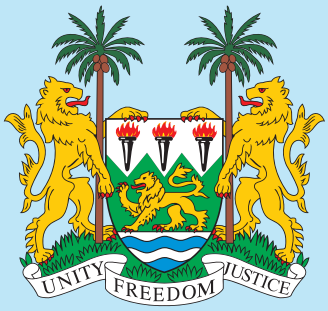


Free Quality School Education

Ministry of Basic and Senior Secondary Education

Pupils' handbook for

JSS Mathematics

JSS 1

Term 3

FOREWORD

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

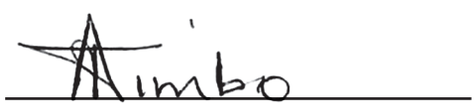
The Teachers' Guides give teachers the support they need to utilize appropriate pedagogical skills to teach; and the Pupils' Handbooks are designed to support self-study by the pupils, and to give them additional opportunities to learn independently.

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

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

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

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



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

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

To achieve this DO NOT WRITE IN THE BOOKS.

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Introduction

to the Pupils' Handbook

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

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

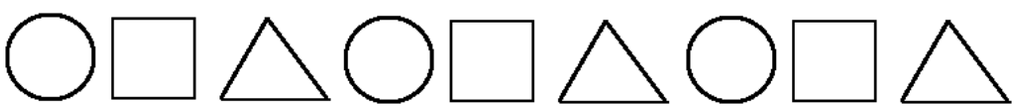
Learning Outcomes

Lesson Title: Identifying Number Patterns	**Theme:** Algebra
Practice Activity: PHM-07-106	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to identify and describe an arithmetic pattern from a list of numbers.

Overview

In a pattern, objects are arranged according to rules. For example, this is a pattern involving shapes:



We also have patterns of numbers. In mathematics, a list of numbers that follows a certain pattern can be referred to as a **sequence**. A pattern where the same number is added again and again to previous numbers is called an **arithmetic pattern** or **arithmetic sequence**.

In an arithmetic pattern, the difference between each term and the next term is constant. Remember that the difference between two numbers is what you get when you subtract the two numbers. This constant difference between the terms of an arithmetic pattern is called the **common difference.**

To determine if a list of numbers is an arithmetic pattern, you find the difference between each of the consecutive numbers. If the difference is the same, it is an arithmetic pattern.

Consider the number pattern: 5, 7, 9, 11, 13, …

Subtract the consecutive terms:

$7 - 5 = 2$ $9 - 7 = 2$ $11 - 9 = 2$ $13 - 11 = 2$

The difference between consecutive terms is always 2. This means that the list of numbers is an arithmetic pattern. The common difference is 2.

Solved Examples

1. Identify whether each of the following lists of numbers is an arithmetic pattern. If it is an arithmetic pattern, give the common difference:
    a. 1, 3, 5, 7, …
    b. 1, 2, 4, 8, 16, …
    c. 4, 6, 8, 10, …
    d. 1, 3, 6, 10, 15, …
    e. 10, 20, 30, 40, 50, …

Solutions

a. Subtract the consecutive numbers to find the differences:
   3 – 1 = 2 5 – 3 = 2 7 – 5 = 2
   The difference is always 2. This is an arithmetic pattern with a common difference of 2.

b. Subtract the consecutive numbers to find the differences:
   2 – 1 = 1 4 – 2 = 2 8 – 4 = 4 …
   There is not a common difference. This is **not** an arithmetic pattern.

c. Subtract the consecutive numbers to find the differences:
   6 – 4 = 2 8 – 6 = 2 10 – 8 = 2
   The difference is always 2. This is an arithmetic pattern with a common difference of 2.

d. Subtract the consecutive numbers to find the differences:
   3 – 1 = 2 6 – 3 = 3 10 – 6 = 4
   There is not a common difference. This is **not** an arithmetic pattern.

e. Subtract the consecutive numbers to find the differences:
   20 – 10 = 10 30 – 20 = 10 40 – 30 = 10
   The difference is always 10. This is an arithmetic pattern with a common difference of 10.

2. Write down the first 6 multiples of 5. Is this an arithmetic pattern?

   Solution

   The first 6 multiples of 5 are: 5, 10, 15, 20, 25, 30

   In this pattern, 5 is added to each number to find the next number. This means that the common difference is 5, and it is an arithmetic pattern.

