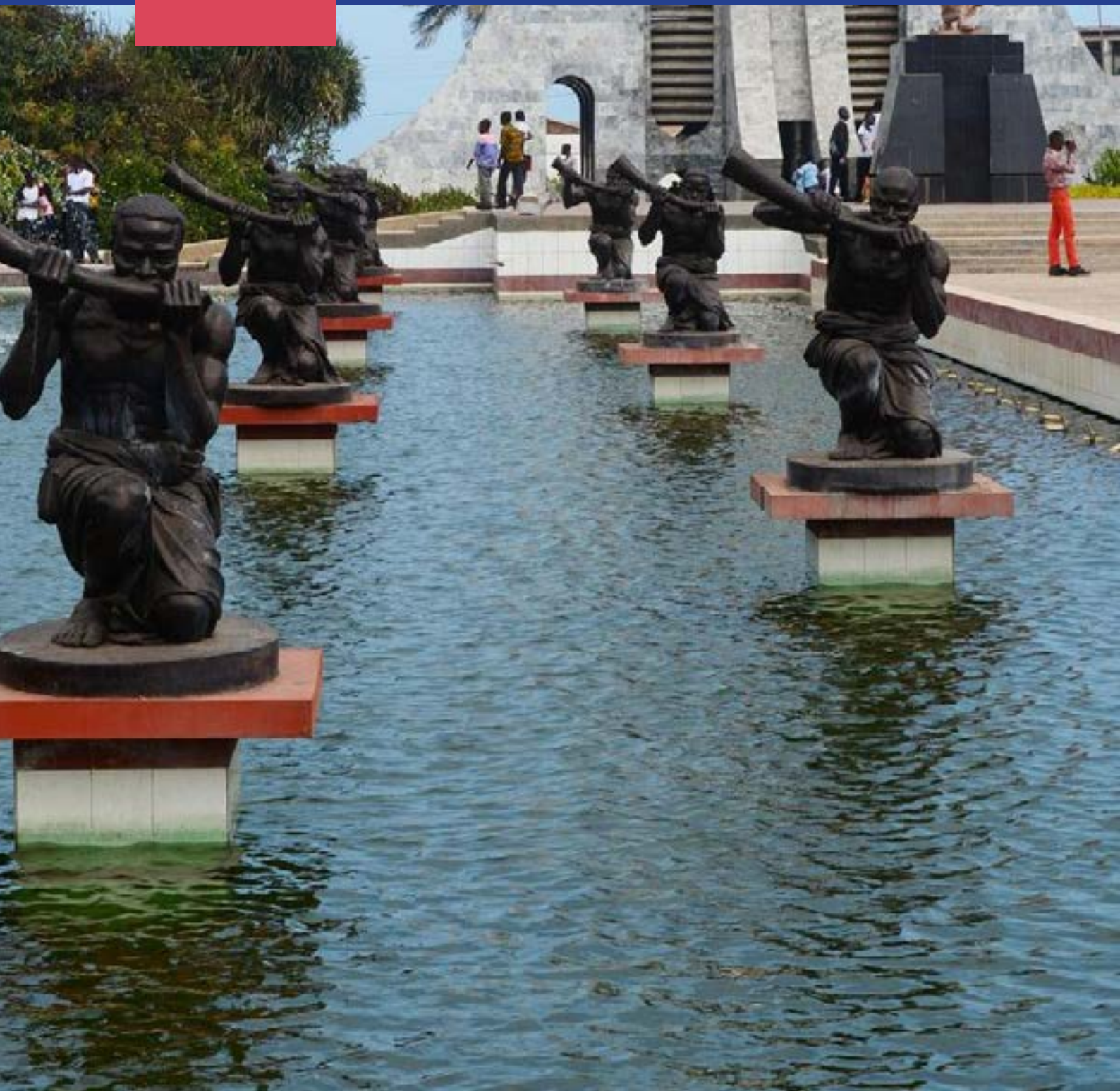


SECTION

2

**RATIO AND  
PERCENTAGES**



# NUMBERS FOR EVERYDAY LIFE

## PROPORTIONAL REASONING

In this section, you will learn to;

1. *Compare and estimate quantities in a given ratio.*
2. *Express one quantity as a percentage of another and vice versa.*

## SECTION INTRODUCTION

In this section, you will compare and estimate quantities in a given ratio, a skill that's vital in everyday situations like cooking, mixing ingredients and budgeting. Ratios help you understand the relationship between different quantities, making it easier to make proportional adjustments. Additionally, you will learn to express one quantity as a percentage of another and vice versa, which is important for interpreting data, calculating discounts and analysing financial information. These concepts will help you make informed decisions and solve problems efficiently in real-life contexts.

## RATIOS AND ITS APPLICATIONS

### FOCAL AREA: THE CONCEPT OF RATIO

Imagine you're planning a party with your friends and you're in charge of making a mixed-fruit drink. You have a recipe that requires 2 cups of pineapple juice for every 1 cup of orange juice. But what if you need to make a larger quantity? How do you make sure the taste stays the same, no matter how much you make?

This is where the concept of ratio comes in. A ratio compares two quantities to show how much of one thing there is compared to another. In the case of the mixed-fruit drink, the ratio of pineapple juice to orange juice is 2:1. Understanding this ratio helps you scale the recipe up or down while keeping the flavours balanced.

Ratios are all around us—in cooking, in maps, in mixing paint colours and even in dividing up work or resources fairly. Learning about ratios will help you make sense of these situations, make better decisions and solve problems more effectively. Whether you're doubling a recipe, figuring out the best deal at the

store or adjusting a model scale, knowing how to work with ratios is a valuable skill.

## REINFORCEMENT ACTIVITIES

### Exploring Ratios in Real-Life Situations

**Purpose:** To help you understand how ratios are used in everyday situations before we dive into the concept of ratios.

### Activity: Comparing Quantities in Real-Life Situations

#### 1. Materials Needed:

- o A notebook and pen
- o A few small items that you can count (like pencils, erasers, or candies)

#### 2. Instructions:

##### a) Step 1: Observing and Counting

Look around the classroom or at home and find two different types of items.

For example, you might find pencils and erasers or apples and oranges.

##### b) Step 2: Counting

Count how many of each item you have. Write down the number of each item in your notebook.

##### c) Step 3: Comparing Quantities

Now, compare the quantities of the two items. Ask yourself:

- o Do I have more pencils or erasers?
- o How many more pencils do I have compared to erasers?

##### d) Step 4: Writing It Down

Write a sentence that describes the comparison. For example:

- o “I have 5 pencils and 2 erasers. I have 3 more pencils than erasers.”

##### e) Step 5: Discussing with a Partner

Pair up with a classmate and share your findings. Discuss how you compared the two items and what you noticed about the quantities.



**Reflection:**

- How did you feel about comparing the quantities?
- Did you notice any patterns in how much more or less of one item you had compared to the other?

## WHAT IS RATIO?

Study the diagram below and come out with the pattern.



The pattern follows that, for every two red circles there are three blue squares. This can be written as 2 red circles to 3 blue squares (2:3).

A **ratio** is a way to compare two or more quantities by showing the relative size of one quantity to another. It tells us how many times one quantity is contained within another or how one quantity relates to another. Ratios are usually written in the form  $a : b$ , where  $a$  and  $b$  are the quantities being compared.

Let's take a look at these examples

**Example 1:**

If there are 28 boys and 23 girls in the class. What is the ratio of girls to boys?

**Solution**

In this case, we are comparing the number of girls to boys in the class. To express the ratio of girls to boys, we place the number of girls first followed by the number of boys separated by colon (:). Therefore, the ratio of girls to boys in the class is 23:28.

This ratio tells us that for every 23 girls in the class, there are 28 boys. It represents the relative sizes of the two groups, allowing us to understand the distribution of gender in the class. As you can see, order is important here.

**Example 2:**

Assuming you spend GH¢ 1 every day and your friend Kofi spends GH¢2. What is the ratio of your expenditure to that of your friend?

**Solution**

The ratio is 1:2

This is because for every GH¢ 1 you spend; Kofi spends GH¢ 2.

This ratio indicates that for every GH¢1 you spend, your friend Kofi spends GH2, representing the amounts spent by each person.

**Example 3:**

Ohemaa has 2 pens and Bryan has 4 pens. Express this in a ratio form.

**Solution**

The ratio of Ohemaa's pens to that of Bryan's is 2:4.

Note, as both of these numbers are multiples of 2, we can divide by 2 to simplify the ratio.

Therefore, the ratio 2:4 is the same as the ratio 1:2.

From the above activities, we can conclude that a ratio is the relationship between two or more quantities or amounts.

**Note this:**

To express two quantities as a ratio, they must have the same units of measure.

For example, express the ratio 30cm to 9m.

The ratio should be 30cm : 900cm

To put the ratio in its simplest form, divide both sides by the lowest common multiple, i.e. 30

$$30/30 : \frac{900}{30} = 1 : 30$$

Ratio with “:” sign has no unit. For example, the ratio 5kg to 2kg is written as 5 : 2.

