \div 1 = 50$ $50 \div 2 = 25$ $50 \div 10 = 5$

Try to recall the factors of numbers from memory. If needed, a multiplication table can be used to identify the factors. For example, find each 50 that occurs in the multiplication table and find its factors at the start of the column and row.

Solved Examples

1. Find the factors of the following numbers:
   a. 34 b. 13 c. 30 d. 28 e. 64

   Solutions

   Consider each number, and list all of its factors.

   a. Factors of 34: 1, 2, 17, 34
   b. Factors of 13: 1, 13
   c. Factors of 30: 1, 2, 3, 5, 6, 10, 15, 30
   d. Factors of 28: 1, 2, 4, 7, 14, 28
   e. Factors of 64: 1, 2, 4, 8, 16, 32, 64

2. Consider the number 100.
   a. List all of its factors.
   b. Identify each factor that is an odd number.
   c. Identify each factor that is a prime number.

Solutions

a. Factors of 100: 1, 2, 4, 5, 10, 20, 25, 50, 100
b. Recall that odd numbers are not divisible by 2. They end in 1, 3, 5, 7, or 9. Factors of 100 that are odd numbers: 1, 5, 25.
c. Recall that prime numbers can only be divided by 1 and themselves. In other words, they have 2 factors. 1 is not a prime number.
   Factors of 100 that are prime numbers: 2, 5.

3. Which number has more factors, 24 or 32?

Solution

First, list the factors of both numbers:

24: 1, 2, 3, 4, 6, 8, 12, 24

32: 1, 2, 4, 8, 16, 32

24 has 8 factors, while 32 only has 6. The answer is 24.

Practice

1. Find the factors of the following numbers:
   a. 22 b. 36 c. 29 d. 120
2. Which number has more factors, 60 or 80?
3. Which number has more factors, 16 or 18?
4. Consider the number 90.
   a. List all of its factors.
   b. Identify each factor that is an even number.
   c. Identify each factor that is a prime number.

Lesson Title: Multiples of Whole Numbers	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-002	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify multiples of given numbers.

Overview

A multiple of a given number can be divided exactly by that number. It is a number you get when you multiply a given number by any other whole number.

For example, the first five multiples of 3 are 3, 6, 9, 12, 15. Multiples of 3 can be found by multiplying 3 by whole numbers:

$3 \times 1 = 3$ $3 \times 2 = 6$ $3 \times 3 = 9$ $3 \times 4 = 12$ $3 \times 5 = 15$

The following are facts about multiples:

- Each number is a multiple of itself.
- Every number is a multiple of 1.
- A multiple of a number cannot be less than the number.
- The list of multiples of any number is infinite, meaning it can continue on and on.

Note that the multiples of a number are the same numbers that you find when skip counting by that number. In other words, you may add the number to find the next multiple.

Try to recall the multiples of numbers from memory. If needed, a multiplication table can be used to identify the multiples. For example, find the row or column for 3 in a multiplication table. Each number in that row or column is a multiple of 3.

Solved Examples

1. Find the first 5 multiples of the following numbers:
   a. 2
   b. 5
   c. 10

   Solutions

   These multiples can be found by simply skip counting:

   a. Multiples of 2: 2, 4, 6, 8, 10

b. Multiples of 5: 5, 10, 15, 20, 25
c. Multiplies of 10: 10, 20, 30, 40, 50

2. Find the first 5 multiples of the following numbers:
   a. 15
   b. 30

Solutions

In these examples, it may be difficult to skip count. You may multiply or add to find the multiples. Both methods are shown below.

a. **Method 1. Multiply** 15 by the numbers 1 through 5 to find the first 5 multiples:

$15 \times 1 = 15$ $15 \times 2 = 30$ $15 \times 3 = 45$ $15 \times 4 = 60$ $15 \times 5 = 75$

Method 2. Add 15 to find each multiple:

$$15$$
$$15 + 15 = 30$$
$$30 + 15 = 45$$
$$45 + 15 = 60$$
$$60 + 15 = 75$$

Answer: 15, 30, 45, 60, 75

b. **Method 1. Multiply** 30 by the numbers 1 through 5 to find the first 5 multiples:

$30 \times 1 = 30$ $30 \times 2 = 60$ $30 \times 3 = 90$ $30 \times 4 = 120$ $30 \times 5 = 150$

Method 2. Add 30 to find each multiple:

$$30$$
$$30 + 30 = 60$$
$$60 + 30 = 90$$
$$90 + 30 = 120$$
$$120 + 30 = 150$$

Answer: 30, 60, 90, 120, 150

3. Circle the numbers that are multiples of 9:

3 9 19 27 45 49 81 89 90 100 900

Solution

Try to recall the multiples of 9 from memory. If needed, use a multiplication table or write them down in a list. The first 12 multiples of 9 are: 9, 18, 27, 36, 45, 54, 63, 72, 81, 90, 99, 108.

Note that 900 is a multiple of 9 because $9 \times 100 = 900$.

Answer: 3 (9) 19 (27) (45) 49 (81) 89 (90) 100 (900)

4. Write down all multiples of 8 greater than 20 but less than 50.

   Solution
   Recall the multiples of 8: 8, 16, 24, 32, 40, 48, 56, 64, and so on.
   Multiples greater than 20 but less than 50 are: 24, 32, 40, 48.

Practice

1. Find the first 5 multiples of the following numbers:
   a. 6
   b. 7
   c. 25
   d. 40
2. Write down all multiples of 3 greater than 20 but less than 40.
3. Circle the numbers that are multiples of 4:
   1 4 8 14 18 20 24 28 34 40 44 400
4. Write down the multiples of 25 greater than 50 but less than 160.

Lesson Title: Prime Factors of Whole Numbers Greater than 20	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-003	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to find prime factors of whole numbers between 20 and 50.

Overview

Recall that factors are numbers that divide other numbers exactly. The factors of a number that are also prime numbers are referred to as **prime factors**.

Recall that a prime number is a number with only 2 factors: 1 and itself. Remember that 1 is not a prime number.

Solved Examples

1. Identify the prime factors of the following numbers:
    a. 6
    b. 15
    c. 21
    d. 32

Solutions

List the factors of each number, and identify the prime numbers among them. You may circle the prime factors as you identify them.

a. Factors of 6: 1, ②, ③, 6
   Prime factors of 6: 2 and 3

b. Factors of 15: 1, ③, ⑤, 15
   Prime factors of 15: 3 and 5

c. Factors of 21: 1, ③, ⑦, 21
   Prime factors of 21: 3 and 7

d. Factors of 32: 1, ②, 4, 8, 16, 32
   Prime factors of 32: 2

2. Complete the table below. Complete the second column by writing down all of the factors of each number. Complete the third column by writing down the prime factors.

Numbers	Factors	Prime factors
24		
29		
30		
42		

Solutions

Numbers	Factors	Prime factors
24	1, 2, 3, 4, 6, 8, 12, 24	2, 3
29	1, 29	29
30	1, 2, 3, 5, 6, 10, 15, 30	2, 3, 5
42	1, 2, 3, 6, 7, 14, 21, 42	2, 3, 7

Practice

1. Identify the prime factors of the following numbers:
    a. 17
    b. 22
    c. 31
    d. 46

2. Complete the table below.

Numbers	Factors	Prime factors
23		
34		
40		
50		

3. List all the prime numbers between 30 and 50.

Lesson Title: Common Factors	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-004	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify common factors of given numbers.

Overview

If two numbers have a factor that is the same, that factor is a common factor of the numbers. For example, consider the factors of 9 and 12:

9: 1, 3, 9

12: 1, 2, 3, 4, 6, 12

The numbers 1 and 3 are in both lists. Therefore, 1 and 3 are common factors of 9 and 12.

All numbers have a common factor of 1.

Solved Examples

1. Find the common factors of the following sets of numbers:
   a. 6 and 15
   b. 24 and 32
   c. 12 and 60
   d. 20 and 100

Solutions

List the factors of each number, and identify the ones in common. You may circle the common factors as you identify them.

a. Factors of 6: ①, 2, ③, 6
   Factors of 15: ①, ③, 5, 15
   Common factors of 6 and 15: 1, 3

b. Factors of 24: ①, ②, 3, ④, 6, ⑧, 12, 24
   Factors of 32: ①, ②, ④, ⑧, 16, 32
   Common factors of 24 and 32: 1, 2, 4, 8

c. Factors of 12: ①, ②, ③, ④, ⑥, ⑫
   Factors of 60: ①, ②, ③, ④, 5, ⑥, 10, ⑫, 15, 20, 30, 60

Common factors of 12 and 60: 1, 2, 3, 4, 6, 12

d. Factors of 20: ①, ②, ④, ⑤, ⑩, ⑳
Factors of 100: ①, ②, ④, ⑤, ⑩, ⑳, 25, 50, 100
Common factors of 20 and 100: 1, 2, 4, 5, 10, 20

2. List the factors of the following 3 numbers: 6, 12, and 15. Identify all of the factors common to all 3 numbers.

Solution

First, list the factors of each number:

6: 1, 2, 3, 6
12: 1, 2, 3, 4, 6, 12
15: 1, 3, 5, 15

1 and 3 are common factors of all 3 numbers.

Practice

1. Find the common factors of the following sets of numbers:
   a. 6 and 20
   b. 8 and 28
   c. 12 and 48
   d. 15 and 50
2. Identify all common factors of the 3 numbers: 12, 18, and 32.
3. Consider the numbers 24 and 36.
   a. List the factors of each number.
   b. Identify the common factors.
   c. Which common factor is the greatest number?

Lesson Title: Highest Common Factors (HCF)	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-005	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify highest common factors of given numbers.

Overview

The HCF of two (or more) numbers is the largest number that divides evenly into both numbers. HCF is the largest of all the common factors. For example, factors of 6 are 1, 2, 3, and 6. Factors of 9 are 1, 3, and 9. Common factors of 6 and 9 are 1 and 3. Since 3 is the bigger of the common factors, it is the HCF of 6 and 9

It is very easy to find the HCF of small numbers like 6 and 9. To find the HCF of big numbers, we use the factor tree.

Follow these steps to use the factor tree method to find the HCF of numbers:

1. Write down the numbers
2. Underneath, multiply any two numbers to get the number at the top.
3. Continue multiplying until you don't have any composite numbers. When you come to a prime number, the branch stops there.
4. Circle the prime factors that the two numbers have in common. These are found at the ends of the branches.
5. Multiply the common prime factors between the two numbers to get the HCF.

Solved Examples

1. Find the highest common factor (HCF) of the following numbers:
   a. 6 and 15
   b. 24 and 32

   Solutions

   For small numbers, we can find the HCF by simply listing the factors and finding the highest common factor in the lists.

   a. Factors of 6: 1, 2, ③, 6
      Factors of 15: 1, ③, 5, 15
      HCF: 3

b. Factors of 24: 1, 2, 3, 4, 6, ⑧, 12, 24
Factors of 32: 1, 2, 4, ⑧, 16, 32
HCF: 8

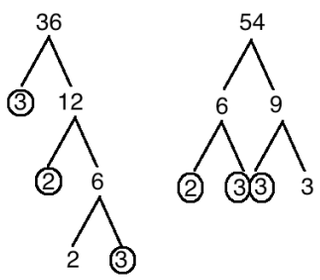
2. Find the HCF of the following numbers:

a. 36 and 54
b. 75 and 90

Solutions

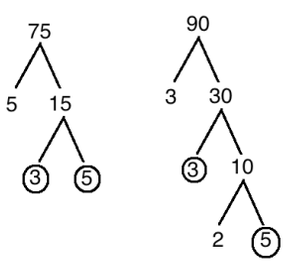
For larger numbers such as these, solve using a factor tree. Follow the steps given in the overview.

a. 36 and 54: Draw the factor trees and circle the common prime factors. Note that there are many ways to draw a factor tree. For example, consider 36. In 3 and 12 are multiplied to get 36. Other factors could have been multiplied here (for example, 4×9).



Multiply the common prime factors: $2 \times 3 \times 3 = 18$
The HCF of 36 and 54 is 18.

b. 75 and 90:



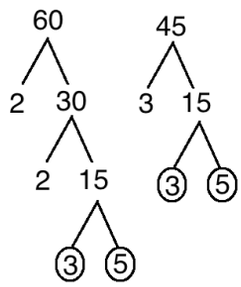
Multiply the common prime factors: $3 \times 5 = 15$
The HCF of 75 and 90 is 15.

3. Find the HCF of the following numbers:
a. 60 and 45

b. 90 and 72

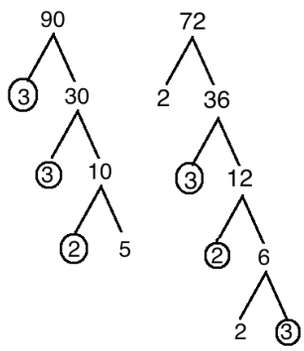
Solutions

a. Since 60 and 45 are large numbers, use the factor tree method in example 2 above:



Multiply the common prime factor: $3 \times 5 = 15$
The HCF of 60 and 45 is 15.

b. Use the factor tree method:

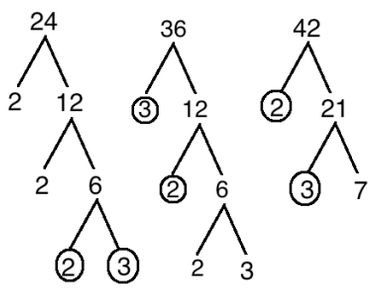


Multiply the common prime factors: $3 \times 3 \times 2 = 18$
The HCF of 90 and 72 is 18.

4. Find the HCF of 24,36 and 42

Solution

Use the factor tree as explained in problem 2 above for all the 3 numbers.



Multiply the common prime factors: $2 \times 3 = 6$

The HCF of 24, 36 and 42 is 6.

Practice

1. Find the HCF of the following numbers:
    a. 8 and 12
    b. 5 and 20
2. Find the HCF of the following numbers using a factor tree:
    a. 48 and 60
    b. 56 and 84
    c. 36 and 54
3. Find the HCF of 54, 72, and 90.

Lesson Title: Common Multiples	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-006	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify common multiples of given numbers.

Overview

If two numbers have a multiple that is the same, that number is a common multiple of the numbers. For example, consider the first 10 multiples of 3 and 5:

3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30

5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50

The numbers 15 and 30 are in both lists. Therefore, 15 and 30 are common multiples of 3 and 5.

Solved Examples

1. List the first 10 multiples of 4 and 6. Circle all of the common multiples you can identify.

   Solution

   First, list the multiples of each number. Then, identify the numbers that are the same in both lists. Circle them.

   4: 4, 8, (12), 16, 20, (24), 28, 32, (36), 40

   6: 6, (12), 18, (24), 30, (36), 42, 48, 54, 60

   The first 3 common multiples of 4 and 6 are 12, 24, and 36.

2. Identify the first common multiple of 9 and 15.

   Solution

   List the multiples of 9 and 15 until you find a multiple that is the same. This is the first common multiple.

   9: 9, 18, 27, 36, 45, 54, 63, 72, 81, **90**

   15: 15, 30, 45, 60, 75, **90**

   The first common multiple of 9 and 15 is 90. This is also called the lowest common multiple, and is covered in the next lesson.

3. Identify the first 3 common multiples of 2 and 3.

   Solution

   List the multiples of 2 and 3 until you find 3 multiples that are the same. These are the first 3 common multiples.

   2: 2, 4, **6**, 8, 10, **12**, 14, 16, **18**
   3: 3, **6**, 9, **12**, 15, **18**

   The first 3 common multiples of 2 and 3 are 6, 12, and 18.

Practice

1. List the first 10 multiples of 8 and 10. Circle all of the common multiples you can identify.
2. Find the first common multiple of 3 and 8.
3. Find the first 3 common multiples of 5 and 6.
4. Find the first 5 common multiples of 4 and 8.

Lesson Title: Lowest Common Multiples (LCM)	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-007	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify the lowest common multiples of given numbers.

Overview

The lowest common multiple (LCM) of two (or more) numbers is the smallest number that is a common multiple of the numbers.

It is very easy to find the LCM of small numbers like 2 and 3. We can simply list the multiples until we find the first one. To find the LCM of larger numbers, we use the factor tree.

Follow these steps to use the factor tree method to find the LCM of numbers:

1. Find the prime factorisation of each number using a factor tree (as in lesson M-07-005). Continue factoring until each branch ends.
2. Identify and list all of the prime factors from both factor trees. List each prime factor the maximum number of times it appears in one tree.
3. Multiply the numbers in your list.

Solved Examples

1. Find the lowest common multiple (LCM) of the following numbers:
    a. 3 and 4
    b. 2 and 5

    Solutions

    For small numbers, we can find the LCM by simply listing the multiples and identifying the first (lowest) one.

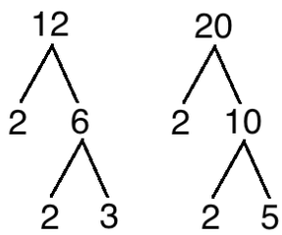
    a. Multiples of 3: 3, 6, 9, ⑫
    Multiples of 4: 4, 8, ⑫
    LCM: 12
    b. Multiples of 2: 2, 4, 6, 8, ⑩
    Multiples of 5: 5, ⑩
    LCM: 10

2. Find the lowest common multiple (LCM) of 12 and 20.

Solution

For larger numbers such as these, solve using a factor tree. Follow the steps given in the overview.

Step 1. Factor each number:



Step 2. Identify the prime factors for both numbers.

12: 2, 2, 3

20: 2, 2, 5

The maximum number of times the prime factor 2 occurs is two. This is for 12 and 20. The prime factors 3 and 5 only occur once. We will list these together: 2, 2, 3, 5

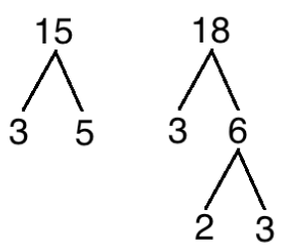
Step 3. Multiply the prime factors to find the LCM: $2 \times 2 \times 3 \times 5 = 60$

The LCM of 12 and 20 is 60.

3. Find the LCM of 15 and 18.

Solution

Step 1. Factor each number:



Step 2. Identify the prime factors for both numbers.

15: 3, 5

18: 2, 3, 3

The maximum number of times the prime factor 3 occurs is two. It should be listed twice. The prime factors 2 and 5 only occur once. We will list these together: 2, 3, 3, 5

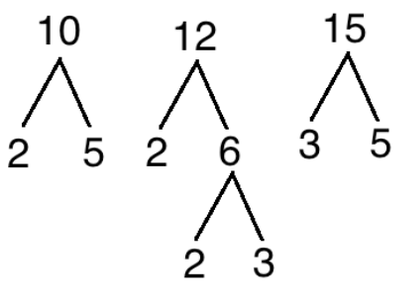
Step 3. Multiply the prime factors to find the LCM: $2 \times 3 \times 3 \times 5 = 90$

The LCM of 15 and 18 is 90.

4. Find the LCM of 10, 12, and 15

Solution

Step 1. Factor each number:



Step 2. Identify the prime factors of each number:

10: 2, 5

12: 2, 2, 3

15: 3, 5

The maximum number of times the prime factor 2 occurs is two. It should be listed twice. The prime factors 3 and 5 only occur once. We will list these together: 2, 2, 3, 5

Step 3. Multiply to find the LCM of 10, 12 and 15: $2 \times 2 \times 3 \times 5 = 60$

The LCM of 10, 12 and 15 is 60.

Practice

1. Find the LCM of the following numbers:
   a. 2 and 4
   b. 3 and 6
2. Find the LCM of the following numbers using a factor tree:
   a. 6 and 24
   b. 15 and 20
   c. 18 and 12
3. Find the LCM of 6, 8, and 10.
4. Find the LCM of 4, 5, 6, and 9.

Lesson Title: Squares of Whole Numbers	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-008	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to find squares of whole numbers to up 10.

Overview

To square a number means to multiply the number by itself. For example, $3^2 = 3 \times 3 = 9$.

3^2 can be read as "three squared" or "three to the power of 2".