Practice

1. Identify whether each of the following lists of numbers is an arithmetic pattern. If it is an arithmetic pattern, give the common difference:
   a. 8, 16, 24, 32, …
   b. 1, 4, 7, 10, 13, …
   c. 3, 6, 12, 24, 48, …
   d. 4, 6, 8, 10, …
   e. 3, 5, 8, 12, 17, …
2. Write down all multiples of 6 greater than 20 but less than 50. Is it an arithmetic pattern?

Lesson Title: Rules in Number Patterns	**Theme:** Algebra
Practice Activity: PHM-07-107	**Class:** JSS 1

Learning Outcomes

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

1. Identify the rule in a given arithmetic pattern.
2. Create basic arithmetic patterns given a rule.

Overview

In this lesson, you will create your own arithmetic pattern. To create an arithmetic pattern, all you need to do is decide what the first number will be and what the difference between two numbers will be. Remember that the difference between the numbers in an arithmetic pattern is called the common difference.

If the numbers in the pattern increase, the common difference is positive. If the numbers decrease, the common difference is negative.

Write 3 periods after a list of numbers to show that it continues. This is called ellipses.

Solved Examples

1. Describe the rules that each pattern follows:
    a. 8, 11, 14, 17, …
    b. 20, 18, 16, 14, …

    Solutions
    a. The arithmetic pattern starts with 8 and has a common difference of 3.
    b. The arithmetic pattern starts with 20 and has a common difference of -2.

2. An arithmetic pattern starts with 10, and has a common difference of 2. Write the first 5 terms of the pattern.

    Solution

    The first term of the pattern is 10. Find the next 4 terms using addition:

    - 10 + 2 = 12
    - 12 + 2 = 14
    - 14 + 2 = 16
    - 16 + 2 = 18

    List the first 5 terms of the pattern: 10, 12, 14, 16, 18

3. Write an arithmetic pattern starting with 0, with a common difference of 4. Write the first 6 terms of the pattern.

   Solution
   It is not necessary to write out the addition each time you write an arithmetic sequence. You can do the addition in your head and write out the list of numbers.

   Start with 0 and add 4 to get each next term: 0, 4, 8, 12, 16, 20

4. Write an arithmetic pattern that starts at 7 and has a common difference of -3.

   Solution
   Start with 7 and subtract 3 to get each next term: $7, 4, 1, -2, -5, -8$ …

   The problem does not tell us how many terms to give. In this case, write several terms and use the ellipses (…) to show that the list continues.

Practice

1. An arithmetic pattern starts with 3, and has a common difference of 5. Write the first 7 terms of the pattern.
2. Write the first 5 terms of an arithmetic pattern starting with 10, with a common difference of 6.
3. Write the first 6 terms of an arithmetic pattern that starts with 10 and has a common difference of -5.
4. Write an arithmetic pattern that starts at 3 and has a common difference of 3.
5. Write an arithmetic pattern that starts with 30 and has a common difference of -4.
6. Write an arithmetic pattern that starts with 0 and has a common difference of -2.
7. Write an arithmetic pattern that starts at 50 and has a common difference of 4.

Lesson Title: Completing Number Patterns	**Theme:** Algebra
Practice Activity: PHM-07-108	**Class:** JSS 1

Learning Outcomes

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

1. Provide the next terms of a number pattern.
2. Provide missing terms of a number pattern.

Overview

The lesson today is completing number patterns and providing missing terms in a given sequence. In completing a number pattern or finding the missing terms of an arithmetic pattern, we need to know the rule of the given sequence. Follow these steps to find missing numbers:

1. Use the given numbers to find the common difference.
2. Use the common difference to find the missing numbers.

Solved Examples

1. Find the next 3 terms of the sequence 3, 13, 23, …

   Solution

   First, find the rule in the pattern. Subtract to find the common difference:

   13 – 3 = 10 23 – 13 = 10

   The common difference is 10. Add 10 to find the next 3 numbers:

   23 + 10 = 33 33 + 10 = 43 43 + 10 = 53

   The next 3 terms of the sequence are 33, 43, 53.

