THE PRESIDENT'S RECOVERY PRIORITIES
Education

Ministry of Education, Science and Technology

Lesson plans for

JSS Mathematics

JSS 1

TERM 1

Foreword

Our country's future lies in the education of our children. The Government of Sierra Leone is committed to doing whatever it takes to secure this future.

As Minister of Education, Science and Technology since 2007, I have worked every day to improve our country's education. We have faced challenges, not least the Ebola epidemic which as we all know hit our sector hard. The Government's response to this crisis – led by our President – showed first-hand how we acted decisively in the face of those challenges, to make things better than they were in the first place.

One great success in our response was the publication of the Accelerated Teaching Syllabi in August 2015. This gave teachers the tools they needed to make up for lost time whilst ensuring pupils received an adequate level of knowledge across each part of the curriculum. The Accelerated Teaching syllabi also provided the pedagogical resource and impetus for the successful national radio and TV teaching programs during the Ebola epidemic.

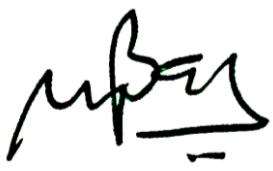
It is now time to build on this success. I am pleased to issue new lesson plans across all primary and JSS school grades in Language Arts and Mathematics. These plans give teachers the support they need to cover each element of the national curriculum. In total, we are producing 2,700 lesson plans – one for each lesson, in each term, in each year for each class. This is a remarkable achievement in a matter of months.

These plans have been written by experienced Sierra Leonean educators together with international experts. They have been reviewed by officials of my Ministry to ensure they meet the specific needs of the Sierra Leonean population. They provide step-by-step guidance for each learning outcome, using a range of recognised techniques to deliver the best teaching.

I call on all teachers and heads of schools across the country to make best use of these materials. We are supporting our teachers through a detailed training programme designed specifically for these new plans. It is really important that these Lesson Plans are used, together with any other materials you may have.

This is just the start of education transformation in Sierra Leone. I am committed to continue to strive for the changes that will make our country stronger.

I want to thank our partners for their continued support. Finally, I also want to thank you – the teachers of our country – for your hard work in securing our future.



Dr. Minkailu Bah

Minister of Education, Science and Technology

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JSS
Mathematics

Introduction

to the Lesson Plan Manual

These lesson plans are based on the National Curriculum
and meet the requirements established
by the Ministry of Education, Science and Technology.

1. The lesson plans will not take the whole term, so use spare time to review material or prepare for exams.
2. Teachers can use other textbooks alongside or instead of these lesson plans.
3. Read the lesson plan before you start the lesson. Look ahead to the next lesson, and see if you need to tell pupils to bring materials for next time.
4. Make sure you understand the learning outcomes, and have teaching aids and other preparation ready – each lesson plan shows these using the symbols on the right.
5. Quickly review what you taught last time before starting each lesson.
6. Follow the suggested time allocations for each part of the lesson. If time permits, extend practice with additional work.
7. Lesson plans have a mix of activities for the whole class and for individuals or in pairs.
8. Use the board and other visual aids as you teach.
9. Interact with all pupils in the class – including the quiet ones.
10. Congratulate pupils when they get questions right! Offer solutions when they don't, and thank them for trying.


Learning outcomes


Teaching aids


Preparation

Lesson Title: Concept and Vocabulary of Factors	**Theme:** Numbers and Numeration	
Lesson Number: M-07-001	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to identify factors of given numbers.	 **Teaching Aids** None	 **Preparation** None

Opening *(4 minutes)*

1. Write two numbers on the board: 12 and 24
2. **Say**: What numbers exactly divide 12 and 24?
3. Allow pupils to brainstorm and give their answers.
   - If pupils find this difficult, explain the meaning of 'divide'. For example, numbers divide 12 if they can be multiplied by other numbers to get 12.
   - It could be helpful to give 1-2 example before asking them to give more answers. (For example, 3 and 4 divide 12 because $12 \div 3 = 4$ or $3 \times 4 = 12$)
4. Write the pupils' answers on the board as they call them out. (Answers: 12: 1, 2, 3, 4, 6, 12, 24: 1, 2, 3, 4, 6, 8, 12, 24)
5. **Say:** Today, we will learn about factors, which are the numbers that divide another number.

Introduction to New Material *(12 minutes)*

1. **Ask:** What are factors?
2. Allow pupils to share ideas. (For example: These are numbers that can go into another number without a remainder). From their ideas discuss the meaning of factors with pupils.
3. **Say:** If a number divides another number without a remainder, that number is a factor. The numbers listed next to 12 and 24 on the board are the factors of 12 and 24.
4. Write another number on the board: 20
5. Ask pupils to name any 2 numbers that will give a product of 20, and list their answers on the board. (Answers: $20 = 1 \times 20, 2 \times 10, 4 \times 5$).
6. **Say:** These numbers can divide 20 without a remainder. Therefore, 1, 2, 4, 5, 10, 20 are factors of 20.
7. Write another number on the board: 60
8. Ask pupils to brainstorm for one minute and write as many factors of 60 as they can in their exercise books.
9. Ask pupils to call out their answers and write them on the board. Encourage them to keep thinking until all of the factors are given. (Answer: $1, 2, 3, 4, 5, 6, 10, 12, 15, 20, 30, 60$)

Guided Practice *(7 minutes)*

1. Write on the board: Find all factors of the following numbers: 40, 28, 48
2. Ask pupils to solve the problems in pairs.

3. Move around the pupils to check for understanding and clear any misconceptions.
4. Allow pairs to compare their answers.
5. Select 3 different pairs to come to the board one at a time to present their answers. (Answers: Factors of 40: $1, 2, 4, 5, 8, 10, 20, 40$ Factors of 28: $1, 2, 4, 7, 14, 28$ Factors of 48: $1, 2, 4, 7, 14, 28$)

Independent Practice *(10 minutes)*

1. Write on the board: Find the factors of the following numbers: 18, 30, 32
   (i) 18 (ii) 30 (iii) 32
2. Ask pupils to work independently to solve the problems in their exercise books.
3. Walk around the class, check whether they are working correctly in their books and clear any misconceptions.
4. Ask pupils to exchange ideas with their seatmates.
5. Ask 3 pupils to stand and list each of the 3 answers. All other pupils should check their own answers. (Answers: Factors of 18: $1, 2, 3, 6, 9, 18$, Factors of 30: $1, 2, 3, 5, 6, 10, 15, 30$, Factors of 32: $1, 2, 4, 8, 16, 32$)

Closing *(2 minutes)*

1. Ask pupils to do an exit ticket problem (a problem to complete before leaving class).
2. Write on the board: 36
3. Ask pupils to list the factors in their exercise books as quickly as they can. Walk around the room and briefly check their answers and understanding of the topic. (Answer: $2, 3, 4, 6, 9, 18, 36$)
4. **Say**: Thank you for your active participation keep it up.

Lesson Title: Multiples of Whole Numbers	**Theme:** Numbers and Numeration	
Lesson Number: M-07-002	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to identify multiples of given numbers.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. Write on the board: List all factors of 15 and 38
2. Ask pupils to find the factors in their exercise books.
3. Call on pupils one at a time to give one of the factors, and list their answers on the board. (Answers: 15: 1, 3, 5, 15, 38: 1, 2, 19, 38)
4. **Say:** Our lesson today is how to identify multiples of given numbers.

Introduction to New Material *(13 minutes)*

1. **Ask:** What is a multiple?
2. Allow pupils to think and share ideas. (Example answer: 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).
3. **Say:** A multiple of a number is formed by multiplying it with another number.
4. Write on the board: $3 \times 4 = 12$
5. **Say:** 12 is a multiple of 3, because we can multiply 3 by another number to get 12.
6. Write on the board: $4 \times 3 = 12$
7. **Say**: 12 is also a multiple of 4. This is because 4 times another number gives 12.
8. Write on the board: $12 \div 3 = 4$
9. **Say:** 12 can be divided exactly by 3. There is no remainder on the answer. This is another way to identify that 12 is a multiple of 3.
10. Write on the board: Write down the first 3 multiples of 5.
11. Remind pupils how to find multiples of a number. Start to multiply the number by 1, then 2, 3, 4, and so on.
12. Write on the board: $5 \times 1 = 5,\ 5 \times 2 = 10,\ 5 \times 3 = 15$
13. **Ask**: What are the first 3 multiples of 5? (Answer: $5, 10, 15$)
14. **Say:** Each number has unlimited multiples. Let's consider more multiples of 5.
15. Write on the board: Multiples of 5: 5, 10, 15, 20, 25, 30, 35, 40…
16. **Say:** This list can go on forever because the multiples of 5 are unlimited.
17. **Say:** Here are some 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, means it can continue on and on.

18. Write another question on the board: Write down all multiples of 4 greater than 10 but less than 30.
19. Discuss the question with pupils.
20. **Say:** We consider only the answers between 10 and 30 which are multiples of 4. Let's make a list, and then choose the ones between 10 and 30.
21. Ask pupils to call out the multiples of 4 and write them on the board**:** 4, 8, 12, 16, 20, 24, 28, 32, 36
22. Ask a pupil to go to the board and underline the multiples of 4 greater than 10 but less than 30. Ask all other pupils to do the task in their exercise books. (Answer: $12, 16, 20, 24, 28$)

Guided Practice *(7 minutes)*

1. Write 2 questions on the board:
   (i) Write down the first 5 multiples of 9.
   (ii) Write down all multiples of 7 greater than 20 but less than 45.
2. Ask pupils to work in pairs.
3. Walk around the class; help them to work with each other, check for understanding and clear misconceptions.
4. Select two pairs to come to the board to present their answers. (Answers: (i) 9, 18, 27, 36, 45 (ii) 21, 28, 35, 42)

Independent Practice *(10 minutes)*

1. Write 2 questions on the board:
   (i) Write down the first 5 multiples of 11.
   (ii) Write down all multiples of 8 greater than 30 but less than 50.
2. Ask pupils to work individually to solve the problems.
3. Move around the class, check whether they are working correctly and clear misconceptions
4. Call 2 pupils to stand and give the answers. (Answers: (i) 11, 22, 33, 44, 55 (ii) 32, 40, 48)
5. Ask pupils to check the answers in their exercise books.
6. Ask pupils what they notice about the answer to (i). Encourage them to notice the pattern of 2 digit numbers, where the tens and ones digits are the same as the number the 11 is multiplied by. (The 2^{nd} multiple of 11 is 22, the 3^{rd} multiple is 33, the 4^{th} multiple is 44 and so on.)

Closing *(2 minutes)*

1. Ask pupil few questions to review. Allow them to share their ideas with the class.
   (i) What are multiples? (Example answer: A multiple of any number is a number which can be divided exactly by that number.)
   (ii) How do we determine multiples of a number? (Multiples of a number can be determined by multiplying the given number by any other whole number.)

Lesson Title: Prime Factors of Whole Numbers	**Theme:** Numbers and Numeration	
Lesson Number: M-07-003	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to find prime factors of whole numbers between 20 and 50.	 **Teaching Aids** Factor table	 **Preparation** Write the Factor table in the Independent Practice on the board.

Opening *(3 minutes)*

1. Ask a pupil to describe prime numbers in his/her own words. (Answer: They are numbers that have only two factors, 1 and the number itself.)
2. Ask pupils randomly to give the prime numbers between 0 and 25. Write their answers on the board. (Answers: 2, 3, 5, 7, 11, 13, 17, 19, 23)
3. **Say**: Today we will learn how to find prime factors of numbers.

Introduction to the New Material (*15 minutes*)

1. **Ask**: What are factors? (Answer: Factors are numbers that divide other numbers exactly.)
2. Write 27 on the board.
3. Ask a pupil to come to the board and list down all the factors of 27. Ask all other pupils to complete the same task in their exercise books. (Answer: 1, 3, 9 and 27)
4. **Say:** The factors of a number that are also prime numbers are referred to as **prime factors**.
5. Write 30 on the board.
6. Ask a pupil to come to the board and write the factors of 30. Ask all other pupils to complete the same task in their exercise books. (Answer: 1, 2, 3, 5, 6, 10, 15, 30)
7. Ask a pupil to identify the prime numbers among the factors of 30. [Answer: 2, 3, 5]
8. **Say**: 2, 3 and 5 are the prime factors of 30.
9. Ask pupils to look at the factors of 27 on the board.
10. Ask a pupil to identify any prime factors of 27 [Answer: 3]
11. **Say**: Learning to find prime factors of numbers will help you to find the highest common factors of numbers (HCF). It will also help you to find the least common multiple (LCM) of numbers. These are used in other math topics.

Guided Practice *(5 minutes)*

1. Ask pupils to work in pairs.
2. Write on the board: 36 and 45.
3. **Say**: Write down all the factors of 36 and 45 in your exercise book. Choose the prime factors from the factors of each number. Make a list of prime factors.
4. Move around the class and observe the pupils as they work.
5. Make corrections where necessary.
6. Ask for two volunteers to write their work on the board. (Answer: Factors of 36: 1, 2, 3, 4, 6, 9, 12, 18, 36. Prime factors of 36: 2, 3. Factors of 45: 1, 3, 5, 9, 15, 45. Prime factors of 45: 3, 5)

Independent Practice *(10 minutes)*

1. Look at the table on the board:

Numbers	Factors	Prime factors
32		
35		
48		

2. Tell the pupils to work individually.
3. **Say**: Complete the 2nd column by writing down all the factors of each number.
4. **Say**: Complete the last column by writing the prime factors among the factors you have listed.

   Answer:

Numbers	Factors	Prime factors
32	1, 2, 4, 8, 16, 32	2
35	1, 5, 7, 35	5, 7
48	1, 2, 3, 4, 6, 8, 12, 16, 24, 48	2, 3

Closing *(2 minutes)*

1. Check for proper understanding of the concept of prime factors.
2. Ask 2 pupils to come in front of the class.
3. Tell each to give a number and list its prime factors on the board.
4. Discuss their numbers and the prime factors with the class.

Lesson Title: Common Factors	**Theme:** Numbers and Numeration	
Lesson Number: M-07-004	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to identify common factors of given numbers.	 **Teaching Aids** None	 **Preparation** None

Opening *(3 minutes)*

1. **Ask**: What is a factor? (Answer: a number that can go into another number without a remainder)
2. **Ask**: What are the factors of 6, 10 and 18?
3. Write pupils' responses on the board. (Answer: 6: 1, 2, 3, 6 10: 1, 2, 5, 10 18: 1, 2, 3, 6, 9, 18)
4. **Say**: Today we are going to identify common factors of given numbers.

Introduction to the New Material *(10 minutes)*

1. Write on the board: 4 and 6.
2. **Ask**: Can someone tell us the factors of 4? (Answer: 4: 1, 2, 4)
3. Write the factors of 4 as the pupil lists the numbers.
4. **Ask**: Can someone tell us the factors of 6? (Answer: 6: 1, 2, 3, 6)
5. Write the factors of 6 as the pupil lists the numbers.
6. **Ask:** What numbers are the same for 4 and 6? Circle the numbers that are common. (Answer: 4: ①, ②, 4; 6: ①, ②, 3, 6)
7. **Say:** The numbers that are factors of both 4 and 6 are common. Therefore, they are called **common factors**.

Guided Practice (*10 minutes*)

1. Write 8 and 12 on the board.
2. **Ask:** Can someone tell us the factors of 8? (Answer: 1, 2, 4, 8)
3. Write the factors of 8 as the pupil lists the numbers.
4. **Ask:** Can someone tell us the factors of 12? (Answer: 1, 2, 3, 4, 6, 12)
5. Write the factors of 12 as the pupil lists the numbers.
6. **Ask:** What numbers are the same for 8 and 12? Circle the numbers that are common. (Answer: 8: ①, ②, ④, 8 12: ①, ②, 3, ④, 6, 12)
7. Ask pupils to explain what a 'common factor' is in their own words. (Example answers: factors that two numbers have in common, a number that divides two different numbers, the same number in two lists of factors.)
8. **Say:** Let's do another problem.
9. Write 9 and 15 on the board.
10. Ask the pupils to list the factors for each number. Allow them 2 minutes to complete the problem in their exercise books. (Answer: 9: 1, 3, 9 15: 1, 3, 5, 15)

11. Ask for pupils to volunteer to list the factors for each number as you write the numbers on the board.

12. **Ask**: What are the common factors of 9 and 15?
    (Answer: 9: ①, ③and 9 15: ①, ③, 5 and 15 Common factors: 1 and 3)

Independent Practice *(10 minutes)*

1. Write 4 pairs of numbers on the board: (a) 6 and 12 (b) 5 and 10 (c) 8 and 20 (d) 9 and 15
2. **Say:** Find the common factors for the pairs of numbers. Write down the factors of the numbers for each pair and circle the common factors in your exercise books.
3. Walk around to check their work and help pupils as needed.
4. Allow pupils 5 minutes to complete the 4 problems.
5. Ask pupils to exchange their exercise books with the pupil next to them and compare answers.
   Answers:
   (a) 6: ①, ②, ③, ⑥ and 12: ①, ②, ③, 4, ⑥, 12
   (b.) 5: ①, ⑤ and 10: ①, 2, ⑤, 10
   (c) 8: ①, ②, ④, 8 and 20: ①, ②, ④, 5, 10, 20
   (d) 9= ①, ③, 9 and 15: ①, ③, 5, 15

Closing *(2 minutes)*

1. **Ask**: What did you learn from the lesson today? (Example answer: to identify common factors of given numbers)
2. **Ask:** Explain the word 'common' in relation to numbers. (Example answer: Common means things or numbers found everywhere.)

Lesson Title: Highest Common Factor (HCF)	**Theme:** Numbers and Numeration	
Lesson Number: M-07-005	**Class/Level:** JSS 1	**Time:** 35 minutes

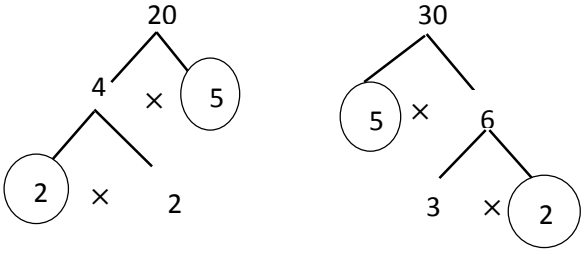
Learning Outcomes By the end of the lesson, pupils will be able to identify highest common factors of a given number.	**Teaching Aids** None	**Preparation** None

Opening *(4 minutes)*

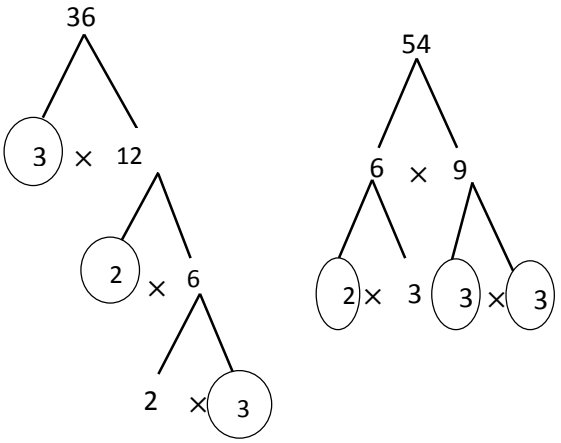
1. Ask a pupil to explain in his/her own words what are factors. (Example answers: numbers that divide another number exactly, numbers that are multiplied together to get a product)
2. Ask another pupil to explain in his/her own words what are common factors. (Example answer: When two or more numbers have the same factor, that factor is called a common factor.)
3. Write on the board: Find all the common factors of 12 and 18
4. Ask pupils to call out the factors of 12, and write them on the board: 12: 1, 2, 3, 4, 6, 12
5. Do the same for 18: 18: 1, 2, 3, 6, 9, 18
6. **Ask:** What are the common factors of 12 and 18?
7. Write the common factors on the board as pupils call them out: 1, 2, 3, 6
8. **Say:** Today we will learn how to find the highest common factor, or HCF of numbers. This will help us to simplify fractions.

Introduction to the New Material *(14 minutes)*

1. **Say:** 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.
2. **Say:** Look at the list of common factors of 12 and 18. Which of these common factors is the biggest? (Answer: 6)
3. **Say:** Therefore the HCF of 12 and 18 is 6
4. **Ask**: What is the HCF of 6 and 9?
5. Allow pupils to think about it for a moment and work in their exercise books. Then, ask a pupil to give the answer. (Answer: 3)
6. **Say:** 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.
7. Write on the board: Find the HCF of 20 and 30
8. Use the factor tree method to find the HCF of 20 and 30 on the board (see below). As you work the problem, explain the steps below to the pupils.
9. Explain the steps to follow in using the factor tree method to find the HCF of numbers:
   i. Write down the numbers
   ii. Underneath, multiply any two numbers to get the number at the top.
   iii. Continue multiplying until you don't have any composite numbers. When you come to a prime number, the branch stops there.
   iv. Circle the prime factors that the two numbers have in common.
   v. Multiply the common prime factors between the two numbers to get the HCF.



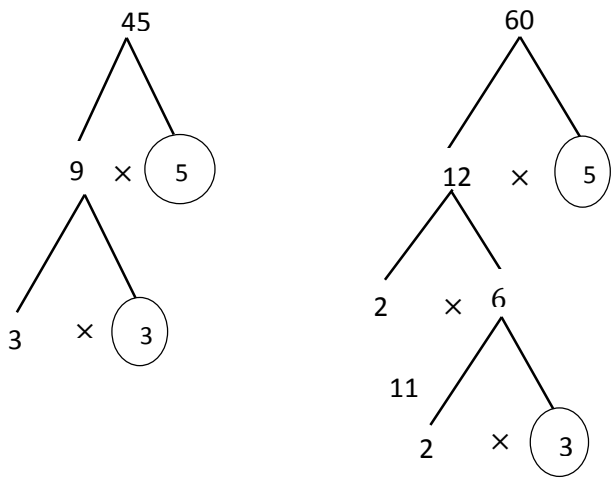
10. Write on the board: HCF of 20 and 30: $2 \times 5 = 10$
11. Write another question on the board: Find the HCF of 36 and 54.
12. Follow the steps above to get the HCF.
13. Ask pupils at each stage of the multiplication to give the two factors we multiply to get the number at the top.



14. Write on the board: HCF of 36 and 54: $2 \times 3 \times 3 = 18$

Guided Practice *(5 minutes)*

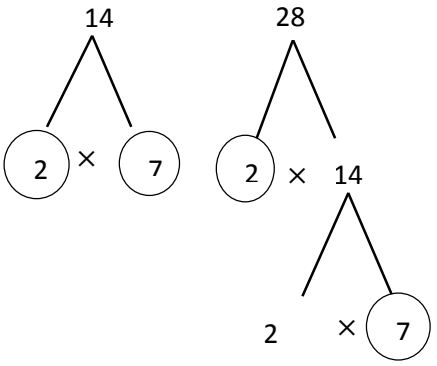
1. Write this question on the board: Use the factor tree to find the HCF of 45 and 60.
2. Ask pupils to work in pairs to solve the problem on the board.
3. Move around and check for any misconception and clarify it.
4. Ask one to write their answer on the board. (Answer: HCF of 45 and 60 $= 3 \times 5 = 15$)



Independent Practice *(10 minutes)*

1. Write two questions on the board: Use a factor tree to find the HCF of:
   a.) 14 and 28 b.) 18 and 30
2. Ask pupils to work independently to solve the problems on the board in their exercise books.
3. Move around and check on pupils work. Assist in case of any difficulties.
4. Ask pupils to exchange books with the pupil next to them and compare answers.
5. Ask two pupils to come to the board and solve the problems. (Answers: a.) $2 \times 7 = 14$ b.) $2 \times 3 = 6$)

(a).



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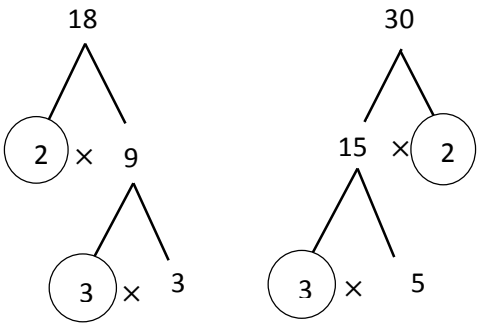


Closing *(2 minutes)*

1. Ask pupils to explain the meaning of HCF in their own words and discuss. (Example answer: HCF is the largest factor among the common factors of the numbers.)

Lesson Title: Common Multiples	**Theme:** Numbers and Numeration	
Lesson Number: M-07-006	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the Lesson pupils will be able to identify common multiples of a given number.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. Ask a pupil to explain multiple in his/her own words. (Example answer: When you multiply a given whole number by any other whole number, the result is a multiple of that number.)
2. Ask a pupil to give the first five multiples of 5. (Answer: 5, 10, 15, 20, 25)
3. Ask another pupil to give the first 6 multiple of 10. (Answer: 10, 20, 30, 40, 50, 60)
4. **Say:** Today, we will learn how to identify the common multiples of numbers.

Introduction to the New Material *(15 minutes)*

1. Write 4 and 6 on the board.
2. Ask pupils to give the first 10 multiples of 4 and record their responses on the board. (Answer: 4, 8, 12, 16, 20, 24, 28, 32, 36, 40)
3. Ask pupils to give the first 8 multiples of 6 and record their responses on the board. (Answer: 6, 12, 18, 24, 30, 36, 42, 48)
4. Call a pupil to come to the board and circle the numbers that are present for both 4 and 6.
   Answer: 4: 4, 8, (12), 16, 20, (24), 28, 32, (36), 40
   6: 6, (12), 18, (24), 30, (36), 42, 48
5. **Say:** The numbers 12, 24, and 36 are some of the multiples that are common to both 4 and 6. They are called common multiples of 4 and 6.
6. **Say:** To find common multiples of two or more numbers, follow this same process:
   a. Make a list of multiples for each number
   b. Continue your list until some of the same numbers appear in both lists
   c. Identify the common multiples by circling them
7. **Say:** Remember that multiples can go on and on, so we only identify *some* of the common multiples of numbers. 4 and 6 have many more common multiples than this.
8. Write 3 and 5 on the board.
9. Ask pupils to list the first 10 multiples of 3 and 5 in their exercise books. As they are working, list them on the board.
   $Answer$: 3: 3, 6, 9, 12, 15, 18, 21, 24, 27, 30
   5: 5, 10, 15, 20, 25, 30, 35, 40, 45, 50
10. Ask a pupil to identify the common multiples of 3 and 5 in the multiples listed on the board. (Answer: 15 and 30)
11. **Say:** The first two common multiples of 3 and 5 are 15 and 30.

Guided Practice *(5 minutes)*

1. Write these questions on the board:
   a. Identify the first two common multiples of 8 and 12.
   b. Identify the first two common multiples of 10 and 15.
2. Ask pupils to work with a partner and solve the problems on the board.
3. Move around and check for any misconception and clarify it.
4. Select a pupil from the back seat to present the answer for (a). (Answer: 24, 48)

   8: 8, 16, 24, 32, 40, 48
   12: 12, 24, 36, 48

5. Ask a pupil from the front seat to present the answer for (b). (Answer: 30, 60)

   10: 10, 20, 30, 40, 50, 60
   15: 15, 30, 45, 60

Independent Practice *(10 minutes)*

1. Write two questions on the board.
   a. Find the first 5 common multiples of 3 and 6.
   b. Find the first 3 common multiples of 6 and 9.
2. Ask pupils to do the exercises on the board in their exercise books.
3. Allow pupils to discuss their answers with the next pupil.
4. Move round and check for any misconception and clarify it.
5. Do corrections together with pupils on the board. (Answer: a. 6, 12, 18, 24, 30; b. 18, 36, 54)

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

   6: 6, 12, 18, 24, 30, 36, 42, 48, 54
   9: 9, 18, 27, 36, 45, 54

Closing *(2 minutes)*

1. Ask pupils to explain in their own words how we arrive at the common multiples of numbers. (Example answer: we first list down some multiples of the numbers. Then we identify multiples that are present for both numbers and select them.)
2. **Say:** Next lesson, we will learn to find the lowest common multiples of numbers.