The number 3 is called the **base**, while 2 is the **power**:

base → 3^2 ← power

Numbers can have different powers. The power of a number says how many times to use the number in multiplication. 'Three squared' means we multiply two 3's together. Any time you see a number with a power of 2, simply multiply that number by itself.

Solved Examples

1. Evaluate the following:
   a. 2^2
   b. 5^2
   c. 8 squared
   d. 0^2

   Solutions

   Multiply each number by itself:

   a. $2^2 = 2 \times 2 = 4$
   b. $5^2 = 5 \times 5 = 25$
   c. 8 squared $= 8^2 = 8 \times 8 = 64$
   d. $0^2 = 0 \times 0 = 0$

2. Find the value of each square:
   a. 10^2
   b. 12^2

c. 20^2

Solutions

2-digit numbers are evaluated in the same way as single digit numbers. Multiply each number by itself:

a. $10^2 = 10 \times 10 = 100$
b. $12^2 = 12 \times 12 = 144$
c. $20^2 = 20 \times 20 = 400$

Practice

1. Find the value of each square:
   a. 1^2
   b. 4 squared
   c. 7^2

2. Evaluate the following:
   a. 11^2
   b. 15 squared
   c. 30^2

Lesson Title: Cubes of Whole Numbers	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-009	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to find cubes of whole numbers to up 10.

Overview

To cube a number means to multiply the number by itself **3 times**. For example, $2^3 = 2 \times 2 \times 2 = 8$.

2^3 can be read as "2 cubed or 2 to the power of 3".

The number 2 is called the **base**, while 3 is the **power**. This is the same as with squares.

base → 2^3 ← power

You will use 2 steps to find the value of cubed numbers. You will multiply twice. You should be able to solve all of the problems in this lesson without a calculator. In some cases, you will need to use vertical multiplication for 2-digit numbers.

Solved Examples

1. Evaluate: 3^3

   Solution

   Multiply 3 by itself 3 times: $3 \times 3 \times 3$. The multiplication is done in 2 steps:

   Step 1. $3 \times 3 = 9$

   Step 2. $9 \times 3 = 27$

   Answer: $3^3 = 27$

2. Evaluate: 6^3

Solution

Multiply 6 by itself 3 times: $6 \times 6 \times 6$. The multiplication is done in 2 steps. Use vertical multiplication to solve step 2.

Step 1. $6 \times 6 = 36$

Step 2. $36 \times 6 = 216$

$$\begin{array}{r} {\scriptstyle 3} \\ 3\ 6 \\ \times\quad 6 \\ \hline 2\ 1\ 6 \end{array}$$

Answer: $6^3 = 216$

3. Find the value of 8^3.

Solution

Multiply 8 by itself 3 times: $8 \times 8 \times 8$. The multiplication is done in 2 steps. Use vertical multiplication to solve step 2.

Step 1. $8 \times 8 = 64$

Step 2. $64 \times 8 = 512$

$$\begin{array}{r} {\scriptstyle 3} \\ 6\ 4 \\ \times\quad 8 \\ \hline 5\ 1\ 2 \end{array}$$

Answer: $8^3 = 512$

Practice

1. Evaluate the following:
   a. 10^3
   b. 4 cubed
   c. 1^3

2. Find the values of the following:
   a. 7^3
   b. 5 cubed
   c. 0^3
   d. 9 to the power 3

Lesson Title: Higher Powers of Whole Numbers	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-010	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to find higher powers (greater than 3) of whole numbers.

Overview

The power on a number tells you how many times to multiply that number by itself. A power can be any number. For example, $2^5 = 2 \times 2 \times 2 \times 2 \times 2$.

2^5 can be read as "2 to the power of 5". base → 2^{5} ← power

A number and its power are called an **index**. For example, 2^5 is an index. The plural form of index (more than 1) is **indices**. For example, 2^5 and 3^2 are indices.

Note the following helpful rules about indices:

Rule	Example
1 raised to any power is 1	$1^4 = 1 \times 1 \times 1 \times 1 = 1$
0 raised to any power is 0	$0^5 = 0 \times 0 \times 0 \times 0 \times 0 = 0$
A number to the power 1 = itself	$2^1 = 2$

Solved Examples

1. Expand: 8^5

   Solution

   Write 8^5 in its expanded form: $8^5 = 8 \times 8 \times 8 \times 8 \times 8$

2. Simplify and leave your answer in index form: $7 \times 7 \times 7 \times 7 \times 7 \times 7$.

   Solution

   7 is multiplied by itself 6 times, so 6 is the power of 7: 7^6

3. Evaluate: 0^6

Solution

0 raised to any power is 0: $0^6 = 0 \times 0 \times 0 \times 0 \times 0 \times 0 = 0$

4. Evaluate: 3^4

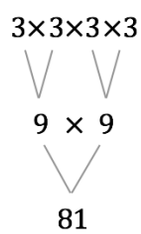
Solution

Multiply 3 by itself 4 times: $3 \times 3 \times 3 \times 3$. The multiplication can be done in 3 steps:

Step 1. $3 \times 3 = 9$
Step 2. $9 \times 3 = 27$
Step 3. $27 \times 3 = 81$

Answer: $3^4 = 81$

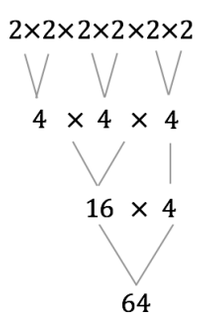
We can also find 3^4 by multiplying 2 of the sets of 3 ($3 \times 3 = 9$ and $3 \times 3 = 9$), then multiplying the results, $9 \times 9 = 81$.



5. Evaluate: 2^6

Solution

Multiply 2 by itself 6 times: $2 \times 2 \times 2 \times 2 \times 2 \times 2$.



Answer: $2^6 = 64$

Practice

1. Expand the following:
    a. 3^8
    b. 8^4
    c. 9^7

2. Write the following in index form:
    a. $7 \times 7 \times 7 \times 7$
    b. $4 \times 4 \times 4 \times 4 \times 4 \times 4 \times 4$
    c. $3 \times 3 \times 3 \times 3 \times 3$
3. Evaluate: 5^4
4. Evaluate: 2^5
5. Evaluate: 1^9

Lesson Title: Multiplying Two Indices	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-011	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to simplify multiplication of two indices less than 10.

Overview

To multiply two or more indices with the same base, add the powers. For example, $3^2 \times 3^5 = 3^{2+5} = 3^7$.

To see why this is true, write each index in its expanded form:

$$\begin{aligned} 3^2 \times 3^5 &= 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \\ &= 3^7 \end{aligned}$$

This is what we refer to as the first law of indices, which has the general formula $a^m \times a^n = a^{m+n}$. Here m and n are the powers of a, and a is the base. This rule only works if the bases are the same.

Solved Examples

1. Simplify: $7^3 \times 7^4$

   Solution

   Add the powers: $7^3 \times 7^4 = 7^{3+4} = 7^7$

2. Simplify: $r^3 \times r^4$

   Solution

   $r^3 \times r^4 = r^{3+4} = r^7$

3. Simplify: $3^7 \times 3$

   Solution

   Remember that a number without a power on it is the same as that number raised to the power of 1. In this problem, $3 = 3^1$.

   $3^7 \times 3 = 3^7 \times 3^1 = 3^{7+1} = 3^8$

4. Simplify: $2^8 \times 2^5$

   Solution

   $2^8 \times 2^5 = 2^{8+5} = 2^{13}$

5. Simplify: $2^3 \times 3^4$

   Solution

   These indices cannot be combined because the bases are different. This expression is already in its simplest form.

6. Simplify: $5^4 \times 5^0$

   Solution

   $5^4 \times 5^0 = 5^{4+0} = 5^4$

Practice

Simplify the following:

1. $a^{12} \times a^3$
2. $u^4 \times u^3$
3. $9^8 \times 9^3$
4. $4^4 \times 4$
5. $9^6 \times 9^6$
6. 7×7^9

Lesson Title: Dividing Two Indices	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-012	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to simplify division of two indices less than 10.

Overview

To divide two or more indices with the same base, subtract the powers. For example, $2^5 \div 2^2 = 2^{5-2} = 2^3$. This is the second law of indices, which has the general formula $a^m \div a^n = a^{m-n}$. Here m and n are the powers of a, and a is the base. This rule only works if the bases are the same.

To see why this rule for indices is true, write the division as a fraction. Then, write each index in its expanded form and cancel:

$$
\begin{aligned}
3^5 \div 3^2 &= \frac{3^5}{3^2} && \text{Write as a fraction} \\
&= \frac{3\times3\times3\times3\times3}{3\times3} && \text{Expand the indices} \\
&= \frac{\cancel{3}\times\cancel{3}\times3\times3\times3}{\cancel{3}\times\cancel{3}} && \text{Cancel two 3's} \\
&= 3 \times 3 \times 3 \\
&= 3^3 && \text{Simplify}
\end{aligned}
$$

We do not need to write the indices in their expanded form each time, we simply subtract the powers: $3^5 \div 3^2 = 3^{5-2} = 3^3$.

Solved Examples

1. Simplify: $3^6 \div 3^2$

   Solution

   Subtract the powers: $3^6 \div 3^2 = 3^{6-2} = 3^4$

2. Simplify: $\frac{p^7}{p^5}$

   Solution

   Fractions are the same as division. Follow the second law of indices and subtract the indices.

$\frac{p^7}{p^5} = p^7 \div p^5 = p^{7-5} = p^2$

3. Divide: $7^6 \div 7$

   Solution
   Remember that $7 = 7^1$.
   Subtract the powers: $7^6 \div 7 = 7^6 \div 7^1 = 7^{6-1} = 7^5$

Practice

Simplify the following:

1. $5^9 \div 5^3$
2. $a^{10} \div a$
3. $2^{30} \div 2^5$
4. $\frac{4^{13}}{4^3}$
5. $\frac{b^9}{b}$
6. $8^{10} \div 8$

Lesson Title: Multiplication and Division of Indices	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-013	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to simplify multiplication and division of two indices less than 10.

Overview

In the previous lessons, you learned to multiply and divide indices. You added powers for multiplication and subtracted powers for division. In some cases, you may need to do both steps for one expression. For example, consider the expression $3^2 \times 3^3 \div 3^4$. The order of operations does not matter for multiplication and division. However, it is often easier to do multiplication first.

Solved Examples

1. Simplify: $3^2 \times 3^3 \div 3^4$

   Solution

   Add the powers for multiplication and subtract the powers for division:

   $3^2 \times 3^3 \div 3^4 = 3^{2+3-4} = 3^{5-4} = 3^1 = 3$

   Note that this expression is the same as $\frac{3^2 \times 3^3}{3^4}$. You can also write the problem as a fraction and then simplify:

   $\frac{3^2 \times 3^3}{3^4} = \frac{3^{2+3}}{3^4} = \frac{3^5}{3^4} = 3^{5-4} = 3^1 = 3$

2. Simplify: $\frac{2^4 \times 2^4}{2^3 \times 2^2}$

   Solution

   The easiest way to simplify this expression is to first simplify both the numerator and denominator of the fraction. Then, handle the division.

   $\frac{2^4 \times 2^4}{2^3 \times 2^2} = \frac{2^{4+4}}{2^{3+2}} = \frac{2^8}{2^5} = 2^{8-5} = 2^3$

3. Simplify: $\frac{3^{10}\times 3}{3^2}$

Solution

Remember that $3 = 3^1$.

$\frac{3^{10}\times 3}{3^2} = \frac{3^{10}\times 3^1}{3^2} = \frac{3^{10+1}}{3^2} = \frac{3^{11}}{3^2} = 3^{11-2} = 3^9$

4. Simplify: $\frac{3^5 \div 3^2}{3^2\times 3}$

Solution

$\frac{3^5 \div 3^2}{3^2\times 3} = \frac{3^{5-2}}{3^{2+1}} = \frac{3^3}{3^3} = 3^{3-3} = 3^0 = 1$

Practice

Simplify the following:

1. $3^7 \div 3^2 \times 3$
2. $\frac{4^{12}\times 4}{4}$
3. $\frac{a^3\times a^2}{a^2\times a^2}$
4. $2 \times 2^8 \div 2^3$
5. $\frac{5^{10}}{5^3\times 5^2}$
6. $\frac{5^4 \div 5^2}{5}$

Lesson Title: Introduction to Fractions	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-014	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to recognise and name fractional parts of a whole.

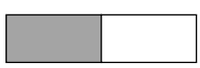
Overview

Fractions describe part of a whole. A fraction is shown with 2 numbers: the numerator and denominator. The numerator is on top and the denominator is on the bottom.

For example, the fraction below is 'one half'. The numerator is 1, and the denominator is 2.

$$\frac{1}{2} \quad \begin{matrix} \leftarrow \text{numerator} \\ \hline \leftarrow \text{denominator} \end{matrix}$$

We can draw a shape and shade part of it to show the size of a fraction. The shape should be divided into pieces that are equal in size. The number of pieces should equal the number in the **denominator**. The **numerator** tells you how many parts are shaded. For example, this rectangle shows $\frac{1}{2}$:

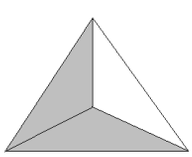


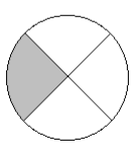
There are 2 ways to read fractions. The table below shows how to read some common fractions.

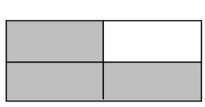
$\frac{1}{2}$	"One half"	"1 over 2"
$\frac{2}{3}$	"Two thirds"	"2 over 3"
$\frac{1}{4}$	"One fourth" (or "one quarter")	"1 over 4"
$\frac{3}{5}$	"Three fifths"	"3 over 5"

Solved Examples

1. Write the fraction for each shape:

a. 

b. 

c. 

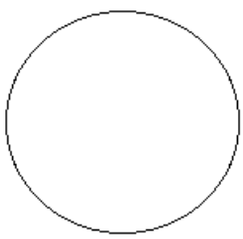
Solution

Count the total number of pieces in each shape, and write that number in the denominator. Count the number of shaded pieces, and write that number in the numerator.

Answers:

a. $\frac{2}{3}$ b. $\frac{1}{4}$ c. $\frac{3}{4}$

2. Draw and shade the circle to show $\frac{3}{4}$:

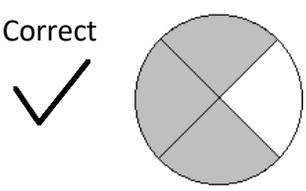


Solution

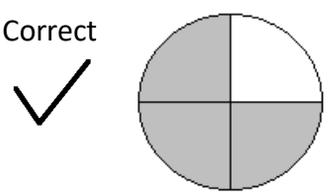
To divide a circle into equal parts, draw lines straight across. The lines should intersect at the centre of the circle. Make sure all 4 parts are the same size.

Example answers:

Correct

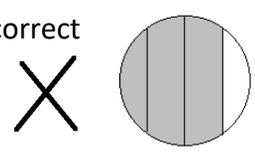


Correct

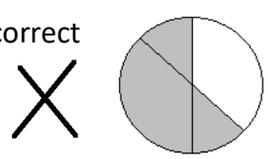


If you divide the circle into 4 **unequal** parts, your answer will **not** be correct because a fraction is an equal part of a whole. For example:

Not correct



Not correct

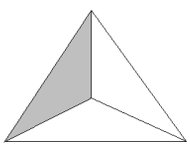


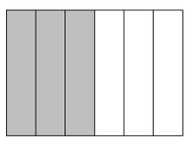
3. Draw shapes to show the following fractions: a. $\frac{1}{3}$ b. $\frac{3}{6}$ c. $\frac{1}{5}$

Solution

You may draw any shape to show the fractions. It is important that all of the parts are the same size.

Example answers:

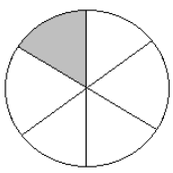
a. 

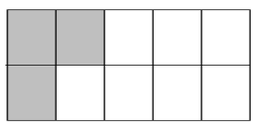
b. 

c. 

Practice

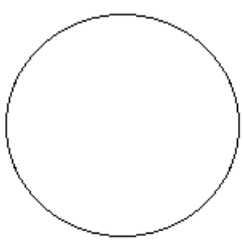
1. Write the fraction for each shape:

a. 

b. 

c. 

2. Draw and shade the circle to show $\frac{3}{8}$:



3. Draw shapes for the following fractions: a. $\frac{5}{6}$ b. $\frac{1}{4}$ c. $\frac{5}{8}$

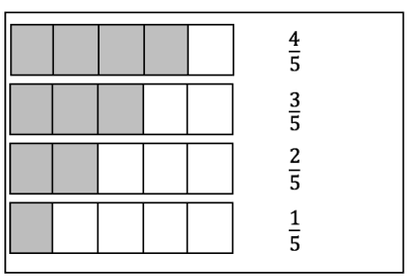
Lesson Title: Fractions with Different Denominators	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-015	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to compare and order fractions with different denominators.

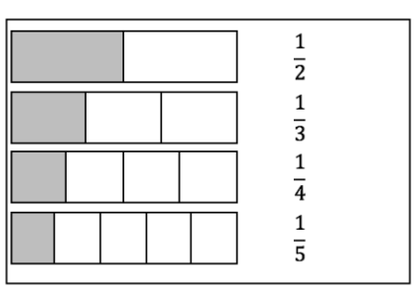
Overview

It is simple to compare fractions if they have the same denominator. A larger numerator means the fraction is larger. For example, consider fifths. We have $\frac{4}{5} > \frac{3}{5} > \frac{2}{5} > \frac{1}{5}$:



We can also easily compare fractions with the **same numerator**. If the fractions have the same numerator, we just compare the denominators. **The bigger the denominator, the smaller the fraction**. Note that a big denominator tells us that the fraction is divided into many small parts. The more parts the fraction is divided into, the smaller each part will be.

Consider the example below, where every fraction has a numerator of 1. Notice that the bigger the denominator the smaller the shaded part.



From this example, we have $\frac{1}{2} > \frac{1}{3} > \frac{1}{4} > \frac{1}{5}$.

Remember that **ascending order** is from smallest to largest. **Descending order** is from largest to smallest.

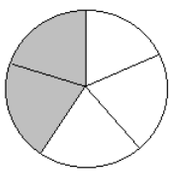
If you have difficulty deciding which fraction is bigger or smaller, draw a picture! A picture can help us to understand fraction size.

Solved Examples

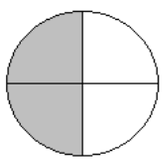
1. Draw a picture for each fraction. Then, write the fractions in ascending order: $\frac{2}{5}, \frac{2}{4}, \frac{2}{6}, \frac{2}{3}$.

   Solution

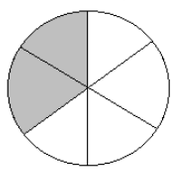
   You can draw your pictures using any shape. It is helpful to use the same shape for all 4 fractions, and to make them the same size. These are examples:

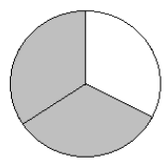
   $\frac{2}{5}$

   $\frac{2}{4}$

   $\frac{2}{6}$

   $\frac{2}{3}$

   Write the fractions in ascending order, from smallest to biggest: $\frac{2}{6}, \frac{2}{5}, \frac{2}{4}, \frac{2}{3}$.

2. Which fraction is bigger, $\frac{3}{6}$ or $\frac{3}{7}$?

   Solution

   $\frac{3}{6}$ is bigger. They have the same numerator, so we can compare the denominators. The fraction with the smaller denominator is bigger.