Let's solve these other examples

**Example 1:**

There are 7 children in a classroom with green shirts, 8 with red shirts, and 10 with yellow shirts. What is the ratio of children with red and yellow shirts?

**Solution**

Alright, so let's look at our problem and see what it is asking us to find and write out the information that we have been given.

So, there are 7 children with green shirts; so, let's write that down. We have Green = 7. We have 8 children with red shirts, so that is Red = 8, and we have 10 children with yellow shirts, Yellow = 10.



Now, the question is asking us to find the ratio of children with red and yellow shirts. This means that we don't even need to look at our number of green shirts. We're just looking for the ratio of red shirts to yellow shirts. Well, we have 8 red shirts and 10 yellow shirts, which gives us a ratio of 8:10. 8 and 10 are both divisible by 2, so the simplified ratio is 4:5.

**Example 2:**

A vegetable tray contains 12 baby carrots, 27 cherry tomatoes, 18 florets of broccoli and 45 slices of red bell peppers. For every 2 baby carrots, there are 3\_\_\_\_\_.

**Solution**

Alright, let's start off the same way that we did our last problem; read through the problem, write down what we know, and find out what is being asked.

So, this vegetable tray contains 12 baby carrots. It contains 27 cherry tomatoes. We have 18 broccoli florets and 45 slices of red bell peppers.



Great, we have all of our information given in the problem, but what are we looking for? It says that for every 2 baby carrots there are 3 somethings. So, we need to find what those somethings are. How do we do that?

Well, look at our original number of baby carrots in the problem, it's 12, but in this ratio, it's been reduced down to 2. What happened to make this number 2? It was divided by 6. So, since we are dealing with a ratio we know that whatever one number in the ratio was reduced by, the other number has to be reduced in the same way. So, we can multiply 6 times our 3, and 6 times 3 is 18.

When we look at all of our information written down, we can see that we have 18 broccoli florets; so there is our answer. For every 2 baby carrots, there are 3 broccoli florets.

### ACTIVITY 2.1: Individual/Pair/Group Work

#### Expressing Quantities as Ratios

**Purpose:** To practise expressing given quantities as ratios by comparing different objects or amounts in everyday situations.

#### Materials Needed:

- A variety of classroom objects (e.g., pencils, erasers, books, markers)
- Worksheet or blank paper
- Pen or pencil

#### Instructions:

##### Step 1: Pair Up

- Pair up with a classmate. Each pair will choose 2 different types of objects available in the classroom (e.g., pencils and erasers).

##### Step 2: Count the Objects

- Count how many of each object you and your partner have. For example, count how many pencils and how many erasers you both have together.

##### Step 3: Express as a Ratio

- Write down the number of pencils and the number of erasers.
- Express the quantities as a ratio. For example, if you have 3 pencils and 5 erasers, write the ratio as 3:5.
- Exchange your ratio with another pair and check each other's work.

**Step 4: Compare Ratios** 6. Discuss with your partner:

- How does your ratio compare to the ratios of other pairs in the class?
- What happens if you switch the order of the quantities (e.g., writing 5:3 instead of 3:5)?

**Step 5: Real-Life Application**

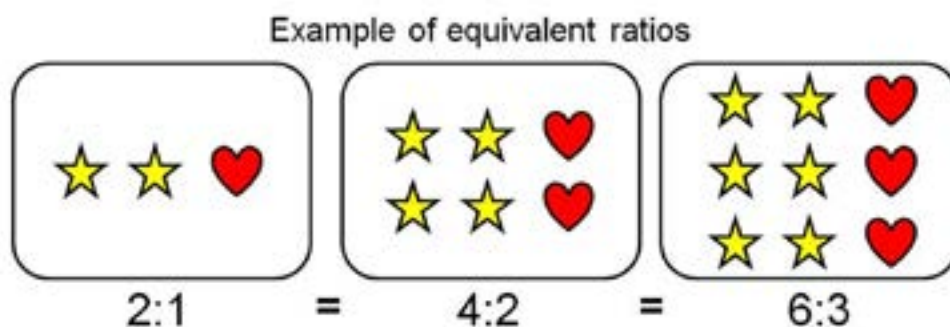
- Imagine you are at a store and you need to buy items in a specific ratios. For example, you want to buy 2 pens for every 3 notebooks. Write down the ratio of pens to notebooks you would buy.
- Share your ratio with the class and explain your reasoning.

**Step 6: Reflection**

Reflect on how understanding ratios can be useful in real-life situations, such as cooking, shopping or dividing things evenly among friends.

## EQUIVALENT RATIOS

Take a look at the three groups of items in the picture below. You can see that in the first group on the left, there are 2 stars and 1 heart so the ratio of stars to heart is 2:1. Now, in the second group, there are 4 stars and 2 hearts so the ratio is 4:2. This ratio is considered to be equivalent to the first group. This is because, in the second group, we can say for every 2 stars there is 1 heart. The same can be said about the ratio (6:3) in the third group. Therefore, the ratios 2:1, 4:2 and 6:3 are considered equivalent.



Two ratios are said to be equivalent if one can be considered as a multiple of the other or they are ratios that have the same value when simplified. An example is 2:6 when simplified is 1:3. Therefore, the ratio 1:3 is equivalent to 2:6.



## Generating Equivalent ratios

We can generate equivalent ratios by multiplying or dividing by a common number. Take a look at the examples;

eg

$$\begin{array}{ccc} & 3:4 & \\ \times 5 \swarrow & = & \searrow \times 5 \\ & 15:20 & \end{array}$$

eg

$$\begin{array}{ccc} & 12:8 & \\ +2 \swarrow & = & \searrow +2 \\ & 6:4 & \end{array}$$

### Example

Find two equivalent ratios for 5 : 20.

### Solution

$$\begin{array}{ccc} & 5:20 & \\ \text{Multiply} & & \text{Divide} \\ 5:20 \rightarrow \frac{5}{20} & & 5:20 \rightarrow \frac{5}{20} \\ \frac{5}{20} \cdot \frac{2}{2} = \frac{5 \cdot 2}{20 \cdot 2} = \frac{10}{40} & & \frac{5}{20} \div \frac{5}{5} = \frac{5 \div 5}{20 \div 5} = \frac{1}{4} \\ \frac{10}{40} \rightarrow \boxed{10:40} & & \frac{1}{4} \rightarrow \boxed{1:4} \end{array}$$

Therefore,  $\frac{1}{4}$ ,  $\frac{5}{20}$ ,  $\frac{10}{40}$  are equivalent fractions and ratios.

### ACTIVITY 2.2: Individual/Pair/Group Work

#### Exploring Equivalent Ratios

**Purpose:** To help you understand and identify equivalent ratios through a hands-on experience and comparison of different scenarios.

#### Materials Needed:

- Coloured blocks or counters (in two different colours)
- Worksheet or blank paper
- Pen or pencil

**Instructions:****Step 1: Create a Ratio**

1. Begin by picking a specific number of blocks or counters in two different colours. For example, choose 4 red blocks and 6 blue blocks.
2. Write down the ratio of red blocks to blue blocks. In this case, it would be 4:6.

**Step 2: Simplify the Ratio.** Simplify the ratio you created by dividing both numbers by their greatest common divisor. For example, 4:6 simplifies to 2:3. Write down the simplified ratio.

**Step 3: Create Equivalent Ratios.** Now, create a new set of blocks or counters that have the same ratio as the simplified ratio. For example, if your simplified ratio is 2:3, you might choose 6 red blocks and 9 blue blocks.

Write down the new ratio and check if it's equivalent to your simplified ratio.

**Step 4: Compare with a Partner.** Pair up with a classmate and compare the ratios you have created. Discuss whether the ratios are equivalent and how you know. Swap your set of blocks or counters with your partner and try to create another equivalent ratio using their ratio as the base.

**Step 5: Real-Life Scenario.** Imagine you are making a fruit salad and for every 2 apples you want to add 3 bananas. Write down the ratio of apples to bananas. If you decide to double the quantity, write down the new ratio and check if it's equivalent to the original ratio.

**Step 6: Reflection.** Reflect on how understanding equivalent ratios can be useful in real-life situations, such as scaling recipes, making mixtures, etc..

**Step 7: Share with the Class.** Share one of your equivalent ratios with the class and explain how you arrived at it. Discuss how knowing equivalent ratios can help solve problems.

## Relating Ratios to Fractions

Ratios in the form **a : b** can be expressed in the fractional form as  $\frac{a}{b}$ . Let's take a look at these examples;

### Example 1:

Samuel has 5 apples and Cynthia has 10 apples. Express this as a ratio and write it in terms of fractions.

**Solution**

$$\text{Samuel: Cynthia} = 5 : 10 = \frac{5}{10} = 1:2 = \frac{1}{2}$$

Comparing, for every 5 apples that Samuel has, Cynthia has 10. This can be expressed as 5:10 and written in the fractional form as  $\frac{5}{10}$ . This means that Samuel has half as many apples as Cynthia.