Lesson Title: Lowest Common Multiple (LCM)	**Theme:** Numbers and Numeration	
Lesson Number: M-07-007	**Class/Level:** JSS 1	**Time:** 35 minutes

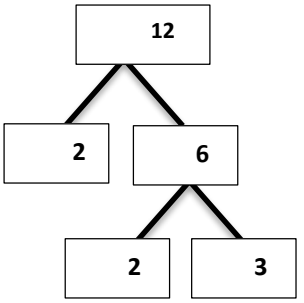
Learning Outcomes By the end of the lesson pupils will be able to identify the lowest common multiple (LCM) of given numbers.	**Teaching Aids** None	**Preparation** Write the questions in the opening on the board.

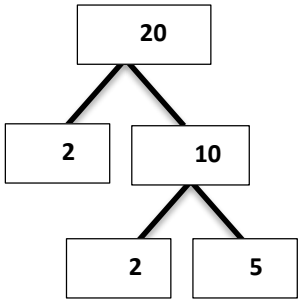
Opening *(3 minutes)*

1. Write two questions on the board:
    a. What are the factors of 20?
    b. What are the first five multiples of 5?
2. Ask pupils to call out the answers verbally.
3. Write down their answers and clear any misconceptions. (Answers: a. 20: 2, 4, 5, 10, 20 b. 5, 10, 15, 20, 25)
4. **Say**: Today we will learn how to identify lowest common multiples (LCM) of given numbers.

Introduction to the New Material *(11 minutes)*

1. Write a problem on the board:
    Find the lowest common multiple (LCM) of 12 and 20
2. **Say**: We are going to use prime factorisation method in finding the LCM of 12 and 20
3. Ask pupils to find the prime factors of 12 and 20 and to write the answers in their exercise books as you write on the board:

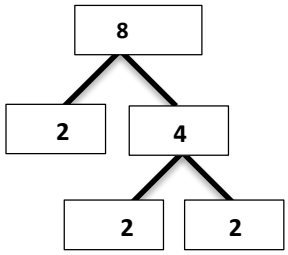


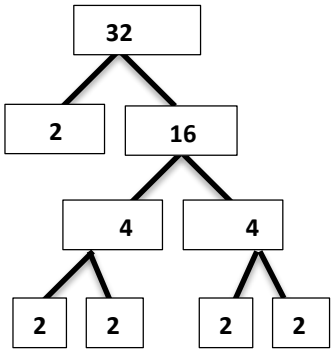


12: 2, 2, 3
20: 2, 2, 5

4. **Say:** The maximum number of times the prime factor 2 occurs is two. This is for 12 and 20.
5. **Say:** The prime factors 3 and 5 only occur once. We will list these together.
6. List these prime factors on the board:
    2, 2, 3, 5
7. **Say**: the product of these prime factors is the LCM.
8. Write on the board: $2\times2\times3\times5 = 60$
9. Write another problem on the blackboard: Find the LCM of 8 and 3

10. Ask pupils to use the same procedure steps 3 and 4 above to write out the factors:



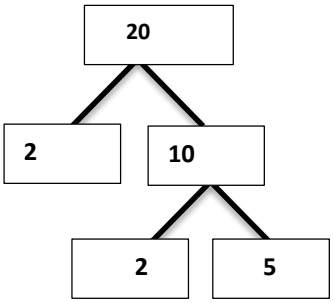


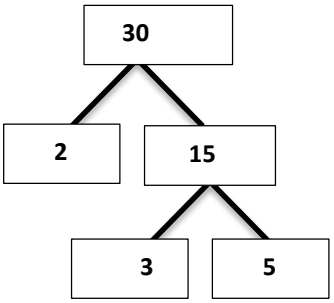
8: 2, 2, 2
32: 2, 2, 2, 2, 2

11. **Say**: Three of the 2's occur in both lists of factors. We will not take duplicate factors from 8 and 32. The prime factors we will look at are five 2's.
12. **Say**: The product of the prime factors is the LCM.
13. Write on the board: $2\times2\times2\times2\times2 = 32$
14. **Say**: the LCM of 8 and 32 is 32

Guided Practice *(6 minutes)*

1. Write a problem on the board: Find the LCM of 20 and 30.
2. Ask pupils to work in pairs.
3. Go round and check pupils' work while they work and clear any misconceptions.
4. Ask one pair to write the correct answer on the board:





20: $2\times2\times5$

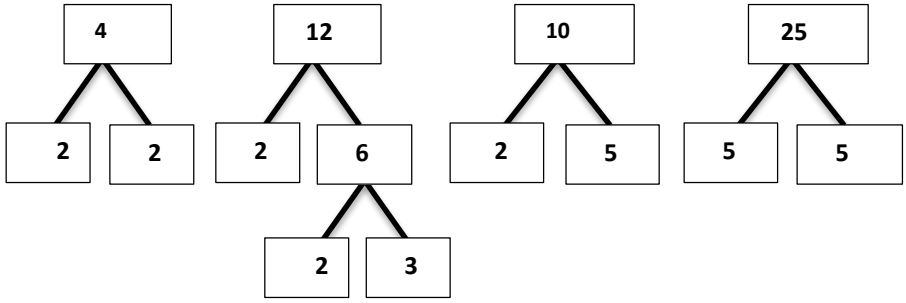
30: $2\times3\times5$

LCM = $2\times2\times3\times5 = 60$

Independent Practice *(10 minutes)*

1. Look at the two problems on the board:
   a. Find the LCM of 4 and 12
   b. Find the LCM of 10 and 25
2. Ask pupils to solve the problems individually in their exercise books.
3. Go round and check pupils while they solve the problems. Check for misconceptions.
4. Ask pupils to exchange exercise books with their seatmates and check their answers.

Answers:

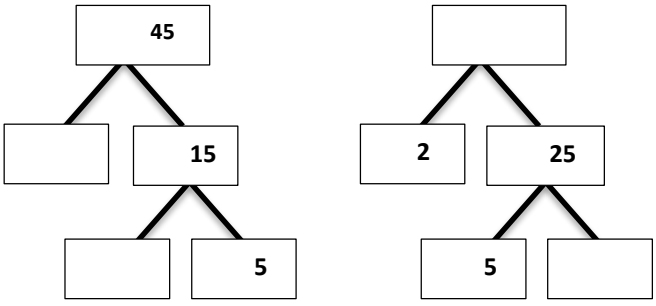


a. 4: 2×2
12: 2×2×3
LCM = 2×2×3 = 12

b. 10: 2×5
25: 5×5
LCM = 2×5×5 = 50

Closing *(5 minutes)*

1. Give pupils an exit ticket.
2. Write a problem on the board:
   Fill in the blank spaces on the diagram below and find the LCM of the numbers.



3. Ask pupils to write out their names and answers on a piece of paper.
4. Ask pupils to hand in the papers. (Answer: 45: 3×3×5, 50: 2×5×5, LCM = 2×3×3×5 = 90)

Lesson Title: Square of Whole Number	**Theme:** Numbers and Numeration	
Lesson Number: M-07-008	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson pupils will be able to find squares of whole numbers up to 10.	None	None

Opening *(3 minutes)*

1. Write the multiplication problems on the board: 2×2 9×9 4×4
2. Give pupils 1 minute to find the answers.
3. Ask pupils to call out each answer, and write them on the board. (Answers: 4, 81, 16)
4. **Say**: Today's lesson is on squares of whole numbers.

Introduction to the New Material *(12 minutes)*

1. Write on the board: 3^2
2. Tell pupils two ways to read this and ask them to repeat both of them after you: 'three squared' and 'three to the power of 2'.
3. Label the 3 as the base and the 2 as the power. → base → 3^2 ← power
4. **Say**: We refer to the big number as the 'base.' The small 2 is referred to as the 'power' or the 'index'.
5. Ask them to think about 3^2 and give their ideas about what it means. (For example, they might know the correct answer, or they might think the 3 and 2 are multiplied together. Encourage their participation.)
6. **Say**: 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.
7. Write on the board: $3^2 = 3 \times 3$
8. Ask pupils to call out the answer to this multiplication problem, and write it on the board: $3^2 = 3 \times 3 = 9$
9. Write on the board: 2^2
10. **Ask**: Can you write this in another way in your exercise books?
11. Ask one pupil to come and write the multiplication on the board: $2^2 = 2 \times 2$
12. Ask another pupil to come and write the answer: $2^2 = 2 \times 2 = 4$
13. Write on the board: 1^2
14. Ask pupils to write the answer in their exercise books.
15. Allow them to share ideas, and ask one pupil to write the answer on the board. (Answer: $1^2 = 1 \times 1 = 1$).
16. Write on the board: $0^2 = 0 \times 0 = 0$

17. Say: The square of one is one, and the square of zero is zero.

Guided Practice *(5 minutes)*

1. Write on the board: Find the values of: (i) 6 squared (ii) 7 squared.
2. Ask pupils to work in pairs to find the answers.
3. Move around the class to supervise and guide pupils as they do their work.
4. Ask one pupil to write the solution of (i) on the board. (Answer: $6^2 = 6 \times 6 = 36$)
5. Ask another pupil to write the solution of (ii) on the board. (Answer: $7^2 = 7 \times 7 = 49$)

Independent Practice *(10 minutes)*

1. Write on the board: Find the values of: (a) 8 squared (b) 9 squared (c) 7 squared.
2. Ask pupils to work independently to find each answer. (Answer: (a) $8^2 = 8 \times 8 = 64$ (b) $9^2 = 9 \times 9 = 81$ and (c) $7^2 = 7 \times 7 = 49$)
3. Walk around the class to check and clear misconceptions. (They might multiply the base by 2. Make sure they multiply each base by itself. For example, 8^2 should be 8×8 and **not** 8×2)

Closing *(5 minutes)*

1. Write on the board: Find the squared values of (i) 10 and (ii) 5
2. Tell pupils to complete this work before the end of class.
3. Check pupils' answers briefly before leaving class. Make sure they understand today's topic. (Answers: (i)$10^2 = 10 \times 10 = 100$ (ii) $5^2 = 5 \times 5 = 25$)

Lesson Title: Cubed Whole numbers	**Theme:** Numbers and Numeration	
Lesson Number: M-07-009	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to find the cube of whole numbers up to 10.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. Write on the board: $2 \times 2 \times 2$ and $3 \times 3 \times 3$
2. Give pupils 1 minute to find the answers.
3. Ask pupils to call out each answer, and write them on the board. (Answers: 8, 27)
4. **Say:** Today's lesson topic is how to find the cube of whole numbers.

Introduction to the New Material *(12 minutes)*

1. Write on the board: 2^3
2. **Ask**: What is the base? (Answer: 2)
3. **Ask**: What is the power? (Answer: 3)
4. Ask pupils two ways to read 2^3 and ask them to repeat both of them after you: 'two cubed' or 'two to the power of 3'.
5. Ask them to think about 3^2 and give their ideas about what it means. (For example, they might know the correct answer, or they might think the 2 and 3 are multiplied together. Encourage their participation.)
6. **Say**: In the last lesson we had a power of 2, and we multiplied the base by itself. When we have a power of 3, we simply multiply the base once more. A cube is a number raised to the power of 3, and it means a number is multiplied by itself three times. 'Two cubed' means that we multiply three 2's.
7. Write on the board: $2^3 = 2 \times 2 \times 2$
8. Ask pupils to call out the answer to this multiplication problem, and write it on the board: $2^3 = 2 \times 2 \times 2 = 8$
9. Write on the board: 4^3
10. Ask a pupil to read 4^3 out loud. (Example answers: 'four cubed' and 'four to the power of 3').
11. Ask another pupil to come to the board and write the multiplication: $4^3 = 4 \times 4 \times 4$
12. Ask another pupil to write the answer: $4^3 = 4 \times 4 \times 4 = 64$
    a. Review multiplication of 2-digit by 1-digit numbers (from primary school) if needed. Pupils should be able to solve these problems without a calculator:

$4^3 = 4 \times 4 \times 4 = 16 \times 4$ → $\begin{array}{r} {\scriptstyle 2}\\ 16\\ \times\ \ 4\\ \hline 64 \end{array}$ → $4^3 = 64$

13. Write on the board: 0^3
14. Ask pupils to write the answer in their exercise books.

15. Allow them to share ideas, and ask one pupil to write the answer on the board. (Answer: $0^3 = 0 \times 0 \times 0 = 0$).
16. Write on the board: $1^3 = 1 \times 1 \times 1 = 1$
17. **Say**: Zero and one can be cubed, but they will give the same zero and one.

Guided Practice *(5 minutes)*

1. Write on the board: Find the values of: (i) 7 cubed (ii) 8 cubed.
2. Ask pupils to work in pairs.
3. Move around the class to guide pupils and clear misconceptions.
4. Ask one pupil to solve (i) on the board. (Answer: $7^3 = 7 \times 7 \times 7 = 343$).
5. Ask another pupil to solve (ii) on the board. (Answer: $8^3 = 8 \times 8 \times 8 = 512$)

Independent Practice *(10 minutes)*

1. Write on the board: Find the values of: $a. 9^3 \; b. 3^3 \quad c. 5^3$
2. Ask pupils to work independently.
3. Move around the class to check answers and clear misconceptions.
   (A common misconception is to multiply the base by the power. For example, 9^3 should be $9 \times 9 \times 9$ and **not** 9×3.)
4. Call three pupils to come to the board to write the answers. (Answers: *a.* $9^3 = 9 \times 9 \times 9 = 729$, *b.* $3^3 = 3 \times 3 \times 3 = 27$, *c.* $5^3 = 5 \times 5 \times 5 = 125$).

Closing *(5 minutes)*

1. Write on the board: Find the value of 6^3
2. Ask pupils to complete this work before the end of class.
3. Check pupils' answers briefly before leaving class. Make sure they understand today's topic. (Answer: $6^3 = 6 \times 6 \times 6 = 216$)

Lesson Title: Higher Powers of Whole Numbers	**Theme:** Numbers and Numeration	
Lesson Number: M-07-010	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of this lesson, pupils will be able to find higher powers (greater than 3) of whole numbers.	**Teaching Aids** None	**Preparation** None

Opening *(5 minutes)*

1. Write on the board:
   Express in index form:
   $2 \times 2 =$
   $2 \times 2 \times 2 =$
   $2 \times 2 \times 2 \times 2 =$
2. Ask pupils to think about the problems on the board for a moment.
3. Ask for a pupil to volunteer the answer for the first one. (Answer: $2 \times 2 = 2^2$)
4. Ask another pupil to answer the second one. (Answer: $2 \times 2 \times 2 = 2^3$)
5. **Ask**: How do you think we will write the third one?
6. Allow pupils to share their ideas, and ask them to write the answer in their exercise books. (Answer: $2 \times 2 \times 2 \times 2 = 2^4$)
7. **Say**: The power is 4 because we multiply the 2 four times.
8. **Say**: Today, you will learn how to find higher powers (greater than 3) of whole numbers.

Introduction to the New Material *(13 minutes)*

1. Ask pupils to look at 2^4.
2. **Ask**: How do you think we read this?
3. Allow them to share their ideas.
4. Say and ask them to repeat: 'two to the fourth power' and 'two to the power four'.
5. **Say**: Any whole number can be a power. For powers greater than 2 or 3, we do not have any special name like 'squared' or 'cubed'.
6. Write on the board: Simplify $7 \times 7 \times 7 \times 7 \times 7$
7. **Say**: This is in expanded form. How can we rewrite it?
8. Allow pupils to share their ideas, and ask one pupil to come to the board and write the answer: 7^5
9. Ask: How do you think we read this?
10. Allow them to share their ideas and correct them. (Answer: 'seven to the fifth power' or 'seven to the power five')
11. Write on the board: Simplify $3 \times 3 \times 3 \times 3 \times 3 \times 3$
12. Ask a pupil to come to the board and rewrite this. (Answer: 3^6).

13. Ask another pupil to read the answer out loud. (Answer: 'three to the sixth power' or 'three to the power six')
14. **Say**: Any number with a power is an index. The plural of index is indices. 7^5 and 3^6 are indices.
15. Write on the board: Expand 4^4
16. **Say**: This example is in index form. What is the expanded form?
17. Allow pupils to share their answers. Remind them that expanded form means written out as a multiplication problem.
18. Write the answer on the board: $4^4 = 4 \times 4 \times 4 \times 4$
19. Write another problem on the board: Expand 5^6
20. Ask a pupil to come to the board to expand 5^6. (Answer: $5^6 = 5 \times 5 \times 5 \times 5 \times 5 \times 5$).
21. Remind pupils that zero and one (0 and 1) are whole numbers, but whatever powers they are raised, the results are always the same. (e.g. (i) $0 \times 0 \times 0 \times 0 = 0^4 = 0$ (ii) $1 \times 1 \times 1 \times 1 = 1^4 = 1$).

Guided Practice *(5 minutes)*

1. Write two problems on the board. Simplify and leave your answers in index form: (i) $5 \times 5 \times 5 \times 5$ (ii) $2 \times 2 \times 2 \times 2 \times 2 \times 2$
2. Ask pupils to work in pairs.
3. Move around to check for pupils understanding and clear misconceptions.
4. Ask for volunteers to give their answers to the two problems on the board. (Answer: (i) $5 \times 5 \times 5 \times 5 = 5^4$ and (ii) $2 \times 2 \times 2 \times 2 \times 2 \times 2 = 2^6$)

Independent Practice *(10 minutes)*

1. Write problems on the board:
   Simplify the following: (a) $6 \times 6 \times 6 \times 6 \times 6$ (b) $7 \times 7 \times 7 \times 7$ (c) $3 \times 3 \times 3 \times 3 \times 3$
   Expand the following: (d) 2^5 (e) 8^4
2. **Say:** Solve the problems independently in your exercise books.
3. Walk around to check for understanding and clear misconceptions.
4. Ask 5 different pupils to come to the board to write the 5 answers. (Answers: (a) 6^5 (b) 7^4 (c) 3^5 (d) $2 \times 2 \times 2 \times 2 \times 2$ (e) $8 \times 8 \times 8 \times 8$)
5. **Say**: Check the answers on the board with those in your exercise books. Make corrections where necessary.

Closing *(5 minutes)*

1. Write on the board: Simplify $2 \times 2 \times 2 + 3 \times 3 \times 3 \times 3$
2. Ask pupils to think about the problem alone before working with a partner to find the answer.
3. Ask a pair to come to the board and share their answer. (Answer: $2^3 + 3^4$)
4. **Say**: We can't add two indices with different bases. We cannot simplify the expression any further.
5. Check their answers and do correction where necessary.

Lesson Title: Multiplying Two Indices	**Theme:** Numbers and Numeration	
Lesson Number: M-07-011	**Class/Level:** JSS 1	**Time:** 35 minutes

minutes

Learning Outcomes By the end of the lesson pupils will be able to simplify multiplication of two indices with base less than 10.	**Teaching Aids** None	**Preparation** Write the problem in the opening on the board.

Opening *(4 minutes)*

1. Write one problem on the board: $2^2 \times 2$
2. Ask pupils to brainstorm a way to rewrite this. Remind them that $2^2 = 2 \times 2$
3. Write on the board: $2^2 \times 2 = 2 \times 2 \times 2 = 2^3 = 8$
4. **Say**: Today's topic is multiplying two indices.

Introduction to the New Material *(10 minutes)*

1. Write 1 problem on the board: Simplify: $2^2 \times 2^3$
2. **Say:** Let's simplify by writing out the multiplication of each 2.
3. Write on the board: $2^2 \times 2^3 = 2 \times 2 \times 2 \times 2 \times 2 = 2^5$
4. Write another problem on the board: Simplify: $3^4 \times 3^2$
5. Write the answer: $3^4 \times 3^2 = 3 \times 3 \times 3 \times 3 \times 3 \times 3 = 3^6$
6. Ask pupils what they noticed. Allow them to share their ideas.
7. **Say**: When multiplying two indices with the same base, simply add the powers. This is the first law of indices.
8. Write the first law of indices on the board: $a^m \times a^n = a^{m+n}$
9. **Say**: m and n are the powers of a, and a is the base. This rule *only* works if two bases are the *same*.
10. Write another problem on the board: $4^3 \times 4^2$
11. **Ask**: What is the base? (Answer: 4) What are the powers? (Answer: 2 and 3)
12. Ask pupils to turn and discuss the answer to this problem with a partner.
13. **Ask:** Simplify $4^3 \times 4^2$.
14. Ask for a pupil to call out the answer. Allow them to discuss. (Answer: 4^5)
15. Write the solution on the board: $4^3 \times 4^2 = 4^{3+2} = 4^5$
16. Write a problem with variables on the board: $y^2 \times y^3$
17. Ask a pupil to call out and explain the answer. (Answer: y^5, because the sum of the powers is 5)
18. Write the solution on the board: $y^2 \times y^3 = y^{2+3} = y^5$
19. **Say**: You can use this law ($a^m \times a^n = a^{m+n}$) to solve many different math problems involving indices.

Guided Practice *(8 minutes)*

1. Write on the board: Simplify the following. Leave your answer in index form:
   (a) $4^2 \times 4$ (b) $2^3 \times 2^4$
2. Ask pupils to work in pairs to solve the two problems.
3. Move around the class to check understanding and clear misconceptions.
4. Call on a pupil to solve (a) on the board: (Answer: $4^2 \times 4 = 4^2 \times 4^1 = 4^{2+1} = 4^3$)
5. Call another pupil to solve (b) on the board: (Answer: $2^3 \times 2^4 = 2^{3+4} = 2^7$)

Independent Practice *(10 minutes)*

1. Write on the board: Simplify the following. Leave your answer in index form:
   (a) $2^4 \times 2^3$ (b) $5^2 \times 5$
2. Ask pupils to work independently.
3. Ask pupils to share ideas in pairs if needed.
4. Go round the class to check their exercise books. Clear any misconceptions.
5. Ask a pupil from the back to come and solve (a) on the board. (Answer=$2^4 \times 2^3 = 2^{4+3} = 2^7$)
6. Ask another pupil in front to solve (b) on the board. (Answer=$5^2 \times 5 = 5^2 \times 5^1 = 5^{2+1} = 5^3$)

Closing *(3 minutes)*

1. Give pupils an exit ticket (a problem to complete before leaving class).
2. Write one question on the board: Simplify $2^6 \times 2^3$
3. Tell pupils that they should complete it and show you before leaving class.
4. Check pupils' answers before they leave the class. (Answer: $2^6 \times 2^3 = 2^{6+3} = 2^9$)

Lesson Title: Dividing Two Indices	**Theme:** Numbers and Numeration	
Lesson Number: M-07-012	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to simplify division of two indices with base less than 10.	**Teaching Aids** None	**Preparation** Write the problem in the opening on the board.

Opening *(2 minutes)*

1. Write a multiplication problem on the board: Simplify $5^5 \times 5^2$
2. Ask pupils to turn and talk about the problem in pairs.
3. Call on a pupil from the back to give the answer. (Answer: $5^5 \times 5^2 = 5^{5+2} = 5^7$)
4. **Say**: The topic today is dividing two indices.

Introduction to the New Material *(15 minutes)*

1. Write on the board: $3^5 \div 3^2$
2. Tell pupils that we can rewrite division problems as fractions: $3^5 \div 3^2 = \frac{3^5}{3^2}$
3. **Ask**: Can you think of any other way to rewrite this?
4. Allow pupils to share their ideas.
5. Expand each index on the board: $3^5 \div 3^2 = \frac{3^5}{3^2} = \frac{3\times3\times3\times3\times3}{3\times3}$
6. **Ask**: Do you notice anything about this fraction? Can we make more changes?
7. Show pupils the 3's that can be cancelled: $3^5 \div 3^2 = \frac{3^5}{3^2} = \frac{\textcircled{3}\times\textcircled{3}\times3\times3\times3}{\textcircled{3}\times\textcircled{3}}$
8. **Say**: We can cancel two 3's from the numerator and two 3's from the denominator. This leaves $3 \times 3 \times 3$.
9. Write the answer on the board: $3^5 \div 3^2 = \frac{3^5}{3^2} = \frac{\textcircled{3}\times\textcircled{3}\times3\times3\times3}{\textcircled{3}\times\textcircled{3}} = \frac{3\times3\times3}{1} = 3 \times 3 \times 3 = 3^3$
10. Ask pupils to look at the problem and the answer: $3^5 \div 3^2 = 3^3$
11. **Ask:** What do you notice?
12. Allow pupils to share their ideas.
13. **Say**: when we divide two indices, we subtract the powers to get the answer. This is the second law of indices.
14. Write the second law of indices on the board: $a^m \div a^n = a^{m-n}$
15. **Say**: m and n are the powers of a, and a is the base. This rule only works if two bases are the same.
16. Write another example on the board: $7^3 \div 7$
17. **Say:** when a number is without an index or power, it has a power of 1.
18. Write on the board**:** $7 = 7^1$
19. Solve the problem on the board: $7^3 \div 7 =: 7^3 \div 7^1 = 7^{3-1} = 7^2$
20. Write on the board: $y^3 \div y$

21. Solve the problem and make sure pupils understand. For example, tell them to write the same variable in the base of the answer. (Answer: $y^3 \div y = y^{3-1} = y^2$)

Guided Practice *(6 minutes)*

1. Ask pupils to work in pairs.
2. Write and ask pupils to solve two problems: (i) $8^5 \div 8$ (ii) $z^4 \div z^3$
3. Move around to check for understanding and clear misconceptions.
4. Call on one pair to write the answer to question (i) on the board. (Answer: $8^5 \div 8 = 8^{5-1} = 8^4$)
5. Ask another pair to write the answer to question (ii). (Answer: $z^4 \div z^3 = z^{4-3} = z^1 = z$)

Independent Practice *(10 minutes)*

1. Write on the board: (i) $2^4 \div 2^2$ (ii) $\frac{t^6}{t^3}$
2. Ask pupils to work independently to simplify.
3. Move around to check for understanding and clear misconceptions.
4. Allow pupils to discuss with their seatmates if needed.
5. Ask a pupil to write the answer on the board for question (i) (Answer: $2^4 \div 2^2 = 2^{4-2} = 2^2$)
6. Ask another pupil to write the answer on the board for question (ii) (Answer: $\frac{t^6}{t^3} = t^6 \div t^3 = t^{6-3} = t^3$)

Closing *(2 minutes)*

1. Give pupils an exit ticket (a problem to complete before leaving class).
2. Write on the board: $4^5 \div 4^{\square} = 4^2$
3. **Ask**: What is the missing power?
4. Tell pupils that they should complete it and show you before leaving class.
5. Allow them to discuss with seatmates.
6. Check their work as they exit the class. (Answer: The missing power is 3 because $5 - 3 = 2$)
7. **Suggested homework:** simplify the following (a) $x^7 \div x^5$ (b) $\frac{6^4}{6^2}$ (Answers: (a) $x^7 \div x^5 = x^{7-5} = x^2$; (b) $\frac{6^4}{6^2} = 6^4 \div 6^2 = 6^{4-2} = 6^2$)

Lesson Title: Multiplication and Division of Indices	**Theme:** Numbers and Numeration	
Lesson Number: M-07-013	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson pupils will be able to simplify multiplication and division of indices less than 10.	None	None

Opening *(3 minutes)*

1. Write two problems on the board: $a. 4^3 \times 4$ b. $3^8 \div 3^6$
2. Give pupils one minute to work the problems in their exercise books.
3. Ask 2 pupils to give their answers and explain. (Answers: 4^4 because the powers are added for multiplication problems; 3^2 because the powers are subtracted for division problems)
4. **Say:** Today we will practise and solve more difficult problems on multiplication and division of indices.