3. Put this list of fractions in ascending order: $\frac{1}{10}, \frac{1}{13}, \frac{1}{9}, \frac{1}{4}, \frac{1}{16}$

   Solution

   All of the fractions have the same numerator, so we can compare the denominators. Ascending order means from smallest to biggest. Write the fractions in order from biggest denominator to smallest denominator:

   $$\frac{1}{16}, \frac{1}{13}, \frac{1}{10}, \frac{1}{9}, \frac{1}{4}$$

4. Put this list of fractions in descending order: $\frac{4}{5}, \frac{4}{10}, \frac{4}{8}, \frac{4}{6}, \frac{4}{12}$

   Solution

   All of the fractions have the same numerator, so we can compare the denominators. Descending order means from biggest to smallest. Write the fractions in order from smallest denominator to biggest denominator:

$$\frac{4}{5}, \frac{4}{6}, \frac{4}{8}, \frac{4}{10}, \frac{4}{12}$$

Practice

1. Which fraction is bigger, $\frac{3}{8}$ or $\frac{3}{4}$?
2. Which fraction is smaller, $\frac{2}{5}$ or $\frac{2}{6}$?
3. Write the fractions in ascending order: $\frac{1}{6}, \frac{1}{9}, \frac{1}{10}, \frac{1}{3}, \frac{1}{2}$
4. Write the fractions in descending order: $\frac{5}{6}, \frac{5}{12}, \frac{5}{20}, \frac{5}{15}, \frac{5}{9}$
5. Circle all of the fractions that are larger than $\frac{3}{8}$:

$$\frac{3}{4} \qquad \frac{3}{10} \qquad \frac{3}{5} \qquad \frac{3}{7} \qquad \frac{3}{12} \qquad \frac{3}{6} \qquad \frac{3}{9} \qquad \frac{3}{11}$$

Lesson Title: Adding Fractions with the Same Denominator	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-016	**Class:** JSS 1

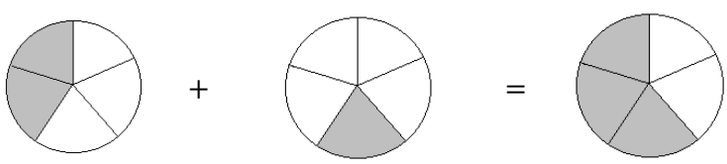
Learning Outcome

By the end of the lesson, you will be able to add fractions with the same denominator.

Overview

Fractions that have the same denominator are called **like fractions**. For example, $\frac{2}{5}$ and $\frac{1}{5}$ are like fractions.

Like fractions can be added by adding the numerators. Use the same denominator in the answer. For example: $\frac{2}{5} + \frac{1}{5} = \frac{2+1}{5} = \frac{3}{5}$. All of the fractions have the same denominator. To see why this is true, consider the addition problem with pictures:



$\frac{2}{5}$ $\frac{1}{5}$ $\frac{3}{5}$

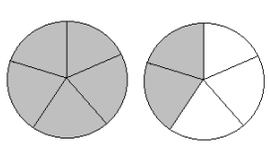
Improper and Mixed Fractions

In some cases, you may add fractions and find that the answer is an **improper fraction**. In an improper fraction, the numerator is larger than the denominator. For example: $\frac{4}{5} + \frac{3}{5} = \frac{4+3}{5} = \frac{7}{5}$.

When your answer is an improper fraction, you must change it to a **mixed fraction**. A mixed fraction has a whole number part and a fraction part.

An improper fraction can be simplified to get a mixed fraction by dividing the numerator by the denominator. To simplify $\frac{7}{5}$, divide: $7 \div 5 = 1$ remainder 2. The mixed fraction is $1\frac{2}{5}$.

We can show $\frac{7}{5} = 1\frac{2}{5}$ with a picture:



Note that to change a mixed fraction to an improper fraction, multiply the whole number part by the denominator, and add the numerator. Write this in the numerator of the result. For example: $1\frac{2}{5} = \frac{1\times5+2}{5} = \frac{7}{5}$.

Solved Examples

1. Add the fractions: $\frac{1}{7} + \frac{2}{7}$

   Solution

   Add the numerators:

   $$\frac{1}{7} + \frac{2}{7} = \frac{1+2}{7} = \frac{3}{7}$$

2. Add the fractions: $\frac{2}{3} + \frac{1}{3}$

   Solution

   Add the numerators of the fractions. Note that the answer is $\frac{3}{3}$. Any fraction with the same number in the numerator and denominator is equal to 1.

   $$\frac{2}{3} + \frac{1}{3} = \frac{2+1}{3} = \frac{3}{3} = 1$$

3. Add the fractions: $\frac{3}{4} + \frac{2}{4}$

   Solution

   Add the numerators of the fractions. Note that the answer is an improper fraction. Convert it to a mixed fraction.

   $$\frac{3}{4} + \frac{2}{4} = \frac{3+2}{4} = \frac{5}{4} = 1\frac{1}{4}$$

4. Foday and Sia shared a pawpaw. Foday ate $\frac{2}{9}$ of the pawpaw, and Sia ate $\frac{5}{9}$ of the pawpaw. How much of the pawpaw did they eat all together?

   Solution

   In this story problem, the words **all together** tell us to **add**. Add the fractions in the story to find the total amount of the pawpaw they ate:

   $\frac{2}{9} + \frac{5}{9} = \frac{2+5}{9} = \frac{7}{9}$ of the pawpaw

Practice

1. Add the fractions: a. $\frac{1}{4}+\frac{2}{4}$ b. $\frac{1}{15}+\frac{3}{15}$ c. $\frac{4}{8}+\frac{1}{8}$
2. Add the fractions: a. $\frac{3}{7}+\frac{4}{7}$ b. $\frac{4}{5}+\frac{4}{5}$ c. $\frac{5}{8}+\frac{4}{8}$
3. Hawa is reading a book. She read $\frac{1}{5}$ of the book yesterday, and $\frac{2}{5}$ of the book today. How much has she read all together?
4. Mustapha and David shared a bowl of rice. Mustapha ate $\frac{5}{8}$ of the bowl, and David ate $\frac{3}{8}$ of the bowl. How much did they eat all together?

Lesson Title: Adding Fractions with Different Denominators	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-017	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to add fractions with different denominators.

Overview

This lesson is on addition of fractions with different denominators, such as $\frac{3}{4}+\frac{1}{8}$.

Fractions should have the same denominator to be added. To add fractions with different denominators, follow these steps:

1. Find a **common denominator,** or a denominator that is the same (the LCM).
2. Write each fraction as an **equivalent fraction** with the LCM denominator. (To review equivalent fractions, see the box below.)
3. Add the fractions.

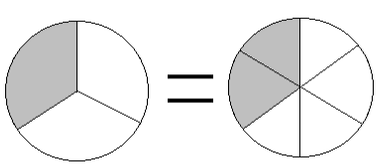
If the answer is an improper fraction, change it to a mixed fraction. Simplify the answer if possible. See Solved Example 2 for an example of an answer that needs to be simplified.

Equivalent Fractions

If the numerator and denominator of a fraction are both multiplied by the same number, the result is an equivalent fraction. For example, $\frac{1}{3}$ and $\frac{2}{6}$ are equivalent fractions because $\frac{1}{3}=\frac{1\times2}{3\times2}=\frac{2}{6}$.

When we simplify, we find equivalent fractions by dividing: $\frac{2}{6}=\frac{2\div2}{6\div2}=\frac{1}{3}$

We can draw pictures to see that $\frac{1}{3}$ and $\frac{2}{6}$ are equivalent fractions. The shaded area is the same size:



Solved Examples

1. Add the fractions: $\frac{3}{4}+\frac{1}{8}$

   Solution

   Step 1. Find a common denominator. The LCM of 4 and 8 is 8.

   Step 2. Make the denominators the same.

   To change $\frac{3}{4}$ to a fraction with 8 in the denominator, multiply the numerator and denominator by the same number. In this case, we multiply by 2: $\frac{3}{4}=\frac{3\times2}{4\times2}=\frac{6}{8}$

   Step 3. Add the like fractions: $\frac{3}{4}+\frac{1}{8}=\frac{6}{8}+\frac{1}{8}=\frac{6+1}{8}=\frac{7}{8}$

2. Add the fractions: $\frac{1}{3}+\frac{5}{12}$

   Solution

   Step 1. Find a common denominator. The LCM of 3 and 12 is 12.

   Step 2. Make the denominators the same.

   Change the denominator 3 to 12: $\frac{1}{3}=\frac{1\times4}{3\times4}=\frac{4}{12}$

   Step 3. Add the like fractions: $\frac{1}{3}+\frac{5}{12}=\frac{4}{12}+\frac{5}{12}=\frac{9}{12}$

   The answer can be simplified, or written in its lowest terms. A fraction can be simplified if it can be written as an equivalent fraction with smaller numbers. Simplify by dividing the numerator and denominator by the same number: $\frac{9}{12}=\frac{9\div3}{12\div3}=\frac{3}{4}$

   The answer is $\frac{1}{3}+\frac{5}{12}=\frac{3}{4}$

3. Add the fractions: $\frac{1}{5}+\frac{5}{6}$

   Solution

   Step 1. Find a common denominator. The LCM of 5 and 6 is 30.

   Step 2. Make the denominators the same.

   Change both denominators to 30:

   $$\frac{1}{5}=\frac{1\times6}{5\times6}=\frac{6}{30} \quad \text{and} \quad \frac{5}{6}=\frac{5\times5}{6\times5}=\frac{25}{30}$$

Step 3. Add the like fractions: $\frac{1}{5}+\frac{5}{6}=\frac{6}{30}+\frac{25}{30}=\frac{6+25}{30}=\frac{31}{30}=1\frac{1}{30}$

- Remember to change improper fractions to mixed fractions!

4. Add the fractions: $\frac{1}{4}+\frac{3}{5}$

Solution

Step 1. Find a common denominator. The LCM of 4 and 5 is 20.

Step 2. Make the denominators the same.

Change both denominators to 20:

$$\frac{1}{4}=\frac{1\times5}{4\times5}=\frac{5}{20} \quad \text{and} \quad \frac{3}{5}=\frac{3\times4}{5\times4}=\frac{12}{20}$$

Step 3. Add the like fractions: $\frac{1}{4}+\frac{3}{5}=\frac{5}{20}+\frac{12}{20}=\frac{5+12}{20}=\frac{17}{20}$

5. Add the fractions: $\frac{2}{3}+\frac{1}{4}+\frac{3}{8}$

Solution

Step 1. Find a common denominator. The LCM of 3, 4 and 8 is 24.

Step 2. Make the denominators the same. Change all the denominators to 24.

$\frac{2}{3}=\frac{2\times8}{3\times8}=\frac{16}{24}$, $\frac{1}{4}=\frac{1\times6}{4\times6}=\frac{6}{24}$, $\frac{3\times3}{3\times8}=\frac{9}{24}$

Step 3. Add the like fractions.

$\frac{16}{24}+\frac{6}{24}+\frac{9}{24}=\frac{16+6+9}{24}=\frac{31}{24}=1\frac{7}{24}$

Practice

Add the fractions:

1. $\frac{1}{3}+\frac{1}{6}$
2. $\frac{4}{5}+\frac{1}{3}$
3. $\frac{1}{15}+\frac{1}{5}$
4. $\frac{1}{2}+\frac{3}{7}$
5. $\frac{1}{6}+\frac{1}{2}$
6. $\frac{3}{5}+\frac{1}{2}+\frac{3}{4}$

Lesson Title: Subtracting Fractions with the Same Denominators	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-018	**Class:** JSS 1

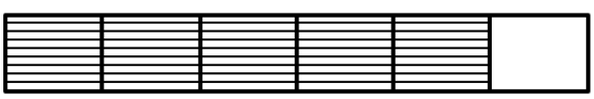
Learning Outcome

By the end of the lesson, you will be able to subtract fractions with the same denominators.

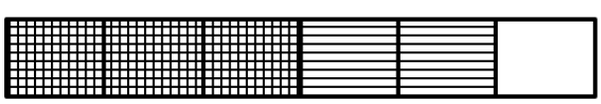
Overview

Like fractions can be subtracted by subtracting the numerators. Use the same denominator in the answer. For example: $\frac{5}{6} - \frac{3}{6} = \frac{5-3}{6} = \frac{2}{6}$. This answer can be simplified: $\frac{2}{6} = \frac{2\div2}{6\div2} = \frac{1}{3}$.

We can show that this is true by drawing a picture. Show the first number, $\frac{5}{6}$:



To subtract, cross out part of $\frac{5}{6}$. Draw lines in the other direction to subtract $\frac{3}{6}$:

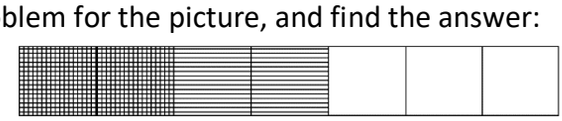


The fraction of $\frac{5}{6}$ that remains is $\frac{2}{6}$. We have shown that $\frac{5}{6} - \frac{3}{6} = \frac{2}{6}$.

Remember to simplify your answers if possible.

Solved Examples

1. Write a subtraction problem for the picture, and find the answer:



Solution

The subtraction problem is: $\frac{4}{7} - \frac{2}{7}$

Subtract the numerators to find the answer, or look at the picture to find the answer.

Answer: $\frac{4}{7} - \frac{2}{7} = \frac{4-2}{7} = \frac{2}{7}$

2. Subtract the fractions: $\frac{6}{9} - \frac{2}{9}$

Solution

Subtract the numerators:

$$\frac{6}{9} - \frac{2}{9} = \frac{6-2}{9} = \frac{4}{9}$$

3. Subtract the fractions: $1\frac{1}{3} - \frac{2}{3}$

Solution

Change $1\frac{1}{3}$ to an improper fraction: $1\frac{1}{3} = \frac{1\times3+1}{3} = \frac{4}{3}$

Subtract: $1\frac{1}{3} - \frac{2}{3} = \frac{4}{3} - \frac{2}{3} = \frac{4-2}{3} = \frac{2}{3}$

4. Subtract the fractions: $\frac{3}{4} - \frac{1}{4}$

Solution

Subtract the fractions, and remember to simplify the answer:

$$\frac{3}{4} - \frac{1}{4} = \frac{3-1}{4} = \frac{2}{4} = \frac{2\div2}{4\div2} = \frac{1}{2}$$

5. Subtract the fractions: $\frac{7}{9} - \frac{7}{9}$

Solution

Subtract the fractions: $\frac{7}{9} - \frac{7}{9} = \frac{7-7}{9} = \frac{0}{9} = 0$

Note that if a fraction has 0 in the numerator, it is equal to 0.

6. Hawa has $\frac{3}{5}$ of a pawpaw. Foday has $\frac{2}{5}$ of a pawpaw. How much more does Hawa have than Foday?

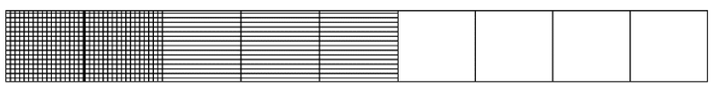
Solution

In this story problem, the words **how much more** tell us to **subtract**. We want to find the **difference** between their amounts of pawpaw. Subtract the fractions in the story:

$$\frac{3}{5} - \frac{2}{5} = \frac{3-2}{5} = \frac{1}{5} \text{ of a pawpaw}$$

Practice

1. Write a subtraction problem for the picture, and find the answer:



2. Subtract the fractions: a. $\frac{5}{6} - \frac{4}{6}$ b. $\frac{12}{15} - \frac{5}{15}$ c. $\frac{4}{8} - \frac{1}{8}$
3. Subtract the fractions: a. $1\frac{3}{7} - \frac{4}{7}$ b. $\frac{4}{5} - \frac{4}{5}$ c. $\frac{5}{8} - \frac{3}{8}$
4. Hawa is reading a book. She read $\frac{1}{6}$ of the book yesterday, and $\frac{3}{6}$ of the book today. How much more did she read today?

Lesson Title: Subtracting Fractions with Different Denominators	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-019	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to subtract fractions with different denominators.

Overview

This lesson is on subtraction of fractions with different denominators, such as $\frac{3}{4} - \frac{1}{8}$.

We will follow the same process that we followed for the addition of fractions with different denominators (Lesson M-07-017).

Fractions should have the same denominator to be subtracted. To subtract fractions with different denominators, follow these steps:

1. Find a **common denominator,** or a denominator that is the same (the LCM).
2. Write each fraction as an **equivalent fraction** with the LCM denominator.
3. Subtract the fractions.

Remember to simplify your answer if needed.

Solved Examples

1. Subtract the fractions: $\frac{3}{4} - \frac{1}{8}$

   Solution

   Step 1. Find a common denominator. The LCM of 4 and 8 is 8.

   Step 2. Make the denominators the same.

   To change $\frac{3}{4}$ to a fraction with 8 in the denominator, multiply the numerator and denominator by the same number. In this case, we multiply by 2: $\frac{3}{4} = \frac{3\times2}{4\times2} = \frac{6}{8}$

   Step 3. Subtract the like fractions: $\frac{3}{4} - \frac{1}{8} = \frac{6}{8} - \frac{1}{8} = \frac{6-1}{8} = \frac{5}{8}$

2. Subtract the fractions: $1\frac{1}{3} - \frac{5}{12}$

Solution

Recall that mixed fractions should be changed to improper fractions before adding or subtracting. Convert $1\frac{1}{3}$: $1\frac{1}{3} = \frac{1\times3+1}{3} = \frac{4}{3}$

We now have the problem $\frac{4}{3} - \frac{5}{12}$.

Step 1. Find a common denominator. The LCM of 3 and 12 is 12.

Step 2. Make the denominators the same.

Change the denominator 3 to 12: $\frac{4}{3} = \frac{4\times4}{3\times4} = \frac{16}{12}$

Step 3. Subtract the like fractions: $1\frac{1}{3} - \frac{5}{12} = \frac{16}{12} - \frac{5}{12} = \frac{16-5}{12} = \frac{11}{12}$

3. Subtract the fractions: $\frac{1}{3} - \frac{1}{5}$

Solution

Step 1. Find a common denominator. The LCM of 3 and 5 is 15.

Step 2. Make the denominators the same.

Change both denominators to 15:

$$\frac{1}{3} = \frac{1\times5}{3\times5} = \frac{5}{15} \quad \text{and} \quad \frac{1}{5} = \frac{1\times3}{5\times3} = \frac{3}{15}$$

Step 3. Subtract the like fractions: $\frac{1}{3} - \frac{1}{5} = \frac{5}{15} - \frac{3}{15} = \frac{5-3}{15} = \frac{2}{15}$

4. A farmer used $\frac{3}{5}$ of his land to plant rice and maize. If $\frac{1}{4}$ of his total land was used to plant maize, what fraction of his land remained for rice?

Solution

The word 'remain' tells us to subtract. Subtract the part used for maize from the total amount used for rice and maize. Write the problem: $\frac{3}{5} - \frac{1}{4}$.

Follow the steps to solve the problem:

Step 1. Find a common denominator. The LCM of 5 and 4 is 20.

Step 2. Make the denominators the same.
Change both denominators to 20:

$$\frac{3}{5} = \frac{3\times4}{5\times4} = \frac{12}{20} \quad \text{and} \quad \frac{1}{4} = \frac{1\times5}{4\times5} = \frac{5}{20}$$

Step 3. Subtract the like fractions: $\frac{3}{5} - \frac{1}{4} = \frac{12}{20} - \frac{5}{20} = \frac{12-5}{20} = \frac{7}{20}$

Practice

Subtract the fractions:

1. $\frac{1}{3} - \frac{1}{6}$
2. $\frac{4}{5} - \frac{1}{3}$
3. $1\frac{4}{15} - \frac{2}{3}$
4. $\frac{1}{2} - \frac{1}{4}$
5. $2\frac{1}{4} - \frac{1}{2}$
6. Sia and Hawa shared $\frac{1}{2}$ of a watermelon. Sia received $\frac{1}{3}$ of the watermelon. How much did Hawa receive?

Lesson Title: Multiplication of Fractions	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-020	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to multiply two or more fractions.

Overview

To multiply 2 fractions, multiply the numerators and multiply the denominators. Simplify the answer if possible.

We can also multiply more than 2 fractions. When multiplying more than 2 fractions, multiply all of the numerators together, and all of the denominators together.

To save time, you may cancel numbers in multiplication problems. Cancelling is done when the numerator and denominator can be divided evenly by the same number. We cancel top-to-bottom and or diagonally but **never** across. For example, consider the problem: $\frac{1}{3} \times \frac{3}{4}$. The 3s can be cancelled because they are diagonal. This is shown in Solved Example 1.

Solved Examples

1. Multiply: $\frac{1}{3} \times \frac{3}{4}$

Solution

Method 1.