**Example 2:**

Express the ratio of 20cm to 15m in the form 1:  $n$

**Solution**

First we need both measurements into matching units:

Converting 15m to cm is  $15\text{m} \equiv 1500\text{cm}$

As a ratio 20 cm : 1500cm

$$\frac{20}{20} : \frac{1500}{20}$$

$$1: 75$$

**Example 3:**

In a class of 30 learners, 12 are girls. What is the ratio of boys to girls?

**Solution**

Total number of learners = 30

Girls = 12. The boys will be  $30 - 12 = 18$

Therefore, the ratio will be  $18 : 12 = 3 : 2$

## Comparing and Estimating Quantities in a Given Ratio

Comparing ratios involves understanding the relationship between different quantities, while estimating ratios involves making educated guesses or approximations about those quantities.

**Example 1:**

A bag contains some quantities of pens and pencils. The ratio of pens to pencils is 3:5. If there are 60 pencils in the bag, calculate the number of pens in the bag.

**Solution**

The ratio is 3:5, which means for every 3 pens, there are 5 pencils.

Given that there are 60 pencils. Let the number of pens be  $x$ .

By comparing the ratios

$$\text{Pens: Pencil} = 3:5 = x : 60$$

$$\frac{3}{5} = \frac{x}{60}$$

$$5x = 3 \times 60$$

$$x = \frac{3 \times 60}{5}$$

$$x = 36$$

Therefore, there are 36 pens.

**Example 2:**

The ratio of boys to girls in a class is 2:5. If there are 10 boys in the class, how many girls are there in the class?

**Solution**

$$2:5 = \text{boys: girls}$$

$$\frac{2}{5} = \frac{\text{number of boys}}{\text{number of girls}}$$

$$\frac{2}{5} = \frac{10}{\text{number of girls}}$$

$$\text{number of girls} = \frac{5 \times 10}{2} = 25$$

It means that for the 10 boys, there are 25 girls.

**ACTIVITY 2.3: Individual/Pair/Group Work****Comparing and Estimating Quantities in a Given Ratio**

**Purpose:** To help you practise comparing and estimating quantities based on a given ratio.

**Materials Needed:**

- Counters or small objects (to represent items like pens and pencils)
- Worksheet or blank paper

- Pen or pencil
- Calculator (optional)

**Instructions:**

**Step 1: Using Counters to Visualise the Ratio.** Take some counters or small objects to represent the pens and pencils. For example, use red counters for pens and blue counters for pencils. Arrange the counters in groups to represent the ratio 3:5. For every 3 red counters (pens), place 5 blue counters (pencils) next to them.

**Step 2: Estimating the Quantity.** Now, suppose there are 60 pencils in the bag. Use the ratio to estimate the number of pens.

- First, identify how many groups of 5 pencils make up the 60 pencils.
- Then, use this to determine how many groups of 3 pens correspond to the 60 pencils.
- Write down your calculation and your estimated number of pens.

**Step 3: Verify Your Estimate.** After estimating, use the counters to check your answer. Arrange 60 blue counters (pencils) and then place red counters (pens) according to the ratio 3:5. Count the total number of red counters (pens) you placed and compare it with your estimation. Did you estimate correctly?

**Step 4: Apply to a New Scenario.** Now, create your own scenario. Decide on a different ratio, such as 4:7, and choose a number for one of the quantities. For example, if you have 28 items for one part of the ratio, estimate the number of items for the other part. Repeat the process of estimation and verification using the counters.

**Step 5: Share Your Findings.** Share your scenario with a classmate and ask them to estimate the quantities based on your ratio. Compare your answers and discuss any differences. Reflect on how using ratios can help in making quick estimations in real life, such as when shopping, cooking, or even dividing tasks.



## WORKING WITH PERCENTAGES

### FOCAL AREA: PERCENTAGES (EXPRESSING ONE QUANTITY AS A PERCENTAGE OF ANOTHER)

Imagine you're at a bookstore with your friends and you all decide to buy books. The bookstore is having a sale, offering a discount on all items. The sign says, "20% off on all books." You pick up a book that originally costs 50 cedis and you want to know how much you will pay after the discount. To figure this out, you need to understand what 20% of 50 cedis is.

Percentages are all around us—in sales, test scores, sports results and even in calculating tips at a restaurant. A percentage represents a part out of 100. When you say 20%, it means 20 out of every 100. In the bookstore example, you're trying to find out what 20% of 50 cedis is so you can calculate your savings.

Understanding how to express one quantity as a percentage of another helps you make informed decisions in real life. Whether you're comparing prices, understanding interest rates, or even figuring out how much time you've spent on different activities, percentages are a useful tool. By learning how to express quantities as percentages, you gain a powerful skill for interpreting and analysing everyday situations.

#### REINFORCEMENT ACTIVITIES

##### "Percentage Scavenger Hunt"

**Purpose:** This game will help you get comfortable with the concept of percentages by finding real-life examples around you. You'll work in teams to find items and situations that represent different percentages.

##### Instructions:

##### 1. Form Teams:

- o Put yourself into small teams of 3-4 learners.

##### 2. Scavenger Hunt Task:

- o Your task is to find or think of as many examples of percentages as you can within the classroom or school environment. Here are some ideas to get you started:
  - A sign showing a discount percentage in the school store or cafeteria.

- A textbook with a percentage mentioned (like 75% of learners like maths).
- A sports scoreboard showing win/loss percentages.
- A food package showing a percentage of a daily value of a nutrient.

### 3. Recording Your Findings:

- o Write down each example you find, including what it represents and the percentage shown.
- o For each percentage, try to explain what it means in words (e.g., “This 20% off sign means we pay 80% of the original price”).

### 4. Sharing and Discussion:

- o After 10 minutes, gather back as a class.
- o Each team will share one or two examples they found, and we’ll discuss what each percentage means.
- o We’ll also talk about why percentages are useful in these real-life situations.

### 5. Winning Team:

- o The team with the most accurate and interesting examples of percentages will win the scavenger hunt.

### Reflection:

- Think about why percentages are important and how often we see them in our daily lives. This activity will help you understand how to express one quantity as a percentage of another as we learn more about the concept of percentages in our lesson!

## WHAT IS A PERCENTAGE?

**Percentage** means “per hundred” or “out of 100” which is used to express a part of a hundred and is denoted by %. “**Percent**” comes from the Latin word ***Per Centum***. ***Centum*** means **100**, for example a Century is 100 years. Expressing one quantity as a percentage of another involves representing a part of a whole as a percentage.

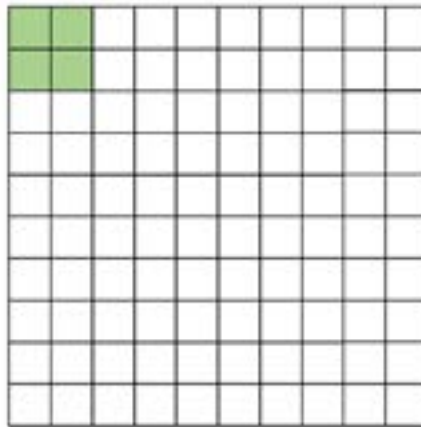
## Use of Percentages in real-life



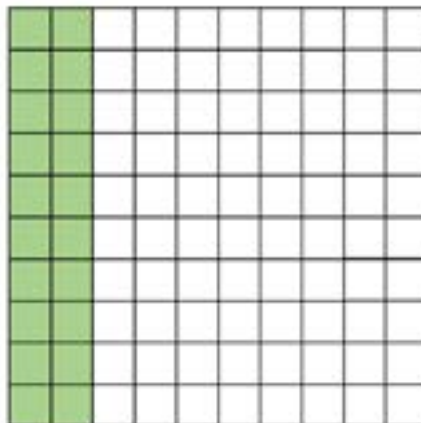
## Using models to represent percentages

### Examples

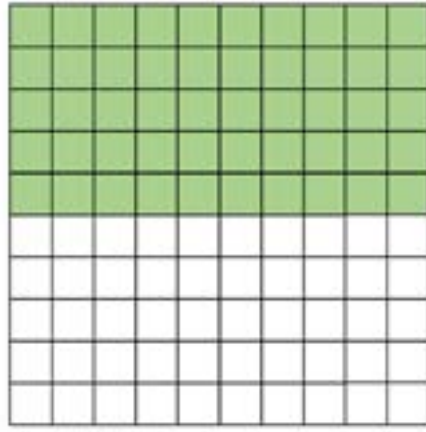
1. This is 10 by 10 grid which is made up of 100 square units. 4 out of 100 is shaded, representing 4% or  $\frac{4}{100}$