Introduction to the New Material *(12 minutes)*

1. Write a problem on the board: Simplify $3^2 \times 3^3 \div 3^4$
2. **Ask**: Can you think of a way to solve this problem?
3. Give pupils a moment to think about it and work the problem in their exercise book. Ask them to share their ideas.
4. **Say**: We know to add powers for multiplication and subtract powers for division. We can do these steps together.
5. Write on the board: $3^2 \times 3^3 \div 3^4 = 3^{2+3-4} = 3^1 = 3$
6. **Say**: There is another way to solve this problem. Remember that we can rewrite division problems as fractions.
7. Write on the board: $3^2 \times 3^3 \div 3^4 = \frac{3^2 \times 3^3}{3^4}$
8. **Say**: First do the multiplication in the numerator, then carry out the division.
9. Solve on the board: $\frac{3^2 \times 3^3}{3^4} = \frac{3^{2+3}}{3^4} = \frac{3^5}{3^4} = 3^{5-4} = 3^1 = 3$
10. Show pupils why this is true. Expand each of the indices and cancel any 3's from the numerator and denominator: $\frac{3^2 \times 3^3}{3^4} = \frac{3 \times 3 \times 3 \times 3 \times 3}{3 \times 3 \times 3 \times 3} = 3$
11. **Say:** We can cancel four 3's from the numerator and four 3's from the denominator, this gives 3.
12. Write another problem on the board: Simplify $2^3 \times 2^5 \div 2^4$
13. Ask pupils if they can think of any way to rewrite this. Encourage one of them to write it as a fraction on the board: $\frac{2^3 \times 2^5}{2^4}$.
14. Ask pupils to describe each step, and solve the problem on the board. (Answer: $2^3 \times 2^5 \div 2^4 = \frac{2^3 \times 2^5}{2^4} = \frac{2^{3+5}}{2^4} = \frac{2^8}{2^4} = 2^{8-4} = 2^4$)
15. Simplify one more problem with the pupils: $\frac{4^5 \times 4^2}{4^4 \times 4}$ (Answer: $\frac{4^5 \times 4^2}{4^4 \times 4} = \frac{4^{5+2}}{4^{4+1}} = \frac{4^7}{4^5} = 4^{7-5} = 4^2$)
16. **Ask**: What is the value of 4^2? (Answer: 16)

17. **Say**: We have simplified this complicated fraction down to the number 16.

Guided Practice *(7 minutes)*

1. Write two problems on the board: Simplify: (a) $\frac{2^3\times2^4}{2\times2^2}$ (b) $3\times3^4\div3^2$
2. Ask pupils to work in pairs to simplify them.
3. Walk around to check for understanding and clear misconceptions.
4. Ask a pair from the back of the class to simplify (a) on the board. (Answer: $\frac{2^3\times2^4}{2^1\times2^2}=\frac{2^{3+4}}{2^{1+2}}=\frac{2^7}{2^3}=2^{7-3}=2^4$)
5. Ask a pair from the middle of the class to simplify (b) on the board. (Answer: $\frac{3^1\times3^4}{3^2}=\frac{3^{1+4}}{3^2}=\frac{3^5}{3^2}=3^{5-2}=3^3$)

Independent Practice *(10 minutes)*

1. Write three problems on the board: Simplify (a) $\frac{3^2\times3^5}{3^4\times3}$ (b) $\frac{2^5\times2^4}{2^3\times2^2}$ (c) $\frac{6^2\times6^3}{6^4}$
2. Ask pupils to work independently.
3. Walk around to check for understanding and clear misconceptions.
4. Ask pupils to turn to their neighbours and share answers.
5. Ask 3 different pupils to come to the board at the same time and write the 3 solutions. (Answers: (a)$\frac{3^2\times3^5}{3^4\times3^1}=\frac{3^{2+5}}{3^{4+1}}=\frac{3^7}{3^5}=3^{7-5}=3^2$; (b)$\frac{2^5\times2^4}{2^3\times2^2}=\frac{2^{5+4}}{2^{3+2}}=\frac{2^9}{2^5}=2^{9-5}=2^4$; (c)$\frac{6^2\times6^3}{6^4}=\frac{6^{2+3}}{6^4}=\frac{6^5}{6^4}=6^{5-4}=6^1=6$)

Closing *(3 minutes)*

1. Give pupils an exit ticket problem to check for understanding of today's topic.
2. Write on the board: simplify $\frac{4^3\times4^2}{4^2}$
3. Check pupils' answers briefly before leaving class. (Answer: $\frac{4^3\times4^2}{4^2}=\frac{4^{3+2}}{4^2}=\frac{4^5}{4^2}=4^{5-2}=4^3$)
4. **Suggested homework**: Simplify: (i) $5^2\times5^4\div5^3$ (ii) $4\times4^3\div4^2$ (Answers: (i) $\frac{5^2\times5^4}{5^3}=\frac{5^6}{5^3}=5^{6-3}=5^3$; (ii) $\frac{4^1\times4^3}{4^2}=\frac{4^{1+3}}{4^2}=\frac{4^4}{4^2}=4^{4-2}=4^2$)

Lesson Title: Introduction to Fractions	**Theme:** Numbers and Numeration	
Lesson Number: M-07-014	**Class/Level:** JSS 1	**Time:** 35 minutes

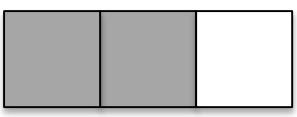
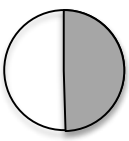
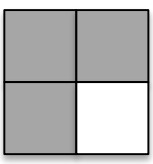
Learning Outcomes By the end of the lesson pupils will be able to recognise and name fractional parts of a whole.	**Teaching Aids** None	**Preparation** None

Opening *(2 minutes)*

1. **Say**: I have 2000 Leones, and I want to give half of it to my son for transport. How much will I give to my son?
2. Ask pupils to turn to their seatmates and discuss the question and find the answer.
3. Ask them to share their answers with the class. (Answer: I will give 1000 to my son, because 1000 Leones is half of 2000 Leones)
4. **Say:** 'Half' is a word that we use in our everyday lives. It means to divide something into two equal parts. We can use 'half' to talk about sharing something between two people.
5. **Say:** Half is also a fraction in mathematics. You studied fractions in primary school, and today we will review them.

Introduction to the New Material *(15 minutes)*

1. **Ask**: How can I express half with numbers?
2. Allow pupils to share their ideas with the class. (Example answer: as a fraction with 1 on top and 2 on bottom)
3. Write on the board: $\frac{1}{2}$
4. **Say**: This fraction is 'one-half' it has a one in the denominator, and a 2 in the denominator.
5. Label the numerator and denominator on the board: $\frac{1}{2}\ \begin{matrix}\leftarrow numerator\\ \leftarrow denominator\end{matrix}$
6. Fractions describe part of a whole. We can draw a shape and shade part of it to show the size of a fraction.
7. Draw a shape on the board showing $\frac{1}{2}$: 
8. **Say**: This rectangle shows one-half. To show a fraction with a shape, divide the shape into pieces that are equal in size. The number of pieces should equal the number in the denominator. Shade the number of pieces in the numerator.
9. Draw 3 more shapes on the board:

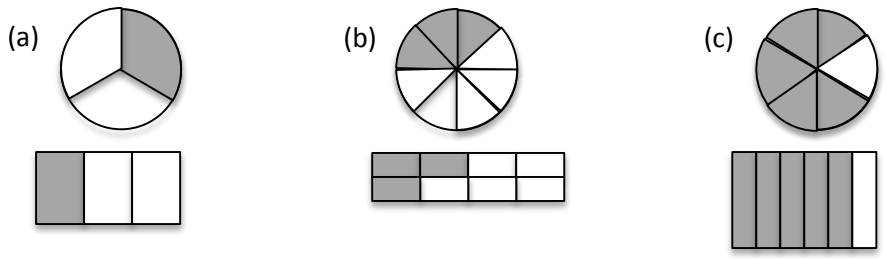
(a)  (b)  (c) 

10. Ask pupils to write down the fraction for each shape in their exercise books. (Answers: (a) $\frac{2}{3}$ (b) $\frac{1}{2}$ (c) $\frac{3}{4}$)

11. Ask 3 different pupils to call out the name of each fraction. As they call them out, write the fraction under each diagram. Repeat the name correctly, and ask the whole class to repeat the name of the fraction. (Answers: (a) 'two-thirds' (b) 'one-half' (c) 'three-fourths' or 'three-quarters')
12. Ask pupils to identify the numerator and denominator in some of the fractions on the board. For example:
    a. What is the numerator in (a)? (Answer: 2)
    b. What is the denominator in (c)? (Answer: 4)

Guided Practice *(5 minutes)*

1. Ask pupils to work in pairs or with seatmates.
2. Write on the board: Draw shapes to show the following fractions: (a) $\frac{1}{3}$ (b) $\frac{3}{8}$ (c) $\frac{5}{6}$
3. Walk around to check for understanding and clear misconceptions. Pupils may use any shape to show the fractions, such as square, rectangle, or circle. Remind them to make all of the parts equal in size.
4. Ask 3 different groups to come to the board and each draw one of the diagrams. They may be in any shape, but some examples are below.



Independent Practice *(10 minutes)*

1. Ask pupils to work in pairs.
2. Ask each pupil to write 3 fractions in their exercise books. Ask them not to use any number greater than 10 in the numerator or denominator. Remind them to make the numerator less than the denominator.
3. After they have written 3 fractions, ask them to exchange exercise books with their partner. Ask them to draw shapes to show each fraction written by their partner.
4. Walk around to check for understanding and clear misconceptions.
5. Ask pupils to check their partners' answers when they both finish drawing.
6. Ask a few pairs to write their example fractions and diagrams on the board if there is enough time.

Closing *(3 minutes)*

1. Read the story problem below and ask pupils to listen carefully.

2. **Say**: Mr. Kamara has a big farm. He has 5 people who work for him on the farm. He wants to divide the farm evenly to give each person a part to work on. How much will each person get? Write your answer as a fraction.
3. Ask pupils to write the fraction in their exercise books.
4. Walk around to check their answers and make sure they understand.
5. Ask a pupil to stand and give the answer. (Answer: $\frac{1}{5}$ One-fifth)

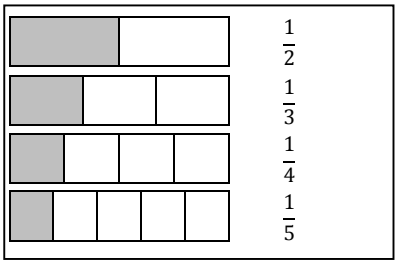
Lesson Title: Fractions with Different Denominators	**Theme:** Numbers and Numeration	
Lesson Number: M-07-015	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson pupils will be able to compare and order fractions with different denominators.	None	Draw the fraction pictures, in the Introduction to the New Material**,** on the board.

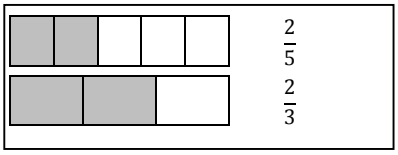
Opening *(5 minutes)*

1. Write the following fractions on the board: $\frac{4}{7}, \frac{1}{7}, \frac{3}{7}, \frac{5}{7}, \frac{2}{7}$.
2. **Say**: In the last lesson we looked at fractions similar to the ones on the board. What do you notice about these fractions?
3. Give a moment for pupils to respond. (Answer: they all have the same denominator)
4. **Say**: We learnt how to put these types of fractions in order. I would like you to put the fractions in ascending order, from smallest to biggest. You have 1 minute.
5. Ask a pupil to come to the board to put the fractions in order. (*Answer:* $\frac{1}{7}, \frac{2}{7}, \frac{3}{7}, \frac{4}{7}, \frac{5}{7}$)
6. **Ask**: What do you notice now about the fractions?
7. Guide pupils to answer that if the fractions have the same denominator, we just compare the numerators. The bigger the numerator, the bigger the fraction.
8. **Say**: Today we are going to compare and order fractions with different denominators.

Introduction to the New Material *(13 minutes)*



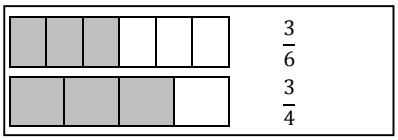
1. Draw the fraction shapes shown on the board.
2. Ask the pupils to work in pairs.
3. **Say**: Look at the fraction shapes on the board. Put the fractions in order starting with the largest.
4. Allow them 2 minutes to discuss.
5. Ask a pupil to come to the board. Ask him or her to put the fractions in descending order (largest to smallest). The class may help. (*Answer:* $\frac{1}{2}, \frac{1}{3}, \frac{1}{4}, \frac{1}{5}$)
6. **Ask**: What do you notice about the fractions?
7. Guide pupils to give the answer that if the fractions have the same numerator, we just compare the denominators. The bigger the denominator, the smaller the fraction.
8. **Say**: 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.
9. Draw the fraction shapes shown on the board.
10. Give pupils a few moments to think before selecting a pupil to answer the next two questions.
11. **Ask**: Which fraction has been divided into more parts? (*Answer:* $\frac{2}{5}$)



12. **Ask**: Is it bigger or smaller than the other fraction? (*Answer:* smaller)
13. Ask a pupil to come to the board and put the fractions in ascending order (*Answer:* $\frac{2}{5}, \frac{2}{3}$).
14. Clear up any misconceptions: For example, ascending order means smallest first, and descending order means largest first.
15. Explain that pupils can use diagrams to compare fractions.

Guided Practice *(5 minutes)*

1. Ask the pupils to work in pairs for 3 minutes to answer the following questions.
   i. Draw the fractions for $\frac{3}{6}$ and $\frac{3}{4}$
   ii. Which fraction is bigger?
2. Ask a pupil to draw the shapes on the board and show which fraction is bigger (*Answer:* Fraction shapes as shown: $\frac{3}{4}$)



Independent Practice *(10 minutes)*

1. Write on the board:
   i. Which fraction is bigger $\frac{4}{5}$ or $\frac{4}{6}$?
   ii. Put this list of fractions in ascending order (smallest first): $\frac{3}{9}, \frac{3}{11}, \frac{3}{5}, \frac{3}{7}$
   iii. Put this list of fractions in descending order (largest first): $\frac{5}{6}, \frac{5}{11}, \frac{5}{8}, \frac{5}{9}$
2. **Say**: Work by yourselves to put the fractions on the board in order.
3. **Say**: You may draw diagrams to help you with the first one only. You must do the others without drawing a diagram.
4. Walk around to check answers and clear misconceptions about ordering fractions with the same numerator, but different denominators. (*Answers:* i. $\frac{4}{5}$, ii. $\frac{3}{11}, \frac{3}{9}, \frac{3}{7}, \frac{3}{5}$, iii. $\frac{5}{6}, \frac{5}{8}, \frac{5}{9}, \frac{5}{11}$)

Closing *(2 minutes)*

1. **Ask**: What are the main points we learnt in this lesson?
2. Allow pupils to give answers and acknowledge answers given.
3. If pupils do not give the answer below, guide them to look at the fraction shapes on the board and in their exercise books.
   (Answer: When fractions have the same numerator, we can just compare the denominators. The bigger the denominator, the smaller the fraction).
4. **Say**: Tomorrow we will mark fractions on the number line. We will compare fractions with different numerators and denominators, such as $\frac{3}{4}$ and $\frac{2}{5}$

Lesson Title: Adding Fractions with the Same Denominator	**Theme:** Numbers and Numeration	
Lesson Number: M-07-016	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes: By the end of the lesson, pupils will be able to add fractions with the same denominator.	**Teaching Aids:** None	**Preparation:** None

Opening *(3 minutes)*

1. Ask one pupil to come to the board and write a fraction.
2. Ask pupils to say the types of fraction that has been written on the board (e.g. proper fraction, improper fraction or mixed fraction).
3. Ask pupils to give reasons for their answers (e.g. the numerator is smaller or bigger than the denominator, or fraction is mixed with a whole number.).
4. **Say**: In the last lesson, you learned how to compare and order fractions with different denominators.
5. **Say**: Today, you will learn how to add fractions with the same denominator.

Introduction to the New Material *(14 minutes)*

1. Write an addition problem on the board: $\frac{4}{13} + \frac{2}{13}$
2. Ask pupils to observe the problems carefully. Guide them to note the same denominator but different numerators.
3. **Ask**: How do you think we can add these fractions?
4. Allow pupils to share their ideas.
5. **Say**: When the fractions have the same denominator, we add the numerators and write the sum all over the same denominator.
6. **Say**: for $\frac{4}{13} + \frac{2}{13}$, add the numerators and keep the same denominator:
7. Solve it on the board: $\frac{4}{13} + \frac{2}{13} = \frac{4+2}{13} = \frac{6}{13}$
8. **Say**: A fraction in which the denominator is bigger than numerator is a **proper fraction.**
9. Write two more examples on the board: (i) $\frac{9}{15} + \frac{6}{15}$ (ii) $\frac{4}{5} + \frac{3}{5}$
10. Ask for pupils to volunteer to explain how to solve (i). (Answer: Add the numerators (9+6), and keep the denominator (15))
11. Write the solution to (i) on the board: $\frac{9}{15} + \frac{6}{15} = \frac{9+6}{15} = \frac{15}{15} = \mathbf{1}$
12. **Say**: Look at the last part, $\frac{15}{15} = \mathbf{1}$**.** When the numerator and the denominator are the same, the fraction equals 1 whole.
13. Solve (ii) on the board: $\frac{4}{5} + \frac{3}{5} = \frac{4+3}{5} = \frac{7}{5}$
14. Ask pupils what they notice about the answer above. Allow them to share their ideas (For example: the denominator is smaller than the numerator).

15. **Say:** When the denominator is smaller than the numerator, the fraction is called an **improper fraction**.
16. **Say**: An Improper fraction can be simplified to get a **mixed fraction** by dividing the numerator by the denominator. Therefore, $\frac{7}{5}$ can be simplified by dividing 7 by 5, 5 goes into 7 one time, and there is a remainder of 2. The mixed fraction is $1\frac{2}{5}$
17. Write this with solution on the board: $\frac{4}{5} + \frac{3}{5} = \frac{4+3}{5} = \frac{7}{5} = 1\frac{2}{5}$
18. **Say**: A mixed Fraction has a whole number 'mixed up' or written together with a fraction.
19. **Say**: Answers to addition problems in fractions are often improper fractions, and we must convert them to mixed fractions.

Guided Practice *(5 minutes)*

1. Ask pupils to work in pairs.
2. Write two problems on the board: (i) $\frac{7}{8} + \frac{2}{8}$ (ii) $\frac{7}{13} + \frac{3}{13}$
3. Ask each pair to solve the problems in their exercise books.
4. Move around to check pupils as they work. Check for understanding and clear misconceptions.
5. Call two pupils, a boy and a girl, to present their answers. (Answers: (i) $\frac{7}{8} + \frac{2}{8} = \frac{7+2}{8} = \frac{9}{8} = 1\frac{1}{8}$ (ii) $\frac{7}{13} + \frac{3}{13} = \frac{7+3}{13} = \frac{10}{13}$)

Independent Practice *(10 minutes)*

1. Write the following problems on the board:
   (i) $\frac{2}{7} + \frac{5}{7}$ (ii) $\frac{2}{9} + \frac{2}{9}$
   (iii) My mother gave me $\frac{3}{8}$ of a pawpaw, and my father gave me $\frac{2}{8}$ of a pawpaw. How much pawpaw do I have in total?
2. Ask pupils to work independently to solve the problems.
3. Move around to check pupils as they work. Clear any misconceptions. For example, in (iii) make sure they can give the addition problem: $\frac{3}{8} + \frac{2}{8}$.
4. Call on pupils randomly to write their answers on the board. (Answers: (i) $\frac{2}{7} + \frac{5}{7} = \frac{2+5}{7} = \frac{7}{7} = 1$ (ii) $\frac{2}{9} + \frac{2}{9} = \frac{2+2}{9} = \frac{4}{9}$ (iii) $\frac{3}{8} + \frac{2}{8} = \frac{3+2}{8} = \frac{5}{8}$)

Closing *(3 minutes)*

1. Write this problem on the board: $\mathbf{\frac{1}{3} + \frac{2}{3}}$
2. **Say**: Solve this problem quickly. Put your hand up to tell the answer when you are finished.
3. Ask one pupil to give the answer and explain. (Answer: $\frac{1}{3} + \frac{2}{3} = \frac{1+2}{3} = \frac{3}{3} = 1$)

Lesson Title: Adding Fractions with Different Denominators	**Theme:** Numbers and Numeration	
Lesson Number: M-07-017	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to add fractions with different denominators.	 **Teaching Aids** None	 **Preparation** None

Opening *(3 minutes)*

1. Write an addition problem with fractions with a common denominator on the board: $\frac{2}{3}+\frac{5}{3}$
2. Give pupils 1 minute to find the answer.
3. Ask a pupil to solve the problem in their exercise books and ask one pupil to solve the problem on the board. (Answer: $\frac{2}{3}+\frac{5}{3}=\frac{2+5}{3}=\frac{7}{3}$)
4. **Say**: Today we will learn about addition of fractions with different denominators.

Introduction to the New Material *(15 minutes)*

1. Write on the board: $\frac{3}{4}+\frac{1}{8}$
2. Ask a pupil to identify the denominators in the given fractions (Answers: 4, 8)
3. **Say:** To subtract fractions with different denominators we need to find a **common denominator,** or a denominator that is the same.
4. **Say:** First we need to find the LCM of the two numbers in the denominators. The lowest number that is divisible by both numbers is the LCM.
5. **Ask**: What is the LCM of 4 and 8? (Answer: 8)
6. **Say**: We must change the numerators and denominators before we can add the fractions. The new denominator will be the LCM, 8. We will rewrite each fraction as an **equivalent fraction** with denominator 8.
   a. Review **equivalent fractions** if needed: If the numerator and denominator of a fraction are both multiplied by the same number, the result is an equivalent fraction. (For example, $\frac{1}{3}=\frac{1\times2}{3\times2}=\frac{2}{6}$, so we know that $\frac{1}{3}$ and $\frac{2}{6}$ are equivalent fractions.
7. Discuss the steps required to change the first fraction:
   - **Say**: Look at the first fraction on the board ($\frac{3}{4}$)
   - **Ask**: How many times can 4 go into the LCM? (Answer: 2)
   - **Say**: Multiply this 2 by the numerator and denominator: $\frac{3}{4}=\frac{3\times2}{4\times2}=\frac{6}{8}$
8. **Say**: The next fraction already has denominator 8, so we do not need to change it.
9. Solve the problem on the board: $\frac{3}{4}+\frac{1}{8}=\frac{6}{8}+\frac{1}{8}=\frac{6+1}{8}=\frac{7}{8}$
10. Write another problem on the board: $\frac{1}{5}+\frac{5}{6}$
11. **Ask:** What is the LCM for 5 and 6? (Answer: 30).

12. Multiply each fraction in the problem to give a new fraction with 30 in the denominator:
    $\frac{1}{5} = \frac{1\times6}{5\times6} = \frac{6}{30}$ and $\frac{5}{6} = \frac{5\times5}{6\times5} = \frac{25}{30}$
13. Ask a pupil to come to the board to add the fractions ($\frac{1}{5} + \frac{5}{6} = \frac{6}{30} + \frac{25}{30} = \frac{6+25}{30} = \frac{31}{30}$)
14. Remind pupils to give their answers in mixed fraction (Answer: $1\frac{1}{30}$).
    a. Review changing improper fractions to **mixed fractions** if needed: Divide the numerator by the denominator. Give the answer as a whole number, and put the remainder in the numerator. ($\frac{31}{30} = 31 \div 30 = 1 \text{ r } 1 = 1\frac{1}{30}$)

Guided Practice *(10 minutes)*

1. Write two problems on the board: (i) $\frac{1}{3} + \frac{2}{9}$ (ii) $\frac{2}{3} + \frac{5}{6}$
2. Ask pupils to work in their exercise books.
3. **Say:** Let us first solve (i).
4. **Ask:** Are the denominators 3 & 9 the same? (Answer: No), so what is the first step we need to do? (Answer: We need to find the LCM of the two numbers in the denominators).
5. **Ask**: What is the LCM of 3 and 9? (Answer: 9)
6. **Ask**: What is our next step? (Call on pupils to volunteer the answer). (Answer: Next, we must change the numerators and denominators before we can add the fractions, we will rewrite each fraction as an **equivalent fraction** with denominator 9.)
7. Discuss the steps required to change the first fraction:
    - **Say**: Look at the first fraction on the board ($\frac{1}{3}$)
    - **Ask**: How many times can 3 go into the LCM 9? (Answer: 3)
    - **Say**: Multiply this 3 by the numerator and denominator: $\frac{1}{3} = \frac{1\times3}{3\times3} = \frac{3}{9}$
8. **Say**: The next fraction already has denominator 9, so we do not need to change it.
9. Continue to solve (i) on the board. (Answer: $\frac{1}{3} + \frac{2}{9} = \frac{3}{9} + \frac{2}{9} = \frac{3+2}{9} = \frac{5}{9}$)
10. Next, ask the pupils to work in pairs to solve the problem (ii). Allow pupils 3 minutes to complete.
11. Walk around the room and check pupils' work.
12. Ask another pair from the middle of the class to solve (ii). (Answer: $\frac{2}{3} + \frac{5}{6} = \frac{4}{6} + \frac{5}{6} = \frac{4+5}{6} = \frac{9}{6} = \frac{3}{2} = 1\frac{1}{2}$)

Independent Practice *(10 minutes)*

1. Ask pupils to work independently.
2. Write the following problems on the board: (i) $\frac{1}{4} + \frac{3}{5}$ (ii) $\frac{2}{5} + \frac{2}{3}$
3. Ask pupils to solve the problems in their exercise books.
4. Move around to check pupils as they work.
5. Ask them to turn to the pupil sitting next to them and share their answers.

6. Call on one pupil from the back and one from the front to go on the board and give the answers. (Answers: (i) $\frac{1}{4}+\frac{3}{5}=\frac{5}{20}+\frac{12}{20}=\frac{5+12}{20}=\frac{17}{20}$ (ii) $\frac{2}{5}+\frac{2}{3}=\frac{6}{15}+\frac{10}{15}=\frac{6+10}{15}=\frac{16}{15}=1\frac{1}{15}$)

Closing *(2 minutes)*

1. **Ask**: Why do we need to study fractions?
2. Allow pupils to share their answers. (Examples: Share resources fairly at home and in the school, gain knowledge on the concept of less than or greater than numbers, become an efficient manager)
3. Inform pupils that the topic for the next lesson is subtracting fractions with common denominators.

Lesson Title: Subtracting Fractions with the Same Denominators	**Theme:** Numbers and Numeration	
Lesson Number: M-07-018	**Class/Level:** JSS 1	**Time:** 35 minutes

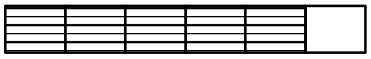
Learning Outcomes By the end of the lesson pupils will be able to subtract fractions with the same denominator.	**Teaching Aids** None	**Preparation** Draw the diagrams on the board.

Opening *(3 minutes)*

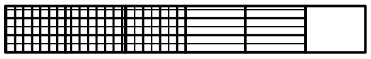
1. **Ask:** What is a fraction?
2. Allow a few pupils to give their answers. (Example answers: a fraction names part of a region or part of a group; it is an amount that is not a whole number)
3. Ask a pupil to name the types of fractions. (Answer: proper, improper and mixed fractions)
4. **Say**: Can a pupil call out examples of the types of fractions? (Example answers: $\frac{1}{2}, \frac{3}{2}$ and $1\frac{1}{2}$)
5. Write the fractions they call out on the board. Make sure pupils understand which ones are proper, improper, and mixed.
6. **Say:** Today, we are subtracting fractions with the same denominators.