Multiply the numerators and denominators. Simplify the result:

$$\frac{1}{3} \times \frac{3}{4} = \frac{1\times3}{3\times4} \quad \text{Multiply numerators and denominators}$$

$$= \frac{3}{12}$$

$$= \frac{3\div3}{12\div3} \quad \text{Simplify}$$

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

Method 2.

Cancel before multiplying the fractions

$\frac{1}{3} \times \frac{3}{4} = \frac{1}{1} \times \frac{1}{4}$ Cancel 3

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

$= \frac{1}{4}$

2. Multiply: $\frac{1}{2} \times \frac{3}{4} \times \frac{2}{3}$

Solution

This problem can be solved in different ways. We can multiply the first two fractions first, then multiply the answer by the third fraction. Another way is to multiply all 3 numerators and denominators together. We can also choose to cancel numbers across all 3 fractions. Two methods are shown below.

Method 1. Without canceling:

$\frac{1}{2} \times \frac{3}{4} \times \frac{2}{3} = \frac{1 \times 3 \times 2}{2 \times 4 \times 3}$ Multiply

$= \frac{6}{24}$

$= \frac{6 \div 6}{24 \div 6}$ Simplify

$= \frac{1}{4}$

Method 2. With canceling:

$\frac{1}{2} \times \frac{3}{4} \times \frac{2}{3} = \frac{1}{1} \times \frac{1}{4} \times \frac{1}{1}$ Cancel 2 and 3

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

$= \frac{1}{4}$

3. Multiply the following:
   a. $\frac{2}{5} \times \frac{1}{5}$
   b. $\frac{3}{10} \times \frac{5}{6}$
   c. $\frac{1}{2} \times \frac{5}{9} \times \frac{2}{5}$

Solutions

Multiply the fractions and simplify if possible. Cancelling is used in the examples below.

a. $\frac{2}{5} \times \frac{1}{5} = \frac{2\times1}{5\times5}$ Multiply

$= \frac{2}{25}$

b. $\frac{3}{10} \times \frac{5}{6} = \frac{1}{2} \times \frac{1}{2}$ Cancel 3 and 5

$= \frac{1\times1}{2\times2}$

$= \frac{1}{4}$

c. $\frac{1}{2} \times \frac{5}{9} \times \frac{2}{5} = \frac{1}{1} \times \frac{1}{9} \times \frac{1}{1}$ Cancel 2 and 5

$= \frac{1\times1\times1}{1\times9\times1}$ Multiply

$= \frac{1}{9}$

Practice

Multiply the fractions and simplify if possible:

1. $\frac{3}{10} \times \frac{2}{5}$
2. $\frac{1}{2} \times \frac{6}{15}$
3. $\frac{1}{4} \times \frac{1}{4}$
4. $\frac{2}{3} \times \frac{1}{4} \times \frac{5}{6}$
5. $\frac{1}{2} \times \frac{5}{8} \times \frac{2}{5}$

Lesson Title: Division of Fractions	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-021	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to divide two fractions.

Overview

To divide two fractions, change the division sign to a multiplication sign. The fraction **after** the division sign is changed to its reciprocal.

To find the reciprocal of a fraction, interchange the position of the numerator and denominator. The reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$.

For example, consider the problem $\frac{2}{5} \div \frac{3}{5}$. To divide, multiply $\frac{2}{5}$ by the reciprocal of $\frac{3}{5}$. That is, multiply $\frac{2}{5} \times \frac{5}{3}$. This problem is Solved Example 1.

Remember to simplify your answers if possible.

Solved Examples

1. Divide: $\frac{2}{5} \div \frac{3}{5}$

   Solution

   Multiply the first fraction by the reciprocal of the second fraction. Remember that you may also solve the multiplication problem without canceling 5.

$$\frac{2}{5} \div \frac{3}{5} = \frac{2}{5} \times \frac{5}{3} \quad \text{Change to multiplication}$$

$$= \frac{2}{1} \times \frac{1}{3} \quad \text{Cancel 5}$$

$$= \frac{2 \times 1}{1 \times 3} \quad \text{Multiply}$$

$$= \frac{2}{3}$$

2. Simplify: $\frac{5}{8} \div \frac{15}{16}$

Solution

$\frac{5}{8} \div \frac{15}{16}$	$= \frac{5}{8} \times \frac{16}{15}$	Change to multiplication
	$= \frac{1}{1} \times \frac{2}{3}$	Cancel 5 and 8
	$= \frac{2}{3}$	Multiply

3. Simplify: $1\frac{3}{4} \div 2\frac{5}{8}$

Solution

$1\frac{3}{4} \div 2\frac{5}{8}$	$= \frac{7}{4} \div \frac{21}{8}$	Change to improper fractions
	$= \frac{7}{4} \times \frac{8}{21}$	Change to multiplication
	$= \frac{1}{1} \times \frac{2}{3}$	Cancel 7 and 4
	$= \frac{2}{3}$	Multiply

4. Divide: $4 \div \frac{1}{2}$

Solution

Note that a whole number can be written as a fraction with denominator 1. For example: $4 = \frac{4}{1}$

$4 \div \frac{1}{2}$	$= \frac{4}{1} \div \frac{1}{2}$	Write 4 as a fraction
	$= \frac{4}{1} \times \frac{2}{1}$	Change to multiplication
	$= \frac{4 \times 2}{1 \times 1}$	Multiply
	$= \frac{8}{1}$	
	$= 8$	

Practice

Divide the fractions and simplify if possible:

1. $\frac{1}{4} \div \frac{1}{12}$
2. $\frac{2}{3} \div \frac{1}{6}$
3. $\frac{1}{3} \div \frac{6}{7}$
4. $3\frac{1}{2} \div 2\frac{1}{4}$
5. $8 \div \frac{1}{3}$
6. $3\frac{2}{3} \div 4$
7. $\frac{5}{6} \div 2\frac{1}{12}$

Lesson Title: Story Problems on the Basic Operations on Fractions	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-022	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to solve story problems on addition, subtraction, multiplication and division of fractions.

Overview

Story problems are maths problems that are expressed as stories. Take your time to read the story problems. Find the numbers, and decide which operation to use.

Here are some key words to look for in story problems. These will help you decide which operation to use:

- **Addition** words: sum, total, more than, all together
- **Subtraction** words: difference, less than, left
- **Multiplication** words: times, each, total, all together
- **Division** words: share, each

Make sure to write your answer with units. For example, in Solved Example 1, the unit is cups. This must be included with the answer.

Solved Examples

1. Sia had $\frac{1}{2}$ cup of rice, and her sister gave her $\frac{1}{4}$ cup more. How much rice did she have in total?

   Solution

   Words like 'more' and 'total' tell us to add. Identify the 2 numbers to be added: $\frac{1}{2}$ and $\frac{1}{4}$.

   Write the problem and carry out the addition:

   $\frac{1}{2}+\frac{1}{4} = \frac{2}{4}+\frac{1}{4}$ Change the denominator

   $= \frac{2+1}{4}$ Add

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

   Sia had $\frac{3}{4}$ cups of rice in total.

2. Martin uses $\frac{1}{4}$ of his money to buy rice, and $\frac{1}{8}$ to buy bananas. What fraction of his money is left?

Solution

Words like 'left' tell us to subtract. We want to subtract the money that Martin spent from 1 whole. Subtract $1 - \frac{1}{4} - \frac{1}{8}$ or $1 - \left(\frac{1}{4} + \frac{1}{8}\right)$.

$1 - \left(\frac{1}{4} + \frac{1}{8}\right) = 1 - \left(\frac{2}{8} + \frac{1}{8}\right)$ Change the denominator

$= 1 - \left(\frac{2+1}{8}\right)$ Add

$= 1 - \frac{3}{8}$

$= \frac{8}{8} - \frac{3}{8}$ Substitute $\frac{8}{8} = 1$

$= \frac{8-3}{8}$ Subtract

$= \frac{5}{8}$ of his money

3. Bendu wants to buy enough rice for her family's dinner. Each member of her family eats $\frac{1}{2}$ cup of rice, and there are 7 members of her family. How many cups should she buy?

Solution

We need to multiply the number of people in the family (7) by the amount of rice each one of them eats ($\frac{1}{2}$ cup). This will tell Bendu how much to buy.

$7 \times \frac{1}{2} = \frac{7}{1} \times \frac{1}{2}$ Substitute $7 = \frac{7}{1}$

$= \frac{7 \times 1}{1 \times 2}$ Multiply

$= \frac{7}{2}$

$= 3\frac{1}{2}$ cups Convert to a mixed fraction

4. Three farmers harvested crops together. They harvested $\frac{3}{4}$ kilogrammes pepper, which they will share equally among themselves. How much does each farmer get?

Solution

Divide the amount they harvested ($\frac{3}{4}$) by the number of farmers (3) to find how much each person gets:

$\frac{3}{4} \div 3 = \frac{3}{4} \div \frac{3}{1}$ Write 3 as a fraction

$= \frac{3}{4} \times \frac{1}{3}$ Change to multiplication

$= \frac{1}{4} \times \frac{1}{1}$ Cancel 3

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

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

Each farmer gets $\frac{1}{4}$ kilogrammes of pepper.

Practice

1. There are 20 books in a stack. The weight of each book is $1\frac{3}{4}$ kg. Find the total weight of the books.
2. You go out for a long walk. You walk $\frac{3}{4}$ mile and then sit down to take rest. Then you walk another $\frac{3}{8}$ mile. How far did you walk altogether?
3. A school wants to make a new playground in an empty field. They give the job of planning the playground to a group of pupils. The pupils decide to use $\frac{1}{4}$ of the playground for a basketball court and $\frac{3}{8}$ for a football field. How much of the playground is left?
4. Juliet is a baker. It takes her $\frac{1}{8}$ of a working day to make one cake. How many cakes can she bake in $2\frac{1}{2}$ working days?
5. A boy plays football for $1\frac{3}{4}$ hours, watches TV for $\frac{3}{4}$ hours and then spends $1\frac{1}{4}$ hours doing his homework. How much time does he spend altogether?
6. Joseph walks $\frac{7}{8}$ mile to school. Paul walks $\frac{1}{2}$ mile to school. How much farther does Joseph walk than Paul?

Lesson Title: Place Value for Decimals	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-023	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify, read and write decimals.

Overview

Numbers with a full stop in the middle of numbers are called decimal numbers. This full stop is called **point**. For example, 2.4 is read as “2 point 4”.

Decimal numbers are divided into two parts: The numbers before the point (to the left of the point) are whole numbers and the numbers after the point (to the right of the point) are parts of a whole.

The number 376.492 is an example of a decimal number. The digits on the left of the decimal point are the whole number 376. The digits on the right of the decimal point are the fractional part. The place value of each digit is shown below:

3	7	6	.	4	9	2
Hundreds	Tens	Ones		Tenths	Hundredths	Thousandths

Decimal numbers can be less than one. If there is only a zero before the decimal point, it is less than one. For example, 0.5 is less than one.

Solved Examples

1. Circle the digit in the **hundredths** place in each decimal number:

10.032 4.56 0.345 132.09

Solution

The hundredths digit is the second digit after the decimal point. The digits should be circled as shown below:

2. In the table below, each digit of the numbers should be written in the correct column. Complete the table below by writing each digit in the column for its place value. The first 2 examples are complete.

	Tens	Ones	.	Tenths	Hundredths	Thousandths
0.4		0	.	4		
13.04	1	3	.	0	4	
10.863			.			
0.314			.			
41.9			.			
1.23			.			
12.001			.			
33.3			.			

Solution

The completed table is below:

	Tens	Ones	.	tenths	hundredths	thousandths
0.4		0	.	4		
13.04	1	3	.	0	4	
10.863	1	0	.	8	6	3
0.314		0	.	3	1	4
41.9	4	1	.	9		
1.23		1	.	2	3	
12.001	1	2	.	0	0	1
33.3	3	3	.	3		

5. Write each decimal number in the table below with words. The first 2 are completed as examples.

12.31	twelve point three one
0.214	zero point two one four
167.3	
30.001	
99.99	
12.12	

Solution

The completed table is below:

12.31	twelve point three one
0.214	zero point two one four
167.3	one hundred sixty-seven point three
30.001	thirty point zero zero one
99.99	ninety-nine point nine nine
12.12	twelve point one two

Practice

1. What is the place value of 8 in 21.418?
2. Circle the digit in the **tenths** place in each decimal number:

   3.14 4.586 10.691 0.10
3. Complete the table below by writing the digits in the correct columns:

	Tens	Ones	.	Tenths	Hundredths	Thousandths
87.017			.			
99.009			.			
15.7			.			
0.11			.			
10.01			.			
9.090			.			

4. Write each decimal number in the table below with words:

24.7	
19.19	
91.03	
9.006	

Lesson Title: Decimals to Fractions	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-024	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to express decimals as fractions.

Overview

Decimal numbers are sometimes called fractional numbers because they can be easily expressed as fractions. To change decimals to fractions, we look at the number of decimal places or the numbers after the decimal point. We write the decimal digits over a power of 10, and simplify. Follow these rules to choose the power of 10 for the denominator:

- If there is 1 decimal place, then the number is expressed over 10.
- If there are 2 decimal places, then the number is expressed over 100.
- If there are more decimal places, the number is expressed over 1,000 and so on.

If the decimal has a whole number part, keep the whole number and change the decimal numbers to a fraction. For example, $2.3 = 2\frac{3}{10}$.

Simplify your answers if possible.

Solved Examples

1. Convert 0.25 to a fraction.

   Solution

   There are 2 decimal places, so express the digits (25) over 100. Then, simplify.

   $$0.25 = \frac{25}{100} = \frac{25 \div 25}{100 \div 25} = \frac{1}{4}$$

2. Convert 0.025 to a fraction.

   Solution

   There are 3 decimal places, so express the digits (025) over 1,000. Then, simplify.

   $$0.025 = \frac{025}{1{,}000} = \frac{25}{1{,}000} = \frac{1}{40}$$

3. Convert 2.8 to a fraction.

   Solution

   Keep the whole number (2) and change the decimal numbers (0.8) to a fraction.

$$2.8 = 2\frac{8}{10} = 2\frac{4}{5}$$

4. Convert the following numbers to fractions:
   a. 0.6
   b. 1.35
   c. 2.302

   Solutions

   a. $0.6 = \frac{6}{10} = \frac{3}{5}$

   b. $1.35 = 1\frac{35}{100} = 1\frac{7}{20}$

   c. $2.302 = 2\frac{302}{1{,}000} = 2\frac{151}{500}$

Practice

Convert the decimals to fractions:

1. 0.45
2. 5.26
3. 0.005
4. 10.05
5. 25.25
6. 9.7
7. 0.08
8. 3.30

Lesson Title: Fractions to Decimals	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-025	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to express fractions as decimals.

Overview

If the denominator of a fraction is a power of 10 such as 10, 100, or 1,000, we can easily change the fraction to a decimal. We follow rules that are the opposite of the rules in the previous lesson:

- If the fraction is over 10, the decimal number has 1 decimal place. Example: $\frac{3}{10} = 0.3$
- If the fraction is over 100, the decimal number has 2 decimal places.
  Example: $\frac{17}{100} = 0.17$
- If the fraction is over 1,000, the decimal number has 3 decimal places.
  Example: $\frac{4}{1{,}000} = 0.004$

To express any other fraction as a decimal, divide the numerator by the denominator. You will do long division. Make sure you write a decimal number after the numerator in the long division problem. You will place a decimal number directly above it in the answer.

For example, this long division shows $\frac{1}{5} = 0.2$. Look at where the decimal is placed. Be very careful to write the decimal in the correct place in your problems and answers.

$$\begin{array}{r} 0.2 \\ 5\overline{)1.0} \\ -\,10 \\ \hline 0 \end{array}$$

Solved Examples

1. Convert the following fractions to decimals:
   a. $\frac{7}{10}$
   b. $\frac{3}{100}$
   c. $\frac{312}{1{,}000}$
   d. $3\frac{13}{1{,}000}$

Solutions

Follow the rules from the Overview to decide how many decimal places to give each answer:

a. $\frac{7}{10} = 0.7$

b. $\frac{3}{100} = .03$

c. $\frac{312}{1{,}000} = 0.312$

d. $3\frac{13}{1{,}000} = 3.013$

2. Convert $\frac{1}{2}$ to a decimal.

Solution

Divide the numerator (1) by the denominator (2).

$$\begin{array}{r|l} & 0.5 \\ \hline 2 & 1.0 \\ -\ & 1\ 0 \\ \hline & 0 \end{array}$$

Answer: $\frac{1}{2} = 0.5$

3. Convert $\frac{7}{8}$ to a decimal.

Solution

Divide the numerator (7) by the denominator (8).

$$\begin{array}{r|l} & 0.875 \\ \hline 8 & 7.000 \\ -\ & 6\ 4\ \ \\ \hline & \ 6\ 0\ \\ -\ & \ 5\ 6\ \\ \hline & \ \ \ 4\ 0 \\ -\ & \ \ 4\ 0 \\ \hline & \ \ \ \ 0 \end{array}$$

Answer: $\frac{7}{8} = 0.875$

4. Convert $\frac{7}{20}$ to a decimal.

   Solution

   Divide the numerator (7) by the denominator (20).

$$
\begin{array}{rr|lll}
 & & 0. & 3 & 5 \\
\cline{3-5}
20 & & 7. & 0 & 0 \\
 & - & 6 & 0 & \\
\hline
 & & 1 & 0 & 0 \\
 & - & 1 & 0 & 0 \\
\hline
 & & & & 0
\end{array}
$$

Practice

Convert the fractions to decimals:

1. $\frac{7}{10}$
2. $\frac{31}{1{,}000}$
3. $1\frac{99}{100}$
4. $\frac{3}{5}$
5. $\frac{3}{8}$
6. $\frac{9}{20}$
7. $4\frac{1}{2}$
8. $\frac{1}{16}$

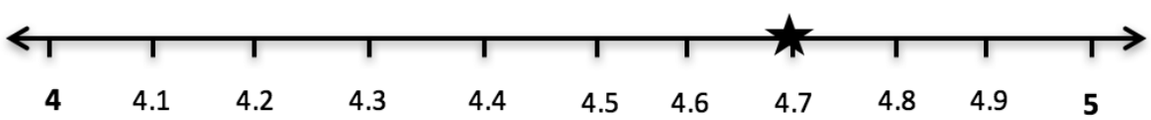
Lesson Title: Rounding off Decimal Numbers to Whole Numbers	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-026	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to round decimal numbers to the nearest whole number.

Overview

To round a decimal number to a whole number, we must find the whole number that it is nearest to. For example, consider 4.7, which is between whole numbers 4 and 5. We can show this on a number line:



Since 4.7 is closer to the whole number **5**, 4.7 rounds up to 5. The decimal 4.7 is rounded up to 5 by adding 1 onto the ones digit (4) and removing the decimal point.

We do not need to draw a number line to round numbers. Use these rules for rounding decimals to whole numbers:

- If the number after the decimal point is less than 5 (0, 1, 2, 3, 4), it is rounded **down** to the next whole number.
- If the number after the decimal point is 5 or more (5, 6, 7, 8, 9), it is rounded **up** to the next whole number.

Solved Examples

1. Round 13.29 to the nearest whole number.

   Solution
   We only consider the digit after the decimal point, 2. This is less than 5, so we round down.
   Answer: 13

2. Round 412.5 to the nearest whole number.

   Solution
   Numbers 5 and greater tell us to round up. Add 1 to 412 to round up.
   Answer: 413

3. Round the following numbers to the nearest whole number:
    a. 20.3
    b. 59.9
    c. 1,000.82
    d. 0.28

    Solutions

    a. Round down: 20
    b. Round up: 60
    c. Round up: 1001
    d. Round down: 0

4. Six farmers harvested their peppers and brought them to the market. They weighed their peppers and recorded the weights in the table below. Round each weight to the nearest kilogramme.

FARMER	WEIGHT (KG)	WEIGHT TO THE NEAREST KG
Hawa	50.68	
Juliet	37.09	
Martin	18.389	
Abass	48.218	
Alice	30.9	
Mohamed	45.2	

Solution

Round each decimal number up or down based on the digit after the decimal point. The answers are given below.