2. This is 20 out of 100. That is 20%



3. In a class of 100 learners, 50 of them are girls, what percentage of the class are girls?



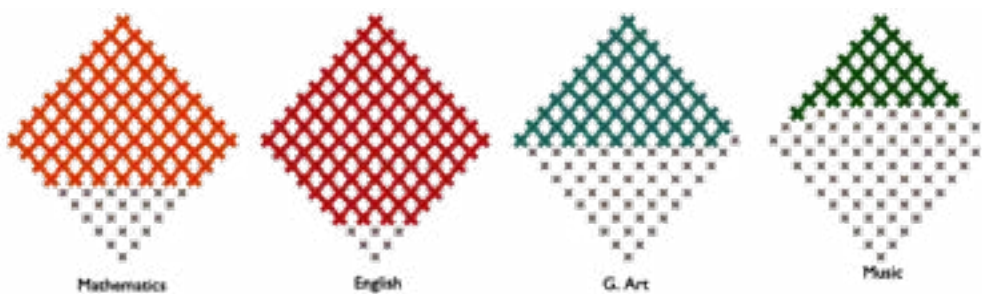
One-Half of the learners are girls and that is 50% of the learners in the class. 50% means 50 per 100 (50 out of 100)

More examples:  $70\% = \frac{70}{100}$ ,  $98\% = \frac{98}{100}$ ,  $120\% = \frac{120}{100}$

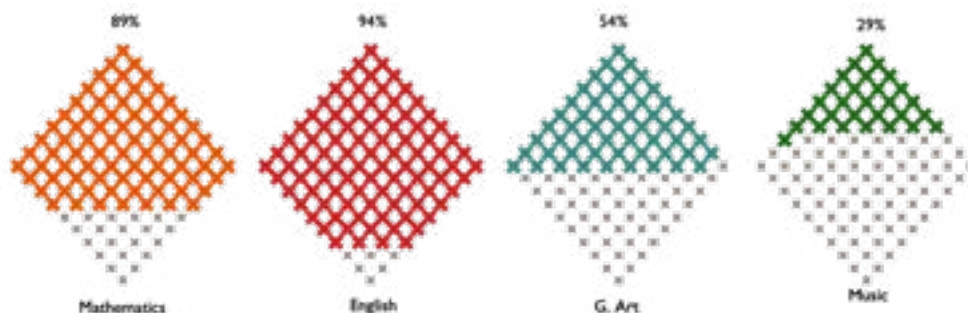
### Example

Kinata obtained the following percentage scores in four subjects during an end of term examination.

What is the percentage score of each subject if there are 100 cross signs in each chart?



### Solution



## EXPRESSING PERCENTAGES AS FRACTIONS AND DECIMALS

When we express a percentage as a fraction or a decimal, we are simply changing the way we represent that part of a whole. A percentage tells us how many parts out of 100 we have, and it can be easily converted into both fractions and decimals.

- **As a Fraction:** A percentage can be expressed as a fraction by placing the percentage number over 100. This fraction can often be simplified by dividing both the numerator and the denominator by their highest common factor (HCF).
- **As a Decimal:** A percentage can be expressed as a decimal by dividing the percentage by 100. This is done by moving the decimal point two places to the left.

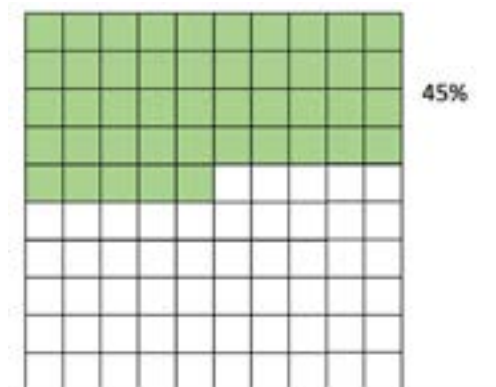


### Expressing percentages as fractions

**Example 1: Express 45% as a fraction.**

**Solution**

This can be represented in the diagram as;



From the diagram, 45 square units out of 100 has been shaded. This implies;  $\frac{45}{100} = \frac{9}{20}$

Therefore,  $45\% = \frac{9}{20}$

This implies that, converting percentages to fractions simply means divide the percentage value by 100 and reducing the fraction to the lowest form.



**Examples;**

1. Express 30% as a fraction.

$$30\% = \frac{30}{100} = \frac{3}{10}$$

2. Kwame scored 75% in a test. Express his scores in a fraction form.

$$75\% = \frac{75}{100} = \frac{3}{4}$$

3. Express  $20\frac{1}{2}\%$  as fraction.

$$\begin{aligned} 20\frac{1}{2}\% &= \frac{20\frac{1}{2}}{100} \\ &= \frac{41}{2} \times \frac{1}{100} \\ &= \frac{41}{200} \end{aligned}$$

**ACTIVITY 2.4: Individual/Pair/Group Work****Expressing Percentages as Fractions**

**Purpose:** To reinforce the concept of converting percentages into fractions and simplifying them.

**Materials Needed:**

- Paper and pencils
- Fraction cards (optional)
- Whiteboard and markers (optional)

**Activity Instructions:**

1. **Warm-Up:** Recall what you know about percentages and fractions. Write down any percentage you know, for example, 50%, 25%, 75%, etc.
2. **Percentage to Fraction Conversion:**
  - Take the percentage you wrote in the warm-up activity.
  - Convert that percentage into a fraction by writing it over 100.
  - For example, if you chose 50%, you would write  $\frac{50}{100}$ .
  - Now, simplify the fraction by finding the highest common factor (HCF) of the numerator and denominator and divide both by it.
    - o Example:  $\frac{50}{100}$  simplifies to  $\frac{1}{2}$  because 50 and 100 can both be divided by 50, the HCF.

**3. Pair Activity:**

- Pair up with a classmate.
- Each of you will pick a percentage between 1% and 100%.
- Convert your percentage into a fraction and simplify it.
- Exchange your work with your partner and check each other's answers.
- Discuss with your partner how you arrived at your answers.

**4. Class Discussion:**

- Share your percentages and fractions with the class.
- Discuss any challenges you faced while simplifying the fractions.
- You will go over some more examples on the whiteboard to ensure everyone understands the process.

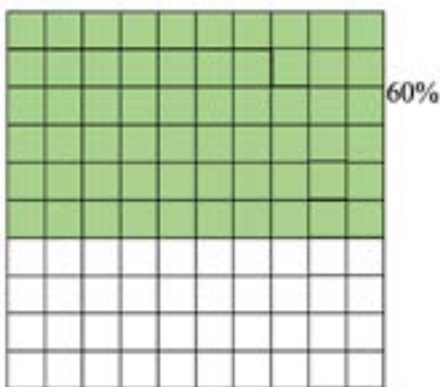
- 5. Reflection:** Write a short paragraph on what you learned during this activity. Include how you felt about converting percentages to fractions and any strategies that helped you simplify the fractions more easily.

**Extension Activity:** For homework, find 5 items at home that list a percentage (such as 20% off on a product, 100% juice on a label, etc.), and convert these percentages into fractions. Bring your work to the next class to share with your classmates.

## Expressing percentages to decimals

### Example 1:

Express 60% as a decimal



Based on previous lessons, we learnt that;

$$\frac{1}{10} = 0.1$$

$$\frac{1}{100} = 0.01$$

$$\frac{1}{1000} = 0.001$$

$$\frac{4}{100} = 0.04$$

Therefore, from the diagram, 60% means  $\frac{60}{100} = \frac{6}{10} = 0.6$

In general terms, to convert a percentage to decimal, simply move the decimal point from left to right twice.

### Example 2:

Express 47% as a decimal.

$$47\% = .47$$

$$47\% = \frac{47}{100} = 0.47$$

### Example 3:

Convert the following percentages to fractions and then to decimals:

- a. 73%
- b. 82.4%
- c. 129%
- d. 8.6%

### Solution

- a.  $73\% = \frac{73}{100} = 0.73$
- b.  $82.4\% = \frac{82.4}{100} = 0.824$
- c.  $129\% = \frac{129}{100} = 1.29$
- d.  $8.6\% = \frac{8.6}{100} = 0.086$

## ACTIVITY 2.5: Individual/Pair/Group Work

### Expressing Percentages as Decimals

**Purpose:** To practise and reinforce the skill of converting percentages into decimals.

#### Materials Needed:

- Paper and pencils
- Percentage cards (optional)
- Whiteboard and markers (optional)

**Instructions:**

- 1. Warm-Up:** Think about what you know about percentages and decimals. Write down three different percentages that come to mind, such as 25%, 50% or 75%.
- 2. Percentage to Decimal Conversion:**
  - Take the percentage you wrote in the warm-up activity.
  - Convert each percentage into a decimal by dividing the percentage by 100.
    - For example, 25% becomes 0.25 because  $25 \div 100 = 0.25$ .
    - Write down the decimal for each percentage on your paper.
- 3. Pair Activity:**
  - Pair up with a classmate.
  - Each of you will pick three new percentages between 1% and 100%.
  - Convert your percentages into decimals.
  - Exchange your work with your partner and check each other's answers.
  - If there are any differences, discuss how you each arrived at your answers.
- 4. Class Discussion:**
  - Share the percentages and their corresponding decimals with the class.
  - Your teacher will write a few examples on the whiteboard to ensure everyone understands the conversion process.
  - Discuss any challenges or patterns you noticed while converting percentages to decimals.
- 5. Reflection:** Write a short paragraph about what you learned during this activity. Consider how converting percentages to decimals is useful in real-life situations, such as calculating discounts or understanding statistics.