Introduction to the New Material *(10 minutes)*

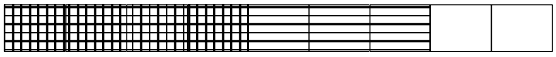
1. Write some examples of fractions on the board? Example: ($\frac{5}{6}, \frac{3}{4}, \frac{2}{3}, \frac{2}{5}, \frac{3}{6}, \frac{4}{7}$)
2. Ask a pupil to circle the fractions with the same denominator. (Answer: $\frac{5}{6}$ and $\frac{3}{6}$)
3. Draw a diagram of the fraction $\frac{5}{6}$ Draw lines in one direction to show shading.
4. **Say:** We will subtract $\frac{3}{6}$ from $\frac{5}{6}$



5. Write on the board: $\frac{5}{6} - \frac{3}{6}$
6. **Say**: We show this in the diagram by crossing out part of $\frac{5}{6}$
7. Cross out 3 of the 5 shaded parts ($\frac{3}{6}$). →



8. **Ask:** what fraction of the $\frac{5}{6}$ remains? (Answer $\frac{2}{6}$).
9. Ask pupils what they noticed. Guide them to see that the numerators were subtracted (5 – 3).
10. Write the subtraction problem on the board: $\frac{5}{6} - \frac{3}{6} = \frac{5-3}{6} = \frac{2}{6} = \frac{1}{3}$
11. Do a second subtraction problem using a diagram:



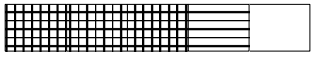
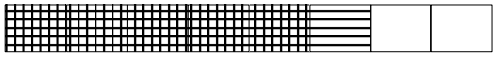
$$\frac{7}{9} - \frac{4}{9} = \frac{7-4}{9} = \frac{3}{9} = \frac{1}{3}$$

12. Write a subtraction problem on the board: $\frac{5}{8} - \frac{2}{8} =$

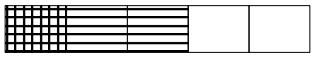
13. Ask pupils to describe how to do the subtraction in their own words. (Example: subtract the numerators, 5 – 2, and write the 8 as a denominator)
14. Write the answer on the board: $\frac{5}{8} - \frac{2}{8} = \frac{5-2}{8} = \frac{3}{8}$
15. **Say:** *When the denominators are the same*, we simply subtract the numerators.
16. **Say**: In everyday life, fractions are used when people tell the time, cook, shop, pay bills and more.

Guided Practice *(10 minutes)*

1. Draw 2 diagrams on the blackboard as shown:

2. Ask pupils to work in pairs.
3. **Say**: For the first diagram, cross out $\frac{3}{5}$ and write the remaining fraction. For the second diagram, cross out $\frac{5}{8}$ and write the remaining fraction. Write the subtraction problem for each shape.
4. Move around to check understanding and clear misconceptions.
5. Ask a pupil from any group to come the blackboard and present their answer for the first problem.
   Answer: $\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$ 
6. Ask a pupil from another group to present their answer for the next problem.
   Answer: $\frac{6}{8} - \frac{5}{8} = \frac{1}{8}$ 
7. Do corrections where necessary.

Independent Practice *(10 minutes)*

1. Write the following problems on the board.
   (a)  (b) $\frac{6}{7} - \frac{4}{7}$ (c) $\frac{10}{11} - \frac{6}{11}$
2. Ask pupils to solve the problems independently.
3. Walk around the classroom to make sure pupils understand the task and are working.
4. **Say:** Exchange your exercise books with a partner and check each other's work.
5. Ask 3 different pupils to come to the blackboard to present their answers to the 3 problems.
   (Answers: (a) $\frac{3}{5} - \frac{1}{5} = \frac{2}{5}$ (b) $\frac{6}{7} - \frac{4}{7} = \frac{2}{7}$ (c) $\frac{10}{11} - \frac{6}{11} = \frac{4}{11}$)

Closing *(2 minutes)*

1. **Ask:** How are fractions applicable in everyday life? (Example answers: we use them to tell time, share among people, pay bills, etc.)
2. **Say:** our next lesson will be multiplication of fractions.
3. **Suggested homework**: Solve the subtraction problem: $\frac{7}{13} - \frac{5}{13}$ (Answer: $\frac{2}{13}$)

Lesson Title: Subtracting Fractions with Different Denominators	**Theme:** Numbers and Numeration	
Lesson Number: M-07-019	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to subtract fractions with different denominators.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. Write 1 problem on the board: $\frac{2}{3} - \frac{1}{3}$
2. Give pupils 1 minute to find the answer.
3. Ask a pupil at random to come to the board to solve the problem. (Answer: $\frac{2}{3} - \frac{1}{3} = \frac{2-1}{3} = \frac{1}{3}$)
4. **Say:** Today, you are going to learn how to subtract fraction with different denominators.

Introduction to the New Material *(15 minutes)*

1. Write a problem on the board: $\frac{3}{4} - \frac{2}{3}$
2. Ask a pupil to read the problem on the board (3 over 4 minus 2 over 3).
3. **Ask:** Are the denominators the same? (Answer: No)
4. **Say**: To subtract fractions with different denominators we need to find a **common denominator**. Since the denominators are different we use the LCM of the two denominators to find one common denominator.
5. **Say**: This is the same process we followed to add fractions with different denominators.
6. **Say:** What is the LCM of 3 and 4? (Answer: 12).
7. Discuss the steps required to change the first fraction ($\frac{3}{4}$):
   - Ask a pupil to tell the denominator of the first fraction. (Answer : 4)
   - **Ask:** How many times can 4 go into 12? (Answer: 3)
   - **Say:** Multiply the answer (3) by the numerator and denominator.
   - Write on the board: $\frac{3}{4} = \frac{3\times3}{4\times3} = \frac{9}{12}$
   - **Say:** $\frac{3}{4}$ and $\frac{9}{12}$ are equivalent fractions.
8. Repeat the same with the next fraction ($\frac{2}{3}$)
   - **Ask:** How many times can 3 go into 12? (answer: 4)
   - **Say:** Multiply the answer (4) by the numerator and denominator.
   - Write on the board: $\frac{2}{3} = \frac{2\times4}{3\times4} = \frac{8}{12}$
9. Write the solution on the board: $\frac{3}{4} - \frac{2}{3} = \frac{9}{12} - \frac{8}{12} = \frac{9-8}{12} = \frac{1}{12}$
10. Write another problem on the board:

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

11. Ask a pupil at the middle of the class to read the question on the board while others listen carefully.
12. Discuss with pupils key word that leads to subtraction – 'remaining'.
13. Call on pupils to say the subtraction problem for this story problem ($\frac{3}{4} - \frac{1}{3}$).
14. Write the subtraction problem on the board: $\frac{3}{4} - \frac{1}{3}$
15. **Ask:** What is the LCM of 4 and 3? (Answer: 12).
16. Discuss the steps required, and write the solution on the board:
    - **Say:** Multiply the numerator and denominator of the first fraction by 3 to give a fraction with denominator 12: $\frac{3}{4} = \frac{3\times3}{4\times3} = \frac{9}{12}$
    - **Say:** Multiply the numerator and denominator of the second fraction by 4 to give a fraction with denominator 12: $\frac{1}{3} = \frac{1\times4}{3\times4} = \frac{4}{12}$
    - Subtract the two fractions**:** $\frac{3}{4} - \frac{1}{3} = \frac{9}{12} - \frac{4}{12} = \frac{9-4}{12} = \frac{5}{12}$
17. **Say**: $\frac{5}{12}$ of the farmer's land was used for rice.
18. **Say:** Math can help farmers to be successful. It can help them decide how many seeds are needed, how much fertilizer to buy, how much their farm will produce, and many other things.

Guided Practice *(5 minutes)*

1. Write a question on the board:
   John and Mary shared $\frac{2}{3}$ kg. of rice. John received $\frac{1}{5}$ kg. How much did Mary receive?
2. **Say:** Discuss and solve the problem on the board in pairs.
3. Move around the class and check for understanding and misconceptions. Write the subtraction problem on the board if needed ($\frac{2}{3} - \frac{1}{5}$).
4. Ask a pupil from any pair to come to the board and solve the problem.
5. Allow the class to discuss the answer on the board until they arrive at the correct answer: $\frac{2}{3} - \frac{1}{5} = \frac{10}{15} - \frac{3}{15} = \frac{10-3}{15} = \frac{7}{15}$ kg.
6. **Say:** Mary received $\frac{7}{15}$ kg. of rice.

Independent Practice *(10 minutes)*

1. Write 2 questions on the board: (i) $\frac{8}{9} - \frac{2}{3}$
   (ii) A man shared $\frac{5}{6}$ of his money between his 2 sons. If the first son received $\frac{3}{4}$ of his total money, what fraction of his money did his second son receive?
2. Ask the pupils to work independently in their exercise books.
3. Move around the class to check on their work and clear misconceptions.
4. Ask pupils to exchange exercise books with their seatmates to check answers.

5. Call two pupils to come to the board and solve the questions. (Answer: (i) $\frac{8}{9}-\frac{2}{3}=\frac{8}{9}-\frac{6}{9}=\frac{8-6}{9}=\frac{2}{9}$, (ii) $\frac{5}{6}-\frac{3}{4}=\frac{10}{12}-\frac{9}{12}=\frac{10-9}{12}=\frac{1}{12}$)

Closing *(2 minutes)*

1. **Say:** Why is it necessary to determine the LCM of the denominators? (Answer: To get a common denominator).
2. **Ask:** pupils at random to give LCM of the following verbally: (i) 7 and 3 (Answer: 21) (ii) 4 and 6 (Answer: 12)

Lesson Title: Multiplication of Fractions	**Theme:** Numbers and Numeration	
Lesson Number: M-07-020	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes: By the end of this lesson, pupils will be able to multiply two or more fractions.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. Write a problem on the board: Solve $\frac{1}{4} + \frac{3}{8}$
2. Allow pupils to solve the problem for 1 minute.
3. Ask one pupil to solve problem on the board. (Answer: $\frac{1}{4} + \frac{3}{8} = \frac{2+3}{8} = \frac{5}{8}$)
4. Say: Today, we will learn how to multiply 2 or more fractions.

Introduction to the New Material *(14 minutes)*

1. Write on the board: $\frac{2}{3} \times \frac{4}{5}$
2. **Ask**: How can you solve this problem?
3. Allow pupils to brainstorm in pairs for 1 minute and share their ideas.
4. **Say:** When we multiply fractions, we multiply the numerators and then also multiply the denominators.
5. Solve the problem on the board: $\frac{2}{3} \times \frac{4}{5} = \frac{2\times4}{3\times5} = \frac{8}{15}$
6. Write another problem on the board: $\frac{2}{7} \times \frac{3}{6}$
7. **Ask:** How will I find the numerator in the answer? (Answer: Multiply the two numerators, 2x3)
8. **Ask:** How will I find the denominator in the answer? (Answer: Multiply the two denominators, 7x6)
9. Solve the problem on the board: $\frac{\mathbf{2}}{\mathbf{7}} \times \frac{\mathbf{3}}{\mathbf{6}} = \frac{\mathbf{2\times3}}{\mathbf{7\times6}} = \frac{\mathbf{6}}{\mathbf{42}}$
10. **Ask**: Can this answer be simplified? (Answer: Yes)
11. Guide pupils to simplify $\frac{6}{42}$. 6 can be canceled from the numerator and denominator.
12. Write the answer on the board: $\frac{2}{7} \times \frac{3}{6} = \frac{2\times3}{7\times6} = \frac{6}{42} = \frac{1}{7}$
13. Write on the board: $\frac{2}{3} \times \frac{3}{6} \times \frac{2}{5}$
14. **Say**: This problem multiplies 3 fractions. How do you think we will solve this problem?
15. Allow pupils to share their ideas with the class.
16. **Say**: 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.
17. Ask one pupil to multiply the first two fractions. (Answer: $\frac{2}{3} \times \frac{3}{6} = \frac{2\times3}{3\times6} = \frac{6}{18} = \frac{1}{3}$)
18. Ask another pupil to multiply this answer ($\frac{1}{3}$) by the third fraction ($\frac{2}{5}$): $\frac{1}{3} \times \frac{2}{5} = \frac{1\times2}{3\times5} = \frac{2}{15}$
19. Write the answer on the board next to the problem: $\frac{2}{3} \times \frac{3}{6} \times \frac{2}{5} = \frac{2}{15}$

Guided Practice (*5 minutes*)

1. Ask pupils to work in pairs.
2. Write a multiplication problem on the board for them to solve: $\frac{1}{2} \times \frac{3}{8} \times \frac{2}{3}$
3. Move around to check pupils as they work.
4. Ask one pair to write their answer on the board. (Answer: $\frac{1}{2} \times \frac{3}{8} = \frac{1\times3}{2\times8} = \frac{3}{16} \rightarrow \frac{3}{16} \times \frac{2}{3} = \frac{6}{48} = \frac{1}{8}$)

Independent Practice *(10 minutes)*

1. Ask pupils to write 2 multiplication problems of their own in their exercise books. Each problem should have two fractions. Each numerator and denominator should be 10 or less. (Examples: $\frac{4}{3} \times \frac{3}{8}$, $\frac{5}{10} \times \frac{2}{8}$)
2. Ask pupils to exchange exercise books with a neighbour. Pupils should solve the two problems written by their classmate.
3. Move around to check for understanding and clear misconceptions. For example, make sure they understand how to simplify the answers.
4. Ask pupils to take their own exercise books and check their partner's answers. They should discuss in their pairs and arrive at the correct answers. (Example answers: $\frac{4}{3} \times \frac{3}{8} = \frac{4\times3}{3\times8} = \frac{12}{24} = \frac{1}{2}$, $\frac{5}{10} \times \frac{2}{8} = \frac{5\times2}{10\times8} = \frac{10}{80} = \frac{1}{8}$)

Closing *(3 minutes)*

1. Give pupils an exit ticket (a problem to complete before leaving class).
2. Write one question on the board: $\frac{2}{3} \times \frac{4}{3}$
3. Tell pupils that they should complete it and show you before leaving class.
4. Check pupils' answers as they leave. (Answer: $\frac{2}{3} \times \frac{4}{3} = \frac{8}{9}$)
5. **Say:** In our next lesson, we will divide fractions.
6. **Suggested Homework**: Solve: $a.\ \frac{3}{5} \times \frac{4}{8}$ $b.\ \frac{4}{6} \times \frac{3}{4}$ (Answers: $a.\ \frac{3}{10}$ $b.\ \frac{1}{2}$)

Lesson Title: Division of Fractions	**Theme:** Numbers and Numeration	
Lesson Number: M-07-021	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to divide two fractions.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. Write a fraction multiplication problem on the board. (Example: $\frac{2}{3}$ x $\frac{1}{5}$)
2. Ask a pupil to go to the board and solve the problem. (Answer: $\frac{2}{3}$ x $\frac{1}{5}$ = $\frac{2}{15}$)
3. **Say**: Today we will learn how to divide fractions.

Introduction to the New Material *(12 minutes)*

1. Write on the board: $\frac{2}{5} \div \frac{3}{5}$
2. **Ask**: What is the reciprocal of $\frac{3}{5}$?
3. Ask pupils to share their ideas about 'reciprocal' with the class.
4. **Say**: A reciprocal of a fraction is to interchange the position of the numerator and denominator. The reciprocal of $\frac{3}{5}$ is $\frac{5}{3}$
5. **Say**: I will tell you the process for dividing two fractions. When we divide two fractions, we change division sign to a multiplication sign. The fraction *after* the division sign is changed to its reciprocal.
6. Rewrite the problem on the board: $\frac{2}{5} \div \frac{3}{5} = \frac{2}{5} \times \frac{5}{3}$
7. Ask: What do you think is the next step that we will take? (Answer: we will simply multiply the two fractions.)
8. Ask a pupil to go to the board and solve this multiplication problem: $\frac{2}{5} \times \frac{5}{3} = \frac{2\times5}{5\times3} = \frac{10}{15}$
9. Ask another pupil to go to the board and simplify the answer: $\frac{10}{15} = \frac{2}{3}$
10. Make sure the full solution is written clearly on the board and that pupils understand. (Answer: $\frac{2}{5} \div \frac{3}{5} = \frac{2}{5} \times \frac{5}{3} = \frac{2\times5}{5\times3} = \frac{10}{15} = \frac{2}{3}$)
11. Write another problem on the board: $\frac{1}{4} \div \frac{3}{5}$
12. Ask one pupil to rewrite this as a multiplication problem: $\frac{1}{4} \times \frac{5}{3}$
13. Ask another pupil to solve this multiplication problem: $\frac{1}{4} \times \frac{5}{3} = \frac{1\times5}{4\times3} = \frac{5}{12}$

Guided Practice *(8 minutes)*

1. Ask pupils to work in pairs or with seatmates.

2. Write two problems on the board: a. $\frac{3}{7} \div \frac{4}{7}$ b. $\frac{4}{9} \div \frac{2}{5}$
3. Ask pupils to work in their exercise books.
4. Move around to check for understanding and clear misconceptions. For example, make sure pupils recall how to change an improper fraction to a mixed fraction.
5. Ask a pupil from the middle of the class to go to the board and write the first answer. (Answer: $\frac{3}{7} \div \frac{4}{7} = \frac{3}{7} \times \frac{7}{4} = \frac{3\times7}{7\times4} = \frac{21}{28} = \frac{3}{4}$)
6. Ask another pupil from the front of the class to give the second answer. (Answer: $\frac{4}{9} \div \frac{2}{5} = \frac{4}{9} \times \frac{5}{2} = \frac{20}{18} = \frac{10}{9} = 1\frac{1}{9}$)

Independent Practice *(10 minutes)*

1. Ask pupils to work individually.
2. Write two problems on the board: a. $\frac{1}{2} \div \frac{2}{3}$ b. $\frac{6}{7} \div \frac{5}{6}$
3. Ask pupils to work the problems in their exercise books.
4. Move around to check pupils work.
5. Call two pupils, one from the front and the other from the back to go to the board one at a time to give the answers. (Answers: a. $\frac{1}{2} \div \frac{2}{3} = \frac{1}{2} \times \frac{3}{2} = \frac{3}{4}$ and b. $\frac{6}{7} \div \frac{5}{6} = \frac{6}{7} \times \frac{6}{5} = \frac{36}{35} = 1\frac{1}{35}$)

Closing *(2 minutes)*

1. Give pupils an exit ticket (a problem to complete before leaving class).
2. Write one question on the board: $\frac{2}{3} \div \frac{1}{3}$
3. Ask pupils to show you their answers in their exercise books before you leave class.
4. Check pupils' answers to make sure they understood today's topic. (Answer: $\frac{2}{3} \div \frac{1}{3} = \frac{2}{3} \times \frac{3}{1} = \frac{6}{3} = 2$)
5. **Say**: The next lesson will be on fraction story problems.

Lesson Title: Story Problems on the Basic Operations on Fractions	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-022	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson, pupils will be able to solve story problems on addition, subtraction, multiplication and division of fractions.	**Teaching Aids** Story problems	**Preparation** Write the story problems, in the Introduction to the New Material and Guided Practice, on the board.

Opening *(3 minutes)*

1. Write on the board: Solve $\frac{2}{3} + \frac{7}{12} - \frac{3}{4}$
2. Allow pupils 1 minute to solve it on their own.
3. Ask 1 pupil to solve the problem on the board. (Answer: $\frac{2}{3} + \frac{7}{12} - \frac{3}{4} = \frac{8}{12} + \frac{7}{12} - \frac{9}{12} = \frac{8+7-9}{12} = \frac{15-9}{12} = \frac{6}{12} = \frac{1}{2}$)
4. Remind pupils of the rules for adding and subtracting fractions with different denominators if needed (find the LCM of the denominators, and change the fractions to equivalent fractions with the LCM in the denominators)
5. **Say:** Today, we will solve story problems on addition, subtraction multiplication and division of fractions.

Introduction to the New Material *(12 minutes)*

1. Look at the story problem on the board:

   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?
2. Ask one pupil from the back of the class to read the problem out loud.
3. **Ask**: To solve this problem, should we add, subtract, multiply, or divide?
4. Allow pupils to share their ideas.
5. **Say**: We will use addition to solve this problem. Words like **more** and **total** tell us to use addition.
6. Ask one pupil to write the addition for this story problem on the board: $\frac{1}{2} + \frac{1}{4}$
7. Ask pupils to explain each step and solve the problem on the board as they do so. (Answer: $\frac{1}{2} + \frac{1}{4} = \frac{2}{4} + \frac{1}{4} = \frac{2+1}{4} = \frac{3}{4}$).
8. **Say**: Sia has $\frac{3}{4}$ cups of rice in total.
9. Look at another problem on the board:

   If it takes $1\frac{3}{4}$ minutes to fry a cake, how many cakes can be fried in $10\frac{1}{2}$ minutes?
10. Ask the pupils what this problem involves?

11. Allow pupils to think and share ideas for 1 minute. (Answer: This involves division of fractions; the total number of minutes ($10\frac{1}{2}$) will be divided by the minutes required to fry one cake ($1\frac{3}{4}$))
12. Ask a pupil to write the division problem on the board: $10\frac{1}{2} \div 1\frac{3}{4}$
13. Ask pupils to describe the steps in solving this problem (Answers: convert the mixed numbers to improper fractions; multiply the first fraction by the reciprocal of the second fraction)
14. Follow the steps the pupils describe to solve the problem on the board. (Answer: $10\ \frac{1}{2}\ \div 1\frac{3}{4} = \frac{21}{2}\ \div\ \frac{7}{4} = \frac{21}{2} \times \frac{4}{7} = \frac{3}{1} \times \frac{2}{1} = 6$ cakes)

Guided Practice *(8 minutes)*

1. Look at the 2 problems on the board:
   (i) Marie uses $\frac{1}{4}$ of her money to buy rice, and $\frac{3}{8}$ to buy palm oil. What fraction of her money is left?
   (ii) Bendu wants to buy enough rice for her family's dinner. Each member of her family eats $\frac{3}{4}$ cup of rice, and there are 8 members of her family. How many cups should she buy?
2. Ask pupils to work in pairs to solve the problems.
3. Move around to check for understanding and clear misconceptions. If needed, remind them of the operation needed to solve each problem (For question (i) both fractions should be subtracted from the whole, 1. For question (ii) the fraction each family member eats should be multiplied by the 8 family members.)
4. Ask two pairs to write their answers on the board. (Answers: (i) $1 - (\frac{1}{4} + \frac{3}{8}) = 1 - \left(\frac{2}{8} + \frac{3}{8}\right) = 1 - \frac{5}{8} = \frac{8}{8} - \frac{5}{8} = \frac{3}{8}$; (ii) $\frac{3}{4} \times 8 = \frac{3}{4} \times \frac{8}{1} = \frac{3\times8}{4\times1} = \frac{24}{4} = 6$ cups)
5. **Say**: For question (i), Marie has $\frac{3}{8}$ of her money left. For question (ii), Bendu should buy 6 cups of rice.

Independent Practice *(10 minutes)*

1. Ask pupils to work independently to solve these problems in their exercise books.
2. Write the following problems on the board:
   a. Abu spent $\frac{1}{3}$ of his time in bed, $\frac{5}{24}$ of his time reading and $\frac{1}{8}$ of his time doing research. What fraction of his time has he spent doing these 3 things?
   b. Juliet is a tailor. It takes her $\frac{1}{3}$ of a working day to make one school uniform. If there are $6\frac{2}{3}$ working days left before school starts, how many school uniforms can she make?
3. Move around to supervise pupils as they work. If needed, remind them of the operation needed to solve the problem (addition is used for a, and division is used for question b).
4. Ask pupils to compare answers with a neighbour when they're done.
5. Ask two pupils to write the answers on the board. Other pupils should compare their answers to those on the board and make corrections where needed. (Answers: (a) $\frac{1}{3} + \frac{5}{24} + \frac{1}{8} = \frac{8}{24} + \frac{5}{24} +$

$\frac{3}{24} = \frac{8+5+3}{24} = \frac{16}{24} = \frac{2}{3}$; (b) First, convert the mixed number to an improper fraction: $6\frac{2}{3} = \frac{6\times3+2}{3} = \frac{20}{3}$. Then solve: $\frac{20}{3} \div \frac{1}{3} = \frac{20}{3} \times \frac{3}{1} = 20$ school uniforms).

6. **Say**: For question (a), Abu spent two-thirds of his time on the 3 activities. For question (b), Juliet is able to make 20 school uniforms.

Closing *(2 minutes)*

1. **Ask:** Why do we need to study about fractions?
2. Allow pupils to share their ideas about the answer for 1 minute. (Example answer: It is not always possible to use whole numbers to describe quantities. It is at times necessary to use fractions. For example, I will eat $\frac{1}{3}$ of my food now and reserve the rest)

Lesson Title: Place Value for Decimals	**Theme:** Numbers and Numeration	
Lesson Number: M-07-023	**Class/Level:** JSS 1	**Time:** 35 minutes

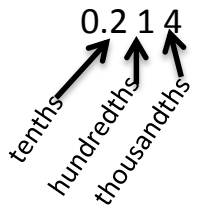
Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson, pupils will be able to identify, read and write decimals.	None	None

Opening *(3 minutes)*

1. **Say:** We have worked with whole numbers and fractional numbers.
2. Ask pupils to give examples of whole numbers. (Example answers: $2, 52, 109, 2000$).
3. Ask pupils to give example of fractions. (Example answers: $\frac{1}{2}, \frac{3}{8}, 1\frac{1}{5}, 5\frac{8}{12}$)
4. **Ask:** How is a fraction different from a whole number? (Example answers: Fractions have a numerator and denominator; fractions are less than 1; fractions are part of a whole)
5. **Say:** Today, we will identify, read and write another type of numbers called decimals numbers.

Introduction to the New Material *(13 minutes)*

1. Write on the board: 0.214
2. **Say**: We have discussed whole numbers and fractions. Can anyone tell me what type of number this is? (Answer: decimal)
3. **Say:** Numbers with a full stop in the middle of numbers are called decimal numbers. This full stop is called 'point.'
4. **Ask:** Can anyone read the decimal number written on the board?
5. Allow pupils to share their ideas. If they don't know, read it for them. (Answer: zero point two one four)
6. **Say:** Decimal numbers are divided into two parts: The numbers before the point are whole numbers and the numbers after the point are parts of a whole.
7. Write a few decimal numbers on the board: $0.5, 3.42, 10.863$
8. Ask pupils one at a time to read the decimal numbers written on the board. Say each one correctly and have the whole class repeat each one. (Answers: zero point five, three point four two, ten point eight six three)
9. **Say**: Decimal numbers have place value, just as whole numbers do.
10. Point out each number in the decimal 0.214 and ask pupils to give its place value. Write their responses on the board.



11. **Say**: the first place after the decimal point is the tenths place. Next is the hundredths, then the thousandths.
12. Draw the table below on the board. Ask pupils to copy it in their exercise books as you are drawing.

	Tens	Ones	.	tenths	hundredths	thousandths
0.5			.			
3.42			.			
10.863			.			

13. Ask pupils to look at the other decimals on the board and name the number in each place (For example, ask: What is in the tenths place?). Write their answers in the table.
    Answers:

	Tens	Ones	.	tenths	hundredths	thousandths
0.5		0	.	5		
3.42		3	.	4	2	
10.863	1	0	.	8	6	3

14. **Say:** When a decimal number has values other than zero before the decimal, it is greater than one. 3.42 and 10.863 are greater than 1. The decimal 3.42 means 3 wholes and a part. The decimal 10.863 means 10 wholes and a part.
15. **Say**: Decimal numbers can also be less than one. If there is only zero before the decimal point, it is less than one. For example, 0.5 is less than one.