FARMER	WEIGHT (KG)	WEIGHT TO THE NEAREST KG
Hawa	50.68	51
Juliet	37.09	37
Martin	18.389	18
Abass	48.218	48
Alice	30.9	31
Mohamed	49.9	50

Practice

1. Round the following numbers to the nearest whole number:
    a. 317.95
    b. 0.399
    c. 1.500
    d. 70.8
    e. 200.999

2. Six pupils measured the distance of their houses from school in kilometres. They recorded the distances in the table below. Round each distance to the nearest whole number.

PUPIL	DISTANCE (KM)	DISTANCE TO THE NEAREST KM
Sia	3.8	
David	1.75	
Annette	0.3	
Yusuf	2.5	
Mary	2.189	
Foday	1.09	

Lesson Title: Rounding off Decimal Numbers to Stated Decimal Places	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-027	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to round decimal numbers to a given number of decimal places.

Overview

Use the same approach as in the previous lesson to round a decimal to a given number of decimal places. Remember that if a digit is less than 5, we round **down**. If a digit is 5 or more, we round **up**.

To round to a given decimal place, look at the digit after the decimal place you are rounding to. For example, consider 6.47. To round to 1 decimal place, look at the digit in the second decimal place (7). 7 is greater than 5, so we round up. Add 1 to the digit in the first decimal place. 6.47 rounded to 1 decimal place is 6.5.

Solved Examples

1. Round 21.2391 to:
    a. 1 decimal place
    b. 2 decimal places
    c. 3 decimal places

    Solution
    a. The digit in the 2nd decimal place is 3, so we round down: 21.2
    b. The digit in the 3rd decimal place is 9, so we round up: 21.24
    c. The digit in the 4th decimal place is 1, so we round down: 21.239

2. Round 4.97 to 1 decimal place.

    Solution
    The digit in the 2nd decimal place is 7, so we round up. When we add 1 to the 9 in the first decimal place, we get 10. This carries over. We add 1 to the whole number 4, and leave 0 in the first decimal place.
    Answer: 5.0

3. Round the following numbers to the nearest hundredth:
    a. 312.201
    b. 54.058
    c. 0.58291
    d. 1.2763

    Solutions

    Recall that the hundredths place is the second place after the decimal point. We want to round to 2 decimal places.

    a. Round down: 312.20
    b. Round up: 54.06
    c. Round down: 0.58
    d. Round up: 1.28

4. Dr. Bangura delivered 5 babies today. She recorded their weights in the table below. Round each weight to 1 decimal place.

BABY	WEIGHT (KG)	WEIGHT (KG) TO 1 DECIMAL PLACE
1	3.125	
2	2.987	
3	2.45	
4	3.001	
5	2.78	

Solution

Round each decimal number up or down based on the digit in the second decimal place. Write all of your answers in the table as shown.

BABY	WEIGHT (KG)	WEIGHT (KG) TO 1 DECIMAL PLACE
1	3.125	3.1
2	2.987	3.0
3	2.45	2.5
4	3.001	3.0
5	2.78	2.8

Practice

1. Round 2.1982 to 1 decimal place.
2. Round 0.981 to the nearest tenth.
3. Round the following numbers to the nearest thousandth:
   a. 2.10481
   b. 0.59198
   c. 21.021021
   d. 9.090909
   e. 310.3579
4. Mustapha has a small shop. He runs his generator every evening. He recorded the amount of fuel that he used each day. Round each number to 1 decimal place.

DAY	FUEL USED (L)	FUEL (L) TO 1 DECIMAL PLACE
Monday	4.578	
Tuesday	3.45	
Wednesday	5.093	
Thursday	0.995	
Friday	3.72	

Lesson Title: Rounding Off Whole Numbers and Decimals to the Nearest 10, 100 and 1,000	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-028	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to round whole numbers and decimals to the nearest 10, 100 and 1,000.

Overview

To round whole numbers, look at the digit to the right of the digit to be rounded. If it is 5 or greater, round up. Otherwise round down if it is 4 or less.

When rounding to the nearest 10, 100 or 1,000, the numbers after the number to be rounded are replaced with zero (0). For example, 2,527 rounded to the nearest hundred is 2,500. The digits in the tens and ones place become 0.

If there are decimal digits in the number you are rounding, they are dropped. For example, 457.9 rounded to the nearest ten is 460. There are no decimal digits in the answer.

The symbol ≈ means **is approximately equal to** and we use it when rounding, because numbers are not exactly equal. For example, $457.9 \approx 460$.

Solved Examples

1. Round the following numbers to the nearest 10:
    a. 58
    b. 412
    c. 31.98
    d. 498

    Solutions

    a. $58 \approx 60$
    b. $412 \approx 410$
    c. $31.98 \approx 30$
    d. Note that in this example, 9 rounds up to 10. This carries over to the 100s place, and 4 becomes 5. We have $498 \approx 500$.

2. Round the following numbers to the nearest hundred:
    a. 3,402
    b. 251
    c. 32,789
    d. 319.99

    Solutions

    a. $3{,}402 \approx 3{,}400$
    b. $251 \approx 300$
    c. $32{,}789 \approx 32{,}800$
    d. $319.99 \approx \ 300$

3. The table below gives the distances between cities in Sierra Leone, in kilometres. Round each distance to the nearest 10.

CITIES	DISTANCE (KM)	DISTANCE (KM) TO THE NEAREST 10
Makeni to Freetown	187	
Makeni to Bo	133	
Bo to Kenema	68.5	
Bo to Freetown	241	
Kambia to Freetown	126	
Kailahun to Makeni	256	

Solution

Round each number in the table to the nearest 10:

CITIES	DISTANCE (KM)	DISTANCE (KM) TO THE NEAREST 10
Makeni to Freetown	187	190
Makeni to Bo	133	130
Bo to Kenema	68.5	70
Bo to Freetown	241	240
Kambia to Freetown	126	130
Kailahun to Makeni	256	260

4. Complete the table by rounding the numbers in the first column to each of the given place values.

Number	To the nearest ten	To the nearest hundred	To the nearest thousand
67		X	X
416			X
6,785			
458,262			

Solution

Number	To the nearest ten	To the nearest hundred	To the nearest thousand
67	70	X	X
416	420	400	X
6,785	6,790	6,800	7,000
458,262	458,260	458,300	458,000

Practice

1. Approximate 52,587 to:
    a. The nearest ten
    b. The nearest hundred
    c. The nearest thousand
2. The table below gives the populations of 6 cities in Sierra Leone. Round each number to the nearest 1,000.

CITY	POPULATION	POPULATION TO THE NEAREST 1,000
Freetown	1,055,964	
Makeni	112,428	
Bo	149,957	
Kenema	200,354	
Kambia	41,200	
Kailahun	525,372	

3. Complete the table by rounding the numbers in the first column to each of the given place values.

Number	To the nearest ten	To the nearest hundred	To the nearest thousand
98.6		X	X
568.19			X
1,115			
56,235			

Lesson Title: Multiplying and Dividing Whole Numbers and Decimals by Powers of 10	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-029	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to multiply and divide whole numbers and decimals by powers of 10.

Overview

Recall that the powers of 10 are equal to 10, 100, 1,000, and so on:

- $10^1 = 10$
- $10^2 = 10 \times 10 = 100$
- $10^3 = 10 \times 10 \times 10 = 1{,}000$

To multiply or divide decimals and whole numbers by powers of 10, we move the point to the **right for multiplication** and to the **left for division**. The power (or the number of zeros) tells us the number of places to move.

To **multiply** whole numbers by powers of 10, we add zeros. This is because if we move the decimal place to the right we need to add zeroes to hold the place. Therefore, the power tells us the number of zeros to be added to the number. For example: $327 \times 10^2 = 32{,}700$. This is the same as $327 \times 100 = 32{,}700$.

To **divide** a whole number by a power of 10, remember that the decimal point is to the right of the whole number and move it to the left. For example: $835 \div 10^3 = 0.835$. This is the same as $835 \div 1{,}000 = 0.835$.

Solved Examples

1. Multiply: $0.0027 \times 1{,}000$

   Solution

   There are 3 zeros in 1,000, so we move the decimal place to the right 3 places:

   $0.0027 \times 1{,}000 = 2.7$

2. Divide: $32{,}600 \div 100$

   Solution
   There are 2 zeros in 100, so we move the decimal place to the left 2 places:
   $32{,}600 \div 100 = 326$

3. Multiply: 2.15×10^3

   Solution
   The power on 10 is 3, so we move the decimal place to the right 3 places:
   $2.15 \times 10^3 = 2{,}150$

4. Divide: $31.9 \div 10^2$

   Solution
   The power on 10 is 2, so we move the decimal place to the left 2 places:
   $31.9 \div 10^2 = 0.319$

Practice

Evaluate the following:

1. 0.15×10^2
2. $2{,}419 \div 10^2$
3. 2.01×10
4. 23×100
5. $9.15 \times 1{,}000$
6. $32{,}000 \div 10$
7. $25 \div 10^3$
8. $25{,}055 \div 100$

Lesson Title: Review of the Four Operations with Whole Numbers	**Theme:** Everyday Arithmetic
Practice Activity: PHM-07-030	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to add, subtract, multiply and divide whole numbers.

Overview

This lesson is review of a topic from primary school: operations on whole numbers. You will practice adding ($+$), subtracting ($-$), multiplying ($\times$) and dividing ($\div$) whole numbers.

Remember that addition, subtraction and multiplication of large numbers is done vertically. Division of large numbers is done using long division, as in Solved Example 4.

Solved Examples

1. Add: $1{,}250 + 345 + 72$

   Solution

   Write the numbers vertically. Make sure the digits are lined up correctly (ones under ones, tens under tens, and so on).

   When you get a number greater than 9, you will **carry over**. In this example, the tens column gives $5 + 4 + 7 = 16$. Carry the 1 to the hundreds column, and write the 6 in the tens place of the answer.

   Answer: 1,667

$$\begin{array}{cccc} & {\scriptstyle 1} & & \\ 1 & 2 & 5 & 0 \\ & 3 & 4 & 5 \\ + & & 7 & 2 \\ \hline 1 & 6 & 6 & 7 \end{array}$$

2. Subtract: $562 - 28$

Solution

Write the numbers vertically. If the number on top is less than the number on bottom, you need to **borrow**. In this example, 2 is less than 8. We borrow one 10 from the tens column. In the tens column, 6 becomes 5. In the ones column, 2 becomes 12.

$$\begin{array}{r} {\scriptstyle 5} \\ 5\ \cancel{6}\ {}^{1}2 \\ -\quad 2\ 8 \\ \hline 5\ 3\ 4 \end{array}$$

Answer: 534

3. Multiply: 31×58

Solution

Write the numbers vertically.

First, multiply each number on top (3 and 1) by the 8 on the right side of the bottom number.

Then, multiply the same 3 and 1 by the 5 on the left side of the bottom number. Finally, add the two resulting numbers together. Remember to use 0 to hold the one's place in the bottom number of the addition problem.

$$\begin{array}{r} 3\ 1 \\ \times\ 5\ 8 \\ \hline 2\ 4\ 8 \\ +\ 1\ 5\ 5\ 0 \\ \hline 1\ 7\ 9\ 8 \end{array}$$

Answer: 1,798

4. Divide: $375 \div 5$

Solution

Write the numbers as a long division problem: $5\overline{)\,3\ 7\ 5}$

Solve the long division problem as shown on the right. These are the steps:

- 5 cannot go into 3, so we first divide $37 \div 5 = 7$ remainder 2
- Write the 7 on top. Multiply $7 \times 5 = 35$, and write the 35 under the 37.
- Subtract $37 - 35 = 2$
- Carry the 5 from 375 down to make 25.
- Divide $25 \div 5 = 5$. Write the 5 on top.
- Multiply $5 \times 5 = 25$, and write this under the 25 at the bottom.
- Subtract $25 - 25 = 0$. The problem is complete because we are left with 0.

$$\begin{array}{r} \quad\ 7\ 5 \\ 5\overline{)\,3\ 7\ 5} \\ -\ 3\ 5\ \downarrow \\ \hline \quad\ 2\ 5 \\ -\ 2\ 5 \\ \hline \quad\ 0 \end{array}$$

Answer: 75

Practice

Evaluate the following without using a calculator:

1. 12×18
2. $8{,}245 + 5{,}129$
3. 5×361
4. $315 \div 9$
5. $1{,}219 - 317$
6. $314 + 58 + 9$
7. $3{,}240 - 829$
8. $600 \div 15$

Lesson Title: Review of Addition and Subtraction With Decimals	**Theme:** Everyday Arithmetic
Practice Activity: PHM-07-031	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to add and subtract decimal numbers.

Overview

Adding and subtracting decimal numbers is similar to adding and subtracting whole numbers. Make sure that the digits are lined up according to their place value (tens under tens, and so on). Also make sure the decimal points are lined up vertically in the problem and answer.

You may apply the same rules for carry over and borrowing that you applied for whole numbers.

Solved Examples

1. Add: $134.5 + 12.31$

   Solution

   Write the numbers with the decimal points lined up vertically, then add.

$$\begin{array}{r} 1\ 3\ 4.\ 5\ 0 \\ +\ 1\ 2.\ 3\ 1 \\ \hline 1\ 4\ 6.\ 8\ 1 \end{array}$$

   Answer: 146.81

2. Add: $29.52 + 12.81$

   Solution

   This problem requires carry over. Note that 1 is carried over from the tenths place (to the right of the decimal point) to the ones place (to the left of the decimal point).

$$\begin{array}{r} {\scriptstyle 1\ \ 1\ \ \ \ } \\ 2\ 9.\ 5\ 2 \\ +1\ 2.\ 8\ 1 \\ \hline 4\ 2.\ 3\ 3 \end{array}$$

   Answer: 42.33

3. Subtract: $215.93 - 42.6$

Solution

Write the numbers vertically, with the larger number on top.

$$\begin{array}{r} {\scriptstyle 1} \\ 2\,\not{1}\,{}^{1}1\;5.\;9\;3 \\ -\quad\;\; 4\;2.\;6\;0 \\ \hline 1\;7\;3.\;3\;3 \end{array}$$

Answer: 173.33

4. Subtract: $19.05 - 5.32$

Solution

This problem requires borrowing. Note that 1 is borrowed from the ones place (to the left of the decimal point) to the tenths place (to the right of the decimal point).

$$\begin{array}{r} {\scriptstyle 8} \\ 1\;\not{9}.\;{}^{1}0\;5 \\ -\quad 5.\;3\;2 \\ \hline 1\;3.\;7\;3 \end{array}$$

5. Mr. Bangura sells rice in his shop. He sold 20.5 kg of rice in the morning, and 15.25 kg of rice in the afternoon. How much did he sell in total?

Solution

'In total' tells us to add the numbers:

$$\begin{array}{r} 2\;0.\;5\;0 \\ +1\;5.\;2\;5 \\ \hline 3\;5.\;7\;5 \end{array}$$

Answer: Mr. Bangura sold 35.75 kg of rice in total.

6. Subtract $14 - 10.83$

Solution

Remember every whole number has a decimal point after the last digit. We can write 14 as 14.00

Note that you cannot borrow from 0, so you must go to the left until you reach a digit you can borrow from. Borrow from 4 first to make 10 in the tenths place, then borrow from that 10 to make 10 in the hundredths place:

$$\begin{array}{r} {\scriptstyle 3\ \ 9} \\ 1\ \cancel{4}.\ \cancel{{}^{1}0}\ {}^{1}0 \\ -1\ 0.\ 8\ 3 \\ \hline 3.\ 1\ 7 \end{array}$$

Answer: 3.17

Practice

Add or subtract the numbers:

1. $215.98 + 125.2$
2. $1.5 - 0.9$
3. $2.25 - 1.81$
4. $18.9 + 21.52$
5. $4.8 + 20.345$
6. $247 - 21.8$
7. $314.98 - 42.7$
8. $2.98 + 3.762$
9. Mary had 6.25 yards of fabric. She used 2.5 yards to make a dress. How much fabric does she have left?

Lesson Title: Review of Multiplying and Dividing With Decimals	**Theme:** Everyday Arithmetic
Practice Activity: PHM-07-032	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to multiply and divide decimal numbers.

Overview

Multiplying and dividing decimal numbers is similar to multiplying and dividing whole numbers. There are some special rules that you should follow. These are given below.

For multiplication, multiply the numbers vertically as you would with whole numbers. The number of decimal places in the answer should be the same as the total number of decimal places in the problem. For example, in $0.25 \times 0.3 = 0.075$, there are 3 decimal places in total in the problem, and 3 decimal places in the answer. See Solved Example 1 for the full solution to this problem.

For division, we must make the divisor a whole number by multiplying by 10 (if it has 1 decimal place), by 100 (if it has 2 decimal places) or by 1,000 (if it has 3 decimal places). Multiply the dividend by the same number you multiplied by the divisor. Then, divide the numbers as we do in whole numbers. For example, consider the problem $1.68 \div 0.2$. The divisor is 0.2. We need to multiply it by 10 to get a whole number: $0.2 \times 10 = 2$. We also multiply 1.68 by 10, $1.68 \times 10 = 16.8$. Rewrite the problem: $1.68 \div 0.2 = 16.8 \div 2$. See Solved Example 2 for the full solution to this problem.

Solved Examples

1. Multiply: 0.25×0.3

   Solution

   You may work the problem with or without the decimal places.

   Method 1. Multiply the decimal numbers. The answer will have 3 decimal places, the same as the problem:

$$\begin{array}{rrrrr} & 0. & 2 & 5 \\ \times & & 0. & 3 \\ \hline & 0 & 7 & 5 \\ 0 & 0 & 0 & 0 \\ \hline 0. & 0 & 7 & 5 \end{array}$$

   Answer: 0.075

Method 2: Omit the decimal point and multiply the numbers as whole numbers. Make sure you have the same number of decimal places in your answer as there is in the question.

$$\begin{array}{rr} & 2\ \ 5 \\ \times & \quad 3 \\ \hline & 7\ \ 5 \end{array}$$

Since we have 3 decimal places in the question, move the decimal point 3 places from right to left.

Answer: 0.075

2. Divide: $1.68 \div 0.2$

Solution

Multiply both the dividend and the divisor by 10, to make the divisor a whole number:

$1.68 \times 10 = 16.8$ and $0.2 \times 10 = 2$

Thus, $1.68 \div 0.2 = 16.8 \div 2$.

Carry out the long division:

$$\begin{array}{r} \quad 8\ .\ 4 \\ \hline 2\,\big|\,1\ 6\ .\ 8 \\ -\ 1\ 6\quad\ \downarrow \\ \hline \quad\ 0\quad 8 \\ \quad -\quad\ 8 \\ \hline \quad\quad\ 0 \end{array}$$

Answer: $1.68 \div 0.2 = 8.4$

3. Multiply: 4×1.35

Solution

Write the number with more digits on top. The answer will have 2 decimal places, the same as the problem.

$$\begin{array}{rr} & 1.\ \ 3\ \ 5 \\ \times & \quad\quad 4 \\ \hline & 5.\ \ 4\ \ 0 \end{array}$$

Answer: 5.40

4. Divide: $18 \div 0.25$

Solution

Multiply both the dividend and the divisor by 100, to make the divisor a whole number:

$18 \times 100 = 1{,}800$ and $0.25 \times 100 = 25$

Thus, $18 \div 0.25 = 1{,}800 \div 25$.

Carry out the long division:

$$
\begin{array}{r}
 7\ 2 \\
25\,\big|\,1\ 8\ 0\ 0 \\
-\ 1\ 7\ 5\ \downarrow \\
\hline
\ 5\ 0 \\
-\ 5\ 0 \\
\hline
\ 0
\end{array}
$$

Answer: $18 \div 0.25 = 72$

5. Juliet is a baker. She uses 5.6 kg of flour each day for her cakes. How much flour does she use in 3 days?

   Solution

   Multiply to find the total amount she uses in 3 days: 5.6×3

$$
\begin{array}{rr}
 & {\scriptstyle 1\ \ \ } \\
 & 5.\ 6 \\
\times & 3 \\
\hline
 & 1\ 6.\ 8
\end{array}
$$

   Answer: She uses 16.8 kg of flour.