**Extension Activity:**

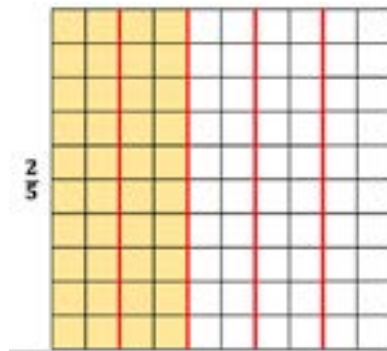
For homework, find 5 examples in your daily life where percentages are used (such as in advertisements, recipes, or reports), and convert those percentages into decimals. Bring your work to the next class to discuss with your classmates.

## Converting fractions and decimals to percentages

### Examples

1. Express  $\frac{2}{5}$  as a percentage

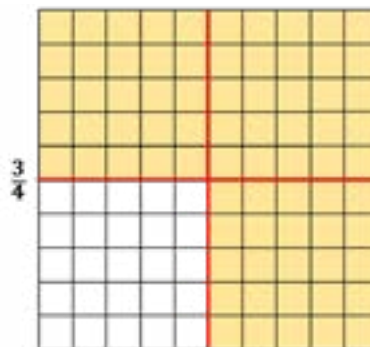
- Draw a grid of 10 by 10 to get 100 small units.
- Divide the grid into 5 equal parts and shade 2 as shown below.



- Count the number of square units shaded. There are 40 square units shaded out of 100 square units.
- This implies that  $\frac{2}{5} = \frac{40}{100} = 40\%$

2. Express  $\frac{3}{4}$  as a percentage

- From the 10 by 10 grid, divide the grid into 4 equal parts and shade 3 as shown below.



- Count the number of square units shaded. There are 75 square units shaded out of 100 square units.
- This implies that  $\frac{3}{4} = \frac{75}{100} = 75\%$

From the two illustrations above, fractions can be converted to a percentage by multiplying the fraction by 100. That is

$$\frac{2}{5} \times 100 = \frac{200}{5} = 40\%.$$



Again

$$\frac{3}{4} \times 100 = \frac{300}{4} = 75\%$$

3. Express the following fractions as percentage.

a.  $\frac{3}{5}$

b.  $\frac{1}{3}$

c.  $1\frac{3}{4}$

**Solution**

a.  $\frac{3}{5} = \frac{3}{5} \times 100$   
 $= \frac{300}{5} = 60\%$

b.  $\frac{1}{3} = \frac{1}{3} \times 100$   
 $\frac{100}{3} = 33.3\%$

c.  $1\frac{3}{4} = \frac{1 \times 4 + 3}{4}$   
 $= \frac{7}{4} \times 100$   
 $= \frac{700}{4} = 175\%$

### ACTIVITY 2.6: Individual/Pair/Group Work

#### Converting Fractions and Decimals to Percentages

**Purpose:** To practise and reinforce the skill of converting fractions and decimals into percentages.

#### Materials Needed:

- Paper and pencils
- Fraction and decimal cards (optional)
- Calculators (optional)
- Whiteboard and markers (optional)

#### Instructions:

1. **Warm-Up:** Think about what you know about fractions, decimals, and percentages. Write down one fraction and one decimal that you are familiar with. For example, you might write  $\frac{1}{2}$  or 0.75.

**2. Fraction to Percentage Conversion:**

- Take the fraction you wrote down in the warm-up activity.
- Convert this fraction into a percentage by following these steps:
  - o First, divide the numerator by the denominator to convert the fraction to a decimal.
  - o Then, multiply the decimal by 100 to convert it to a percentage.
  - o For example,  $\frac{1}{2}$  becomes 0.5 and  $0.5 \times 100 = 50\%$ , so  $\frac{1}{2} = 50\%$ .
- Write down the percentage next to the fraction on your paper.

**3. Decimal to Percentage Conversion:**

- Take the decimal you wrote down in the warm-up activity.
- Convert this decimal into a percentage by multiplying it by 100.
  - o For example,  $0.75 \times 100 = 75\%$ , so  $0.75 = 75\%$ .
- Write down the percentage next to the decimal on your paper.

**4. Group Activity:**

- Form small groups of 3-4 learners.
- Each group will receive a set of fraction and decimal cards (or create your own fractions and decimals).
- As a group, convert each fraction and decimal to a percentage.
- Write your conversions on a large sheet of paper or whiteboard.

**5. Class Discussion:**

- Share your group's conversions with the class.
- Discuss any patterns you noticed, such as how fractions like  $\frac{1}{4}$  or  $\frac{3}{4}$  convert to percentages (25% and 75%, respectively).
- If there were any challenges, talk about how you overcame them.

- 6. Reflection:** Write a short paragraph about the importance of converting fractions and decimals to percentages. Think about how percentages are used in everyday life, such as in discounts, statistics or measurements.

**Extension Activity:**

For homework, find 5 examples where fractions or decimals are used in real life (such as in recipes, sports statistics, or measurements) and convert them to percentages. Bring your examples to the next class to share with your classmates.

## Converting decimals to percentages

In general, to convert a decimal to a percentage, you multiply by 100. This is the same as moving the decimal point two places to the right.


### Examples

1. Express the following decimals as percentages:

- |         |         |
|---------|---------|
| a. 0.8  | b. 0.45 |
| c. 2.05 | d. 0.07 |

### Solution

a.  $0.8 \times 100 = 80\%$

$$0.8 \times 100 = 0.80$$


b.  $0.45 \times 100 = 45\%$

c.  $2.05 \times 100 = 205\%$

d.  $0.07 \times 100 = 7\%$

### ACTIVITY 2.7: Individual/Pair/Group Work

#### Converting Decimals to Percentages

**Purpose:** To reinforce your understanding of how to convert decimals into percentages through practical exercises.

#### Materials Needed:

- Paper and pencils
- Decimal cards (optional)
- Calculators (optional)
- Whiteboard and markers (optional)

#### Instructions:

1. **Warm-Up Exercise:** Think about what you already know about decimals and percentages. Write down a decimal that you see or use in daily life. For example, you might write 0.25 or 0.85.
2. **Decimal Conversion Practice:**
  - Take the decimal you wrote during the warm-up exercise.

- Convert this decimal into a percentage by multiplying it by 100.
  - For example,  $0.25 \times 100 = 25\%$ , so  $0.25 = 25\%$ .
- Write down the percentage next to the decimal on your paper.

### 3. Pair Work Activity:

- Pair up with a classmate.
- Each pair will take turns selecting a decimal from a set of provided decimal cards (or create your own decimals).
- Convert each decimal to a percentage and write down your answers.
- Compare your answers with your partner to ensure you both have the same result. If you disagree, discuss and find the correct answer together.

### 4. Group Challenge:

- Form small groups of 3-4 learners.
- Your group will receive a list of decimal numbers.
- Work together to convert each decimal into a percentage as quickly and accurately as possible.
- The first group to correctly convert all decimals to percentages wins a small prize or recognition.

### 5. Class Sharing and Discussion:

- Each group shares their answers with the class.
- Discuss any decimals that were challenging to convert and how you solved them.
- Talk about why it's useful to convert decimals to percentages, such as in understanding discounts, grades or data.

6. **Reflection:** On your own, write a short paragraph explaining why converting decimals to percentages is important. Think about situations where you might need to use this skill outside of school, like when shopping or analysing statistics.

### Extension Activity:

For homework, find 5 examples of decimals in real life (such as in store prices, measurements, or sports scores) and convert them to percentages. Bring your examples to the next class to share with your classmates.

## Expressing one quantity as a percentage of another

From the outset, we established that percentages are used in everyday life. For example, sales discounts, population growth rates or exam scores etc. In this aspect, we want to find what percentage one quantity represents of another.

To express one quantity as a percentage of another:

- write a fraction with the ‘part amount’ as the numerator and the ‘whole amount’ as the denominator.
- convert the fraction to a percentage by multiplying by 100.

### Examples

1. Akosua scored 16 out of 20 in a test. Express her marks as a percentage.

### Solution

The 16 represents the ‘**part**’ we are to express as a percentage out of 20, which is the ‘**whole**’.

$$\begin{aligned}\frac{16}{20} \times 100 &= \frac{1600}{20} \\ &= 80\%\end{aligned}$$

2. If a class has 40 learners, and 22 of them are studying Mathematics, what percentage of the class is studying Mathematics?

### Solution

The 22 represent the ‘**part**’ and the 40 is the ‘**whole**’.

$$\begin{aligned}\frac{22}{40} \times 100 &= \frac{2200}{40} \\ &= 55\%\end{aligned}$$

3. Akoto weighs 18kg. His father weighs 74kg. What percentage of her father’s weight does Akoto weigh, correct to one decimal place?