Guided Practice *(5 minutes)*

1. Ask pupils to work with a partner.
2. Ask each pupil to write a decimal number in his or her exercise book. Then his or her partner should take turns reading the decimal number out loud. They should agree on the correct way to read it. Then they should identify the place value of each digit in the decimal number.
3. Walk around and check for understanding. Listen to as many pupils as possible and make sure they are reading the decimals correctly. (For example, 4.257 is 'four point two five seven' and ***not*** 'four point two hundred and fifty seven')
4. Ask pupils from different seats to read out the decimal numbers they have written for the rest of the class.

Independent Practice *(10 minutes)*

1. Ask pupils to write four examples of decimal numbers in their exercise books.

2. Ask pupils to exchange exercise books with a partner. Then ask them to write the decimal numbers their partner wrote in a place value table like the one on the board.
3. Move around and make sure pupils work and help where necessary.
4. Ask pupils take their own exercise book, and check the answers written by their partner. Partners should discuss their work together.

Closing *(3 minutes)*

1. Do a problem-solving activity.
2. Write two numbers on the board: 10.021 and 0.998
3. Ask pupils to read the numbers out loud. (Answers: 'ten point zero two one' and 'zero point nine nine eight')
4. **Ask**: Which of these numbers is greater?
5. Allow pupils to brainstorm and share their ideas.
6. **Say**: 10.021 is greater than 0.998. It has a whole number of ten in front of the decimal number. That means it is 10 wholes and a part. The other number, 0.998 is less than one. It is just part of a whole.

Lesson Title: Decimals to Fractions	**Theme:** Numbers and Numeration	
Lesson Number: M-07-024	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson, pupils will be able to express decimals as fractions.	**Teaching Aids** None	**Preparation** None

Opening *(4 minutes)*

1. Ask pupils to give examples of fractions. (Example answers: $3\frac{1}{6}, \frac{4}{9}, \frac{8}{15}, 5\frac{1}{2}$)
2. Ask pupils to give examples of decimal numbers. (Example answers: 1.54, 0.8, 6.636, 13.1)
3. Ask pupils to name the 2 parts of a fraction. (Answer: numerator and denominator)
4. **Ask**: What are the numbers before the point in a decimal? (Answer: whole numbers)
5. **Ask**: What are the numbers after the point in a decimal? (Answer: decimal numbers; part of a whole)
6. **Say:** You have learned that both fractions and decimals describe part of a whole. Today we are going to learn how to change decimals to fractions.

Introduction to the New Material *(13 minutes)*

1. **Say:** Decimal numbers are sometimes called fractional numbers because they can be easily expressed as fraction.
2. **Say:** To change decimals to fractions, we look at the number of decimal places or the numbers after the point.
    a. If there is 1 number after the point, then that number is expressed over 10.
    b. If there are 2 numbers after point, then it is expressed over 100.
    c. If there are more numbers after the point, it is expressed over 1000 and so on.
3. Write 3 decimal numbers on the board: $(a)\ 0.25 \quad (b)\ 0.3 \quad (c)\ 0.108$
4. **Ask:** How many decimal places are there in question a? (Answer: 2 decimal places)
5. Write on the board: $0.25 = \frac{25}{100}$
6. **Say**: We write 100 in the denominator because there are two decimal places in 0.25
7. **Ask**: How many decimal places are there in question b? (Answer: 1 decimal place)
8. **Ask**: If we write 0.3 as a fraction, what number will be in the denominator? (Answer: 10)
9. Ask one pupil to write the fraction for 0.3 on the board. Ask all other pupils to complete the task in their exercise book. (Answer: $0.3 = \frac{3}{10}$)
10. **Ask**: If we write 0.108 as a fraction, what number will be in the denominator? (Answer: 1000)
11. Ask one pupil to write the fraction for 0.108 on the board. Ask all other pupils to complete the task in their exercise book. (Answer: $0.108 = \frac{108}{1000}$)
12. **Say:** Remember that we can simplify fractions if one of the numbers can go into the other without a remainder, or we find a common factor.

13. **Ask:** Can we simplify any of the fractions on the board? (Answer: Yes, we can simplify $\frac{25}{100}$ and $\frac{108}{1000}$)
14. Ask pupils to simplify $\frac{25}{100}$ in their exercise books.
15. Write the solution on the board: $0.25 = \frac{25}{100} = \frac{1}{4}$
16. **Say**: We simplified $\frac{25}{100}$ because 25 can go into itself and 100. We found that 0.25 equals $\frac{1}{4}$
17. Ask pupils to simplify $\frac{108}{1000}$ in their exercise books.
18. Write the solution on the board: $0.108 = \frac{108}{1000} = \frac{54}{500} = \frac{27}{250}$
19. **Say**: We can easily see that $\frac{108}{1000}$ can be simplified because both the numerator and denominator are even. We divide both numbers by 2 twice to find that 0.108 equals $\frac{27}{250}$
20. Write another decimal on the board: 1.25
21. **Ask**: How will we convert this to a fraction?
22. Allow pupils to share their ideas. Guide them to see that we will keep the whole number (1) and change the decimal numbers (0.25) to a fraction.
23. Write on the board: $1.25 = 1\frac{25}{100} = 1\frac{1}{4}$

Guided Practice *(6 minutes)*

1. Ask pupils to work in pairs.
2. Write on the board: Express the following as fractions in their lowest terms:
   (i) 0.75
   (ii) 0.105
3. Move round the class assisting the pupils and clearing any misconceptions.
4. Ask 2 pairs or groups to each solve a problem on the board. (Answers: (a) 0.75= $\frac{75}{100}$ =$\frac{3}{4}$
   (b) 0.105= $\frac{105}{1000}$=$\frac{21}{200}$)
5. Ask pupils to compare their answers to the answers on the board.

Independent Practice *(10 minutes)*

1. Ask pupils to work independently the following exercises in their books.
2. Write on the board: Express the following as fractions in their lowest terms:
   a. 5.32
   b. 0.325
   c. 0.66
3. Move round the class to see pupils at work and clear any misconception.
4. Ask three pupils to come to the board and explain to the class, how to change a decimal to a fraction (in their own words). Answer: (a) 5.32 = $5\frac{32}{100}$ = $5\frac{8}{25}$ (b) 0.325 = $\frac{325}{1000}$ = $\frac{13}{40}$
   (c) 0.66= $\frac{66}{100}$ = $\frac{33}{50}$)

Closing *(2 minutes)*

1. Give an exit ticket problem.
2. Ask the pupils to solve the following problem as a class exercise: Express 0.2 as a fraction in its lowest terms
3. Ask pupils to submit their work for correction before you leave class. Make sure they understood the topic. (Answer: $0.2 = \frac{2}{10} = \frac{1}{5}$)

Lesson Title: Fractions to Decimal	**Theme:** Numbers and Numeration	
Lesson Number: M-07-025	Class/Level: JSS 1	Time: 35 minutes

 Learning Outcomes By the end of the lesson, pupils will be able to express fractions as decimals.	 Teaching Aids None	 Preparation None

Opening *(2 minutes)*

1. Write on the board: Express 0.8 as a decimal
2. Ask pupils to solve the problem in their exercise books and raise their hands when they're finished.
3. When most pupils are finished, ask one pupil to give the answer and explain. (Answer: 0.8 = $\frac{8}{10}$ =$\frac{4}{5}$)
4. **Say:** In the last lesson we converted decimals to fractions. Today we will convert fractions to decimals.

Introduction to the New Material *(15 minutes)*

1. Write 2 problems on the board: Change to a decimal (a) $\frac{3}{10}$ (b) $\frac{17}{100}$
2. **Say**: If the denominator of a fraction is a power of 10 such as 10, 100, or 1000, we can easily change the fraction to a decimal.
3. Ask pupils to look at (a)
4. **Ask**: If a fraction has a denominator of 10, how many decimal places will the decimal have? (Answer: 1 decimal place)
5. Write on the board: $\frac{3}{10} = 0.3$
6. Ask pupils to look at (b)
7. **Ask**: If a fraction has a denominator of 100, how many decimal places will the decimal have? (Answer: 2 decimal places)
8. Ask a pupil to find the decimal for (b) on the board. Ask all other pupils to complete the task in their exercise books. (Answer: $\frac{17}{100} = 0.17$)
9. Write 2 more problems on the board: Change to a decimal (c) $\frac{1}{5}$ (d) $1\frac{1}{2}$
10. **Say**: These fractions do not have a power of 10 in the decimal. We need to divide to find the decimal for each.
11. **Say:** To express a fraction as decimal, divide the numerator by the denominator.
12. Solve (c) on the board using long division, and explain each step to the pupils (The numerator is the dividend, and the denominator is the divisor. Place a decimal point after the dividend, and another directly above in the answer. Add a zero after the decimal point in the dividend, and use it to divide ($10 \div 5 = 2$).)

$$\frac{1}{5} = \begin{array}{r} 0.\ 2 \\ 5\overline{)\ 1.\ 0} \\ -\ 1\ 0 \\ \hline 0 \end{array} = 0.2$$

13. Ask pupils to look at question (d).

14. **Say**: To express a mixed number as decimal, keep the same whole number and change the fraction to a decimal. This whole number is 1, so we know there will be a 1 before the decimal point in the decimal answer.
15. **Convert** $\frac{1}{2}$ to a decimal on the board:

$$\frac{1}{2} = \begin{array}{r} 0.\ 5 \\ 2\overline{)\ 1.\ 0} \\ -\ 1\ 0 \\ \hline 0 \end{array} = 0.5$$

16. Write another problem on the board: Express $\frac{3}{4}$ as a decimal.
17. **Ask:** How do we express a proper fraction as decimal? (Answer: we divide the numerator by the denominator)
18. Ask pupils to solve the problem in their exercise books.
19. Write the solution on the board and ask them to check their work.

$$\frac{3}{4} = \begin{array}{r} 0.\ 7\ 5 \\ 4\overline{)\ 3.\ 0\ 0} \\ -\ 2\ 8 \\ \hline 2\ 0 \\ -\ 2\ 0 \\ \hline 0 \end{array} = 0.75$$

Guided Practice *(5 minutes)*

1. Write 2 problems on the board: Express as decimal: (a) $\frac{7}{100}$ (b) $1\frac{1}{4}$
2. Ask pupils to discuss the problems with their seatmates and solve.
3. Move around the class and check for understanding and clear misconceptions. For example, remind pupils that (a) should have 2 decimal places, and the 7 should be in the last decimal place.
4. Ask 2 pupils from different seats to each solve a problem on the board.

Answers: (a) $\frac{7}{100} = 0.07$ (b) $\frac{1}{4} = \begin{array}{r} 0.\ 2\ 5 \\ 4\overline{)\ 1.\ 0\ 0} \\ -\ \ 8 \\ \hline 2\ 0 \\ -\ 2\ 0 \\ \hline 0 \end{array} = 0.25 \rightarrow 1\frac{1}{4} = \mathbf{1.25}$

5. Ask pupils to compare their answers with the answers on the board.

Independent Practice *(10 minutes)*

1. Write 3 problems on the board: (a) $\frac{4}{5}$ (b) $1\frac{19}{100}$ (c) $39\frac{1}{2}$
2. Ask pupils to work the problems individually in their exercise books.
3. Move around the class checking for understanding and clear misconceptions.
4. Ask 3 pupils to solve the problems on the board one at a time.

Answers: (a) $\frac{4}{5} = \begin{array}{r} 0.\ 8 \\ 5\overline{)\ 4.\ 0} \\ -\ 4\ 0 \\ \hline 0 \end{array} = 0.8$ (b) $1\frac{19}{100} = 1.19$

(c) $\frac{1}{2} = \begin{array}{r} 0.\ 5 \\ 2\ \overline{)\ 1.\ 0} \\ -\ 1\ 0 \\ \hline 0 \end{array} = 0.5 \rightarrow 39\frac{1}{2} = \mathbf{39.5}$

5. Ask pupils to compare their answers with the answers on the board.

Closing *(3 minutes)*

1. Give an exit ticket problem.
2. Ask pupils to solve the following problem as a class exercise on a piece of paper: Express $\frac{1}{8}$ as a decimal
3. Ask pupils to submit their work for correction before you leave class. Make sure they understood the topic.

$$\frac{1}{8} = \begin{array}{r} 0.\ 1\ 2\ 5 \\ 8\ \overline{)\ 1.\ 0\ 0\ 0} \\ -\ \ 8 \\ \hline \ \ 2\ 0 \\ -\ 1\ 6 \\ \hline \ \ \ \ 4\ 0 \\ -\ 4\ 0 \\ \hline \ \ \ \ \ 0 \end{array} = 0.125$$

Lesson Title: Rounding off Decimal Numbers to Whole Numbers	**Theme:** Numbers and Numeration	
Lesson Number: M-07-026	**Class/Level:** JSS 1	**Time:** 35 minutes

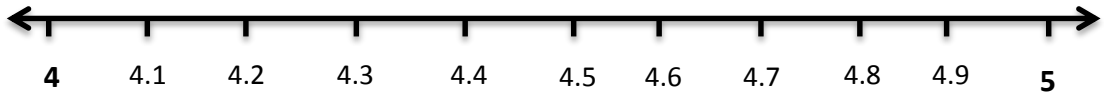
Learning Outcomes: By the end of the lesson pupils will be able to round decimal numbers to the nearest whole number.	**Teaching Aids:** 1. Number lines 2. Table	**Preparation:** 1. Draw the number lines, in the Introduction to the New Material, on the board. 2. Draw the first table, in the Guided Practice, on the board.

Opening *(3 minutes)*

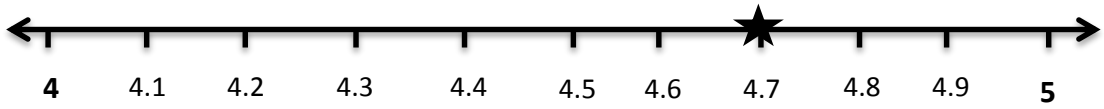
1. Ask a pupil to express 0.75 as a fraction. (Answer: $0.75 = \frac{75}{100} = \frac{3}{4}$)
2. Ask pupils to change $\frac{3}{8}$ to a decimal. (Answer: $\frac{3}{8} = 3 \div 8 = 0.375$)
3. **Say**: Today we will learn to round decimal numbers to the nearest whole numbers.

Introduction to the New Material *(13 minutes)*

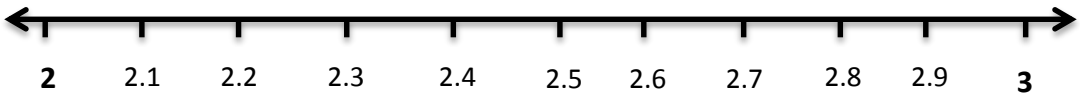
1. Ask pupils to write examples of decimal numbers on the board: e.g. 3.6, 5.9, 4.7, 2.53, 6.91
2. **Say:** Approximating decimals is a method of assuming precise values to figures. It is a system of counting to the nearest whole number.
3. Draw a number line on the board as shown below. It shows decimal numbers between 4 and 5 to the tenths digit.



4. Ask a pupil to mark the position of 4.7 on the number line.



5. **Ask:** which of the whole numbers (4 and 5) is 4.7 closer to? (Answer: 5)
6. **Say:** 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.
7. Ask pupils to repeat: '4.7 rounds up to 5'.
8. **Say:** Decimals round to the nearest whole number.
9. Draw another number line on the board:



10. Ask a pupil to mark 2.3 on the number line

11. **Ask:** which of the whole numbers 2 or 3 is 2.3 closer to? (Answer: 2)
12. **Say:** Since 2.3 is closer to 2 than it is to 3, the decimal 2.3 is rounded down to 2.
13. Ask pupils to repeat: '2.3 rounds down to 2'.
14. Write on the board: 6.5
15. **Ask:** What whole number will we round 6.5 to?
16. Allow pupils to brainstorm and share their answers.
17. **Say:** Any decimal with a 5 in the tenths place rounds up. 6.5 rounds up to 7.
18. Write on the board**:** 3.527
19. **Ask:** What whole number do you think this rounds to?
20. Allow pupils to brainstorm and share their answers.
21. **Say**: 3.527 rounds up to 4. We only look at the decimal in the tenths place when rounding to whole numbers. It doesn't matter how many decimal places there are.
22. Give additional examples:
    a. Round 16.4 to the nearest whole number. (Answer: 16)
    b. Round 428.27 to the nearest whole number. (Answer: 429)
23. **Say**: Remember that if the number behind the decimal point is less than 5, it is rounded down to the next whole number. If the number behind the decimal point is 5 or more, it is rounded up to the next whole number.
24. **Say:** We need to round numbers in everyday life. For example, when we measure a length, we round the answer to the nearest unit.

Guided Practice *(7 minutes)*

1. Ask pupils to work in pairs.
2. Look at the table below on the board. It shows the weights of six containers.
3. **Say**: Copy and complete the table. Approximate each number to the nearest whole number.

CONTAINER	WEIGHT (KG.)	WEIGHT TO THE NEAREST KG.
1	58.3	
2	49.5	
3	36.6	37
4	34.8	
5	33.4	
6	12.7	13

4. Move around the class to check for understanding and clear misconceptions.
5. Ask pupils to volunteer the answers.
   Answer (below):

CONTAINER	WEIGHT (KG.)	WEIGHT TO THE NEAREST KG.
1	58.3	**58**
2	49.5	**50**

3	36.6	37
4	34.8	**35**
5	33.4	**33**
6	12.7	13

Independent Practice *(10 minutes)*

1. Write the following story problem on the board:
   In a mathematics test, Amadu and Fatmata were asked to round 36.5 to the nearest whole number. Amadu's answer was 36 while Fatmata's was 37. Which of them is correct?
   Give reasons.
2. Ask pupils to work independently to solve the problem. (Answer: Fatmata's answer was correct because 0.5 can be rounded up by adding 1 to 36. This makes 36.5 become 37 when rounded to the nearest whole number.)
3. Ask pupils to compare their answers with their seatmates.
4. Move around and observe pupils at work.
5. Ask some pupils to say their answers and explain.

Closing *(2 minutes)*

1. Write two numbers on the board: 109.6 and 241.863
2. Ask pupils to round each number to the nearest whole number. They should write their answers on a small piece of paper with their name and give it to you before leaving class. (Answers: 110, 242)

Lesson Title: Rounding Off Decimal Numbers	**Theme:** Numbers and Numeration	
Lesson Number: M-07-027	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes: By the end of the lesson, pupils will be able to round decimal number to a given number of decimal places.	**Teaching Aids:** None	**Preparation:** None

Opening *(5 minutes)*

1. Ask questions to review decimals and rounding to whole numbers:
    a. How many decimal places are there in 2.0106? (Answer: 4 decimal places)
    b. How many digits are there in 2.0106? (Answer: 5 digits)
    c. What is 2.0106 rounded to the nearest whole number? (Answer: 2)
2. **Say:** Today we are going to extend the work you have already done on rounding whole numbers. We will round off decimal numbers to a given number of decimal places.

Introduction to the New Material *(12 minutes)*

1. **Say:** You can use the same approach as in the last lesson to round a decimal to a given number of decimal places.
2. **Ask:** Which numbers tell us to round down? (Answer: 0, 1, 2, 3, 4)
3. **Ask:** Which numbers tell us to round up? (Answer: 5, 6, 7, 8, 9)
4. Write on the board: 6.47
5. **Ask:** What is 6.47 when rounded to 1 decimal place?
6. Ask pupils to think about it for a moment, then discuss in pairs. Finally, ask them to share their ideas with the class.
7. **Say**: To round to 6.47 to one decimal place, we must look at the digit in the second decimal place. The digit in the second place is 7, which is greater than 5. We add 1 to the digit in the first decimal place (4). Therefore, 6.47 rounds up to 6.5
8. Write on the board: Round to 1 decimal place: (a) 25.27 (b) 25.72
9. Ask pupils to give the two answers and explain their reason.
    a. 25. 27 = 25.3 ← The second decimal place is 7, which is 5 or more, so round up
    b. 25.72 = 25.7 ← The second decimal place is 2, which is less than 5, so round down
10. **Say:** To round to a given number of decimal places, count that number of decimal places from the decimal point. Look at the next digit on. If it is 5 or more, you need to round up. Otherwise, leave off this digit and any that follow it.
11. Write on the board: Round to 3 decimal places: 4.4315
12. Ask pupils to give their ideas about how to solve it.
13. Write on the board: 4.4315 → 4.431
14. **Say**: The digit after the 3rd decimal place is 5, so round up and the 1 in the third decimal place becomes 2.
15. Work 2 more problems on the board, and make sure pupils understand rounding to a given decimal place.

a. Round 7.3962 to 2 decimal places. (Answer: 7.40)
b. Round 5.93582 to 3 decimal places. (Answer: 5.936)

Guided Practice *(6 minutes)*

1. Ask pupils to work in pairs.
2. Write two questions on the board:
   (a) Round 9.04681 to 2 decimal places.
   (b) Round 51.0196 to 1 decimal place.
3. Move around the class to check for understanding and clear misconceptions. For example, in (b) it is important to write the zero (51.0196 → 51.0) to hold the one decimal place that they are asked to round to.
4. Ask 2 different pairs to show their work and explain their reasons on the board. (Answers: (a) The next digit after the second decimal place is 6. As this more than 5, we round the 4 up to 5. So 9.04681 → 9.05. (b) The next digit after the first decimal place is 1. As this is less than 5, we round down to 0. So 51.0196 → 51.0).

Independent Practice *(10 minutes)*

1. Write the exercises below on the board.
   Round to the number of decimal place given in brackets:
   (a) 7.263 (2) (b) 73.0448 (2) (c) 0.04168 (3) (d) 0.7208 (3)
2. Ask pupils to work independently.
3. Move around the class to check for understanding and clear misconceptions.
4. Ask 4 different pupils to say their answers. (Answers: (a) 7.263 → 7.26 (b) 73.0448 → 73.04 (c) 0.04168 → 0.042 (d) 0.7208 → 0.0721)

Closing *(2 minutes)*

1. **Ask:** What are some examples from everyday life of times when we would write a number correct to a given number of decimal places?
2. Allow pupils to share their ideas with the class. (Example answer: When you find a fraction of an amount of money, you may need to round the answer to two decimal places.)

Lesson Title: Rounding Off Whole Numbers and Decimals to the Nearest 10, 100 and 1000	**Theme:** Numbers and Numeration	
Lesson Number: M-07-028	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson, pupils will be able to round whole numbers and decimals to the nearest 10, 100 and 1000.	 **Teaching Aids** None	 **Preparation** None

Opening *(5 minutes)*

1. Write a problem on the board: Round off to 2 decimal places: 6.4753
2. **Ask:** How do we round off 6.4753 to 2 decimal places?
3. Allow pupils to think for a moment, then share their answers with the class. (Example answer: To round up to 2 decimal places, look the digit in the third place. If it is 5 or greater, round up, or add 1 to the number in the second decimal place. If it is less than 5, round down, or keep the same number in the second decimal place)
4. Ask a pupil to solve the problem on the board. Ask all other pupils to complete the task in their exercise books. (Answer: 6.47⑤3 = drop 5 and add 1 to the 7. We get 6.48.)
5. **Say:** Today, we are going to round whole numbers and decimals to the nearest 10, 100 or 1000.

Introduction to the New Material *(10 minutes)*

1. **Say:** 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.
2. Write on the board: 2163
3. **Say:** We are going to round off 2163 to the nearest Tens, Hundreds and Thousands.
4. **Say:** First we are rounding to the nearest Tens.
5. Ask a pupil to identify the number in the Tens column. (Answer: 6)
6. Ask another pupil to identify the number to the right of 6 (in the ones column) and say whether it is greater or less than 5. (Answer: 3, less than 5).
7. **Say:** Because 3 is less than 5, we round down. Therefore 2163 becomes 2160.
8. Write on the board: $2163 \approx 2160$
    - Remind pupils that $\approx$ means 'is approximately equal to' and we use it because these numbers are not exactly equal.
9. **Say**: When rounding to the nearest 10, 100 or 1000, the numbers after the number to be rounded are replaced with zero (0).
10. Ask another pupil to identify the number in the Hundreds column in 2163. (Answer: 1)
11. **Ask:** Which number is on the right of 1 in 2163? (Answer: 6)
12. **Ask:** What should we do when the number right of the number to be rounded is greater than 5? (Answer: We round up)
13. Solve the problem on the board. (Answer: $2163 \approx 2200$)
14. Ask pupils to try rounding 2163 to the nearest Thousands in their exercise books.

15. Ask them to call out their answers and discuss. (Answer: $2163 \approx 2000$, because the number in the Hundreds column is 1, we round the number in the thousands column down to 2.)
16. Write on the board: Round 276.43 to the nearest 10.
17. **Ask**: How do you think we will round 276.43 to the nearest Tens?
18. Allow pupils to share their answers.
19. **Say**: We do not even need to consider the decimal. We follow the same rules that we have been following. If we want to round to the nearest Tens, we look at the number to the right, in the ones column.
20. Ask a pupil to identify the number in the Tens column. (Answer: 7)
21. Ask a pupil to identify the number on the right of 7. (Answer: 6)
22. **Ask**: To round to the nearest Tens, will we round up or down? (Answer: Up)
23. Ask a pupil to come to the board and write the answer. Ask all other pupils to do the task in their exercise books. (Answer: $276.43 \approx 280.00$ *or* 280)

Guided Practice *(5 minutes)*

1. Write 2 problems on the board: (a) Round 7852 to the nearest 100 (b) Round 53.24 to the nearest 10.
2. Go round the class to check for understanding and clear misconceptions.
3. Ask 2 pupils to each solve a problem on the board.
   (Answers: (a) 7⑧52≈7900
   (b) ⑤3.25≈50.00.
4. Ask pupils to compare their answers with the answers on the board.

Independent Practice *(10 minutes)*

1. Write 3 problems on the board: (a) Round 6309 to nearest 10; (b) Round 9672.64 to nearest 100; (c) Round 5085.12 to nearest 1000.
2. Ask pupils to solve the problems in their exercise books individually.
3. Move round the class and help where necessary.
4. Ask 3 pupils to each solve the problem on the board. (Answer: (a) 63⓪9 = 6310 (b) 9⑥72.64 = 9700.00 or 9700 (c) ⑤085.12 = 5000.00 or 5000.
5. Ask pupils to compare their answers with the answers on the board.

Closing *(5 minutes)*

1. Read the story problem below and ask pupils to listen carefully.
2. **Say**: Yusuf took transport to the hospital. His driver said it cost 1700 Leones, but asked him to pay in Thousands. Yusuf needs to round 1700 to the nearest Thousands. How much will he pay?
3. Ask pupils to think about it and write their answer in their exercise books.
4. Walk around to check their answers and make sure they understand.
5. Ask a pupil to stand and give the answer. (Answer: 2000 Leones)

6. **Ask**: Is it better for Yusuf to pay the original amount or the rounded amount? (Answer: It's better to pay the original amount, because it was rounded up and cost Yusuf more money.)

Lesson Title: Multiplying and Dividing Whole Numbers and Decimals by Powers of 10	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-029	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to multiply and divide whole numbers and decimals by powers of 10.	**Teaching Aids** None	**Preparation** None

Opening *(3 minutes)*

1. **Ask:** What are decimal numbers? (Example answers: numbers that have a point, numbers that are part of a whole)
2. Ask pupils to give examples of decimal numbers. (Example answers: 0.9, 5.8, 12.72, 1.345)
3. **Ask:** What are whole numbers? (Example answers: numbers without a point; numbers without a decimal or fraction part)
4. Ask pupils to give examples of whole numbers. (Example answers: 15, 38, 45, 93, 112)
5. **Say:** Whole numbers have a decimal point after the last number though most of the time it is not shown.
6. **Say:** Today we are going to multiply and divide whole numbers and decimals by powers of 10.