2. Find the common difference and write the missing numbers in each pattern:

   a. 5, 10, 15, ___, ____, ____, 35, 40

   b. 2, 4, 6, ____, 10, ____, _____, 16

   c. 9, 12, ____, 18, 21, 24, _____

   Solutions

   a. Subtract consecutive numbers to find the common difference:

   10 – 5 = 5 15 – 10 = 5

   The common difference is 5. Add 5 to find each missing number:

   5, 10, 15, <u>20</u>, <u>25</u>, <u>30</u>, 35, 40

b. Subtract consecutive numbers to find the common difference:

   4 – 2 = 2 6 – 4 = 2

   The common difference is 2. Add 2 to find each missing number:

   2, 4, 6, 8, 10, 12, 14, 16

c. Subtract consecutive numbers to find the common difference:
   12 – 9 = 3 21 – 18 = 3

   The common difference is 3. Add 3 to find each missing number:

   9, 12, 15, 18, 21, 24, 27

Practice

1. Write the next 4 terms of each sequence:
   a. 15, 10, 5, …
   b. –9, –6, –3, …
   c. 4, 10, 16, …
   d. 8, 6, 4, …

2. Find the common difference and write the missing numbers in each pattern:
   a. 6, 12, ____, 24, 30, ____, _____, 48
   b. 3, 6, 9, ____, ____, _____
   c. 35, 40, _____, 50, _____, _____, 65

Lesson Title: Variables	**Theme:** Algebra
Practice Activity: PHM-07-109	**Class:** JSS 1

Learning Outcomes

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

1. Identify variables as unknown values.
2. Identify the variable in a given equation and find its value.

Overview

This lesson is on how to identify the values of variables in simple algebraic expressions.

A **variable** is a letter that is used in an algebraic expression to represent a number. A variable is an unknown value. It is a letter in place of a missing number. In algebra, we are often asked to solve for variables. This means to find the number value for a variable. While x is the most common variable used in algebra, any letter can be used.

For example, consider the expression $2 + x = 5$. The variable x represents a specific number that will sum to 5 when 2 is added to it.

A number by itself in an equation is called a **constant**. Unlike a variable, a constant does not change. In the equation $2 + x = 5$, the numbers 2 and 5 are constants.

An **algebraic expression** is a collection of letters and symbols combined with at least one or more of the mathematical operations, $+$, $-$, $\times$ or $\div$. For example, these are some algebraic expressions: $3m + n - 5$, $5pq^3$, and $3pst \div 9p^2t^2s$

Solved Examples

1. Identify the variables in the algebraic expressions:

   a. $5r - h + 6$ b. $x + y - 5$ c. $v = u + 9.8t$

   Solutions

   a. r and h are variables
   b. x and y are variables
   c. u, v and t are variables

2. Write the following statements as algebraic expressions:
   a. 8 less than a certain number
   b. 7 more than a certain number

   Solutions

   Let x be the "certain number" in each example. Then we have:

   a. $x - 8$
   b. $x + 7$

3. Find the value of x in the equation $x + 3 = 8$.

   Solution

   x is an unknown number. When 3 is added to it, the result is 8. You can solve this problem using your mental maths problem-solving skills. Notice that $5 + 3 = 8$. The unknown number must be 5.

   You can also solve this by drawing a picture: x + ○○○ = ○○○○○ / ○○○

   We can see from the picture that x must be 5 because $5 + 3 = 8$.

4. Find the value of y in the equation $3 = 10 - y$.

   Solution

   In this problem, y is the unknown number. When we subtract y from 10, the result is 3. It might help to write the problem another way: $10 - y = 3$

   Notice that $10 - 7 = 3$, so the unknown value is 7.

   You can also solve by drawing a picture: ○○○○○ / ○○○○○ $- y =$ ○○○

   We can see from the picture that 7 is subtracted from 10 to make 3. We have $y = 7$.

Practice

1. Identify the variables in the algebraic expressions:
   a. $4r^2 - 4h$
   b. $m + n - 4$
   c. $x = ut + \frac{1}{2}at^2$

2. Write the following statements as algebraic expressions:
   a. 12 less than a certain number
   b. 5 more than a certain number

3. Find the value of x in each equation:
   a. $x + 2 = 6$
   b. $5 - x = 1$
   c. $x + 8 = 10$
   d. $9 - x = 6$
   e. $x - 2 = 7$

Lesson Title: Solving for a Variable	**Theme:** Algebra
Practice Activity: PHM-07-110	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to find the value of a variable in simple algebraic equations involving addition and subtraction.

Overview

In this lesson, you will solve simple algebraic equations involving addition and subtraction. For example, you will be able to solve $p + 4 = 7$. To 'solve' an algebraic equation means to find the value of the variable.

To solve for a variable, we want to get the variable alone on one side of the equals sign. Consider our example, $p + 4 = 7$. We can get p alone on the left-hand side by subtracting 4. If we subtract 4 from **both** sides of the equals sign, it is still a true math equation.