### Solution

The 18kg represent the ‘**part value**’ and the 74kg is the ‘**whole**’.

$$\begin{aligned}\frac{18}{74} \times 100 &= \frac{1800}{74} \\ &= 24.3\%\end{aligned}$$



**ACTIVITY 2.8: Individual/Pair/Group Work****Expressing One Quantity as a Percentage of Another**

**Purpose:** To practise expressing one quantity as a percentage of another through interactive and practical exercises.

**Materials Needed:**

- Paper and pencils
- Calculators (optional)
- Rulers (for drawing diagrams, optional)
- Small items for counting (e.g., coins, counters, or small objects)

**Instructions:**

1. **Warm-Up Exercise:** Think of a situation where you need to compare two quantities. For example, if you have 8 apples and 20 oranges, you might want to know what percentage of the total fruit is apples.
2. **Percentage Calculation Practice:**
  - Each learner will receive a list of pairs of quantities.
  - For each pair, express the first quantity as a percentage of the second quantity.
    - o For example, if you have 12 pencils out of a total of 30 pencils, calculate the percentage of pencils you have.
  - Write down your percentage calculations and answers.
    - o To calculate:  $\text{Percentage} = \left(\frac{\text{Part}}{\text{Whole}}\right) \times 100$
3. **Practical Application:**
  - Divide into small groups of 3-4 learners.
  - Each group will receive a bag of small items (e.g., 20 coins, 30 counters) and a set of scenarios where they need to find the percentage.
    - o Example scenarios:
      - **Scenario 1:** Out of 30 counters, 12 are red. What percentage of the counters are red?
      - **Scenario 2:** In a basket of 50 fruits, 15 are apples. What percentage of the fruits are apples?

- Use the items to physically count and calculate the percentage for each scenario.
- Discuss your findings with your group members and compare answers.

#### 4. Creative Challenge:

- Each group will create a simple visual representation (like a bar or pie chart) showing the percentage of one quantity in relation to another.
  - o For example, draw a pie chart showing what percentage of a basket's total fruits are apples versus oranges.
- Present your visual representations to the class and explain how you calculated the percentages.

#### 5. Class Sharing and Discussion:

- Share your answers and visual representations with the class.
- Discuss any difficulties you encountered and how you solved them.
- Reflect on why it's useful to express one quantity as a percentage of another, such as understanding proportions in recipes, analysing survey data, or interpreting results.

- 6. Reflection:** Write a brief paragraph about a real-life situation where expressing one quantity as a percentage of another is important. Consider situations like budgeting, sports statistics, or shopping discounts.

#### Extension Activity:

For homework, find three real-life examples where you need to calculate the percentage of one quantity in relation to another. Record your findings and bring them to the next class to share with your peers.

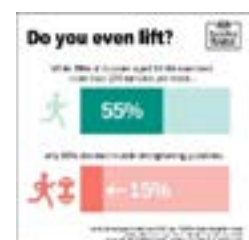
## APPLICATION OF PERCENTAGES

### FOCAL AREA: USE PERCENTAGES TO SOLVE REAL-LIFE PROBLEMS

Imagine you're planning to buy a new video game that costs GH¢60. The store is having a sale and they are offering a 25% discount on all games. To get the best deal, you need to know how much you'll actually pay after the discount. This situation is a perfect example of why understanding percentages is so important.

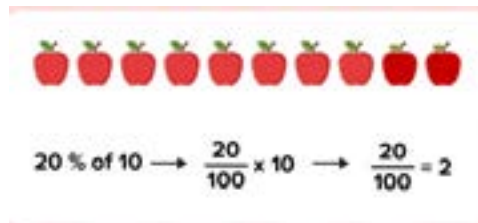
### Why Are Percentages Important?

1. **Shopping and Discounts:** When shopping, percentages help you understand how much money you'll save on sales and discounts. Knowing how to calculate this ensures you make informed purchasing decisions and manage your money wisely.
2. **Finance and Budgeting:** Percentages are used to calculate interest rates on savings and loans. Understanding this can help you make better financial decisions, whether you're saving for a goal or taking out a loan.
3. **Cooking and Recipes:** Percentages help you adjust recipes based on the number of servings you need. For example, if a recipe serves 4 but you need it to serve 10, knowing how to scale ingredients using percentages ensures you get the right quantities.
4. **Health and Fitness:** Percentages are used in health metrics, like body fat percentage or nutrient content on food labels. This helps you make healthier choices and track your progress towards fitness goals.



## Finding Percentage of a Quantity

Take a look at the picture. There are 10 apples. Let's find out the number of apples that represent 20%?



Now let's solve some more examples.

### Example 1:

Find 30% of GH¢ 200.00.

### Solution

$$30\% = \frac{30}{100} = 0.30$$

Multiply the fraction or the decimal by the quantity:

$$\frac{30}{100} \times 200 = \text{GH¢ } 60.00$$

In other words,

$$0.30 \times 200 = \text{GH¢ } 60.00$$

Therefore, 30% of GH¢ 200.00 is GH¢ 60.00

### Example 2:

In a class of 80 learners, 75% passed a test.

- a) How many learners passed?
- b) How many learners failed?

### Solution

a)  $\frac{75}{100} \times 80 = 60$  learners passed.

- b) *Number who failed = Total number of students – Number of students of students who passed.*  
 $= 80 - 60 = 20$  learners failed.

**Example 3:**

Of the pupils in a class 46% are males. If there are 50 pupils altogether, how many of them are females?

**Solution**

$$\text{Number of males} = \frac{46}{100} \times 50 = 23 \text{ males}$$

$$\text{Number of females} = \text{Total number of pupils} - \text{Number of males}$$

$$\text{Number of females} = 50 - 23 = 27 \text{ females}$$

**ACTIVITY 2.9: Individual/Pair/Group Work****Finding a Percentage of a Quantity**

**Purpose:** Practise finding the percentage of a given quantity using real-life scenarios.

**Materials Needed:**

- Paper
- Pencils or pens
- Calculators (optional)
- Worksheets with scenarios (provided below)

**Instructions:****1. Read Each Scenario Carefully:**

- o For each scenario provided, you will need to calculate the percentage of the given quantity.

**2. Calculate the Percentage:**

- o Use the formula:  $\text{Percentage of a Quantity} = \left(\frac{\text{Percentage}}{100}\right) \times \text{Total Quantity}$
- o Perform the calculations to find the answers.
- o Write down the percentage you calculated for each scenario in the provided space.
- o After completing the activity, compare your answers with a partner and discuss any differences.

**Scenarios:****1. Scenario 1:**

- o You have a jar with 120 marbles. If 25% of the marbles are blue, how many blue marbles are there in the jar?

**2. Scenario 2:**

- o A book has 200 pages. If you have read 40% of the book, how many pages have you read?

**3. Scenario 3:**

- o A class of 30 learners took a quiz. If 60% of the learners scored above 80%, how many learners scored above 80%?

**4. Scenario 4:**

- o You bought a shirt originally priced at \$50. The store offers a 15% discount. How much money will you save with the discount?

**5. Scenario 5:**

- o A garden has 50 flowers. If 10% of the flowers are roses, how many roses are there in the garden?

**Worksheet:**

Scenario	Percentage	Total Quantity	Calculation	Answer
Scenario 1	25%	120 marbles	$\left(\frac{25}{100}\right) \times 120$	
Scenario 2	40%	200 pages	$\left(\frac{40}{100}\right) \times 200$	
Scenario 3	60%	30 learners	$\left(\frac{60}{100}\right) \times 30$	
Scenario 4	15%	GH¢50	$\left(\frac{15}{100}\right) \times 50$	
Scenario 5	10%	50 flowers	$\left(\frac{10}{100}\right) \times 50$	

**Extension:**

- Once you've completed the scenarios, create your own real-life problem where you need to find a percentage of a quantity and solve it.

**Discussion Points:**

- How did you find the percentage of the quantity?
- Were there any challenges you faced while calculating the answers?



- How can knowing how to find percentages help you in daily life?

Remember to ask your classmates or teacher if you have any questions or need further assistance!

## Use Percentages to Compare and Order Fractions

To compare and order fractions using percentages, first, convert each fraction into its equivalent percentage. To convert a fraction to a percentage, divide the numerator by the denominator, then multiply by 100.

To convert a fraction to a percentage, multiply the fraction by 100.

$$\frac{a}{b} \times 100 = \frac{100a}{b}$$

To write a decimal as a percentage, multiply the decimal by 100.