Introduction to the New Material *(15 minutes)*

1. Write 10^2 and 10^3on the board.
2. Ask pupils to read out the numbers. (Example answers: '10 raised to the power 2' and '10 raised to the power 3')
3. Ask two pupils to simplify these on the board. Ask all other pupils to do the task in their exercise books. (Answers: $10^2 = 10 \times 10 = 100$; $10^3 = 10 \times 10 \times 10 = 1000$)
4. **Say:** We will multiply and divide numbers by powers of 10. In other words, we will be multiplying and dividing them by 10, 100 or 1000.
5. Write 2 problems on the board:
   a) 327×10^2
   b) $835 \div 10^3$
6. **Say:** 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 tells us the number of places to move.
7. **Say:** To multiply whole numbers by powers of 10, we must 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.
8. **Ask:** What is the power in the first problem? (Answer: 2)
9. **Say:** We therefore add 2 zeros to 327.
10. Write on the board: $327 \times 10^2 = 32{,}700$

11. **Say:** 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.
12. **Ask:** What is the power in the second problem? (Answer: 3)
13. **Say:** We therefore move the decimal 3 places to the left.
14. Write on the board: $835 \div 10^3 = .835 = .835$
15. Write two problems on the board: a) 0.0027×1000 b) $478.6 \div 100$
16. **Say**: We call 1000 and 100 'powers of 10', although they are not written with the power.
17. **Say**: To multiply decimal numbers by these powers of 10, move the decimal point to the right according to the number of zeroes. 100 has 2 zeroes, so we move the decimal place 2 places to the right. 1000 has 3 zeroes, so we move the decimal place 3 places to the right.
18. Solve problem a on the board: $a)\ 0.0027 \times 10^3 = 0.0027 = 0002.7 = 2.7$
19. **Say**: To divide decimal numbers by these powers of 10, move the decimal point to the left according to the number of zeroes. 100 has 2 zeroes, so we move the decimal place 2 places to the left. 1000 has 3 zeroes, so we move the decimal place 3 places to the left.
20. Solve the problem b on the board: $b)\ 478.6 \div 10^2 = 478.6 = 4.786$

Guided Practice *(5 minutes)*

1. Write 2 problems on the board: $(\mathrm{a})\ 32 \div 10^2 \quad (b)\ 14.14 \div 10$
2. **Say:** Discuss and solve each of the problems on the board with your seatmates.
3. Walk around to check for understanding and clear misconceptions. For example, you may need to remind pupils that 10 in question b has a power of 1.
4. Ask for representatives from 2 seats to solve the problems on the board 1 at a time. (Answers: (a) **.**32 (b) 1.414)
5. Ask pupils to compare their answers with the answers on the board.

Independent Practice *(10 minutes)*

1. Write 3 problems on the board: $(a)\ 7300 \div 100 \quad (b)\ 5.38 \times 1000 \quad (c)\ 5.6 \div 10^2$
2. Ask pupils to solve the problems individually in their books. They may share ideas with their seatmates or neighbours.
3. Go round and check for understanding and clear misconceptions. For example, you may need to remind pupils that they can rewrite 100 as 10^2, and 1000 as 10^3
4. Ask 3 pupils to solve the problems on the board. (Answers: (a) 73.00=73 (b) 5,380 (c) .056)
5. Ask pupils to compare their answers to the answers on the board.

Closing *(2 minutes)*

1. **Ask:** Explain the steps we take to multiply a whole number by 10 or power of 10? (Answer: we add zeros to the number. The power tells us how many zero to add.)
2. **Ask:** Explain the steps we take to divide any number by 10 or power of 10? (Answer: we move the decimal point to the left. The power tells us how many places to move it.)
3. **Suggested homework:** Write 2 problems on the board: (a) 0.0056×10^3 (b) $25.48 \div 10^2$ (Answers: (a) 5.6 (b) 0.2548)

Lesson Title: Review of the Four Operations with Whole Numbers	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-030	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils should be able to add, subtract, multiply and divide whole numbers.	**Teaching Aids** 4 different colours of chalk	**Preparation** Write the questions, in the Opening, Introduction to the New Material, Guided Practice, on the board.

Opening *(5 minutes)*

1. Look at the 2 questions (1 addition and 1 subtraction) on the board:
   a) 6374 + 815
   b) 3476 – 35
2. Ask pupils to solve the problems in their exercise books.
   Answers:

$$\begin{array}{r} {\scriptstyle 1} \\ 6374 \\ +\ 815 \\ \hline 7189 \end{array} \qquad \begin{array}{r} 3476 \\ -\ 35 \\ \hline 3441 \end{array}$$

3. **Ask:** What is important in adding or subtracting whole numbers?
4. Allow pupils to share their ideas. (Example answers: Numbers must be in their correct column (numbers in the Units place are lined up, numbers in the Tens place are lined up.). In subtraction the greater number must be on top).

Introduction to the New Material *(12 minutes)*

1. Read these questions on the board: (a) add 6247, 13 and 8 (b) subtract 327 from 680
   (c) multiply 32 by 12 (d) divide 150 by 10
2. Get 4 bits of chalk with different colours. (For example, white, blue, green and red)
3. Explain: The white chalk is for addition, the blue for subtraction, the green for multiplication and the red for division.
4. **Say:** When I give some chalk to you, go to the board and solve 1 of the problems.
   - If you do not have different colours of chalk, give pupils white chalk and tell them which problem to solve (addition)
5. Remind pupils of the different colours and the operation each colour represents.
6. Assist a pupil to complete the addition problem. →
7. Remind pupils of the place value system (Units, Tens, Hundreds, Thousands). Tell them that when adding and subtracting whole numbers, it is important to line the Units up correctly (Units under Units, Tens under Tens).
8. **Ask**: Why do we carry the 1? (Answer: because 7+3+8=18, which is greater than 9. We carry the 1 to the Tens place, and write the 8 in the Units place.)

$$\begin{array}{r} {\scriptstyle 1} \\ 6247 \\ 13 \\ +\ 8 \\ \hline 6268 \end{array}$$

9. Assist a pupil to complete the subtraction problem →
10. **Ask**: how did we subtract the 7 from 0? (Answer: We had to borrow a 1 from the Tens place, to make 10 above the 7. This reduced the 8 in the Tens place to 7.)
11. Assist a pupil to complete the multiplication problem →
12. Ask a pupil to explain the process for multiplying 32 by 12 (Example: We first multiplied each number on top (3 and 2) by the 2 on the right side of the bottom number. We then multiplied the same 3 and 2 by the 1 on the left side of the bottom number. We then add the two resulting numbers together. Remember to use 0 to hold the one's place in the bottom number of the addition problem.)
13. Assist a pupil to complete the division problem. →
14. Ask a pupil to explain the process for dividing 150 by 10 (Example: We can just cancel the 0 in 150 to give 15 Pupils may also explain the process for long division, shown on the right.)

$$\begin{array}{r} {\scriptstyle 7} \\ 6\ \cancel{8}\ {}^{1}0 \\ -\ 3\ 2\ 7 \\ \hline 3\ 5\ 3 \end{array}$$

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

$$\begin{array}{r|l} & 1\ 5 \\ \hline 1\ 0 & 1\ 5\ 0 \\ -\ 1\ 0\ \downarrow & \\ \hline 5\ 0 & \\ -\ 5\ 0 & \\ \hline 0 & \end{array}$$

Guided Practice *(5 minutes)*

1. Look at these on the board: (a) Subtract: $95{,}186 - 42{,}877$ (b) Multiply: 641×7
2. Ask pupils to work in pairs to solve the problems.
3. Choose 4 pupils to solve the problems on the board. See solutions on the next page. (Answers: (a) 52,309 (b) 4487)
4. Correct the answer and clear any misconceptions among the pupils.

Independent Practice *(10 minutes)*

1. Write these on the board: (a) Add: $2096 + 4360 + 3685$ (b) Subtract: $840 - 512$
   (c) Multiply: 45×32 (d) Divide: $1005 \div 5$
2. **Say:** Solve the problems in your exercise books.
3. Go round the class and make sure all the pupils are at work. Clear any misconceptions.
4. **Say:** Exchange your books with your seatmate and compare the answer.
5. Select 4 pupils and ask them to solve each of the questions on the board. See solution on the next page. (Answers: (a) 10,141 (b) 328 (c) 1440 (d) 201)

Closing *(3 minutes)*

1. Give pupils an exit ticket (a question to complete before leaving class).
2. Write one question on the board: $381 + 2 + 49 + 1035$
3. Tell pupils that they should complete it and show you before leaving class.
4. Check pupils' answers before they leave the class. See solution on the next page.

(Answer: 1467)

[SOLUTIONS TO OPERATIONS PROBLEMS]

Guided Practice

(a) $95{,}186 - 42{,}877 = 52{,}309$ →

$$\begin{array}{r} {\scriptstyle 4}\quad\quad {\scriptstyle 7} \\ 9\ \not{5}\ {}^{1}1\ \not{8}\ {}^{1}6 \\ -\ 4\ 2\ 8\ 7\ 7 \\ \hline 5\ 2\ 3\ 0\ 9 \end{array}$$

(b) $641 \times 7 = 4487$ →

$$\begin{array}{r} {\scriptstyle 2} \\ 6\ 4\ 1 \\ \times\quad\quad 7 \\ \hline 4\ 4\ 8\ 7 \end{array}$$

Independent Practice

(a) $2096 + 4360 + 3685 = 10{,}141$ →

$$\begin{array}{r} {\scriptstyle 1}\ {\scriptstyle 2}\ {\scriptstyle 1} \\ 2\ 0\ 9\ 6 \\ 4\ 3\ 6\ 0 \\ +\ 3\ 6\ 8\ 5 \\ \hline 1\ 0\ 1\ 4\ 1 \end{array}$$

(b) $840 - 512 = 328$ →

$$\begin{array}{r} {\scriptstyle 3} \\ 8\ \not{4}\ {}^{1}0 \\ -\ 5\ 1\ 2 \\ \hline 3\ 2\ 8 \end{array}$$

(c) $45 \times 32 = 1440$ →

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

(d) $1005 \div 5 = 201$ →

$$\begin{array}{r|l} & 2\ 0\ 1 \\ \hline 5 & 1\ 0\ 0\ 5 \\ -\ 1\ 0 & \downarrow\ \downarrow \\ \hline 0\ 0 & \downarrow \\ -\quad 0 & \downarrow \\ \hline 0\ 5 & \\ -\quad 5 & \\ \hline 0 & \end{array}$$

Closing

(a) $381 + 2 + 49 + 1035 = 1467$

$$\begin{array}{cccc} & {\scriptstyle 1} & {\scriptstyle 1} & \\ 1 & 0 & 3 & 5 \\ & 3 & 8 & 1 \\ & & 4 & 9 \\ + & & & 2 \\ \hline 1 & 4 & 6 & 7 \end{array}$$

Lesson Title: Review of Addition and Subtraction of Decimals	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-031	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to add and subtract decimal numbers	 **Teaching Aids** None	 **Preparation** None

Opening *(3 minutes)*

1. **Ask:** What is important to consider in adding or subtracting whole numbers? (Example answers: We make sure that each number is in its correct column, according to place value. In subtraction, the greater number must be placed on top.)
2. Write a review problem on the board. $47 + 563 + 9$
3. Ask a pupil to solve the problem on the board. Ask all other pupils to complete the task in their exercise books, and check their answer with the board.
   Answer:

$$\begin{array}{cccc} & {\scriptstyle 1} & {\scriptstyle 1} & \\ & & 4 & 7 \\ & 5 & 6 & 3 \\ + & & & 9 \\ \hline & 6 & 1 & 9 \end{array}$$

4. **Say:** Today, we are going to add and subtract decimal numbers.

Introduction to the New Material *(13 minutes)*

1. Ask pupils at random to give examples of decimal numbers. (Answers: 0.98, 0.4, 0.125, etc.)
2. **Ask:** What is important to consider in adding and subtracting decimals?
3. Allow pupils to share their ideas. Guide them to understand the following answers. (Answers: (i) each number must be in its correct column; (ii) the points must be lined up together vertically; (iii) in subtracting decimals the greater number must be at the top).
4. Write 3 problems on the board: (a) $11.54 + 10.30$ (b) $5.4 - 3.6$ (c) $5.82 + 13.6$
5. Ask 3 pupils to arrange each problem on the board as explained. Ask all other pupils to complete the task in their exercise books.
   Answer:

(a)
$$\begin{array}{cccccc} & 1 & 1 & . & 5 & 4 \\ + & 1 & 0 & . & 3 & 0 \\ \hline \end{array}$$

(b)
$$\begin{array}{cccc} & 5 & . & 4 \\ - & 3 & . & 6 \\ \hline \end{array}$$

(c)
$$\begin{array}{cccccc} & & 5 & . & 8 & 2 \\ + & 1 & 3 & . & 6 & 0 \\ \hline \end{array}$$

6. **Say**: Notice that for question c, we add a zero to the end of the decimal to hold the place. This makes it possible for us to line up the decimal points.
7. **Say**: Each of these problems follows the same steps as adding and subtracting whole numbers. Remember to write the decimal place in the answer directly under the decimal points in the question.

8. Ask 3 pupils to solve the problems on the board. Ask all other pupils to complete the task in their exercise books. (Answers: (a) 21.84 (b) 1.8 (c) 19.42)
9. **Say:** In subtracting decimals, one decimal number may have more decimal places than the other. Always remember to add zeros to the decimal with less decimal place to make the digits equal in number.
10. Write an example on the board: $4.8 - 0.357$.
11. **Ask:** Which of the numbers has less decimal places? (Answer: 4.8)
12. **Ask:** What do we do to make the decimal places equal? (Answer: we add 2 zeros to 4.8)
13. Solve the problem on the board for the pupil to see:

$$\begin{array}{r} 4.800 \\ -\ 0.357 \\ \hline 4.443 \end{array}$$

Guided Practice *(6 minutes)*

1. Write 2 problems on the board: a) $5.91 + 6.42$ b) $1.2 - 0.87$
2. Ask pupils to discuss each of the problems on the board with their seatmates and solve.
3. Go round and check for understanding and clear misconceptions.
4. Ask 2 pupils to each solve 1 problem on the board.

   Answers:

$$\text{a)}\ \begin{array}{r} 5.91 \\ +\ 6.42 \\ \hline 12.33 \end{array} \qquad \text{b)}\ \begin{array}{r} 1.20 \\ -\ 0.87 \\ \hline 0.33 \end{array}$$

5. **Say:** Compare your answers with the answers on the board.

Independent Practice *(10 minutes)*

1. Write 2 problems on the board: a) $15.47 + 9.656$ b) $45.7 - 18.635$
2. Ask pupils to work the problems individually in their exercise books. They may share ideas with their seatmates.
3. Go round and check for understanding and clear misconception.
4. Ask 2 pupils to each solve 1 problem each on the board.

   Answer:

$$\text{a)}\ \begin{array}{r} 15.47 \\ +\ 9.656 \\ \hline 25.126 \end{array} \qquad \text{b)}\ \begin{array}{r} 45.700 \\ -\ 18.635 \\ \hline 27.065 \end{array}$$

5. **Say:** Compare the answer you got with the answer on the board.

Closing *(2 minutes)*

1. Write 1 problem on the board: $a)\ 1.2 + 2.3 - 1.4$
2. **Ask**: How do you think we will solve this problem? (Answer: We can do the addition first, then the subtraction.

3. **Say:** Solve the problem and check your answer with a neighbour.
4. Ask 2 pupils to read their answers to the class. (Answer: 2.1)

Lesson Title: Review Multiplying and Dividing Decimals	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-032	**Class/Level:** JSS 1	**Time:** 35 minutes

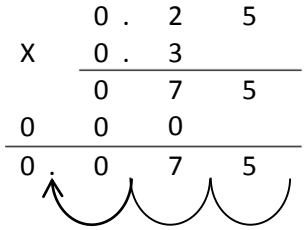
Learning Outcomes By the end of the lesson pupils will be able to multiply and divide decimal numbers.	**Teaching Aids** None	**Preparation** None

Opening *(5 minutes)*

1. Write on the board: (a) 13.157×100 (b) $46.52 \div 10$
2. **Ask:** What happens when you multiply decimal numbers by 10, 100 or 1000? (Answer: The number becomes 10, 100 or 1000 time bigger. Move the point 1, 2 or 3 steps to the right depending on the number of zeroes.)
3. Ask 1 pupil to solve the first problem on the board. Ask all other pupils to complete the task in their exercise books. (Answer: $13.157 \times 100 = 1315.7$)
4. **Ask:** What happens when you divide decimal numbers by 10, 100 and 1000? (Answer: The number becomes 10, 100 or 1000 time smaller. Move the point 1, 2 or 3 places to the left depending on the number of zeroes.)
5. Ask 1 pupil to solve the second problem on the board. Ask all other pupils to complete the task in their exercise books. (Answer: $46.52 \div 10 = 4.652$.)
6. **Say:** Today, we are going to multiply and divide decimal numbers.

Introduction to the New Material *(12 minutes)*

1. Write these on the board: (a) 0. 25 x 0.3 (b) 1.68 ÷ 0.2
2. **Say:** Look at (a).
3. **Say:** To multiply decimal numbers: (a) Check how many decimal places are in each of the numbers given. (b) Multiply the numbers like whole numbers. (c) From the last number in the answer, count to the left the total number of decimal places in the given numbers and put a point.
4. **Ask:** How many decimal places are there in the first number? (Answer: 2)
5. **Ask:** How many decimal places are there in the second number? (Answer: 1)
6. **Ask:** So how many decimal places will there be in the answer? (Answer: 3 because 2+1=3)
7. Solve the first problem with the pupils. (Answer: 0.075)
   Solution:



8. **Say:** Look at problem (b).

9. **Say:** In dividing decimal numbers, we 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 1000 (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.
10. **Ask:** In problem b, what is the divisor? (Answer: 0.2)
11. **Ask:** What do we need to multiply 0.2 by to get a whole number? (Answer: 10)
12. **Say:** Remember to multiply both 1.68 and 0.2 by the same 10.
13. Solve the second problem on the board with the pupils. (Answer: $1.68 \div 0.2 = (1.68 \times 10) \div (0.2 \times 10) = \frac{16.8}{2} = 8.4$ see long division on the right)
14. **Say**: Sometimes we need to carry out long division where the dividend is a decimal number. Write the decimal point in the answer directly above the decimal point in the dividend.
15. Make sure pupils understand the long division involved.

```
      8 . 4
   ┌──────
 2 │ 1 6 . 8
   - 1 6     ↓
   ──────
       0     8
     -       8
     ─────────
             0
```

Guided Practice (*6 minutes)*

1. Write 2 problems on the board: (a) 5.9 × 0.4 (b) 1.65 ÷ 0.05
2. Ask pupils to discuss and solve the problems with a partner.
3. Move round the class to check for understanding and clear misconceptions.
4. Ask 2 pupils from different pairs to solve the problems on the board.
   Answer:

```
a)    5 . 9
   ×  0 . 4
   ─────────
      2 3 6
   +  0 0
   ─────────
      2.3 6   = 2.36
```

b) $1.65 \div 0.05 = (1.6\,5 \times 100) \div (0.0\,5 \times 100) = 165 \div 5 = 33$

5. **Say:** Compare your answers with the answers on the board.

Independent Practice *(10 minutes)*

1. Write 2 problems on the board: i) 0.24×0.02 ii) $1.341 \div 0.03$
2. **Say:** Solve the problems in your exercise books.
3. Move around the class and assist when necessary.
4. Ask 2 pupils to solve a problem each on the board.

Answers:

5. *i*)

$$\begin{array}{r} 0.24 \\ \times\ 0.02 \\ \hline 048 \\ 000 \\ 000 \\ \hline 0.0048 \end{array}$$

ii) $1.341 \div 0.03 (1.341 \times 100) \div (0.03 \times 100) = 134.1 \div 3 = 44.7$

$$\begin{array}{r|l} & 44.7 \\ \hline 3 & 134.1 \\ -\ 12 & \downarrow\ \downarrow \\ \hline & 14\ \downarrow \\ -\ & 12\ \downarrow \\ \hline & 21 \\ & 21 \\ \hline & 0 \end{array}$$

Closing *(2 minutes)*

1. Ask pupils to explain the process for multiplying decimal numbers and discuss. (Check the number of decimal places in each number, then multiply. The number of decimal places in the factors tell us how many decimal places to put in the product.)
2. Ask pupils to explain the process for dividing decimal numbers and discuss. (Make the divisor a whole number by multiplying by 10, 100 or 1000, depending on the decimal place in the divisor. Then divide like whole numbers.)
3. **Suggested homework:** Write 2 problems on the board, for example: (a) 0.05 × 0.23 (b) 5.6 ÷ 0.7. (Answers: (a) 0.0115 (b) 8

Lesson Title: Order of Operations - BODMAS	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-033	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to carry out calculations using the correct order of operations (BODMAS).	 **Teaching Aids** None	 **Preparation** None

Opening *(3 minutes)*

1. Write on the board: $6 - 2 \times 3$
2. Give pupils 1 minute to find the answer. They may share ideas in pairs.
3. Allow pupils to call out their answers. (Some pupils might call out 12 (incorrect), and others might call out 0 (correct))
4. **Ask:** Which of the operations do we work *first* in the problem? (Answer: multiplication)
5. **Say:** Solve the multiplication first and then the subtraction.
6. Write on the board: $2 \times 3 = 6$ and $6 - 6 = 0$
7. **Say:** If you work the subtraction before the multiplication, you will get 12, which is *not* the correct answer.

Introduction to New Material *(12 minutes)*

1. **Ask:** Who can tell us what the letters of BODMAS stand for? (Answer: Bracket, Of, Division, Multiplication, Addition and Subtraction)
2. Write on the board: BODMAS = Bracket Of Division Multiplication Addition Subtraction
3. **Say:** This tells us the order in which we should work the operations in a math problem.
4. **Ask:** Which sign does the word 'of' represent? (Answer: It represents the multiplication sign)
5. **Say**: This year in JSS 1, we started learning about 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.
6. Write on the board: $4 + 2^3$
7. **Ask**: What will we do first to solve this? (Answer: Find 2^3)
8. Solve the problem on the board: $4 + 2^3 = 4 + 2 \times 2 \times 2 = 4 + 8 = 12$
9. Write two problems on the board:
   (a) $4 + 2 \times 3$ (b) $(4 + 2) \times 3$
10. Give pupils 2 minutes to work in pairs to find the answers to the two problems.
11. Ask a different pair to give each answer on the board. Make sure pupils understand why the two answers are different (question **b** asks us to do the addition before the multiplication by placing the addition problem in brackets).
    Answers: (a) $4 + 2 \times 3 = 4 + 6 = 10$ (b) $(4 + 2) \times 3 = 6 \times 3 = 18$

12. Give questions on decimals and fractions to review the work from previous weeks:
    (a) $(1.2 + 3.5) + 3^2$ (b) $\frac{5}{12} + \frac{1}{3}(\frac{1}{4} + \frac{1}{2})$
13. Go through each steps on the board with the pupils and make sure they understand:
    (a) $(1.2 + 3.5) + 3^2$
    $= 4.7 + 3^2$
    $= 4.7 + 9$
    $= 13.7$
    (b) $\frac{5}{12} + \frac{1}{3}(\frac{1}{4} + \frac{1}{2})$
    $= \frac{5}{12} + \frac{1}{3}(\frac{3}{4})$
    $= \frac{5}{12} + \frac{3}{12}$
    $= \frac{8}{12} = \frac{2}{3}$

Guided Practice *(8 minutes)*

1. Write 2 problems on the board.
    a) $(5 + 3) \times 2.5$ b) $4^2 \times \frac{1}{2}$
2. Ask the pupils to solve the problems with a partner.
3. Move around and check pupils' work and clear any misconceptions.
4. Ask a pupil from any seat to solve the first problem.
    Answer: $(5 + 3) \times 2.5$
    $= 8 \times 2.5$
    $= 20$
5. Ask another pupil to solve the second problem.
    Answer: $4^2 \times \frac{1}{2}$
    $= 16 \times \frac{1}{2}$
    $= 8$

Independent Practice *(10 minutes)*

1. Write 3 problems on the board:
    a. $5.1 \times (6.2 - 3)$
    b. $7 \times 2^3 \div 4$
    c. $15 \div 3 + 4^3$
2. **Say:** Solve the problems on the board in your exercise books individually.
3. Ask one pupil at a time to solve the problems on the board.
    Answers: a. $5.1 \times (6.2 - 3) = 5.1 \times 3.2 = 16.32$
    b. $7 \times 2^3 \div 4 = 7 \times 8 \div 4 = 7 \times 2 = 14$
    c. $15 \div 3 + 4^3 = 15 \div 3 + 64 = 5 + 64 = 69$

Closing *(2 minutes)*

1. Write 1 problem on the board. Example: $4 + 8 \times 1$.
2. Ask pupils to solve this problem. (Answer: $4 + 8 = 12$).
3. Briefly check pupils' work, and make sure they understand today's topic.

Lesson Title: Estimation	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-034	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to: 1. Round numbers to find rough estimates before calculating. 2. Check answers by calculating.	**Teaching Aids** None	**Preparation** None

Opening *(2 minutes)*

1. Write a few numbers on the board: 315 16,348 2196
2. Ask questions about place value and call on different pupils to stand and give the answer. For example:
   - What is the place value of 3 in 315? (Answer: 3 in 315 is 3 Hundreds).
   - What is the place value of 6 in 16,348? (Answer: 6 in 16,348 is 6 Thousands).
3. **Say:** Today we are going to practise rounding numbers. We will use rounded numbers to find rough estimates for calculations.

Introduction to the New Material *(15 minutes)*

1. Write on the board: $308 + 1369$
2. **Say:** We can solve this problem by adding the two numbers together. It could take us a few minutes. We can save time and find an estimate by rounding the numbers and adding those together.
3. **Say**: Let's round both of the numbers on the board to the nearest Tens place.
4. Ask 2 pupils to come to the board and round the 2 numbers to the nearest Tens place. Ask all other pupils to do the task in their exercise books. (Answer: $310 + 1370$)
5. Ask a pupil to add the two numbers on the board. Ask all other pupils to do the task in their exercise books. (Answer: $310 + 1370 = 1680$)
6. **Say**: 1,680 is an estimation for the answer to the addition problem $308 + 1369$.
7. Write on the board: $308 + 1369 \approx 1680$
8. **Say:** This symbol looks like a curvy equals sign. It means 'is approximately equal to.'
9. Ask 2 pupils to come to the board and round the 2 numbers to the nearest hundreds place. Ask all other pupils to do the task in their exercise books. (Answer: $300 + 1400$)
10. **Ask**: Can anyone solve this problem without writing?
11. Allow pupils to share their answers. Guide them to understand that they can simply add the 3 and 14 and write the same 2 zeros after their answer.
12. **Say**: 3 hundreds plus 14 hundreds equals 17 hundreds because 3 plus 14 gives us 17.
13. Write the answer on the board: $300 + 1400 = 1700$
14. **Say**: 1700 is another estimation for the answer to the addition problem $308 + 1369$. If we round to a high enough place value, we get a math problem that we can solve mentally. This means we can estimate an answer very quickly.