Solve for p by subtracting 4 from both sides:

$p + 4$	$=$	7	Equation
$p + 4 - \mathbf{4}$	$=$	$7 - \mathbf{4}$	Subtract 4 from both sides
p	$=$	3	Simplify

We have solved the equation. The answer is $p = 3$. You can check your answer by substituting it into the given equation.

Check:

$p + 4$	$=$	7	Equation
$3 + 4$	$=$	7	Substitute
7	$=$	7	Simplify
LHS	$=$	RHS	

The solution is correct because the left-hand side is equal to the right-hand side.

Solved Examples

1. Find the value of the variable in the expression $x - 2 = 3$. Check your answer.

   Solution
   To get x alone, we need to add 2 to both sides. This will eliminate -2 from the left-hand side.

$x - 2$	$=$	3	Equation
$x - 2 + 2$	$=$	$3 + 2$	Add 2 to both sides
x	$=$	5	Simplify

Check your answer using substitution:

$x-2$	$=$	3	Equation
$5-2$	$=$	3	Substitute
3	$=$	3	Simplify
LHS	$=$	RHS	

The answer is $x = 5$.

2. Solve $12 = y - 3$.

Solution

To get y alone, we need to add 3 to both sides. This will eliminate -3 from the right-hand side.

12	$=$	$y-3$	Equation
$12+3$	$=$	$y-3+3$	Add 3 to both sides
15	$=$	y	Simplify

3. Solve $15 + x = 20$ for x.

Solution

To get x alone, we need to subtract 15 from both sides. This will eliminate 15 from the left-hand side.

$15+x$	$=$	20	Equation
$15-15+x$	$=$	$20-15$	Subtract 15 from both sides
x	$=$	5	Simplify

4. Solve $x - 4 = 3 + 9$.

Solution

Simplify the right-hand side before solving for x.

$x-4$	$=$	$3+9$	Equation
$x-4$	$=$	12	Simplify RHS
$x-4+4$	$=$	$12+4$	Add 4 to both sides
x	$=$	16	Simplify

Practice

Find the value of the variable in each of the following expressions. Check your answers.

1. $x + 1 = 14$
2. $z - 4 = 2$
3. $12 + x = 20$
4. $x - 9 = 2$
5. $3 + t = -1$
6. $12 = y + 8$
7. $6 = x - 7$
8. $15 - 3 = p + 6$
9. $b + 3 = 32$
10. $a - 3 = -1$

Lesson Title: Coefficients	**Theme:** Algebra
Practice Activity: PHM-07-111	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to identify the coefficient in an expression as a number multiplied by a variable.

Overview

When you see a number before a variable, it means the variable is multiplied by that number. Any number multiplied by a variable is called a **coefficient**. The coefficient is always written in front of the variable.

For example, in $8m$, 8 is the coefficient of m. The coefficient is actually multiplied by the variable, so that $8m = 8 \times m$. We do not write this multiplication sign.

A number on its own (without any variable) is not a coefficient. It is called a **constant** term in an algebraic expression. For example, in $3x + 5$, 3 is a coefficient, but 5 is a constant term.

A variable without a number written in front of it has a coefficient of 1. For example, x has a coefficient of 1. A variable with a negative symbol in front of it has a coefficient of -1. For example, $-x$ has a coefficient of -1.

Solved Examples

1. Simplify each expression and identify the coefficient:
   a. $6 \times t$
   b. $y \times 4$
   c. $x + x + x$
   d. $z + z + z + z + z + z$

   Solutions
   a. Simplified expression: $6t$
      Coefficient: 6
   b. Simplified expression: $4y$
      Coefficient: 4
   c. Simplified expression: $x + x + x = 3 \times x = 3x$
      Coefficient: 3
   d. Simplified expression: $z + z + z + z + z + z = 6 \times z = 6z$
      Coefficient: 6

2. Identify the coefficients of x and y and the constant term in the following algebraic expressions:

   a. $-6x + 5y + 7$ b. $\frac{1}{2}y - x - 1$ c. $x + y + 10$

   Solutions

   a. $-6x + 5y + 7$:
   The coefficient of x is -6
   The coefficient of y is 5
   The constant term is 7

   b. $\frac{1}{2}y - x - 1$:
   The coefficient of x is -1
   The coefficient of y is $\frac{1}{2}$
   The constant term is -1

   c. $x + y + 10$:
   The coefficient of x is 1
   The coefficient of y is 1
   The constant term is 10

3. Write the following statements as algebraic expressions:
   a. Half a certain number
   b. -17 times a certain number
   c. 3 less than 2 times a certain number