### Example 1:

Compare  $\frac{2}{3}$  and  $\frac{3}{4}$

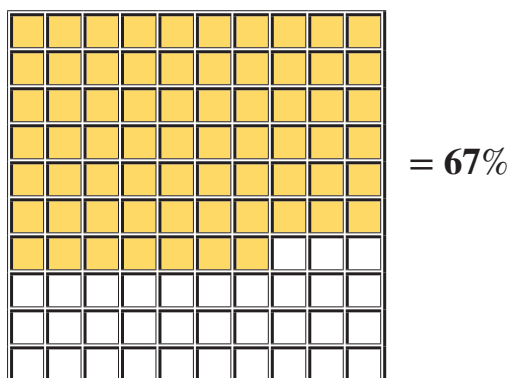
### Solution

First, express  $\frac{2}{3}$  and  $\frac{3}{4}$  as percentages

$$\frac{2}{3} \times 100\%$$

$\frac{2}{3}$  can be written in a decimal form as  
 $0.66667 \approx 0.67$  ( $2 \div 3$ )

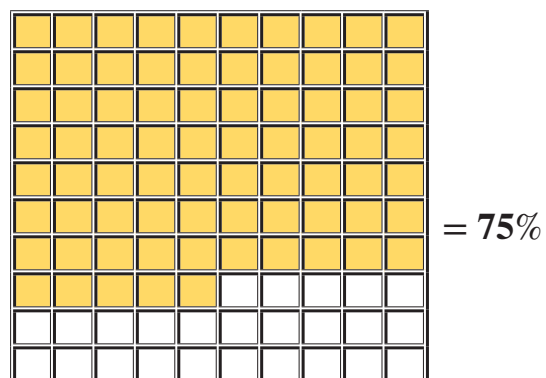
$$0.67 \times 100\% = 67\%$$



$$\frac{3}{4} \times 100\%$$

$\frac{3}{4}$  can be written in a decimal form as  
 $0.75$

$$0.75 \times 100\% = 75\%$$



Since 67% is smaller than 75%, it implies that  $\frac{2}{3} < \frac{3}{4}$  or  $\frac{3}{4} > \frac{2}{3}$

**Example 2:**

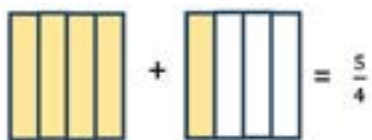
Compare  $1\frac{1}{4}$  and  $\frac{1}{4}$

**Solution**

Since  $1\frac{1}{4}$  is a mixed fraction, first convert it to an improper fraction.

$$1\frac{1}{4} = \frac{1 \times 4 + 1}{4} \\ = \frac{5}{4}$$

$1\frac{1}{4}$  can be modelled as;



Then express  $\frac{5}{4}$  as a percentage,  $\frac{5}{4} \times 100\% = 1.25 \times 100\% = 125\%$

$$\frac{1}{4} \times 100\% = 25\%$$

$$1\frac{1}{4} > \frac{1}{4} \text{ as } 125\% > 25\%$$

**ACTIVITY 2.10: Individual/Pair/Group Work****Using Percentages to Compare and Order Fractions**

**Purpose:** Practise converting fractions to percentages to compare and order them.

**Materials Needed:**

- Paper
- Pencils or pens
- Calculators (optional)
- Worksheet with fractions (provided below)

**Instructions:****1. Convert Each Fraction to a Percentage:**

- For each fraction given in the table below, convert it to a percentage using the formula:

$$\text{Percentage} = \left( \frac{\text{Numerator}}{\text{Denominator}} \right) \times 100$$

- Write the percentage in the appropriate column.

## 2. Compare the Percentages:

- Once you have the percentages, compare them to determine which fraction represents the largest and which represents the smallest value.
- Write the fractions in order from smallest to largest based on their percentage values.

## 3. Order the Fractions:

- After comparing the percentages, list the original fractions in order from smallest to largest.

### Fractions to Convert and Compare:

Fraction	Percentage Calculation	Percentage	Order from Smallest to Largest
$\frac{1}{4}$	$\left(\frac{1}{4}\right) \times 100$		
$\frac{3}{5}$	$\left(\frac{3}{5}\right) \times 100$		
$\frac{2}{3}$	$\left(\frac{2}{3}\right) \times 100$		
$\frac{5}{8}$	$\left(\frac{5}{8}\right) \times 100$		
$\frac{7}{10}$	$\left(\frac{7}{10}\right) \times 100$		

## 4. Discuss Your Findings:

- Share your results with a classmate or in a group.
- Discuss any challenges you faced during the conversion and ordering process.

## 5. Extension Activity:

- Create your own set of fractions, convert them to percentages and then compare and order them. Share your results with a partner.

## 6. Discussion Questions:

- Why is it useful to convert fractions to percentages for comparison?

- How does this method help in understanding the relative sizes of different fractions?
- Can you think of any real-life situations where comparing fractions as percentages would be useful?

## Finding the Percentage Increase or Decrease of a Given Quantity

Percentage increase or decrease is a concept used to measure the change in a quantity relative to its original value over time.

$$\text{Percentage Increase} = \left( \frac{\text{Increase in value}}{\text{Original value}} \right) \times 100\%$$

$$\text{Percentage Decrease} = \left( \frac{\text{Decrease in value}}{\text{Original value}} \right) \times 100\%$$

### Percentage Increase

#### Example 1:

The price of a bag of rice increased from GH¢ 80.00 to GH¢ 96.00. The increase in value is GH¢ 16.00. Find the percentage increase.

#### Solution:

**1. Identify the increase in value:**

$$\text{Increase in value} = \text{GH¢}96.00 - \text{GH¢}80.00 = \text{GH¢}16.00$$

**2. Calculate the percentage increase:**

$$\text{Percentage Increase} = \left( \frac{\text{Increase in value}}{\text{Original value}} \right) \times 100$$

$$\text{Percentage Increase} = \left( \frac{\text{GH¢}16.00}{\text{GH¢}80.00} \right) \times 100$$

$$\text{Percentage Increase} = 0.2 \times 100 = 20\%$$

**Answer:** The percentage increase is **20%**.

#### Example 2:

If the price of fuel increased from GH¢ 50.00 to GH¢ 60.00, the increase in value is GH¢ 10.00. Find the percentage increase.

#### Solution

$$\begin{aligned} \text{Percentage Increase} &= \frac{10}{50} \times 100\% \\ &= 20\% \end{aligned}$$

## Percentage Decrease

To decrease a quantity by a certain percentage, we subtract the percentage of the new quantity from the original quantity.

### Example 1:

The price of a laptop decreased from GH¢ 2 000.00 to GH¢ 1 800.00. The decrease in value is GH¢ 200.00.

Find the percentage decrease.

### Solution:

**1. Identify the decrease in value:**

$$\text{Decrease in value} = \text{GH¢}2\,000.00 - \text{GH¢}1\,800.00 = \text{GH¢}200.00$$

**2. Calculate the percentage decrease:**

$$\text{Percentage Decrease} = \left( \frac{\text{Decrease in value}}{\text{Original value}} \right) \times 100$$

$$\text{Percentage Decrease} = \left( \frac{\text{GH¢}200.00}{\text{GH¢}2\,000.00} \right) \times 100$$

$$\text{Percentage Decrease} = 0.1 \times 100 = 10\%$$

**Answer:** The percentage decrease is **10%**.

### Example 2:

The price of fuel decreased from GH¢ 60.00 to GH¢ 50.00, the decrease in value is GH¢ 10.00.

Find the percentage decrease.

$$\begin{aligned} \text{Percentage Decrease} &= \frac{10}{60} \times 100\% \\ &= 16.67\% \end{aligned}$$

**ACTIVITY 2.11: Individual/Pair/Group Work****Finding the Percentage Increase or Decrease of a Given Quantity**

**Purpose:** To help you understand how to calculate the percentage increase or decrease of a given quantity through real-life scenarios.

**Instructions:****1. Scenario 1: Price Increase**

- o Imagine you are a shopkeeper who sells notebooks. Last month, you were selling a notebook for GH¢ 10.00. This month, the price increased to GH¢ 12.00.
- o **Task:** Calculate the percentage increase in the price of the notebook.
- o **Steps:**
  - i. Find the difference between the new price and the old price.
  - ii. Divide the difference by the old price.
  - iii. Multiply the result by 100 to find the percentage increase.
- o **Record your work:** Write down the original price, the new price, and show your calculations step-by-step to find the percentage increase.

**2. Scenario 2: Price Decrease**

- o Imagine your favourite fruit at the market is apples. Last week, the price of apples was GH¢ 80.00 per kilogram. This week, the price dropped to GH¢ 60.00 per kilogram.
- o **Task:** Calculate the percentage decrease in the price of apples.
- o **Steps:**
  - i. Find the difference between the old price and the new price.
  - ii. Divide the difference by the old price.
  - iii. Multiply the result by 100 to find the percentage decrease.
- o **Record your work:** Write down the original price, the new price, and show your calculations step-by-step to find the percentage decrease.



### 3. Scenario 3: Bonus Marks

- o Your teacher decided to give you bonus marks for completing an assignment. Initially, your score was 40 out of 50. After adding the bonus, your score increased to 45 out of 50.
- o **Task:** Calculate the percentage increase in your score due to the bonus marks.
- o **Steps:**
  - i. Find the difference between your new score and your original score.
  - ii. Divide the difference by the original score.
  - iii. Multiply the result by 100 to find the percentage increase.
- o **Record your work:** Write down the original score, the new score, and show your calculations step-by-step to find the percentage increase.

#### Reflection Questions:

1. How does understanding percentage increase and decrease help you in everyday situations?
2. Can you think of other real-life scenarios where you might need to calculate a percentage increase or decrease?