15. Write on the board: $308 + 1369 \approx 1700$
16. Ask pupils to add the two original numbers in their exercise books.
17. Write the answer on the board: $308 + 1369 = 1677$
18. Write the answer and the two estimated answers together: 1680 1700 1677
19. Ask pupils what they notice about the 3 numbers and allow them to share their ideas.
20. **Say**: The first two numbers are what we get when we round the answer to the Tens and Hundreds places.
21. Write 1 addition and 1 subtraction problem on the board:
    a. Estimate 237 + 568 to the nearest hundred
    b. Estimate 6719 – 4312 to the nearest thousand
22. Solve each problem with the pupils. Guide them to round each number and estimate the sum or difference mentally:

Estimate 237 + 568

237	+	568	**Round the numbers to the Hundreds. Then add.**
↓		↓	
200	+	600	= 800
237	+	568	≈ 800

237 + 568 is approximately 800

Estimate 6719 – 4312

6719	-	4312	**Round the numbers to the Thousands. Then subtract.**
↓		↓	
7000	-	4000	= 3000
6719	-	4312	≈ 3000

6719 - 4312 is approximately 3000)

Guided Practice *(6 minutes)*

1. Write 2 problems on the board: (a) Round 419865 to the nearest Ten Thousands place (b) Estimate 5706 – 1973 to the nearest Thousands place.
2. Ask pupils to solve the problems with their seatmates.
3. Move round to check for understanding and clear misconceptions.
4. Ask representatives from 2 seats to solve each problem on the board.
   (Answers: (a) 420,000; (b) 6000 – 2000 = 4000)
5. **Say:** Compare the answer on the board with the answer you got.

Independent Practice *(10 minutes)*

1. Write 3 problems on the board: (a) Round 63,194 to nearest Thousands; (b) Estimate 828 + 43 to the nearest Tens place (c) Estimate 23,489 – 2373 to the nearest Thousands place.
2. Ask pupils to solve the problems individually. They may discuss with their seatmates if needed.
3. Ask 3 pupils to solve the problems on the board. (Answer: (a) 63,000 (b) 870 (c) 21,000)
4. **Say:** Compare your answers with the answers on the board.

Closing *(2 minutes)*

1. Write a few addition problems on the board with rounded numbers. For example: (a) $500 + 1100$ (b) $23{,}000 + 6000$ (c) $780 - 120$
2. Ask pupils to solve them mentally as quickly as they can. Ask them to write down the answers and raise their hands when they're finished.
3. Ask pupils to call out the answers. (Answers: (a) 1600 (b) 29,000 (c) 660)
4. **Suggested homework:** Write a few estimation problems, for example: (a) Round 1678 to nearest Tens place (b) Estimate 6032 – 4684 to the nearest Thousands place. (Answers: (a) 1680 (b) 1000)

Lesson Title: Story Problems with Whole Numbers and Decimals	**Theme:** Everyday Arithmetic	
Lesson Number: M-07-035	**Class/Level**: JSS 1	**Time:** 35 minutes

Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson pupils will be able to solve story problems with whole numbers and decimals.	Story problems	Write the story problems, in the Introduction to the New Material and Guided Practice, on the board.

Opening *(3 minutes)*

1. **Say:** I know you have all done addition, subtraction, multiplication and division of both whole numbers and decimals. Today we will use these in story problems.
2. Ask pupils open-ended questions: What are the words used for addition in maths?
3. Allow pupils to give their answers, and tell them any other answers. (Example answers: Sum, total, add, increase, altogether).
4. Repeat this question for subtraction, multiplication and division. (Answer: Subtraction (subtract, takeaway, difference, reduce, decrease) Multiplication (Multiply, 'of', product) division (divide, quotient, share).

Introduction to the New Material *(12 minutes)*

1. Read the problem: 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.
2. **Ask:** What can we to do to find the total height of the boys? (Answer: We **add** 1.5 m. and 1.3 m.)
3. **Ask:** Why do you think we should add? (Answer: Because of the word total.)
4. Give pupils 1 minute to solve the addition problem in their exercise books.
5. Ask 1 pupil to come to the board and present their answer. (Answer: 2.8 m. which rounds up to 3 m.)

$$\begin{array}{rr} & 1.5 \\ + & 1.3 \\ \hline & 2.8 \end{array}$$

6. **Say**: Their total height is 2.8 metres. We know to round up to 3 kg. because 8 is greater than 5.
7. Read these story problems on the board:
   a) Abigail sells sugar by the pound. At the beginning of the day she had 19.5 pounds of sugar, and at the end of the day 12.5 pounds remained. How much sugar did she sell?
   b) Mr. Koroma is paid le 8,000 for each hour he works. How much will he be paid if he works for 7.5 hours?
   c) Four friends did some gold mining together. They found 3.6 grams of gold, and want to divide it evenly between themselves. How much gold will each friend get?
8. **Ask:** Read the problems on the board and say which operation we use to solve each of them. (Answer: a) Subtraction, b) Multiplication, c) Division)
9. **Ask:** For each problem, ask pupils in the class to call out the math problem. Work through each problem with the whole class.

Solutions:

$$\begin{array}{r} 19.5 \\ -\ 12.5 \\ \hline 7.0 \end{array} \qquad \begin{array}{r} 8000 \\ \times\ \ 7.5 \\ \hline 40000 \\ +\ 56000 \\ \hline 60000.0 \end{array} \qquad \begin{array}{r} 0.9 \\ 4\overline{)3.6} \\ -\ 36 \\ \hline 0 \end{array}$$

10. Make sure pupils give the correct units for each answer. (Answers: a) 7 pounds b) le 60,000 c) 0.9 grams)

Guided Practice *(10 minutes)*

1. Read these 3 problems on the board:
   a) Five boys in a class have equal weights of 70.5 kg. What is their total weight? Round your answer to the nearest kilogram.
   b) The total weight of 6 tins of sardines is 540 g. What is the weight of 1 tin of sardines?
   c) James, Sarah and Martha went to the forest to collect fruit. James collected 10.5 kg. of mangoes, Sarah 16 kg. of guavas, and Martha 18.5 kg. of oranges. What was the total weight of the fruit they collected?
2. **Say:** Work in pairs and discuss the problems on the board.
3. Go around the class to check for the understanding and clear misconceptions.
4. Ask pupils to share their answers with the class. (Answers: a) $5 \times 70.5\ \text{kg.} = 352.5\ \text{kg.} \rightarrow 353\ \text{kg.}$ b) $540\ \text{g.} \div 6 = 90\ \text{g.}$ c) $10.5 + 16 + 18.5 = 45\ \text{kg.}$)

Independent Practice *(10 minutes)*

1. Write 2 problems on the board:
   a) A trader has 500 mangoes. After selling some mangoes, the number reduced to 289. How many mangoes were sold?
   b) After recovering from illness, Mustapha tried to gain weight. For 7 weeks he was able to gain 0.4 kg. each week. How much did he gain in total? Round your answer to the nearest kilogram.
2. **Say:** Solve the problems individually in your exercise books.
3. Move around the class to make sure all the pupils work in their own and help where necessary.
4. **Ask:** 2 pupils to solve each of the problems on the board 1 at a time. (Answers: a) $500 - 289 = 211$ mangoes; b) $7 \times 0.4\ \text{kg.} = 2.8\ \text{kg.} \rightarrow 3\ \text{kg.}$)
5. **Say:** Compare your answers with the answers on the board.

Closing *(2 minutes)*

1. **Say:** Anyone I point at should say 1 word and the operation used for that word. (Examples: 'Of' is for multiplication, decrease is for subtraction, sum is for addition, quotient is for division)
2. **Suggested homework:** Assign any story problems from the question bank on the next page.

[QUESTION BANK]

Mary bought a carton with 25 fish inside. If the fish weighed 12.5 kg. in total, around how much did each fish weigh?

Answer: $12.5 \text{ kg.} \div 25 = 0.5 \text{ kg.}$

Bendu uses 6.5 g. of milk powder each day. She wants to buy enough milk powder for 2 weeks. How much should she buy?

Answer: $6.5 \text{ g.} \times 14 = 91 \text{ g.}$

Musu and Albert are planting a rice farm together. They have 3 hectares of land, and Albert planted on 1.4 hectares. If Musu comes to plant on the rest, how many hectares will she plant on?

Answer: $3 - 1.4 = 1.6$ hectares

Philip has 0.8 litres of fuel in his motorbike. If he buys 1.5 more litres of fuel, how much will he have in total?

Answer: $0.8 + 1.5 = 2.3$ litres

Lesson Title: Percentages	**Theme:** Numbers and Numeration	
Lesson Number: M-07-036	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to identify percentages as part of 100.	**Teaching Aids** None	**Preparation** Write the story problems, in the Guided Practice and Independent practice, on the board.

Opening *(5 minutes)*

1. Write two fractions on the board: i. $\frac{30}{100}$ **ii.** $\frac{5}{100}$
2. **Say:** Simplify the fractions and express as decimals.
3. Ask volunteers to come to the board to solve the problems. (Answers: i. $\frac{30}{100} = \frac{3}{10} = 0.3$ ii. $\frac{5}{100} = \frac{1}{20} = 0.05$)
4. **Say:** Today you are going to learn about percentages.

Introduction to the New Material *(13 minutes)*

1. **Ask**: What do we mean by 'per cent'?
2. Ask pupils to brainstorm in pairs for 1 minute.
3. Ask 2 pupils to explain the meaning of 'per cent' to the class in their own words. (Example answer: Per cent means per hundred, or part of 100, or out of 100).
4. **Say**: For example 30 per cent means 30 per hundred or 30 out of hundred.
5. Show pupils the diagram on the last page of this lesson. Make sure all of the pupils see it.
6. **Say**: This is a square divided into 100 small pieces. Thirty of the squares are shaded. This shows 30%.
7. Write on the board: 30 per cent = 30% = $\frac{30}{100}$
8. **Say**: Can you imagine the same large square with 50 pieces shaded? What will it look like?
9. Allow pupils to share their ideas. Guide them to understand that half of the small squares would be shaded.
10. Write the percentage on the board: 50%
11. Write some fractions with denominator 100 on the board, for example: $\frac{45}{100}$, $\frac{20}{100}$, $\frac{7}{100}$
12. Ask pupils to come one at a time to write the per cent for each fraction (Answers: 45%, 20%, and 7%)
13. Ask a pupil to write the fraction of '20 out of 100' on the board. (Answer: $\frac{20}{100}$)
14. Ask another pupil to write this as a percentage. (Answer: 20%).
15. Erase the board and write another question:

    60 pupils out of 100 pupils said mathematics is their favourite class. Express this as a percentage.
16. Ask a pupil at the back of the class to read the question on the board while others sit and listen carefully.

17. **Ask:** How many pupils are there in total? (Answer: 100 pupils)
18. **Ask:** How many pupils like mathematics best? (Answer: 60 pupils)
19. **Ask:** What percentage of pupils like mathematics best? (Answer: 60%)

Guided Practice *(5 minutes)*

1. Ask pupils to work in pairs.
2. Write a question on the board:
   A team lost 5 games out of 100 games. What is the percentage of the games they lost?
3. Allow the pairs to read and discuss the question for one minute, and then allow them to solve the problem.
4. Go around the class, discuss with them, and check for understanding and misconceptions.
5. Allow a pupil from any pair to come to the board and write the answer.
6. Allow the class to compare their answers with the answer on the board, and discuss in pairs until they arrive at a final and correct answer. (Answer: 5 games out of 100 games$= 5\ out\ of\ 100 = \frac{5}{100} = 5\%$)

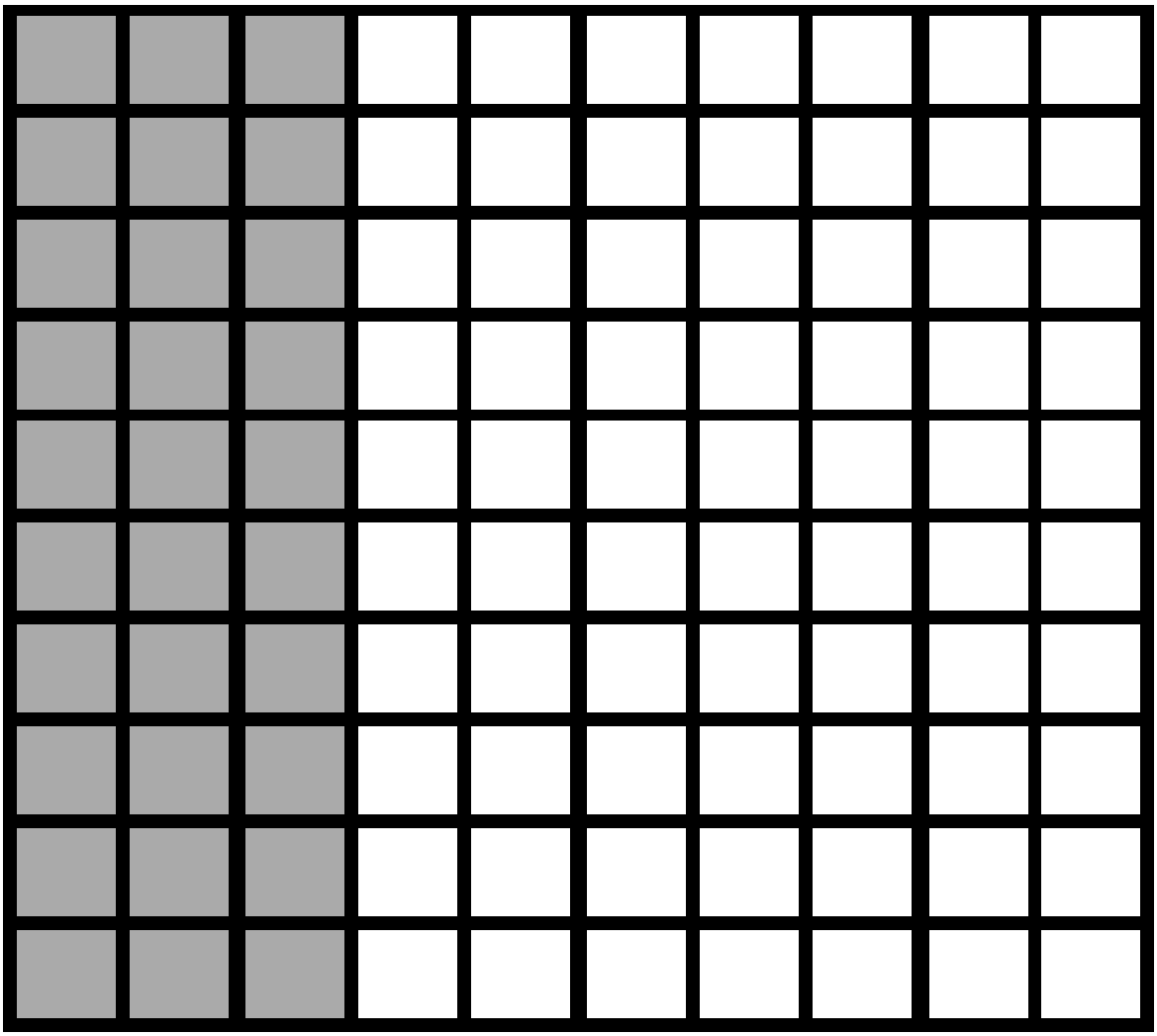
Independent Practice *(10 minutes)*

1. Write these questions on the board:
   i. A student scored 85 marks out of 100 on an exam. Express this as a percentage.
   ii. There were 100 women in a meeting, but 25 of them left. What percentage of the women left the meeting?
   iii. There are 100 pupils registered in a school, and 56 of them are girls. What percentage of the pupils are girls? What percentage are boys?
2. Ask pupils to work independently.
3. Go around the class and check for understanding and misconceptions. Discuss and assist where necessary.
4. Allow them to exchange answers with their seatmates to check and compare their answers.
5. Ask 3 pupils to come to the board and solve the problems while other watch carefully. (Answers: i. 85 out of 100 = 85% ii. 25 out of 100 = 25% iii. Girls: 56 out of 100 = 56% Boys: $100 - 56 = 44$ → 44 out of 100 = 44%)

Closing *(2 minutes)*

1. Write two questions on the board:
   i. 53 out 0f 100
   ii. 75 out of 100
2. Call pupils one at a time to give the percentage of each. (Answers: i. 53 out of 100 $=$ 53% ii. 75 out of 100 $=$ 75%)

[PERCENTAGE DIAGRAM: 30%]



Lesson Title: Percentages as Fractions and Decimals	**Theme:** Numbers and Numeration	
Lesson Number: M-07-037	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to express percentages as fractions and decimals.	**Teaching Aids** None	**Preparation** Write these questions on the board: Express the following as percentages i. 15 out of 100 ii. 90 out of 100

Opening *(3 minutes)*

1. Have pupils read the problems on the board.
2. Ask 2 pupils to come to a board one at a time to solve the problems. All other pupils answer the problems in their exercise book. (Answers: i. 15 out of 100 $= \frac{15}{100} = 15\%$; ii. 90 out of 100 $= \frac{90}{100} = 90\%$)
3. Say: Today, you are going to learn how to express percentages as fractions and decimals.

Introduction to the New Material *(13 minutes)*

1. Write these questions on the board:
   Express the following percentages as fractions and decimals:
   i. 40% ii. 25%
2. Ask a pupil to read the questions on the board.
3. Ask another pupil to come write 40% as a fraction. (Answer: $\frac{40}{100}$)
4. Ask a pupil to come on the board to simplify $\frac{40}{100}$ (Answer: $\frac{2}{5}$)
5. **Say**: To convert a percentage to a fraction, simply place the numbers over a denominator of 100 and simplify to its lowest term.
6. **Say**: Now we want to convert 40% to a decimal. To express percentage as decimal, divide the percentage by 100.
7. **Say**: Recall what happens when we divide a decimal or whole number by 100 - the decimal place moves 2 digits to the left.
8. **Ask**: What is 40 divided by 100 as a decimal? (Answer: 0.4)
9. Write on the board and explain to pupils: $40 \div 100 = 0.4\,0$
10. Write on the board: $40\% = \frac{40}{100} = \frac{4}{10} = \frac{2}{5} = 0.40 = 0.4$
11. **Say**: All of our answers are equal. They are different ways to show the same value. Any percentage can be converted to a fraction and a decimal.
12. **Say**: Now we will follow the same process with 25%.

13. Ask a pupil to write 25% as a fraction with denominator 100. (Answer: $\frac{25}{100}$)
14. Ask another pupil to simplify the fraction. (Answer: $\frac{25}{100} = \frac{1}{4}$)
15. Ask another pupil to convert 25% to a decimal. (Answer: $25\% = 0.25$)
16. Write on the board: $25\% = \frac{25}{100} = \frac{1}{4} = 0.25$

Guided Practice *(7 minutes)*

1. Ask pupils to work in pairs.
2. Write on the board: Express as a fraction and as a decimal:
   i. 80%
   ii. 20 %
3. Move around them to check for understanding and misconceptions.
4. Discuss and assist where necessary.
5. Call 2 pupils from different pairs to come to the board one after the other to work out the problem. (Answers: i. $80\% = \frac{80}{100} = \frac{4}{5} = 0.80 = 0.8$; ii. $20\% = \frac{20}{100} = \frac{1}{5} = 0.20 = 0.2$)

Independent Practice *(10 minutes)*

1. Write on the board:
   Three friends divided a pawpaw. Michael ate 30%, Zainab ate 25%, and Juliette ate 45%.
   i. Write each percentage as a fraction and simplify the fraction. Write the fraction as a decimal.
   ii. Add all three fractions together, and add all three decimals together.
2. Ask pupils to do the work in their exercise books.
3. Move around the class to check for understanding. Some pupils may work quickly and finish both parts. Other pupils may only finish part i. Encourage all of them.
4. Allow pupils to check their work with their seatmates.
5. **Say**: If you did part 1 correctly, your fractions and decimals will add up to 1 whole pawpaw in part 2.
   (Answer: i. $30\% = \frac{30}{100} = \frac{3}{10} = 0.30 = 0.3$ $25\% = \frac{25}{100} = \frac{1}{4} = 0.25$ $45\% = \frac{45}{100} = \frac{9}{20} = 0.45$; ii. $\frac{3}{10} + \frac{1}{4} + \frac{9}{20} = \frac{6+5+9}{20} = \frac{20}{20} = 1$ $0.3 + 0.25 + 0.45 = 1.0$)

Closing *(2 minutes)*

1. Write a question on the board: Express 45% in as many different ways as possible.
2. Ask pupils to brainstorm for 1 minute before calling pupils to come write their ideas on the board. (Answer: $45\% = \frac{45}{100} = \frac{9}{20} = 0.45$)

Lesson Title: Fractions and Decimals to Percentages	**Theme:** Numbers and Numeration	
Lesson Number: M-07-038	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to express fractions and decimals as percentages.	 **Teaching Aids** None	 **Preparation** Write this question on the board: Express 70% as a fraction and decimal.

Opening *(3 minutes)*

1. Ask pupils to read the question on the board.
2. Allow the pupils to work on it for 1 minute, and then ask a pupil to come to the board and write the answer. (Answer: $70\% = \frac{70}{100} = \frac{7}{10} = 0.7$)
3. **Say:** In the previous lesson, we learned how to convert percentages to fractions and decimals. Today, we will do the opposite. We will express fractions and decimals as percentages.

Introduction to the New Material *(13 minutes)*

1. Write on the board: Express $\frac{3}{10}$ as a percentage.
2. **Say:** Recall that percentage means per 100, or out of 100. Therefore, to express fractions as percentages, we multiply the fraction by 100.
3. Write on the board: $\frac{3}{10} \times \frac{100}{1}$
4. Solve the multiplication and explain each step to the pupils:
    - Multiply the numerators ($3 \times 100 = 300$)
    - Multiply the denominators ($10 \times 1 = 10$)
    - Therefore, $\frac{3}{10} \times \frac{100}{1} = \frac{300}{10}$
    - Divide numerator by denominator ($300 \div 10$) to get the final answer in percent: 30
    - Write the percentage sign (%) after the answer.
5. Write the full solution on the board: $\frac{3}{10} \times \frac{100}{1} = \frac{300}{10} = 30\%$
6. Write another problem on the board: Express $\frac{9}{20}$ as a percentage.
7. Solve on the board and make sure pupils understand each step:
   $\frac{9}{20} = \frac{9}{20} \times \frac{100}{1} = \frac{900}{20} = \frac{90}{2} = 45\%$
8. **Say**: Now we will convert decimals to percentages.
9. Write on the board. Express 0.34 as a percentage.
10. **Say:** 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. Then add on the percentage symbol (%) to the figure.
11. Write on the board: 0.34×100.

12. Ask a pupil to come to the board to write the answer and explain. (Answer: 34%; Explanation: If we move the decimal two places to the right, we get the whole number 34 (0.34→3.4→34.). Then we add a percentage sign.)
13. Write on the board: $0.34 = 34\%$
14. Write on the board: Express 0.9 as a percentage.
15. Ask a pupil to come to the board and write the multiplication problem we need to solve. (Answer: 0.9×100)
16. Ask another pupil to write the answer and explain. (Answer: 90%; Explanation: If we move the decimal places two places to the right, we must add a zero to hold the place (0.9→9. →90.). Then we add the percentage sign.)
17. Write on the board: $0.9 = 90\%$

Guided Practice *(7 minutes)*

1. Ask pupils to work in pairs or with seatmates.
2. Write 2 questions on the board:
   i. Express 0.55 as a percentage.
   ii. Sia scored $\frac{18}{20}$ on a math assignment. What was her percentage mark?
3. Allow pupils to work in pairs.
4. Walk around the class to check their work for understanding and clear misconceptions.
5. Discuss with them and assist where necessary.
6. Call 2 pupils from different groups to come one at a time to the board and do the work.
7. Allow other members from different groups to contribute where difficulties occur.
   (Answer: $i.\ 0.55 = 0.55 \times 100\% = 55\%$ ii. $\frac{18}{20} = \frac{18}{20} \times \frac{100}{1} = \frac{1800}{20} = \frac{180}{2} = 90\%$).

Independent Practice *(10 minutes)*

1. Write some problems on the board:
   Express the following as a percentage:
   i. 0.65 ii. $\frac{4}{5}$ iii. 0.2
2. Ask the pupils to solve the problems independently.
3. Move round the class to see that pupils are working individually in their exercise books.
4. Check and assist where difficulties occur.
5. Ask pupils to exchange their work with seatmates to check their work for correct answers.
6. Ask 3 pupils to share their answers with the class. (Answers: i. $0.65 = 0.65 \times 100\% = 65\%$ ii) $\frac{4}{5} = \frac{4\times100}{5} = \frac{400}{5} = 80\%$ iii $0.2 = 0.2 \times 100\% = 20\%$)

Closing *(2 minutes)*

1. Write a problem on the board: Express $\frac{3}{10}$ as both a decimal and percentage.
2. Ask pupils to write the answers in their exercise books.

3. Ask 1-2 pupils to share their answers and have all the pupils check their own work before leaving the class. Make sure they understand the topic for the day. (Answer: $\frac{3}{10} = 0.3 = 30\%$)

Lesson Title: Identify the Percentage of a Given Quantity	**Theme:** Numbers and Numeration	
Lesson Number: M-07-039	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson pupils will be able to calculate a given percentage of a given quantity.	None	Write the following question on the board: Express 18% (i) as a fraction in its simplest form (ii) as a decimal.

Opening *(3 minutes)*

1. Ask pupils to read the problem on the board.
2. Select pupils one at a time to come to the board to work through the calculation.
3. Ask the class if they agree with the answers. Correct any errors.
   (Answers: i. 18% as a fraction $= \frac{18}{100} = \frac{9}{50}$ (simplest form) ii. 18% as decimal $= 0.18$.)
4. **Say:** The topic for today is how to calculate a given percentage of a given quantity.

Introduction to the New Material *(13 minutes)*

1. Write the following questions on the board:
   i. Calculate 15% of 500
   ii. Le 30,000 was shared between Abu and Bob. If Bob received 55%, what was Bob's share in Leones?
2. Ask pupils to first look at i.
3. **Ask**: How do we express 15% as a fraction? (Answer: $\frac{15}{100}$)
4. Ask a pupil to call out the given quantity in the question (Answer: 500).
5. Show on the board how to calculate the required percentage.

$$15\% \text{ of } 500 = \frac{15}{100} \times \frac{500}{1} = \frac{7500}{100} = 75$$

6. **Say**: We first change the percentage to a fraction, and then multiply it by the given quantity. We often need to simplify the answer.
7. Ask a pupil to explain the calculation required for the story problem in ii. (Answer: 55% of Le30, 000).
8. Ask a pupil to come to the board and work through the calculation. Assist as needed. Ask the other pupils in the class to complete the problem in their exercise books.
9. Discuss and correct any errors. (Answer: 55% of Le 30, 000 $= \frac{55}{100} \times \frac{30000}{1} = 55 \times 300 = 16{,}500$ Bob's share = Le 16,500).

Guided Practice *(7 minutes)*

1. Ask pupils to get into pairs.
2. Write the question on the board:

25% of 60 acres of land was given to Beindu. Calculate the amount of land that was given to Beindu.

3. Give pupils 2-3 minutes to discuss and answer the question.
4. Walk around to check answers and clear misconceptions.
5. Select one pupil from each part of the room - back, middle, and front - to present answers on the board.
6. Discuss any differences between the calculations or answers.
   (Answer: $\frac{25}{100}$ of $\frac{60}{1} = \frac{1}{4} \times \frac{60}{1} = \frac{60}{4} = 15$ acres)

Independent Practice *(10 minutes)*

1. Write the questions below on the board:
   i. Calculate 22% of Le 60,000.
   ii. Alpha was given 42% of Le 150, 000. Calculate the amount given to Alpha.
2. Ask the pupils to answer the questions independently in their exercise books.
3. Walk around to check answers and clear misconceptions.
4. Ask volunteers to come to the board to present their answers.
5. Ask the class if they agree with the answers. Discuss and correct any errors.
   (Answers: i. 22% of Le 60,000 $= \frac{22}{100} \times \frac{60,000}{1}$ = Le 13,200;
   ii. 42% of Le 150,000 $= \frac{42}{100} \times \frac{150,000}{1}$ = Le 63,000)

Closing *(2 minutes)*

1. Ask the questions below for pupils to give verbal answers.
2. **Ask:** What is 50% as a fraction? (Answer: $\frac{50}{100}$ or $\frac{1}{2}$).
3. **Ask:** What is $\frac{1}{2}$ of 20? (Answer: 10).
4. **Ask:** What is 50% of 20? (Answer: 10).
5. **Say:** In the next lesson we will be calculating one quantity as a percentage of another.