Practice

Multiply or divide the numbers:

1. 125×0.7
2. $16 \div 0.5$
3. $8.5 \div 0.25$
4. 0.8×0.2
5. 250.5×0.5
6. $9 \div 0.3$
7. 1.8×0.35
8. $6.25 \div 0.5$
9. Mustapha has 6.9 litres of juice. If he shares it equally between his 3 children, how much does each child get?

Lesson Title: Order of Operations - BODMAS	**Theme:** Everyday Arithmetic
Practice Activity: PHM-07-033	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to carry out calculations using the correct order of operations (BODMAS).

Overview

The letters BODMAS stand for: Bracket, Of, Division, Multiplication, Addition and Subtraction. When working problems which have more than one operation (of, $\times$, $+$, $-$, $\div$), we use BODMAS. The letters of the word (BODMAS) tell us the order in which we should work the operations in a math problem.

The term 'of' represents the multiplication sign, which includes powers. For example, 3^2. Now we need to know where powers come in the order of operations. Remember that they are like multiplication, because 3^2 means '3 times 3'. Powers are with 'of'. We work powers after brackets and before division.

Solved Examples

1. Simplify: $4 + 2^3$

   Solution

   First, look at the problem and decide what needs to be done. There is addition, and a power. Simplify the power first, then add:

$4 + 2^3$	$= 4 + 2 \times 2 \times 2$	Find 2^3
	$= 4 + 8$	
	$= 12$	Add

2. Simplify: $7 + (6 + 5^2) \times 3$

   Solution

$7 + (6 + 5^2) \times 3$	$= 7 + (6 + 25) \times 3$	Start inside brackets, using **of** first.
	$= 7 + (31) \times 3$	Add inside the brackets
	$= 7 + 93$	Multiply
	$= 100$	Add

3. Evaluate: $3 + 6 \times (5 + 4) \div 3 - 7$

Solution

$3 + 6 \times (5 + 4) \div 3 - 7$	$= 3 + 6 \times 9 \div 3 - 7$	Bracket
	$= 3 + 6 \times 3 - 7$	Division
	$= 3 + 18 - 7$	Multiplication
	$= 21 - 7$	Addition
	$= 14$	Subtraction

4. Evaluate: $1\frac{2}{3} - (1\frac{3}{4} \div 2\frac{5}{8})$

Solution

BODMAS applies to fractions and decimal numbers.

$1\frac{2}{3} - (1\frac{3}{4} \div 2\frac{5}{8})$	$= \frac{5}{3} - \left(\frac{7}{4} \div \frac{21}{8}\right)$	Convert mixed fraction to improper fraction
	$= \frac{5}{3} - \left(\frac{7}{4} \times \frac{8}{21}\right)$	Solve inside the bracket
	$= \frac{5}{3} - \left(\frac{1}{1} \times \frac{2}{3}\right)$	
	$= \frac{5}{3} - \frac{2}{3}$	Subtract
	$= \frac{3}{3}$	
	$= 1$	

5. Simplify: $2.5 \times (1.8 + 1.2)$

Solution

$2.5 \times (1.8 + 1.2)$	$= 2.5 \times (3.0)$	Bracket
	$= 7.5$	Multiplication

Practice

1. Evaluate $3^2 \times \frac{1}{3}$
2. Evaluate $(10 + 5.5) \times 3$
3. Simplify $12 + 5^2 \times 2$
4. Simplify $10 + (4^2 - 3) \times 2$
5. Simplify $\frac{1}{3} + \frac{5}{12} - \frac{5}{8} \times \frac{4}{10}$
6. Simplify $2\frac{1}{2} \times (\frac{1}{6} + \frac{1}{3})$

Lesson Title: Estimation	**Theme:** Everyday Arithmetic
Practice Activity: PHM-07-034	**Class:** JSS 1

Learning Outcomes

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

1. Round numbers to find rough estimates before calculating.
2. Check answers by calculating.

Overview

When we estimate an amount, we find the approximate value or quantity. We find something **close** to the answer, but not the exact answer. We can often make a rough estimate of a calculation by rounding numbers first, then applying operations. Estimation is very useful in everyday life because it allows us to find amounts without using a calculator.

The symbol ≈ means **is approximately equal to**. It is used to show rounded or approximated numbers.

Solved Examples

1. Estimate $4 \times 2{,}420$ to the nearest thousand.

   Solution

   Step 1. Round $2{,}420$ to the nearest thousand: $2{,}420 \approx 2{,}000$

   Step 2. Multiply: $4 \times 2{,}000 = 8{,}000$

   Therefore, $4 \times 2{,}420 \approx 8{,}000$

2. Estimate $514 + 391$ to the nearest hundred.

   Solution

   Step 1. Round the numbers: $514 \approx 500$ and $391 \approx 400$

   Step 2. Add: $500 + 400 = 900$

   Therefore, $514 + 391 \approx 900$

3. Sia spends Le 29,500 per month on transportation. How much does she spend per year? Find a rough estimate.

Solution

By rounding to the nearest ten thousand, we find that Sia spends around Le 30,000 per month on transportation. Using this estimate, she spends $30{,}000 \times 12 = \text{Le } 360{,}000$ per year on transportation.

4. A budget for local councils was organised in 2015. A council requested $3{,}825{,}000$ Leones for a radio broadcast. Give at least three ways in which a newspaper might have reported this amount.

Solution

The newspaper could have reported an estimate. Possibilities include 4,000,000, 3,800,000, or 3,830,000 Leones.

These numbers can also be written 4 million, 3.8 million, and 3.83 million. Newspapers often report large numbers in this way.

5. The monthly salary of a director of studies is $\text{Le } 794{,}306.00$ per month.
   a. Find an estimate for the director's monthly salary.
   b. Use the estimate to find how much she makes in a year.

   Solutions

   a. $\text{Le } 794{,}306.00 \approx \text{Le } 800{,}000.00$
   b. There are 12 months in a year. Multiply her estimated monthly salary by 12 to estimate how much she makes in a year:
   $\text{Le } 800{,}000 \times 12 = \text{Le } 9{,}600{,}000.00.$

6. a. Use a calculator to find the value of $\frac{3.967 \times 0.0992}{2.06}$.
   b. Check your result by making a rough estimate.

Solution

a. $\frac{3.967\times0.0992}{2.06} = \frac{0.3935264}{2.06}$ Multiply the numerator

$= 0.191032$ Divide (rounded to 6 decimal places)

b. $\frac{3.967\times0.0992}{2.06} = \frac{4\times0.1}{2}$ Use rough estimates of the numbers

$= \frac{0.4}{2}$ Multiply and simplify

$= 0.2$

The answer to b is near the answer to a. It is a good estimate.

Practice

1. Estimate $34{,}980 - 15{,}420$ to the nearest thousand.
2. Estimate $221 + 592$ to the nearest hundred.
3. The table below gives the estimated population of 5 districts in the eastern part of Sierra Leone in 2012.

District	Population	Estimated Population
Kailahun	525,372	
Kenema	609,873	
Kono	505,767	
Kambia	343,686	
Koinadugu	408,097	

   a. Round the populations to the nearest hundred thousand and complete the table. Use the rounded figures to answer the following questions.
   b. What is the approximate population difference between the districts with the highest and lowest populations?
   c. What is the approximate total population of the 5 districts?
4. A pupil writes 9 words on each line of writing. His exercise book has 29 lines in each page. Approximately how many words can he write on the page?
5. A petty trader makes Le 61,250.00 each day. If she works 5 days in a week, approximately how much money does she make each week? Estimate to the nearest ten thousand.

Lesson Title: Story Problems with Whole Numbers and Decimals	**Theme:** Everyday Arithmetic
Practice Activity: PHM-07-035	**Class:** JSS 1

Learning Outcomes

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

1. Solve story problems with whole numbers and decimals.
2. Give answers to a specified degree of accuracy.
3. Estimate answers to story problems with whole numbers and decimals before solving.

Overview

When you read story problems, look for key words that tell you which operation to use. Here are some examples of key words:

- **Addition:** Sum, total, add, increase, altogether
- **Subtraction**: Subtract, takeaway, difference, reduce, decrease, left
- **Multiplication**: Multiply, 'of', product, each, times
- **Division**: divide, quotient, share, each

Remember to write the units for each answer. For example, if the numbers in the problem give metres, you will also write metres on your answer.

Solved Examples

1. Abu's height is 1.5 m. and Foday's height is 1.3 m. What is their total height? Round your answer to the nearest metre.

   Solution

   The word 'total' tells us to add their heights: $1.5 + 1.3 = 2.8$

   We are asked to round the answer to the nearest metre. $2.8 \approx 3$ m.

$$\begin{array}{rrrr} & 1 & . & 5 \\ + & 1 & . & 3 \\ \hline & 2 & . & 8 \end{array}$$

2. Abu's height is 1.5 m and Foday's height is 1.3 m. How much taller is Abu than Foday?

   Solution

   None of the key words are here. However, the words 'how much taller' tell us that we want to find the difference in their heights. We will subtract: $1.5 - 1.3$

   Abu is 0.2 metres taller than Foday.

$$\begin{array}{rrrr} & 1 & . & 5 \\ - & 1 & . & 3 \\ \hline & 0 & . & 2 \end{array}$$

3. This morning, Mr. Bangura harvested 25.92 kg pepper from his farm. If he sold 12.67 kg of the pepper, how much does he have left?

   Solution

   The words 'how much does he have left' tell us to subtract: $25.92 - 12.67$

   Mr. Bangura has 13.25 kg pepper left.

$$\begin{array}{r} {\scriptstyle 8} \\ 2\ 5\ .\ \cancel{9}\ {}^{1}2 \\ -\ 1\ 2\ .\ 6\ 7 \\ \hline 1\ 3\ .\ 2\ 5 \end{array}$$

4. Hawa earns Le 65,000.00 each day. How much does she earn in 3 days?

   Solution

   Multiply to find the amount she earns in 3 days: $3 \times 65{,}000$

   Hawa earns Le 1,950,000 in 3 days.

$$\begin{array}{r} {\scriptstyle 1} \\ 6\ 5\ 0\ 0\ 0 \\ \times\ \ \ \ \ 3 \\ \hline 1\ 9\ 5\ 0\ 0\ 0 \end{array}$$

5. Three farmers work together on a farm. They share all of the work and all of the food equally. Today they harvested 31.2 kg of eggplant. How much will each farmer get?

   Solution

   The words "share…equally" tell us to divide: $31.2 \div 3$

   Each farmer gets 10.4 kg of eggplant.

$$\begin{array}{r} 1\ 0\ .\ 4 \\ 3\overline{)\ 3\ 1\ .\ 2} \\ -\ 3\ 0\ \ \downarrow \\ \hline \ \ \ \ 1\ \ 2 \\ -\ 1\ \ 2 \\ \hline \ \ \ \ \ \ 0 \end{array}$$

Practice

1. Sia has Le 36,000.00. She wants to buy new clothes for her 2 children. She will share the money equally between them. How much money will each child get for new clothes?
2. Abu has a shop. He sells 3.8 kg of sugar each day. If his store is open for 6 days in a week, how much sugar does he sell in 1 week?
3. Juliet is 167 cm tall, and Alice is 159.5 cm tall. How much taller is Juliet than Alice?
4. Mustapha harvested the cassava from his farm. It took him 3 days to sell all of it. He recorded the weight of the cassava he sold each day: 21.5 kg, 30.6 kg, 9.3 kg. How much cassava did he have all together?
5. David weighed 87.4 kg. If he reduced his weight by 4.9 kg, how much does he weigh now?

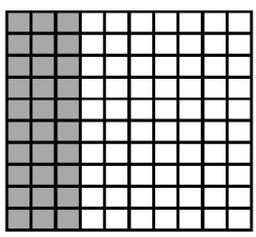
Lesson Title: Percentages	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-036	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify percentages as part of 100.

Overview

Percent means part of 100, or out of 100. For example, 30 percent means 30 out of one hundred. The square below is divided into 100 small pieces. Thirty of the squares are shaded. This shows 30%. This can also be written as a fraction: $30\% = \frac{30}{100}$



Solved Examples

1. A pupil scored 92 marks out of 100 on an exam. Express this as a percentage.

   Solution

   Percent means **out of 100**. This problem tells us that 92 is out of 100, so 92 is written as a percentage: 92%.

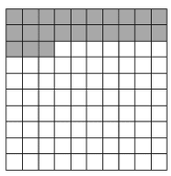
2. Express the following as a percentage:
   a. 41 out of 100
   b. $\frac{7}{100}$
   c. $\frac{99}{100}$
   d. 68 out of 100

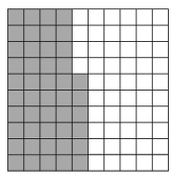
   Solution

   Each number is given out of 100. Each one can simply be expressed as a percentage:

   a. 41%
   b. 7%
   c. 99%
   d. 68%

3. The diagrams below each have 100 boxes. Write the percentage of boxes that are shaded in each one:

a. 

b. 

Solutions

Count the number of shaded boxes in each diagram. This number gives the percentage. Note that each row has 10 boxes. You can count quickly by counting by 10s.

a. 23%

b. 46%

4. There are 100 pupils enrolled in JSS1 in a certain school. Ninety-five of them passed their maths exam. What percentage of the pupils passed?

Solution

95 out of 100 passed the test. That is, 95% passed.

5. Of the 100 pupils in JSS1, 53 of them are girls. What percentage are girls?

Solution

53 out of 100 are girls. That is, 53% are girls.

6. A newspaper seller went out with 100 newspapers to sell. He sold 62 and the rest were unsold.

    a. What percentage of the papers were sold?

    b. What percentage of the papers were unsold?

Solutions

a. Sixty-two out of 100 were sold. That is 62%.

b. Subtract to find the number out of 100 that were unsold: $100 - 62 = 38$.
Thirty-eight out of 100 were unsold. That is 38%.

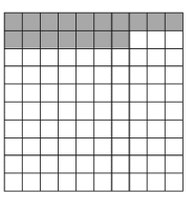
Practice

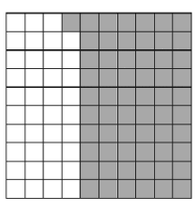
1. There are 100 children in a certain village. 21 of them are under 5 years old. What percentage of the children are under 5 years old?

2. Of the 100 children in the village, 11 of them are over 15 years old. What percentage of the children are over 15 years old?

3. Express the following as a percentage:
    a. $\frac{15}{100}$
    b. 3 out of 100
    c. $\frac{50}{100}$
    d. 81 out of 100

4. The diagrams below each have 100 boxes. Write the percentage of boxes that are shaded in each one:

    a. 

    b. 

5. There are 100 people living in a certain village. 32 of them are children and the rest are adults.
    a. What percentage of the people are children?
    b. What percentage of the people are adults?

Lesson Title: Percentages as Fractions and Decimals	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-037	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to express percentages as fractions and decimals.

Overview

Remember that percentage is out of 100. To convert a percentage to a fraction, simply place the numbers over a denominator of 100 and simplify to its lowest term. For example, 50% is the same as $\frac{50}{100}$. We also need to simplify it: $50\% = \frac{50}{100} = \frac{1}{2}$.

To express percentage as a decimal, divide the percentage by 100. Recall what happens when we divide a decimal or whole number by 100 - the decimal place moves 2 digits to the left. For example, consider 40%. The decimal place moves 2 digits to the left:

$$40\% \div 100 = 0.40$$

0.40 can be simplified to 0.4.

Solved Examples

1. Convert the percentages to fractions:
   a. 60% b. 48% c. 10% d. 15% e. 97%

   Solutions

   a. $60\% = \frac{60}{100} = \frac{6}{10} = \frac{3}{5}$
   b. $48\% = \frac{48}{100} = \frac{12}{25}$
   c. $10\% = \frac{10}{100} = \frac{1}{10}$
   d. $15\% = \frac{15}{100} = \frac{3}{20}$
   e. $97\% = \frac{97}{100}$

2. Convert the percentages to decimals:
   a. 12% b. 5% c. 90% d. 41% e. 10%

   Solutions

   a. $12\% = 0.12$
   b. $5\% = 0.05$
   c. $90\% = 0.90 = 0.9$
   d. $41\% = 0.41$
   e. $10\% = 0.10 = 0.1$

3. Ali and Sam shared a bowl of rice. Ali ate 20% of the bowl. Sam ate 0.3 of the bowl. Who ate more?

   Solution
   To compare fractions, decimals and percentages, we should convert them all to the same form. We can then use the skills we know to compare them. Let's convert 20% to a decimal number, then compare it to 0.3.

   Conversion of Ali's part: $20\% = 0.20 = 0.2$

   We know that $0.2 < 0.3$. Sam ate more than Ali.

4. Juliet and Sia shared a pawpaw. Juliet ate 40% of the pawpaw, and Sia ate $\frac{1}{5}$ of the pawpaw.
   a. Write both numbers as fractions.
   b. Find how much they ate in total. Give your answer as a fraction.
   c. How much of the pawpaw is left? Give your answer as a fraction.

   Solutions

   a. Sia's part is already a fraction, $\frac{1}{5}$. Convert Juliet's part to a fraction: $40\% = \frac{40}{100} = \frac{4}{10} = \frac{2}{5}$
   b. Add to find the total they ate: $\frac{1}{5} + \frac{2}{5} = \frac{3}{5}$ of the pawpaw
   c. Subtract the total amount they ate from 1 to find how much is left: $1 - \frac{3}{5} = \frac{5}{5} - \frac{3}{5} = \frac{5-3}{5} = \frac{2}{5}$ of the pawpaw

Practice

1. Write as fractions in their simplest form: a. 9% b. 45% c. 61%
2. Convert the percentages to decimals: a. 7% b. 21% c. 80%
3. Mohamed and Joseph shared a watermelon. Mohamed ate $\frac{1}{2}$ of the watermelon, and Joseph ate 20%. Who ate more?
4. Bendu, Hawa and Fatu share a watermelon. Bendu eats 25% and Hawa eats $\frac{1}{3}$. Fatu eats the rest.
    a. Write both numbers as fractions.
    b. Find how much Bendu and Hawa ate in total. Give your answer as a fraction.
    c. How much did Fatu eat? Give your answer as a fraction.

Lesson Title: Fractions and Decimals as Percentages	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-038	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to express fractions and decimals as percentages.

Overview

Remember that percentage is out of 100. Therefore, to express fractions as percentages, we multiply the fraction by 100, and simplify the result. For example, consider $\frac{3}{10}$. Multiply: $\frac{3}{10} \times \frac{100}{1} = \frac{300}{10} = 30\%$.

To express decimal as percentage, simply multiply the decimal by 100. Remember the rule for multiplying a decimal by 100 - move the decimal point two places to the right. Remember to write the percentage symbol (%) with the answer. For example, consider 0.25. The decimal place moves 2 digits to the right:

$$0.25 = 0.25 \times 100\% = 25\%$$

Remember that it is not necessary to write a decimal point after a whole number. The answer is 25%.

Solved Examples

1. Convert the following fractions to percentages:

   a. $\frac{4}{10}$ b. $\frac{1}{5}$ c. $\frac{7}{100}$ d. $\frac{3}{8}$ e. $\frac{17}{20}$

   Solutions

   a. $\frac{4}{10} \times \frac{100}{1} = \frac{400}{10} = 40\%$

   b. $\frac{1}{5} \times \frac{100}{1} = \frac{100}{5} = 20\%$

   c. $\frac{7}{100} \times \frac{100}{1} = \frac{7}{1} = 7\%$

   d. $\frac{1}{8} \times \frac{100}{1} = \frac{100}{8} = \frac{25}{2} = 12\frac{1}{2}\%$

   e. $\frac{17}{20} \times \frac{100}{1} = \frac{1700}{20} = 85\%$ or, cancel before multiplying: $\frac{17}{20} \times \frac{100}{1} = \frac{17}{1} \times \frac{5}{1} = \frac{85}{1} = 85\%$

2. Convert the following decimals to percentages:
   a. 0.5 b. 0.06 c. 0.13 d. 0.99 e. 0.1

Solutions

a. $0.5 = 0.5 \times 100\% \ = 50\%$
b. $0.06 = 0.06 \times 100\% = 6\%$
c. $0.13 = 0.13 \times 100\% = 13\%$
d. $0.99 = 0.99 \times 100\% = 99\%$
e. $0.1 = \ 0.1 \times 100\% = 10\%$

3. John scored $\frac{19}{20}$ on a maths exam. What was his percentage mark?

Solution

Method 1. To find John's percentage mark, convert $\frac{19}{20}$ to a percentage:

$$\frac{19}{20} \times \frac{100}{1} = \frac{19}{1} \times \frac{5}{1} = 95\%$$

John's mark on the maths exam was 95%.