   Solutions

   Let x be the "certain number" in each example. Then we have:

   a. $\frac{1}{2}x$. This can also be written $\frac{x}{2}$
   b. $-17 \times x = -17x$
   c. $2x - 3$

Practice

1. Simplify each expression and identify the coefficient:
    a. $-5 \times x$
    b. $z \times 12$
    c. $x + x + x + x$
    d. $p + p + p + p + p + p + p$

2. Identify the coefficients and the constant terms in each expression:
    a. $-5a + 6y - 10$
    b. $\frac{4}{5}y + 7 - x$
    c. $x - y + 10$
3. Write the following statements as algebraic expressions:
    a. A certain number times 60.
    b. 100 times as big as y.
    c. 9 more than two times x.

Lesson Title: Solving for a Variable with a Coefficient	**Theme:** Algebra
Practice Activity: PHM-07-112	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to find the value of a variable in simple algebraic expressions involving multiplication.

Overview

In this lesson, you will solve simple algebraic equations involving coefficients. For example, you will solve $2x = 6$.

Remember that to solve for a variable, we want to get the variable alone on one side of the equals sign. Consider our example, $2x = 6$. On the left-hand side, we have x multiplied by 2. We can get x alone by dividing by 2. If we divide on **both** sides of the equals sign, it is still a true math equation.

Solve for x by dividing by 2 on both sides:

$2x$	$=$	6	Equation
$\frac{2x}{2}$	$=$	$\frac{6}{2}$	Divide both sides by 2
x	$=$	3	Simplify

We have solved the equation. The answer is $x = 3$. You can check your answer by substituting it into the given equation.

Check:

$2x$	$=$	6	Equation
$2(3)$	$=$	6	Substitute
6	$=$	6	Simplify
LHS	$=$	RHS	

The solution is correct because the left-hand side is equal to the right-hand side.

Solved Examples

1. Find the value of the variable in $2y = 10$.

   Solution
   Divide both sides of the equation by 2 to cancel 2 from the left-hand side.

$2y$	$=$	10	Equation
$\frac{2x}{2}$	$=$	$\frac{10}{2}$	Divide both sides by 2
x	$=$	5	Simplify

2. Solve: $3a = 6$ for a

   Solution
   Divide both sides of the equation by 3 to cancel 3 from the left-hand side.

$3a$	$=$	6	Equation
$\frac{3a}{3}$	$=$	$\frac{6}{3}$	Divide both sides by 3
a	$=$	2	Simplify

3. Solve: $-4x = 16$

   Solution
   Divide both sides of the equation by -4 to cancel -4 from the left-hand side.
   Remember the rules for multiplying and dividing negative numbers. A positive number divided by a negative gives a negative: $(+) \div (-) = (-)$.

$-4x$	$=$	16	Equation
$\frac{-4x}{-4}$	$=$	$\frac{16}{-4}$	Divide both sides by -4
x	$=$	-4	The result is negative

4. Solve: $-5y = -20$

   Solution
   Divide both sides of the equation by -5 to cancel -5 from the left-hand side.
   Remember the rules for multiplying and dividing negative numbers. A negative number divided by a negative gives a positive: $(-) \div (-) = (+)$.

$-5y$	$=$	-20	Equation
$\frac{-5y}{-5}$	$=$	$\frac{-20}{-5}$	Divide both sides by -5
y	$=$	4	The result is positive

5. Solve: $2x = 3 + 5$

Solution

Simplify the right-hand side before solving for x.

$2x$	$=$	$3 + 5$	Equation
$2x$	$=$	8	Add RHS
$\frac{2x}{2}$	$=$	$\frac{8}{2}$	Divide both sides by 2
x	$=$	4	Simplify

Practice

Find the value of the variable in each of the following expressions. Check your answers.

1. $3x = 12$
2. $2y = 20$
3. $-2x = 8$
4. $8p = 24$
5. $-3a = -9$
6. $10x = 100$
7. $2a = 50$
8. $3x = -12$
9. $4z = 3 + 9$
10. $10x = 12 + 8$

Lesson Title: Like Terms	**Theme:** Algebra
Practice Activity: PHM-07-113	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to identify like terms as those with the same variable and power.

Overview

In maths, terms with the same variable and power are called **like terms**. Like terms are the same type, and they can be combined together. You will combine them in the next lesson. Unlike terms are different and cannot be combined together.

For example, $2a, 3a, 5a$ are all like terms, with the variable a to the power 1. As another example, $5p^2$ and $8p^2$ are like terms. The coefficients can be different, but the rest of the terms must be exactly the same.