Lesson Title: Express One Quantity as a Percentage of Another	**Theme:** Numbers and Numeration	
Lesson Number: M-07-040	**Class/Level: JSS 1**	**Time:** 35 minutes

Learning Outcomes	**Teaching Aids**	**Preparation**
By the end of the lesson pupils will be able to calculate one quantity as a ercentage of another.	None	Write these questions on the board: (i) Calculate 60% of 90 (ii) Find the value of 25% of 900

Opening *(5 minutes)*

1. Ask pupils to read the questions on the board.
2. Call one pupil from the back of the class, and one from the front to come to the board to work through the questions.
3. Ask the class to verify the calculations. Correct any errors.
   (Answers: i. $\frac{60}{100} \times \frac{90}{1} = 54$ ii. $\frac{25}{100} \times \frac{900}{1} = 225$)
4. **Say:** Today we will learn how to express one quantity as a percentage of another.

Introduction to the New Material *(13 minutes)*

1. Write on the board:
   i. In a box of 200 bananas, 180 are good. What percentage is good?
   ii. Express 25 metres as a percentage of 1 kilometre
2. Ask a pupil to read the first problem out loud.
3. **Say**: We want to find the percentage that is good out of all of the bananas in the box.
4. **Say**: To express a quantity as a percentage of another, express the first quantity as a fraction of the second quantity. Multiply the fraction by 100%.
5. Write on the board: $\text{Percentage good} = \frac{\text{quantity of good bananas}}{\text{total quantity of bananas}} \times 100\%$
6. Calculate the answer on the board: $\frac{180}{200} \times \frac{100}{1} = \frac{180}{2} = 90\%$
7. **Say:** 90% of the bananas are good.
8. Ask a pupil to read the second question out loud: Express 25 metres as a percentage of 1 kilometre.
9. **Ask:** What can we say about the units in this question? (Answer: The first quantity is in metres while the second is in kilometres.)
10. **Ask:** What should we do when we have different units? (Answer: Change both quantities to the same unit.)
11. **Ask**: So, what unit should we change the quantities to? (Answer: metres).
12. Explain to pupils that we usually change from the larger unit to the smaller because it is easier to do the calculations with whole numbers rather than fractions or decimals.
13. **Ask**: How many metres make 1 kilometre? (Answer: 1000 metres).
14. Write on the board: 1000 m = 1 km
15. **Say**: We want to calculate 25 m as a percentage of 1000 m

16. Ask a pupil to give the fraction that we will use in the calculation. (Answer: $\frac{25 \text{ metres}}{1000 \text{ metres}}$)
17. Show the calculation to express 25 as a percentage of 1000: $\frac{25}{1000} \times \frac{100}{1} = \frac{2500}{1000} = 2.5\%$
18. **Say**: 25 metres is 2.5% of 1000 metres. This means that 25 is also 2.5% of 1 kilometre.

Guided Practice *(5 minutes)*

1. Get pupils to get into pairs.
2. Write this question on the board.
   In a Mathematics examination, a girl scored 72 marks out of a total of 80 marks. What percentage did she score?
3. Ask pupils to work in pairs for 3 minutes to discuss and answer the question.
4. Walk around to check answers and clear misconceptions.
5. Call a pupil from any of the pairs to come to the board to work through their answer. Allow other pupils to help as needed. (Answer: $\frac{72}{80} \times \frac{100}{1} = \frac{720}{8} = 90\%$)
6. Discuss and correct any errors.

Independent Practice *(10 minutes)*

1. Write two questions on the board:
   i. In a mathematics lesson, 5 pupils are absent from a class of 25 pupils. What percentage of the class is absent?
   ii. 7 out of every 10 people have watched a football match at the National Stadium. What is this as a percentage?
2. **Say:** Work the questions on the board independently in your exercise books.
3. Walk around to check answers and clear misconceptions.
4. Allow pupils to exchange books with their neighbour to check and discuss each other's answer.
5. Call two pupils to come to the board to work through their answers.
6. Discuss and correct any errors.
   (Answer: *a.* $\frac{5}{25} \times \frac{100}{1} = \frac{500}{25} = 20\%$ $b. \frac{7}{10} \times \frac{100}{1} = \frac{700}{10} = 70\%$)

Closing *(2 minutes)*

1. **Ask**: What should we do if we want to calculate one quantity as a fraction of another? (Answer: write the first quantity as a fraction of the second and multiply by 100)
2. **Ask**: What if we have different units for the two quantities? (Example answers: Change to the same unit; Change to the smaller unit because it is easier to do the calculations with whole numbers rather than fractions or decimals)

Lesson Title: Percentage Increase	**Theme:** Numbers and Numeration	
Lesson Number: M-07-041	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to calculate the percentage increase given two numbers.	**Teaching Aids** Questions	**Preparation** Write the questions, in the Introduction to the New Material, Guided Practice, and Independent Practice, on the board.

Opening *(3 minutes)*

1. Write on the board: What percentage of 75g is 45g?
2. Give pupils 1 minute to find the answer in their exercise books.
3. Ask a pupil to come to the board to solve the problem. (Answer: $\frac{45}{75} \times \frac{100\%}{1} = 60\%$)
4. **Say:** Today, we are going to learn how to calculate percentage increase given 2 numbers.

Introduction to the New Material *(13 minutes)*

1. Read these questions on the board:
   (i) The population of a village increased from 2500 to 3000. Calculate the percentage increase.
   (ii) In 2014 a primary school has 500 students registered. In 2015 there were 550 pupils who registered. Calculate the percentage increase.
2. **Ask:** What do we mean by increase?
3. Allow pupils to share their own ideas. (Example answer: Increase means addition to a quantity)
4. Write on the board: $\text{Percentage increase} = \frac{\text{change in quantity}}{\text{original quantity}} \times 100\%$
5. **Say**: 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%.
6. **Say**: To calculate *change in quantity* for an increase, subtract the original quantity from the new quantity (New quantity – Original quantity).
7. In question 1, ask a pupil to call out the new quantity (Answer: $= 3000$ people). Ask another pupil to call out the original quantity (Answer: $= 2500$ people).
8. **Ask:** Can someone calculate the population increase in question 1? (Answer: $3000 - 2500 = 500$ people).
9. Calculate the percentage increase in population on the board: $\frac{500}{2500} \times \frac{100\%}{1} = 20\%$
10. **Say**: The population of the village increased by 20%.
11. Ask pupils to look at question 2 and tell them we will use the same steps above.
12. In question 2, ask a pupil to call out the new quantity (Answer: $= 550$ pupils). Ask another pupil to call out the original quantity (Answer: $= 500$ pupils)
13. Ask a pupil to calculate the increase in quantity in the second question. (Answer: $550 - 500 = 50$ pupils).

14. Ask another pupil to calculate percentage increase. Other class members may assist them as needed. (Answer: $\frac{50}{500} \times \frac{100\%}{1} = 10\%$)
15. **Say**: The number of primary school students is increased by 10%.

Guided Practice *(7 minutes)*

1. Read this question on the board:
   The transport cost was increased from le 30,000 to le 45,000. Calculate the percentage increase.
2. Put the pupils in groups of 3.
3. Allow the groups to read the question and brainstorm themselves for one minute.
4. Ask the pupils to work out the problem at group level.
5. Move around the class, check for understanding, discuss and assist for any misconceptions.
6. Call on one group to come to the board and write their answer. They should explain.
7. Allow pupils to compare and discuss with the answer on the board. (Answer: $\frac{15,000}{30,000} \times \frac{100\%}{1} = 50\%$)

Independent Practice *(10 minutes)*

1. Read these questions on the board:
   (i) A bag of rice cost le 150,000, and was increased to le 210,000. Calculate the percentage increase.
   (ii) A man sells cassava in the market. One week he sold 200 bags and the next week he sold 240 bags. Calculate the percentage increase.
2. Ask pupils to work independently in their exercise books.
3. Move around the class to check for understanding and clear misconceptions.
4. Ask for 2 volunteers to come to the board and work out the problems.
5. Allow pupils to compare and discuss the answer on the board. (Answers: (i) $\frac{60,000}{150,000} \times \frac{100\%}{1} = 40\%$; (ii) $\frac{40}{200} \times \frac{100\%}{1} = 20\%$)

Closing *(2 minutes)*

1. Write a question on the board: A man's salary was increased from le 200,000 to le 250,000. Calculate the percentage increase.
2. **Say:** Can someone volunteer to come to the board to solve the problem? (Answer: $\frac{50}{200} \times \frac{100}{1} = 25\%$)

Lesson Title: Percentage Decrease	**Theme:** Numbers and Numeration	
Lesson Number: M-07-042	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to calculate the percentage decrease given 2 numbers.	**Teaching Aids** Questions	**Preparation** Write the questions, in the Opening, Introduction to the New Material, Guided Practice, and Independent Practice, on the board.

Opening *(5 minutes)*

1. Read this question on the board: The number of class 1 pupils in a school increased from 50 to 100. Calculate the percentage increase.
2. Give pupils 1-2 minutes to solve in their exercise books.
3. Remind them of the formula from the previous lesson if needed: $\text{Percentage increase} = \frac{\text{change in quantity}}{\text{original quantity}} \times 100\%$
4. Call a pupil to come to the board to solve the question. (Answer: $\frac{50}{50} \times \frac{100\%}{1} = 100\%$)
5. **Say**: There was a 100% increase in class 1 pupils at the school.
6. **Say:** Today, we will learn how to calculate percentage decrease given 2 numbers.

Introduction to the New Material *(13 minutes)*

1. Read this question on the board:
   A village started using mosquito nets and the number of children with malaria decreased from 30 each month to 12 each month. Calculate the percentage decrease.
2. **Ask:** What do we mean by decrease?
3. Allow pupils to share their own ideas. (Example answer: decrease means that a quantity goes down, or gets reduced).
4. Write on the board: $\text{Percentage decrease} = \frac{\text{change in quantity}}{\text{original quantity}} \times 100\%$
5. **Say**: This is the same equation that we used for percentage increase.
6. **Say**: 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.
7. Write on the board:
   Increase: new quantity – original quantity
   Decrease: original quantity – new quantity
8. **Ask**: What is the original quantity of children with malaria? (Answer: 30)
9. **Ask**: What is the new quantity of children with malaria? (Answer: 12)
10. Calculate the decrease in quantity on the board: $30 - 12 = 18$
11. Calculate the percentage decrease on the board: $\frac{18}{30} \times \frac{100\%}{1} = \frac{180\%}{3} = 60\%$
12. **Say**: There was a 60% decrease in children with malaria.
13. Read this question on the board:

The number of pupils enrolled in a school one year was 600, and the following year it was 540. Calculate the percentage decrease.

14. In the question above ask pupils to tell the original quantity and the new quantity. (Answer: original quantity = 600, new quantity = 540)
15. Ask a pupil to explain how to find the size of the decrease. (Answer: Subtract the new quantity from the original quantity)
16. Write on the board: $600 - 540 = 60$
17. Ask pupils to tell you the next steps. (Answer: Divide by the original value and multiply by 100%.)
18. Solve on the board: $\frac{60}{600} \times \frac{100\%}{1} = \frac{60\%}{6} = 10\%$
19. **Say:** The number of pupils in the school decreased by 10%.

Guided Practice *(5 minutes)*

1. Read this question on the board:
   Bendu sells oranges by the road. In the morning she had 80 oranges, and at the end of the day she only had 60. Calculate the percentage decrease.
2. Ask pupils to work in pairs to solve the problem.
3. Go around the class to check for understanding and clear misconceptions.
4. Solve the problem on the board.
5. Allow pupils to compare and discuss their answers with the one on the board.
   (Answer: $80 - 60 = 20$; $\frac{20}{80} \times \frac{100\%}{1} = 25\%$)

Independent Practice *(10 minutes)*

1. Read these questions on the board:
   i. A businesswoman sells her lappa for le 20,000 per yard, but she sold one yard to her friend for le 15,000. Calculate the percentage decrease.
   ii. In one year, the number of people who own cell phones in one village increased from 40 people to 60 people. Calculate the percentage increase.
2. **Say**: One of the problems is on increase, and one is on decrease. You will use what you learned in the previous lesson and today's lesson.
3. Ask pupils to work individually in their exercise books.
4. Move around the class to check for understanding and clear misconceptions.
5. Call on two pupils to come on the board and work out the problems.
6. Allow pupils to compare and discuss their answers with the ones on the board.
   (Answers: i. $\frac{5{,}000}{20{,}000} \times \frac{100\%}{1} = 25\%$; ii. $\frac{20}{40} \times \frac{100\%}{1} = 50\%$)

Closing *(2 minutes)*

1. Ask open-ended questions to review percentage increase and decrease. Allow pupils to share their ideas and discuss.

a. What is the difference in meaning between increase and decrease? (If a quantity increases it becomes more; if a quantity decreases it becomes less.)
b. Which two numbers must we subtract before finding the percentage decrease? (original quantity – new quantity)
c. Which two numbers must we subtract before finding the percentage increase? (new quantity – original quantity).

Lesson Title: Percentage Increase or Decrease	**Theme:** Numbers and Numeration	
Lesson Number: M-07-043	Class/Level: JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to calculate a number given the percentage increase or decrease upon a given number.	**Teaching Aids** Questions	**Preparation** Write the questions, in the Opening, Introduction to the New Material, Guided Practice, and Independent Practice, on the board.

Opening *(3 minutes)*

1. Read this question on the board: Calculate the percentage decrease of 40 to 20.
2. Ask pupils to work the problem in their exercise books.
3. Call a pupil to solve the question on the board. Ask other pupils to check their answers. (Answer: $40 - 20 = 20 \rightarrow \frac{20}{40} \times \frac{100}{1} = 50\%$)
4. **Say:** Today, we will learn how to calculate the number that we get after an increase or decrease. We will use the original quantity and the percentage increase or decrease to find this number.

Introduction to the New Material *(15 minutes)*

1. Ask pupils questions to review the meaning of percentage increase and percentage decrease.
   a. What is the difference between increase and decrease? (Example answer: If a quantity increases it becomes more; if a quantity decreases it becomes less)
   b. What is the formula for finding the percent increase or decrease? (Answer: $\frac{\text{change in quantity}}{\text{original quantity}} \times 100\%$)
2. **Say:** 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.
3. Read these questions on the board:
   (i) The number 500 is increased by 10%. Calculate the new number.
   (ii) The number 500 is decreased by 10%. Calculate the new number.
4. **Say**: This is the type of question we will learn to solve today.
5. **Say:** To calculate a number given the percentage increase or decrease upon a 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.

   There are 2 common methods for finding the result after an increase or decrease. This introduction follows one method. The other method is on the attached page. Use the method that you are comfortable with. If there is enough time, you may teach both.
6. Write on the board:

New number $= \frac{100+percentage\ increase}{100} \times \frac{the\ given\ number}{1}$

7. **Ask**: What is the percentage increase in problem 1? (Answer: 10%)
8. **Ask**: What do we get when we add this to 100%? (Answer: 110%)
9. **Say:** We divide this 110 percent by 100, and multiply it by the given number, 500.
10. Substitute the values into the formula, and solve on the board: $\frac{110}{100} \times \frac{500}{1} = 550$
11. **Say**: After a 10% increase, 500 becomes 550.
12. **Say:** Now look at the second problem. We are asked to find the number after a decrease.
13. **Ask**: What is the percentage increase in problem 2? (Answer: 10%)
14. **Ask**: What do we get when we subtract this from 100%? (Answer: 90%)
15. **Write on the board**:

    New number $= \frac{100-percentage\ decreae}{100} \times \frac{given\ number}{1}$
16. **Say:** To express the new number, use the same steps. But mind you, we are now using percentage decrease, which is always less than 100.
17. Substitute the values into the formula, and solve on the board: $\frac{90}{100} \times \frac{500}{1} = 450$
18. **Say**: After a 10% decrease, 500 becomes 450.

Guided Practice *(5 minutes)*

1. Read this question on the board: A primary school in one village had 80 pupils. The next year, the number of pupils increased by 20%. Calculate the new number of pupils.
2. Ask pupils to work in pairs to solve the problem.
3. Walk around the class to check for understanding and clear any misconceptions. For example, they might have difficulty identifying the given value and percentage, or substituting them in the formula. Help them by calling out the numbers or doing the substitution on the board.
4. Ask pupils to compare answers with their neighbours if they finish early.
5. Ask a pair to present their work on the board. Allow pupils to comment on the answer. (Answer: $100 + 20 = 120; \frac{120}{100} \times \frac{100}{1} = 120$ pupils)

Independent Practice *(10 minutes)*

1. Look at another 2 questions on the board:
   (i) There were 800 people living in a village in 2005. By 2015, the population had grown by 20%. What was the population in 2015?
   (ii) David had 400 DVDs for sale in his shop, but he sold 30% of them. How many DVDs remain in his shop?
2. **Ask**: Is question 1 an increase or decrease problem? How do you know? (Answer: increase; the word 'grown' tells us it's an increase (or addition) problem)
3. **Ask**: Is question 2 an increase or decrease problem? How do you know? (Answer: decrease; the word 'remain' tells us it's a decrease (or subtraction) problem)
4. Ask pupils to work the problems independently in their exercise books.
5. Walk around the class, checking for understanding and clearing misconceptions.

6. Ask 2 pupils to come to the board to solve the problems, while the others check their answers. Allow pupils to comment on the answers. (Answers: (i) $100 + 20 = 120 \frac{120}{100} \times \frac{800}{1} = 960$ (ii) $100 - 30 = 70 \frac{70}{100} \times \frac{400}{1} = 280$ DVDs)

Closing *(2 minutes)*

1. Ask questions to check for understanding of today's topic. Allow pupils to respond in their own words.
   a. What is the process for finding the new amount after a number is *increased* by a percentage? (Example answer: Add 100 to the percentage, divide by 100, and multiply by the given amount)
   b. What is the process for finding the new amount after a number is *decreased* by a percentage? (Example answer: Subtract 100 from the percentage, divide by 100, and multiply by the given amount)

[ANOTHER METHOD OF CALCULATION]

Two different methods can be used to find the result after a number is increased or decreased by a certain percentage. Method 1 is described in the introduction. Method 2 is described below. Use the method that you are more comfortable with.

Using method 2 for finding increase:

Example Problem: The number 500 is increased by 10%. Calculate the new number.

Solution Steps:

1. State the increase in percent: 10%
2. Divide the percent increase by 100% and multiply it by the given number:
$$\frac{10}{100} \times \frac{500}{1} = \frac{5000}{100} = 50$$
3. *Add* the answer to the given number to give the new number:
$$500 + 50 = 550$$

Answer: 550

Using method 2 for finding decrease:

Example Problem: The number 500 is decreased by 10%. Calculate the new number.

Solution Steps:

1. State the increase in percent: 10%

2. Divide the percent increase by 100% and multiply it by the given number:

$$\frac{10}{100} \times \frac{500}{1} = \frac{5000}{100} = 50$$

3. *Subtract* the answer from the given number to give the new number:

$$500 - 50 = 450$$

Answer: 450

Lesson Title: Applying Percentages to Problem with Money	**Theme:** Numbers and Numeration	
Lesson Number: M-07-044	**Class/Level:** JSS 1	**Time:** 35 minutes

 **Learning Outcomes** By the end of the lesson pupils will be able to solve problems with percentages involving money.	 **Teaching Aids** Questions	 **Preparation** Write the questions, in the Opening, Introduction to the New Material, Guided Practice, and Independent Practice, on the board.

Opening *(4 minutes)*

1. Read the problem on the board: There were 300 wild chimpanzees living in a certain area in 2015. In 2016, the population had fallen by 25%. How many chimpanzees remained?
7. **Ask**: Is this an increase or decrease problem? (Answer: decrease, the word 'remain' tells us it's a decrease (or subtraction) problem)
2. Ask pupils to work on the problem in their exercise books.
3. Call a pupil to solve the question on the board. Ask other pupils to check their answers. (Answer: $100 - 25 = 75; \frac{75}{100} \times \frac{300}{1} = 165$ chimpanzees).
4. **Say:** Today, we will learn how to solve problems with percentages involving money.

Introduction to the New Material *(10 minutes)*

1. Read the problem on the board:
   The price of a bag of rice was increased by 5%. If the original price was Le250, 000 per bag, what is the new price of rice per bag?
2. **Ask:** Can someone read the question on the board loudly while others seat and listen carefully?
3. Ask pupils to observe and think about it for a minute.
4. **Ask:** What is the given number? (Answer: 250,000)
5. **Ask**: What is the percent increase or decrease? (Answer: 5% increase)
6. Remind pupils the steps used to calculate the new number when an increased in percent is given.
   - Add the increased percent to 100
   - Divide the answer by 100
   - Multiply the answer by the given number.
7. Ask pupils to tell you the formula for calculating the new price after a percentage increase. They can look at their notes from the previous class.
8. Write the formula on the board as they say it:
   New price$= \frac{100+percentage\ increase}{100} \times \frac{original\ price}{1}$
9. Ask a pupil to come to the board and substitute the values from the problem into the formula. Ask all other pupils to do the task in their exercise books. (Answer: New price $= \frac{105}{100} \times \frac{250{,}000}{1}$)
10. Solve the multiplication problem on the board while pupils do the same in their exercise books. (Answer: Le262,500)

Guided Practice *(7 minutes)*

1. Read the question on the board:
   Beindu paid Le20, 000 for school fees last year. This year, her school fees will be decreased by 10%. How much will she pay for school fees this year?
2. Ask pupils to work in pairs.
3. Work around, check for understanding and help them to work with each other.
4. Ask a pair to present their answer on the board.
5. Allow pupils to compare and discuss the answers on the board. (Answer: $100 - 10 = 90\ \frac{90}{100} \times \frac{20{,}000}{1} = Le18{,}000$).

Independent Practice *(10 minutes)*

1. Read the questions on the board:
   i. Francis opened a new cookery shop. On the first day, his profit was Le150, 000. The second day, his profit was 25% lower. What was his profit the second day?
   ii. Juliet sells lappa in the market. Before, she sold it for le15, 000 per yard. However, the cost of her rent increased and she wants to increase the price of her lappa by 15%. What will be the new price per yard?
2. Ask pupils to solve the problem independently in their exercise books.
3. Go round the class to observe and guide the pupils in their work and to ensure that they work correctly.
4. Allow pupils to exchange work with seatmates for review.
5. Take note of pupils struggling with the question so that you can help them.
6. Call on a pupil to present his/her work on the board.
7. Allow pupils to comment on the answer on the board. (Answers: (i) $100 - 25 = 75 \frac{75}{100} \times \frac{150{,}000}{1} = Le112{,}500$ (ii) $100 + 15 = 115\ \frac{115}{100} \times \frac{15{,}000}{1} = Le17{,}250$)

Closing *(4 minutes)*

1. Ask pupils to complete an exit ticket problem.
2. Write a question on the board:
   A market due was Le8, 000 per day. Later, it was decreased by 20%. Calculate the new market due.
3. Ask pupils to complete the problem in their exercise books.
4. Walk around to briefly check their answers and make sure they understood the topic.
   (Answer: $100 - 20 = 80\ \frac{80}{100} \times \frac{8{,}000}{1} = Le6{,}400$).

Lesson Title: Story Problems with Percentages	**Theme:** Numbers and Numeration	
Lesson Number: M-07-045	**Class/Level:** JSS 1	**Time:** 35 minutes

Learning Outcomes By the end of the lesson pupils will be able to solve story problems with percentages.	**Teaching Aids** Questions	**Preparation** Write the questions, in the Introduction to the New Material, Guided Practice, and Independent Practice, on the board.

Opening *(3 minutes)*

1. **Say**: We have been studying percentage for several lessons now.
2. **Ask**: What types of percentage problems do we know how to solve?
3. Allow pupils to respond. Encourage them to look at their notes in their exercise books and describe the types of problems they have solved so far. (Examples: converting decimals and fractions to percentages, finding the percentage of a given quantity, expressing one quantity as a percentage of another, percentage increase and decrease, percentage money problems)
4. **Say**: Today, we will practise solving story problems. You will need to identify how to solve each one based on what you have already studied.

Introduction to the New Material *(13 minutes)*

1. Read these questions on the board:
   a. There are 1200 pupils in a school, and 20% of them are enrolled in JSS 1. How many of the pupils are enrolled in JSS 1?
   b. The college fee of Le500,000 per term was increased by 20%. How much was the fee after the increase?
2. Ask pupils to look at each problem and describe the process to solve it. Discuss each one as a class. For example:
   a. In question (a) we need to find the percentage of a number, so we multiply the number (1200) by the percentage written as a fraction ($\frac{20}{100}$).
   b. Question (b) is a percentage increase problem, so we need to use the formula to find the fee pupils pay after the increase.
3. Ask pupils to solve question (a) in their exercise books.
4. Ask one pupil to write the solution on the board and explain. Ask all other pupils to check their own answers. (Answer: $1200 \times \frac{20}{100} = 240$ pupils)
5. **Say**: 240 of the pupils in the school are enrolled in JSS 1.
6. Ask pupils to solve question (b) in their exercise books.
7. Ask one pupil to write the solution on the board and explain. Ask all other pupils to check their own answers. (Answer: $\frac{120}{100} \times \frac{500{,}000}{1} = Le600{,}000$).
8. **Say**: The college fee is Le600,000 after the increase.

Guided Practice *(7 minutes)*

1. Read these question on the board:
   25 pupils took a test in mathematics, and 23 of them passed. What percentage failed the test?
2. Ask pupils to work in pairs to solve the problem.
3. Walk around to observe, check, and guide the pupils where necessary.
4. Ask one pair to share their answer on the board and explain. Other pupils should check their own answers. (Answer: If 23 pupils passed the test, then 2 pupils failed ($25 - 23 = 2$). The percentage that failed is $\frac{2}{25} \times \frac{100}{1} = \frac{200}{25} = 8\%$)
5. **Say**: 8% of pupils failed the test.

Independent Practice *(10 minutes)*

1. Read these questions on the board:
   a. Abass gets 80% correct in a test of 20 questions. Calculate the number of questions in the test he got wrong.
   b. A man bought a car for Le8,000,000 and sold it a year later at Le6,000,000. What was the percentage decrease in the value of the car?
2. Ask pupils to solve the questions independently.
3. Move around the class to check for understanding and clear misconceptions.
4. Allow pupils to review their answers with a neighbour if they finish.
5. Call two pupils to write their answers on the board and explain.
   Answers:
   a. If Abass got 80% correct, then he got 20% wrong ($100\% - 80\% = 20\%$). The number of questions he got wrong is $\frac{20}{100} \times \frac{20}{1} = \frac{400}{100} = 4$ questions.
   b. Calculate the amount of the decrease: $8{,}000{,}000 - 6{,}000{,}000 = \text{Le}2{,}000{,}000$. Divide the amount decrease by the original quantity and multiply by 100: $\frac{2{,}000{,}000}{8{,}000{,}000} \times \frac{100}{1} = \frac{200}{8} = 25\%$.
6. **Say**: Abass got 4 questions wrong on the test. The value of the car decreased by 25%.

Closing *(2 minutes)*

1. **Say**: You have now seen many ways that percentages can help us in our everyday lives.
2. **Ask**: What are some times when it is useful to understand percentages?
3. Allow pupils to share their ideas. (Example answers: to run a successful business, to understand tax, to calculate interest at a bank, to calculate profit or loss, to compare amounts of different things in the community)

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