Method 2. Note that it is easiest to solve $\frac{19}{20} \times \frac{100}{1}$ by cancelling diagonally before multiplying. We can also solve without cancelling, but we will need to divide $\frac{1{,}900}{20}$:

$$\frac{19}{20} \times \frac{100}{1} = \frac{1{,}900}{20} = 95\%$$

Practice

1. Convert the fractions to percentages: a. $\frac{1}{4}$ b. $\frac{4}{5}$ c. $\frac{7}{10}$ d. $\frac{11}{20}$ e. $\frac{1}{3}$
2. Convert the decimals to percentages: a. 0.9 b. 0.15 c. 0.88 d. 0.01
3. George scored $\frac{6}{10}$ on his maths assignment.
   a. Write his score as a percentage.
   b. Write his score as a decimal.
4. Hawa worked 4 maths problems for her assignment. She got 3 of them correct.
   a. Write the part she got correct as a fraction.
   b. Convert the fraction to a percentage.

Lesson Title: Identify the Percentage of a Given Quantity	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-039	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to calculate a given percentage of a given quantity.

Overview

Remember that we can write percent as fraction over 100. For example, $30\% = \frac{30}{100}$, and $25\% = \frac{25}{100}$.

To find the percentage of a given quantity, express the percentage as a fraction and then multiply the fraction by the given quantity.

Solved Examples

1. Calculate 15% of 500.

   Solution

   Step 1. Express 15% as a fraction: $\frac{15}{100}$

   Step 2. Find 15% of 500: $\frac{15}{100} \times \frac{500}{1} = \frac{7500}{100} = 75$

2. Calculate 65% of Le 50,000.00.

   Solution

   When there are units in a problem (for example, Leones) make sure you include the units with your answer. Note that money sometimes includes 2 extra zeros. These are for showing cents. If the two zeros are given in the problem, give them in the answer too. In this problem, Le 50,000.00 = 50,000. These amounts are the same.

   Step 1. Express 65% as a fraction: $\frac{65}{100}$

   Step 2. Find 65% of Le 50,000.00: $\frac{65}{100} \times \frac{50{,}000}{1} = \frac{65 \times 500}{1}$ = Le 32,500.00

3. Find 20% of 90 mangoes.

   Solution

   Step 1. Express 20% as a fraction: $20\% = \frac{20}{100}$

   Step 2. Multiply the fraction by 90: $\frac{20}{100} \times 90 = \frac{1}{5} \times 90 = 18$ mangoes

4. Musu gave 30% of her 50 oranges to her sister. How many oranges did she give away?

   Solution

   Step 1. Express the percent as a fraction: $30\% = \frac{30}{100}$

   Step 2. Multiply the fraction by 50: $\frac{30}{100} \times 50 = \frac{3}{10} \times 50 = 3 \times 5 = 15$ oranges

5. Joe is given $\text{Le } 15{,}000.00$ as lunch and transport to and from school every day. If he spends 40% of this amount as transport to and from school, how much is left for lunch?

   Solution

   We must first find how much he spends on transportation. Then, subtract that amount from 15,000 to find the amount left for lunch.

   Money spent on transportation $= \frac{40}{100} \times 15{,}000 = \text{Le } 6{,}000.00$

   Money left for lunch $= \text{Le } 15{,}000 - \text{Le } 6{,}000 = \text{Le } 9{,}000.00$

6. In a school with a pupil population of 900, 55% are girls. How many boys are there in the school?

   Solution

   We first find the number of girls. Then we subtract our answer from the total population.

   Step 1. Number of girls $= \frac{55}{100} \times 900 = 55 \times 9 = 495$ girls

   Step 2. Number of boys: $= 900 - 495 = 405$ boys

Practice

1. Find 60% of 800.
2. Find 5% of 1,000.
3. Find 2% of Le 48,000.00.
4. Find 35% of 120 mangoes.
5. Fatu bought a bag containing 150 oranges, but 10% were rotten. How many were rotten?
6. A village has a population of 1,500 people. If 28% of the population are children, then how many children are there?
7. A newspaper vendor has 500 newspapers to sell. He sold 25% of them. How many did he sell?
8. Magret was given Le 200,000.00 to buy shoes and a bag. She spent 40% to buy shoes, how much was left with her to buy the bag?

Lesson Title: Expressing One Quantity as a Percentage of Another	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-040	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to calculate one quantity as a percentage of another.

Overview

To express one quantity as a percentage of another, make sure both are in the same unit. You may see problems with different units, for example kilometres and metres. Always convert the bigger units to the smaller one to avoid complications. If you have a problem with both kilometres and metres, convert the kilometres to metres before solving.

To express a quantity as a percentage of another (both in the same unit) write the given quantity as a fraction of the total. Multiply by 100% and simplify.

Solved Examples

1. In a bag containing 250 mangoes, 30 got rotten. What percentage of the mangoes got rotten?

   Solution

$$\begin{aligned}\text{Percentage of rotten mangoes} &= \frac{\text{number of rotten mangoes}}{\text{total number of mangoes}} \times 100\% \\ &= \frac{30}{250} \times \frac{100}{1}\% \\ &= \frac{3}{25} \times \frac{100}{1}\ \% \\ &= \frac{3}{1} \times \frac{4}{1}\ \% \\ &= 12\%\end{aligned}$$

2. What percentage of Le $72{,}000.00$ is Le $1{,}800.00$?

   Solution

   Calculate Le $1{,}800$ as a percentage of Le $72{,}000$:

$$\frac{1800}{72{,}000} \times 100\% = \frac{18}{720} \times 100\% = \frac{180}{72} = \frac{5}{2} = 2.5\% \text{ or } 2\frac{1}{2}\%$$

3. On a maths exam, Fatu scored 38 marks out of a total of 40 marks. What percentage did she score?

Solution

Calculate 38 as a percentage of 40:

$$\frac{38}{40} \times 100\% = \frac{19}{20} \times 100\% = \frac{1900}{20}\% = 95\%$$

4. Express 60 g as a percentage of 2 kg.

Solution

Step 1. Use the fact that 1 kg = 1,000 g. Convert kg to g, because grammes are the smaller unit:

$$2\ \text{kg} = 2\ \text{kg} \times \frac{1{,}000\ \text{g}}{1\ \text{kg}} = 2{,}000\ \text{g}$$

Step 2. Write the given quantity (60 g) as a fraction of the total (2,000 g): $\frac{60}{2{,}000}$

Step 3. Multiply the fraction by 100%:

$$\frac{60}{2{,}000} \times 100\% = \frac{60}{20}\% = 3\%$$

5. In a class of 50 pupils, 35 are girls. Find the percentage of:
   a. Girls in the class
   b. Boys in the class

Solutions

a.

$$\begin{aligned} \text{Percentage of girls} &= \frac{number\ of\ girls\ in\ class}{number\ of\ pupils\ in\ class} \times 100 \\ &= \frac{35}{50} \times 100 \\ &= 70\% \end{aligned}$$

b.

$$\begin{aligned} \text{Number of boys} &= number\ of\ pupils\ - number\ of\ girls \\ &= 50 - 35 \\ &= 15\ boys \\ \text{Percentage of boys} &= \frac{number\ of\ boys\ in\ class}{number\ of\ pupils\ in\ class} \times 100 \\ &= \frac{15}{50} \times 100 \\ &= 30\% \end{aligned}$$

Practice

1. Express Le 100.00 as a percentage of Le $1{,}000.00$.
2. Express 400 g as a percentage of 2 kg.
3. During a mathematics test lasting 1 hour, a pupil took 9 minutes to answer one question. What percentage of the test time was used to answer the question?
4. Koroma had 300 mangoes and sold 240 of them.
    a. What percentage of the mangoes did he sell?
    b. What is the percentage of mangoes left?
5. In a farm there are 100 chickens, 700 goats, 200 sheep. What percentage of the total number of animals on the farm are:
    a. Chickens
    b. Goats
    c. Sheep

Lesson Title: Percentage Increase	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-041	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to calculate the percentage increase, given two numbers.

Overview

Percentage change is all about comparing old to new values. A change can be either an increase or a decrease. When the new value is greater than the old value, it is a percentage increase. When the new value is less than the old value, it is a decrease.

This lesson is on percentage increase. To find percentage increase, express the change in quantity as a fraction of the original quantity and then multiply by 100.

The formula for calculating percentage change is:

$$\text{Percentage change} = \frac{\text{change in quantity}}{\text{original quantity}} \times 100$$

To find the percentage increase, we need the change in quantity and the original quantity. Then, we substitute the numbers into this formula. We divide them and multiply by 100%. To calculate change in quantity for an increase, subtract the original quantity from the new quantity (New quantity – Original quantity).

Solved Examples

1. The cost of petrol increased from $\text{Le } 4{,}500.00$ to $\text{Le } 6{,}300.00$ per litre. Calculate the percentage increase.

   Solution
   Step 1. Calculate the change in quantity: $6{,}300 - 4{,}500 = \text{Le } 1{,}800.00$
   Step 2. Calculate percentage increase using the formula:

$$\text{Percentage increase} = \frac{1{,}800}{4{,}500} \times 100 = \frac{1{,}800}{45} = 40\%$$

2. Martin is a farmer. One week, he harvested 12 kg of cassava. The next week, he harvested 21 kg of cassava. What was the percentage increase?

   Solution
   Step 1. Calculate the change in quantity: $21 - 12 = 9$ kg
   Step 2. Calculate percentage increase using the formula:

$$\text{Percentage increase} = \frac{9}{12} \times 100 = \frac{3}{4} \times 100 = \frac{300}{4} = 75\%$$

3. There were 44 pupils in a class. If 11 more pupils enroll in the class, what is the percentage increase?

   Solution
   Step 1. The change in quantity is given in the problem. It is 11.
   Step 2. Calculate the percentage increase using the formula:

$$\text{Percentage increase} = \frac{11}{44} \times 100 = 25\%$$

Practice

1. A factory increases its annual production of shoes from 4,000 to 4,600. Calculate the percentage increase in the number of shoes.
2. A litre of petrol cost Le 8,000.00, and the price increased to Le 8,500.00. What was the percentage increase?
3. The population of a village increased from 500 to 525. Calculate the percentage increase.
4. Last year, there were 50 babies born at a certain hospital. This year, there were 65 babies born at the same hospital. What is the percentage increase?
5. Fatu scored 60 marks on her maths exam. She was not happy with her score, and decided to study a lot. On her next maths exam, she scored 90 marks. What was the percentage increase of her score?
6. Mr. Kargbo was paying Le 500,000.00 rent per year. His landlord decided to increase the rent to Le 550,000.00. Calculate the percentage increase.

Lesson Title: Percentage Decrease	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-042	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to calculate the percentage decrease, given two numbers.

Overview

Finding percentage decrease is similar to finding percentage increase, which was the topic of the previous lesson. We use the same formula. To find percentage decrease, express the change in quantity as a fraction of the original quantity and then multiply by 100.

The formula for calculating percentage change is:

$$\text{Percentage change} = \frac{\text{change in quantity}}{\text{original quantity}} \times 100$$

The difference is how we find the change in quantity. To calculate change in quantity for a **decrease**, subtract the new quantity from the original quantity (original quantity – new quantity). This is the opposite of what we did to find the change in quantity for an increase.

In summary, this is how to find the change in quantity for each:

- Increase: new quantity – original quantity
- Decrease: original quantity – new quantity

Note that we always subtract the smaller number from the larger number.

Solved Examples

1. Mustapha is a farmer. Last week, he sold his cassava for Le 4,000.00 per kilogramme. This week, there is more cassava on the market. He could only sell his cassava for Le 3,800.00 per kilogramme. What is the percentage decrease in the price?

   Solution

   Step 1. Calculate the change in quantity: $4{,}000 - 3{,}800 = \text{Le } 200.00$

   Step 2. Calculate percentage decrease using the formula:

   $$\text{Percentage decrease} = \frac{200}{4{,}000} \times 100 = \frac{200}{40} = \frac{20}{4} = 5\%$$

2. A new health centre was built in a particular town and the number of babies dying per month decreased from 20 to 8. Calculate the percentage decrease.

   Solution
   Step 1. Calculate the change in quantity: $20 - 8 = 12$ babies
   Step 2. Calculate percentage increase using the formula:

$$\text{Percentage decrease} = \frac{12}{20} \times 100 = \frac{120}{2} = 60\%$$

3. The population of a village was 800 people. Twenty young people moved away to enrol in university. What is the percentage decrease?

   Solution
   Step 1. The change in quantity is given in the problem. It is 20.
   Step 2. Calculate the percentage decrease using the formula:

$$\text{Percentage decrease} = \frac{20}{800} \times 100 = \frac{20}{8} = 2.5\%$$

Practice

1. Fatu scored 90 marks on her previous maths exam. She was very happy with her score, and she did not study for the next exam. She scored 45 marks on her next exam. What was the percentage decrease of her score?
2. A litre of petrol cost Le 8,000.00, and the price decreased to Le 7,400.00. What was the percentage decrease?
3. The population of a village decreased from 640 to 560. Calculate the percentage decrease.
4. Last year, there were 8,000 patients treated at a certain hospital. This year, 7,600 patients were treated at the same hospital. What is the percentage decrease?
5. Hawa sells oranges at the market. She had 100 oranges, and she sold 51 of them. Calculate the percentage decrease.

Lesson Title: Applying Percentage Increase or Decrease	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-043	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to calculate a number given the percentage increase or decrease upon a given number.

Overview

The previous lessons focused on finding the percentage increase or decrease given 2 numbers. In this lesson, you will find the new quantity after an increase or decrease. If there is a percentage increase, it means we add to the original amount. If there is a percentage decrease, it means we subtract from the original amount.

To calculate a new quantity given the percentage increase or decrease upon the original, given number, follow these steps:

- State the increase or decrease in percent.
- For percent increase, **add** the percentage to 100%.
- For percent decrease, **subtract** the percentage from 100%.
- Since it is percent, divide the answer by 100 to cancel the percentage.
- Multiply the answer by the given number to give the new number.

Use the following formulae:

Percentage increase: New number $= \frac{100+\text{percentage increase}}{100} \times \frac{\text{the given number}}{1}$

Percentage decrease: New number $= \frac{100-\text{percentage decreae}}{100} \times \frac{\text{given number}}{1}$

Solved Examples

1. The number 600 is increased by 35%. Find the new number.

   Solution

   Use the formula for percentage increase:

$$\begin{aligned}\text{New number} &= \frac{100+\text{percentage increase}}{100} \times \frac{\text{the given number}}{1} \\ &= \frac{100+35}{100} \times \frac{600}{1} \\ &= \frac{135}{1} \times \frac{6}{1} \\ &= 135 \times 6 \\ &= 810\end{aligned}$$

2. The number 600 is decreased by 35%. Find the new number.

   Solution

   Use the formula for percentage decrease:

$$\begin{aligned}\text{New number} &= \frac{100-\text{percentage decrease}}{100} \times \frac{\text{the given number}}{1} \\ &= \frac{100-35}{100} \times \frac{600}{1} \\ &= \frac{65}{1} \times \frac{6}{1} \\ &= 65 \times 6 \\ &= 390\end{aligned}$$

3. The population of a certain village is 5,600 people. If the population increased by 12%, what is the new population?

   Solution

   Use the formula for percentage increase to find the new population:

$$\begin{aligned}\text{New number} &= \frac{100+\text{percentage increase}}{100} \times \frac{\text{the given number}}{1} \\ &= \frac{100+12}{100} \times \frac{5{,}600}{1} \\ &= \frac{112}{1} \times \frac{56}{1} \\ &= 112 \times 56 \\ &= 6{,}272 \text{ people}\end{aligned}$$

4. Mohamed's profit last week was Le 90,000.00. If his profit decreased by 15% this week, what is his profit this week?

Solution

Use the formula for percentage decrease to find his new profit:

$$\text{New number} = \frac{100-\text{percentage decrease}}{100} \times \frac{\text{the given number}}{1}$$
$$= \frac{100-15}{100} \times \frac{90{,}000}{1}$$
$$= \frac{85}{1} \times \frac{900}{1}$$
$$= 85 \times 900$$
$$= \text{Le } 76{,}500.00$$

5. A man bought a piece of land for $\text{Le } 500{,}000$. Ten years later, the value of the land had increased by 60%. Calculate the new value of the land.

Solution

$$\text{The new value} = \frac{100+60}{100} \times \frac{\text{Le } 500{,}000}{1}$$
$$= \frac{160}{100} \times \frac{\text{Le } 500{,}000}{1}$$
$$= 160 \times \text{Le } 5{,}000$$
$$= \text{Le } 800{,}000.00$$

6. A track which was 60 m long is decreased by 15%. Calculate the new length of the track.

Solution

$$\text{The new length} = \frac{100-15}{100} \times \frac{60}{1}$$
$$= \frac{85}{100} \times \frac{60}{1}$$
$$= \frac{85}{10} \times 6$$
$$= 8.5 \times 6$$
$$= 51 \text{ m}$$

Practice

1. A seamstress gives a discount of 5% for customers who pay in advance. Calculate the reduced price of a dress that originally cost $\text{Le } 70{,}000.00$.
2. An athlete took 10 seconds to sprint 100 m during practice. If in the actual race, he reduced his time by 8%. How long did it take him to run the actual race?
3. Increase a length of 80 cm by 30%.
4. A messenger received a salary of $\text{Le } 68{,}500.00$. He was promoted to a higher grade and his salary increased by 14%. Calculate his new salary.
5. The number of pupils enrolled in a certain school was 520 last year. This year, enrolment increased by 15%. How many pupils are enrolled in the school this year?
6. Joe's parents usually give him Le 5,000.00 as lunch. He misbehaved one day and his lunch money was reduced by 20%. How much did he take to school that day?

Lesson Title: Apply Percentages to Problems with Money	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-044	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to solve problems with percentages involving money.

Overview

In this lesson, you will practise what you have learned in the previous 3 lessons on percentages. You will apply these skills to real-life problems involving money. Review the information in Lessons 41 to 43 if needed.

Solved Examples

1. Last year, Hawa's profit from her business was Le 7,500,000.00. This year, her profit increased by 21%. What is her profit this year?

   Solution

   Use the formula to find the new profit after a percentage increase:

$$\begin{aligned}\text{New profit} &= \frac{100+\text{percentage increase}}{100} \times \frac{\text{the given number}}{1} \\ &= \frac{100+21}{100} \times \frac{\text{Le } 7{,}500{,}000}{1} \\ &= \frac{121}{1} \times \frac{\text{Le } 75{,}000}{1} \\ &= 121 \times \text{Le } 75{,}000 \\ &= \text{Le } 9{,}075{,}000.00\end{aligned}$$

2. Last year, Mustapha spent Le 800,000.00 on his children's school fees. This year, he spent Le 760,000.00 on their school fees.
   a. Did the school fees increase or decrease?
   b. What is the percentage change?

Solution

a. The school fees decreased. We know this because the new amount (Le 760,000.00) is less than the original amount (Le 800,000.00).
b. First, calculate the change in quantity: $800{,}000 - 760{,}000 = \text{Le } 40{,}000.00$

$$\begin{aligned}\text{Percentage change} &= \frac{\text{change in quantity}}{\text{original quantity}} \times 100 \\ &= \frac{40{,}000}{800{,}000} \times 100 \\ &= \frac{40{,}000}{8{,}000} \\ &= 5\% \text{ decrease}\end{aligned}$$

3. Sia sells rice in the market. Last month, she sold rice for Le 1,200.00 per cup. However, the price of rice increased. She wants to increase the cost of her rice by 10% per cup. How much will her rice cost per cup now?