**Note:** Make sure to double-check your calculations and discuss any difficulties you encounter with your classmates or teacher.

## Increasing or Decreasing a Quantity by a Given Percentage

To increase or decrease a quantity by certain percentage; Assume the original quantity is 100%. If the percentage increase is  $x\%$ , then the new quantity will be  $(100\% + x\%)$  of the original.

**Increasing a Quantity:** To increase a quantity by a certain percentage, we add the percentage of the increase to the original 100% and then multiply it by the original quantity. The formula for increasing a quantity by a percentage is:

#### Method 1

$$\text{New Quantity} = \frac{(100 + \text{Percentage Increase})}{100} \times \text{Original Quantity}$$

For example, if we want to increase a quantity by 20%, we add 20% to 100 and divide by 100. This gives us the percentage multiplier, 1.2. If the original quantity is 100, the new quantity would be:

$$\text{New Quantity} = \left( \frac{100 + 20}{100} \right) \times 100$$

$$1.2 \times 100 = 120$$

or

### Method 2

$$\text{New Quantity} = \text{Original Quantity} + \left( \frac{\text{Percentage Increase}}{100 \times \text{Original Quantity}} \right)$$

For example, if we want to increase a quantity by 20%, we add 20% of the original quantity to the original quantity. If the original quantity is 100, the new quantity would be:

$$\text{New Quantity} = 100 + \left( \frac{20}{100} \times 100 \right)$$

$$100 + 20 = 120$$

### Example 1

A pack of exercise books which costs GH¢ 250.00 is increased by 60%. What is the new price of the exercise books?

### Solution

#### Method 1

$$\text{New Price} = \frac{(100 + \text{Percentage Increase})}{100} \times \text{Original Price}$$

$$\text{New price} = \frac{100 + 60}{100} \times \text{GH¢ } 250$$

$$\text{New Price} = \frac{160}{100} \times \text{GH¢ } 250$$

$$\text{New Price} = \text{GH¢ } 400.00$$

#### Method 2

$$\text{New price} = \text{Original Price} + \left( \frac{\text{Percentage Increase}}{100} \times \text{Original price} \right)$$

$$\text{New price} = \text{GH¢ } 250 + \left( \frac{60}{100} \times \text{GH¢ } 250 \right)$$

$$\text{New price} = \text{GH¢ } 250 + \text{GH¢ } 150$$

$$\text{New price} = \text{GH¢ } 400.00$$

**Decreasing a Quantity:** To decrease a quantity by a certain percentage, we subtract the percentage decrease from the original 100% and then multiply it by the original quantity. The formula for decreasing a quantity by a percentage is:

### Method 1

$$\text{New Quantity} = \frac{(100 - \text{Percentage Decrease})}{100} \times \text{Original Quantity}$$

For example, if we want to decrease a quantity by 10%, we subtract 10% from 100 and divide by 100. This gives us the percentage multiplier, 0.9. If the original quantity is 200, the new quantity would be:

$$\text{New Quantity} = \left( \frac{100 - 10}{100} \right) \times 200$$

$$0.9 \times 200 = 180$$

### Method 2

$$\text{New Quantity} = \text{Original Quantity} - \left( \frac{\text{Percentage Decrease}}{100} \times \text{Original Quantity} \right)$$

For instance, if we want to decrease a quantity by 10%, we subtract 10% of the original quantity from the original quantity. If the original quantity is 200, the new quantity would be:

$$\text{New Quantity} = 200 - \left( \frac{10}{100} \times 200 \right)$$

$$200 - 20 = 180$$

### Example 2:

A pack of exercise books which costs GH¢ 250.00 is decreased by 60%, what is the new price of the exercise books?

### Method 1

$$\text{New price} = \frac{(100 - \text{Percentage Decrease})}{100} \times \text{Original price}$$

$$\text{New price} = \frac{(100 - 60)}{100} \times \text{GH¢ } 250$$

$$\text{New price} = 4 \frac{0}{100} \times 250$$

$$\text{New price} = \text{GH¢ } 100.00$$

### Method 2

$$\text{New price} = \text{Original price} - \left( \frac{\text{Percentage Decrease}}{100} \times \text{Original price} \right)$$

$$\text{New price} = \text{GH¢ } 250.00 - \left( \frac{60}{100} \times \text{GH¢ } 250.00 \right)$$

$$\text{New price} = \text{GH¢ } 250.00 - \text{GH¢ } 150.00$$

$$\text{New price} = \text{GH¢ } 100.00$$

### ACTIVITY 2.12: Individual/Pair/Group Work

#### Increasing or Decreasing a Quantity by a Given Percentage

**Purpose:** To help you practise how to increase or decrease a quantity by a given percentage using real-life examples.

#### Instructions:

##### 1. Scenario 1: Increasing Pocket Money

- o Imagine you receive weekly pocket money of GH¢ 50.00 from your parents. They decide to increase your pocket money by 10% because of your excellent performance in school.
- o **Task:** Calculate the new amount of pocket money you will receive after the 10% increase.
- o **Steps:**
  - i. Calculate 10% of GH¢ 50.00.
  - ii. Add this amount to your original pocket money to find the new total.
- o **Record your work:** Write down your original pocket money, the percentage increase, and show your calculations step-by-step to find the new pocket money.

##### 2. Scenario 2: Decreasing the Price of a Product

- o Imagine a store is having a sale and the price of a T-shirt is reduced by 20%.  
The original price of the T-shirt is GH¢ 40.00.
- o **Task:** Calculate the new price of the T-shirt after the 20% decrease.
- o **Steps:**
  - i. Calculate 20% of GH¢ 40.00.
  - ii. Subtract this amount from the original price to find the sale price.

- o **Record your work:** Write down the original price of the T-shirt, the percentage decrease, and show your calculations step-by-step to find the new price.

### 3. Scenario 3: Increasing Ingredients in a Recipe

- o You are baking a cake that requires 200 grams of sugar. You decide to increase the amount of sugar by 15% to make the cake sweeter.
- o **Task:** Calculate the new amount of sugar you will use in your recipe.
- o **Steps:**
  - i. Calculate 15% of 200 grams.
  - ii. Add this amount to the original quantity of sugar to find the new total.
- o **Record your work:** Write down the original amount of sugar, the percentage increase, and show your calculations step-by-step to find the new amount of sugar.

#### Reflection Questions:

1. How do you determine whether to add or subtract the percentage when increasing or decreasing a quantity?
2. Can you think of other situations where you might need to increase or decrease a quantity by a given percentage in real life?

# REVIEW QUESTIONS

## Solve the following questions

1. A bag contains red and blue marbles in the ratio 3:4. If there are 24 blue marbles, estimate the number of red marbles.
2. The ratio of boys to girls in a class is 2:3. If there are 30 girls, work out the number of boys.
3. In a recipe, the ratio of sugar to flour is 1:4. If you have 12 cups of flour, estimate the amount of sugar needed.
4. Express 25% as a fraction.
5. Express 40% as a fraction.
6. Express 75% as a fraction.
7. Express 65% as a decimal.
8. Express 15% as a decimal.
9. Express 90% as a decimal.
10. Convert  $\frac{1}{4}$  to a percentage.
11. Convert 0.25 to a percentage.
12. Convert  $\frac{1}{5}$  to a percentage.
13. The price of a book increased from GH¢40 to GH¢50. Find the percentage increase.
14. The number of learners decreased from 200 to 160. Find the percentage decrease.
15. A store reduced the price of a shirt from GH¢80 to GH¢60. Find the percentage decrease.
16. Increase GH¢120 by 15%.
17. Decrease 250 litres by 20%.
18. Increase 80 kg by 10%.
19. Compare  $\frac{3}{5}$  and  $\frac{4}{7}$  using percentages.
20. Compare  $\frac{1}{2}$  and  $\frac{3}{8}$  using percentages.



- 21. Compare  $\frac{3}{4}$  and  $\frac{1}{2}$  using percentages.
- 22. Find 20% of 150.
- 23. Find 35% of 400.
- 24. Find 15% of 60.
- 25. Express 25 as a percentage of 50.
- 26. Express 80 as a percentage of 200.
- 27. Express 15 as a percentage of 75.

## ANSWERS TO REVIEW QUESTIONS

1.  $3 \times 6 = 18$  red marbles
2. 20 boys
3. 3 cups of sugar
4.  $\frac{1}{4}$
5.  $\frac{2}{5}$
6.  $\frac{3}{4}$
7. 0.65
8. 0.15
9. 0.90
10. 75%
11. 25%
12. 40%
13. 25%
14. 20%
15. 25%
16. GH¢138
17. 200 litres
18. 88 kg
19.  $\frac{3}{5}$  (60%)  $>$   $\frac{4}{7}$  (57.14%)
20.  $\frac{5}{8}$  (62.5%)  $>$   $\frac{1}{2}$  (50%)
21.  $\frac{3}{4}$  (75%)  $>$   $\frac{2}{3}$  (66.67%)
22. 30
23. 140
24. 9
25. 50%
26. 40%
27. 20%

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