Solution

Use the formula below for percentage increase to find the new cost of her rice:

$$\begin{aligned}\text{New number} &= \frac{100+\text{percentage increase}}{100} \times \frac{\text{the given number}}{1} \\ &= \frac{100+10}{100} \times \frac{1200}{1} \\ &= \frac{110}{1} \times \frac{12}{1} \\ &= 110 \times 12 \\ &= \text{Le } 1{,}320.00\end{aligned}$$

4. Martin opened a new cookery shop. On the first day, his profit was Le 210,000.00. The second day, his profit was 5% lower. What was his profit the second day?

Solution

Use the formula below for percentage decrease to find his new profit:

$$\begin{aligned}\text{New number} &= \frac{100-\text{percentage decrease}}{100} \times \frac{\text{the given number}}{1} \\ &= \frac{100-5}{100} \times \frac{210{,}000}{1} \\ &= \frac{95}{1} \times \frac{2{,}100}{1} \\ &= 95 \times 2100 \\ &= \text{Le } 199{,}500.00\end{aligned}$$

5. Fatu is an engineer. Her monthly salary is Le 1,200,000.00. Next year, her monthly salary will increase to Le 1,500,000.00. What is the percentage increase?

   Solution

   Step 1. Find the change in quantity: $1{,}500{,}000 - 1{,}200{,}000 = 300{,}000$

   Step 2. Use the formula for percentage change:

$$\begin{aligned} \text{Percentage change} &= \frac{\text{change in quantity}}{\text{original quantity}} \times 100 \\ &= \frac{300{,}000}{1{,}200{,}000} \times 100 \\ &= \frac{300{,}000}{12{,}000} \\ &= 25\% \text{ increase} \end{aligned}$$

Practice

1. Last year, Bendu's profit from her business was Le 9,000,000.00. This year, her profit decreased by 15%. What is her profit this year?
2. Foday is a professional football player. His monthly salary is Le 2,500,000.00. Next year, his monthly salary will increase by 10%. What will his new salary be?
3. Sam sells vegetables in the market. On Monday, his profit was Le 120,000.00. On Tuesday, his profit was Le 138,000.00.
   a. Did his profit increase or decrease?
   b. What was the percentage change?
4. Sia is a doctor. Her monthly salary is Le 3,200,000.00. Next year, her monthly salary will increase to Le 3,360,000.00. What is the percentage increase?
5. The price of a bag of rice decreased by 5%. If the original price was Le 300,000.00 per bag, what is the new price of rice per bag?

Lesson Title: Story Problems with Percentages	**Theme:** Numbers and Numeration
Practice Activity: PHM-07-045	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to solve story problems with percentages.

Overview

In this lesson, you will practise what you have learned in the previous lessons on percentages. You will apply these skills to story problems. The story problems in this lesson are similar to the story problems on the BECE exam. Review the information in Lessons 39 to 43 if needed.

Solved Examples

1. Sia gets 85% correct on a test of 40 questions. Calculate the number of questions in the test she got wrong.

   Solution

   Step 1. Calculate how many questions she got correct:

   $\frac{85}{100} \times 40 = \frac{85}{10} \times 4 = \frac{340}{10} = 34$ questions

   Step 2. Calculate how many questions she got wrong:

   If she got 34 questions correct, then she got $40 - 34 = 6$ questions wrong

2. A tank contains 500 litres of water. If 150 litres are used, what percentage is left?

   Solution

   Step 1. Find the number of litres left:

   $500 - 150 = 350$ litres

   Step 2. Find the percentage that is left. Calculate 350 as a percentage of 500:

   $\frac{350}{500} \times 100\% = \frac{350}{5}\% = 70\%$

3. Abu is 12% heavier than Yusuf. If Yusuf weighs 20 kg, what is Abu's weight?

   Solution

   Use the formula for percentage **increase** to find Abu's weight, because he weighs **more** than Yusuf:

$$\text{New number} = \frac{100+\text{percentage increase}}{100} \times \frac{\text{the given number}}{1}$$

$$\text{Abu's weight} = \frac{100+12}{100} \times \frac{20}{1}$$

$$= \frac{112}{100} \times \frac{20}{1}$$

$$= \frac{112}{5} \times \frac{1}{1}$$

$$= 22\frac{2}{5} \text{ kg or } 22.4 \text{ kg}$$

4. Kwame bought a car for GHc 60,000.00. He sold the same car for GHc 63,000.00. What was the percentage increase in the price?

   Solution

   On the BECE exam, you may see currencies that are not Leones. Treat the problem the same as you would treat Leones. Write the correct unit on the answer. This problem handles Ghanaian cedi, which has the symbol GHc. You may also see dollars ($).

   Step 1. Find the change in quantity: $63{,}000 - 60{,}000 = 3{,}000$

   Step 2. Use the formula to find the percentage increase:

$$\text{Percentage change} = \frac{\text{change in quantity}}{\text{original quantity}} \times 100$$

$$= \frac{3{,}000}{60{,}000} \times 100$$

$$= \frac{3{,}000}{600}$$

$$= 5\% \text{ increase}$$

Practice

1. Aminata bought a car for Le 10,000,000.00 and sold it a year later for Le 7,500,000.00. What was the percentage decrease in the value of the car?
2. In a classroom of 50 pupils, 27 are girls. What percentage of the pupils are boys?
3. Mary is 15% taller than Ama. If Ama is 140 cm tall, what is Mary's height?
4. Mark got 92% of his answers correct on a test of 50 questions. Calculate the number of questions in the test he got wrong.
5. A doctor treated 250 patients in a week. A total of 32% of them were children, and the rest were adults.
   a. How many children did the doctor treat?
   b. How many adults did the doctor treat?

Answer Key – JSS 1 Term 1

Lesson Title: Concept and Vocabulary of Factors
Practice Activity: PHM-07-001

1. a. 22: 1, 2, 11, 22; b. 36: 1, 2, 3, 4, 6, 9, 12, 18, 36; c. 29: 1,29; d. 120: 1, 2, 3, 4, 5, 6, 8, 10, 12, 15, 20, 24, 30, 40, 60, 120
2. 60
3. 18
4. a. 90: 1, 2, 3, 5, 6, 9, 10, 15, 18, 30, 45, 90; b. Even number factors: 2, 6, 10, 18, 30, 90; c. Prime number factors: 2, 3, 4.

Lesson Title: Multiples of Whole Numbers
Practice Activity: PHM-07-002

1. a. 6, 12, 18, 24, 30; b. 7, 14, 21, 28, 35; c. 25, 50, 75, 100, 125; d. 40, 80, 120, 160, 200.
2. 21, 24, 27, 30, 33, 36, 39
3. The circled numbers are: 4, 8, 20, 24, 28, 40, 44, 400
4. 75,100,125,150

Lesson Title: Prime Factors of Whole Numbers
Practice Activity: PHM-07-003

1. a. 17; b. 2, 11; c. 31; d. 2, 3, 23
2. Completed table:

Numbers	Factors	Prime factors
23	1, 23	23
34	1, 2, 17, 34	2, 17
40	1, 2, 4, 5, 8, 10, 20, 40	2, 5
50	1, 2, 5, 10, 25, 50	2, 5

3. 31, 37, 41, 43, 47

Lesson Title: Common Factors
Practice Activity: PHM-07-004

1. a. 1, 2; b. 1, 2, 4; c. 1, 2, 3, 4, 6, 12; d: 1, 5
2. 1, 2
3. a. 24: 1, 2, 3, 4, 6, 8, 12, 24; 36: 1, 2, 3, 4, 6, 9, 12, 18, 36; b. 1, 2, 3, 4, 6, 12; c. 12

Lesson Title: Highest Common Factor (HCF)
Practice Activity: PHM-07-005

1. a. 4; b. 5
2. a. 12; b. 28; c. 18
3. 18

Lesson Title: Common Multiples
Practice Activity: PHM-07-006

1.

   8: 8, 16, 24, 32, (40), 48, 56, 64, 72, (80)

   10: 10, 20, 30, (40), 50, 60, 70, (80), 90, 100

2. 24
3. 30, 60, 90
4. 8, 16, 24, 32, 40

Lesson Title: Lowest Common Multiple (LCM)
Practice Activity: PHM-07-007

1. a. 4; b. 6
2. a. 24; b. 60; c. 36
3. 120
4. 180

Lesson Title: Square of Whole Number
Practice Activity: PHM-07-008

1. a. 1; b. 16; c. 49
2. a. 121; b. 225; c. 900

Lesson Title: Cubed Whole Numbers
Practice Activity: PHM-07-009

1. a. 1000; b. 64; c. 1
2. a. 343; b. 125; c. 0; d. 729

Lesson Title: Higher Powers of Whole Numbers
Practice Activity: PHM-07-010

1. a. $3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3 \times 3$; b. $8 \times 8 \times 8 \times 8$; c. $9 \times 9 \times 9 \times 9 \times 9 \times 9 \times 9$
2. a. 7^4; b. 4^7; c. 3^5
3. 625
4. 32
5. 1

Lesson Title: Multiplying Two Indices
Practice Activity: PHM-07-011

1. a^{15}
2. u^7
3. 9^{11}
4. 4^5
5. 9^{12}
6. 7^{10}

Lesson Title: Dividing Two Indices
Practice Activity: PHM-07-012

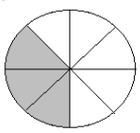
1. 5^6
2. a^9
3. 2^{25}
4. 4^{10}
5. b^8
6. 8^9

Lesson Title: Multiplication and Division of Indices
Practice Activity: PHM-07-013

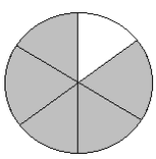
1. 3^6
2. 4^{12}
3. a
4. 2^6
5. 5^5
6. 5

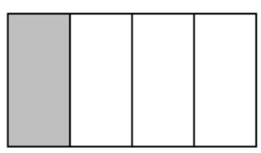
Lesson Title: Introduction to Fractions
Practice Activity: PHM-07-014

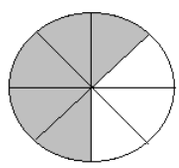
1. a. $\frac{1}{6}$; b. $\frac{3}{10}$; c. $\frac{1}{3}$
2. $\frac{3}{8}$:



3. You may draw any shapes. These are examples:

a. 

b. 

c. 

Lesson Title: Fractions with Different Denominators
Practice Activity: PHM-07-015

1. $\frac{3}{4}$
2. $\frac{2}{6}$
3. $\frac{1}{10}, \frac{1}{9}, \frac{1}{6}, \frac{1}{3}, \frac{1}{2}$
4. $\frac{5}{6}, \frac{5}{9}, \frac{5}{12}, \frac{5}{15}, \frac{5}{20}$
5. Circled fractions: $\frac{3}{4}, \frac{3}{5}, \frac{3}{6}, \frac{3}{7}$

Lesson Title: Adding Fractions with the Same Denominator
Practice Activity: PHM-07-016

1. a. $\frac{3}{4}$; b. $\frac{4}{15}$; c. $\frac{5}{8}$
2. a. 1; b. $1\frac{3}{5}$; c. $1\frac{1}{8}$
3. $\frac{3}{5}$ of the book
4. 1 bowl of rice

Lesson Title: Adding Fractions with Different Denominators
Practice Activity: PHM-07-017

1. $\frac{1}{2}$
2. $1\frac{2}{15}$
3. $\frac{4}{15}$
4. $\frac{13}{14}$
5. $\frac{2}{3}$
6. $1\frac{17}{20}$

Lesson Title: Subtracting Fractions with the Same Denominator
Practice Activity: PHM-07-018

1. $\frac{5}{9} - \frac{2}{9} = \frac{3}{9} = \frac{1}{3}$
2. a. $\frac{1}{6}$; b. $\frac{7}{15}$; c. $\frac{3}{8}$
3. a. $\frac{6}{7}$; b. 0; c. $\frac{1}{4}$
4. $\frac{1}{3}$ of the book

Lesson Title: Subtracting Fractions with Different Denominators
Practice Activity: PHM-07-019

1. $\frac{1}{6}$
2. $\frac{7}{15}$
3. $\frac{3}{5}$
4. $\frac{1}{4}$
5. $1\frac{3}{4}$
6. $\frac{1}{6}$ of the watermelon

Lesson Title: Multiplication of Fractions
Practice Activity: PHM-07-020

1. $\frac{3}{25}$
2. $\frac{1}{5}$
3. $\frac{1}{16}$

4. $\frac{5}{36}$
5. $\frac{1}{8}$

Lesson Title: Division of Fractions
Practice Activity: PHM-07-021

1. 3
2. 4
3. $\frac{7}{18}$
4. $1\frac{5}{9}$
5. 24
6. $\frac{11}{12}$
7. $\frac{2}{5}$

Lesson Title: Story Problems on the Basic Operations on Fractions
Practice Activity: PHM-07-022

1. 35 kg.
2. $1\frac{1}{8}$ mile
3. $\frac{3}{8}$ of the field
4. 20 cakes
5. $3\frac{3}{4}$ hours
6. $\frac{3}{8}$ of a mile

Lesson Title: Place Value for Decimals
Practice Activity: PHM-07-023

1. Thousandths
2. Circled digits:

   3.14 4.586 10.691 0.10

3. Completed table:

	Tens	Ones	.	tenths	hundredths	thousandths
87.017	8	7	.	0	1	7
99.009	9	9	.	0	0	9
15.7	1	5	.	7		
0.11		0	.	1	1	
10.01	1	0	.	0	1	
9.090		9	.	0	9	0

4. Completed table:

24.7	Twenty-four point seven
19.19	Nineteen point one nine
91.03	Ninety-one point zero three
9.006	Nine point zero zero six

Lesson Title: Decimals to Fractions
Practice Activity: PHM-07-024

1. $\frac{9}{20}$
2. $5\frac{13}{50}$
3. $\frac{1}{200}$
4. $10\frac{1}{20}$
5. $25\frac{1}{4}$
6. $9\frac{7}{10}$
7. $\frac{2}{25}$
8. $3\frac{3}{10}$

Lesson Title: Fractions to Decimals
Practice Activity: PHM-07-025

1. 0.7
2. 0.031
3. 1.99
4. 0.6
5. 0.375
6. 0.45
7. 4.5
8. 0.0625

Lesson Title: Rounding off Decimal Numbers to Whole Numbers
Practice Activity: PHM-07-026

1. a. 318; b. 0; c. 2; d. 71; e. 201
2. Completed table:

PUPIL	DISTANCE (KM)	DISTANCE TO THE NEAREST KM.
Sia	3.8	4
David	1.75	2
Annette	0.3	0
Yusuf	2.5	3
Mary	2.189	2
Foday	1.09	1

Lesson Title: Rounding off Decimal Numbers
Practice Activity: PHM-07-027

1. 2.2
2. 1.0
3. a. 2.105; b. 0.592; c. 21.021; d. 9.091; e. 310.358
4. Completed table:

DAY	FUEL USED (L.)	FUEL (L) TO 1 DECIMAL PLACE
Monday	4.578	4.6
Tuesday	3.45	3.5
Wednesday	5.093	5.1
Thursday	0.995	1.0
Friday	3.72	3.7

Lesson Title: Rounding Off Whole Numbers and Decimals to the Nearest 10, 100 and 1000
Practice Activity: PHM-07-028

1. a. 52,590; b. 52,600; c. 53,000
2. Completed table:

CITY	POPULATION	POPULATION TO THE NEAREST 1000
Freetown	1,055,964	1,056,000
Makeni	112,428	112,000
Bo	149,957	150,000
Kenema	200,354	200,000
Kambia	41,200	41,000
Kailahun	525,372	525,000

3. Completed table:

Number	To the nearest ten	To the nearest hundred	To the nearest thousand
98.6	100	X	X
568.19	570	600	X
1,115	1,120	1,100	1,000
56,235	56,240	56,200	56,000

Lesson Title: Multiplying and Dividing Whole Numbers and Decimals by Powers of 10
Practice Activity: PHM-07-029

1. 15
2. 24.19
3. 20.1
4. 2,300
5. 9,150
6. 3,200
7. 0.025
8. 250.55

Lesson Title: Review of the Four Operations with Whole Numbers
Practice Activity: PHM-07-030

1. 216
2. 13,374
3. 1,805
4. 35
5. 902
6. 381
7. 2,411
8. 40

Lesson Title: Review of Addition and Subtraction with Decimals
Practice Activity: PHM-07-031

1. 341.18
2. 0.6
3. 0.44
4. 40.42
5. 25.145
6. 225.2
7. 272.28
8. 6.742
9. 3.75 yards

Lesson Title: Review of Multiplication and Division with Decimals
Practice Activity: PHM-07-032

1. 87.5
2. 32
3. 34
4. 0.16
5. 125.25
6. 30
7. 0.63
8. 12.5
9. 2.3 litres

Lesson Title: Order of Operations – BODMAS
Practice Activity: PHM-07-033

1. 3
2. 46.5
3. 62
4. 36
5. $\frac{1}{2}$
6. $1\frac{1}{4}$

Lesson Title: Estimation
Practice Activity: PHM-07-034

1. 20,000
2. 800
3. a. See completed table below; b. 300,000; c. 2,300,000

District	Population	Estimated Population
Kailahun	525,372	500,000
Kenema	609,873	600,000
Kono	505,767	500,000
Kambia	343,686	300,000
Koinadugu	408,097	400,000

4. There are different possible answers based on how you estimate: $10 \times 29 = 290$ words or $10 \times 30 = 300$ words
5. $\text{Le}60{,}000 \times 5 = \text{Le}300{,}000.00$

Lesson Title: Story Problems with Whole Numbers and Decimals
Practice Activity: PHM-07-035

1. Le 18,000.00
2. 22.8 kg
3. 7.5 cm
4. 61.4 kg
5. 82.5 kg

Lesson Title: Percentages
Practice Activity: PHM-07-036

1. 21%
2. 11%
3. a. 15%; b. 3%; c. 50%; d. 81%
4. a. 17%; b. 61%
5. a.32% b.68%

Lesson Title: Percentages as Fractions and Decimals
Practice Activity: PHM-07-037

1. a. $\frac{9}{100}$; b. $\frac{9}{20}$; c. $\frac{61}{100}$
2. a. 0.07; b. 0.21; c. 0.8
3. $\frac{1}{2} > \frac{1}{5}$; Mohamed ate more
4. a. $\frac{1}{4}$, $\frac{1}{3}$; b. $\frac{7}{12}$; c. $\frac{5}{12}$

Lesson Title: Fractions and Decimals as Percentages
Practice Activity: PHM-07-038

1. a. 25%; b. 80%; c. 70%; d. 55%; e. $33\frac{1}{3}$%
2. a. 90%; b. 15%; c. 88%; d. 1%
3. a. 60%; b. 0.6
4. a. $\frac{3}{4}$; b. 75%

Lesson Title: Identify the Percentage of a Given Quantity
Practice Activity: PHM-07-039

1. 480
2. 50
3. Le 960.00
4. 42 mangoes
5. 15 oranges
6. 420 children
7. 125 newspapers
8. Le120,000.00

Lesson Title: Express One Quantity as a Percentage of Another
Practice Activity: PHM-07-040

1. 10%
2. 20%
3. 15%
4. a. 80%; b. 20%
5. a. 10%; b. 70%; 20%

Lesson Title: Percentage Increase
Practice Activity: PHM-07-041

1. 15%
2. 6.25%
3. 5%
4. 30%
5. 50%
6. 10%

Lesson Title: Percentage Decrease
Practice Activity: PHM-07-042

1. 50%
2. 7.5%
3. 12.5%
4. 5%
5. 51%

Lesson Title: Percentage Increase or Decrease
Practice Activity: PHM-07-043

1. Le 66,500.00
2. 9.2 seconds
3. 104 cm.
4. Le 78,090.00
5. 598 pupils
6. Le4000.00

Lesson Title: Apply Percentages to Problems with Money
Practice Activity: PHM-07-044

1. Le 7,650,000.00
2. Le 2,750,000.00
3. a. Increase; b. 15%
4. 5%
5. Le 285,000.00

Lesson Title: Story Problems with Percentages
Practice Activity: PHM-07-045

1. 25%
2. 46%
3. 161 cm
4. 4 questions
5. a. 80 children; b. 170 adults

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