Integers are also like terms. If you see 2 or more integers in an expression, they can be combined.

Solved Examples

1. In the list below, circle the terms that are like terms of x.

$$2y \quad 6 \quad 7y \quad -7x \quad 12 \quad z \quad 5x \quad -10z \quad y \quad -x$$

Solution
Terms must have the same variable and the same power to be like terms. All of the terms with x to the power 1 are like terms. The following terms should be circled: $-7x, 5x, -x$.

2. In the list below, circle the terms that are like terms of $-y^2$.

$$-3y \quad 6x^2 \quad 6y^2 \quad -7y^3 \quad 2y \quad y^2 \quad -3x^2 \quad -10y^2 \quad y \quad -y^3$$

Solution
Terms must have the same variable and the same power to be like terms. All of the terms with y to the power 2 are like terms. The following terms should be circled: $6y^2, y^2, -10y^2$

3. Write 5 terms that are like terms of y.

Solution
You may write any terms with y to the power of 1. The coefficient can be any number. These are 5 examples: $y, -y, 2y, 25y, -4y$

4. Identify all of the like terms in the expression $2a - 5 + b - 6a + 7$.

   Solution

   The terms with a 'to the power of 1' are like terms: $2a$ and $-6a$

   The integers are like terms: -5 and 7.

Practice

1. In the list below, circle the terms that are like terms of y.

   $$2y \quad -z \quad 7y \quad -11x \quad 13 \quad -13y \quad 5x \quad -10z \quad y \quad -x$$

2. In the list below, circle the terms that are like terms of x^3.

   $$-3x \quad 6x^2 \quad 6y^2 \quad -7x^3 \quad 2y \quad x^2 \quad -3x^2 \quad 10x^3 \quad y \quad -x^3$$

3. Write 5 terms that are like terms for each of the following:
   a. x^2
   b. z
   c. $-y$

4. Identify all of the like terms in the expression $18 + x^3 + 6x^2 - x + 9 + 7x - x^2$.

Lesson Title: Combining Like Terms	**Theme:** Algebra
Practice Activity: PHM-07-114	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to group and combine like terms in a given algebraic expression.

Overview

Like terms can be combined by adding or subtracting to give a single term. The result will have the same variable with the same power. The coefficients of the terms are added or subtracted. Consider these examples:

$$3a + 2a = (3 + 2)a = 5a$$

$$4a - a = (4 - 1)a = 3a$$

$$4a + a - 2a = (4 + 1 - 2)a = 3a$$

Unlike terms are two or more terms that are not like terms. That is, they do not have the same variables or powers. Unlike terms cannot be combined. For example, the following examples cannot be combined:

$$2a + 3b + 4c$$
$$3x + 2x^2$$

Solved Examples

1. Combine the like terms: $15a - 9a$

   Solution
   Subtract the coefficients: $15a - 9a = (15 - 9)a = 6a$

2. Simplify: $30z + 9z$

   Solution
   Add the coefficients: $30z + 9z = (30 + 9)z = 39z$

3. Simplify: $6x - 10x$

   Solution
   Subtract the coefficients: $6x - 10x = (6 - 10)x = -4x$

4. Simplify: $-y + 4y$

Solution
Add the coefficients: $-y + 4y = (-1 + 4)y = 3y$

5. Simplify: $-4b - 3b$

   Solution
   Subtract the coefficients: $-4b - 3b = (-4 - 3)b = -7b$

6. Simplify: $3ab + 2ab$

   Solution
   Add the coefficients: $3ab + 2ab = (3 + 2)ab = 5ab$

Practice

Combine the like terms:

1. $8x - 7x$
2. $15y + y$
3. $5x - 10x$
4. $4ab - ab$
5. $-2x - 7x$
6. $100z - 20z$
7. $xy - 5xy$
8. $-5x + 7x$
9. $-10x + x$
10. $14y - 14y$

Lesson Title: Simplifying Algebraic Expressions	**Theme:** Algebra
Practice Activity: PHM-07-115	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to simplify simple algebraic expressions**.**

Overview

In this lesson, you will simplify algebraic expressions by combining like terms. When you are given an algebraic expression, collect the like terms together first. Remember that the order of addition does not matter, so the position of the terms can be changed. However, be careful with signs. If you change the order of the terms, keep the original sign on each term.

After collecting like terms, combine all of the like terms.

Solved Examples

1. Simplify: $8x - 2y - 4x + 5y$

Solution

$8x - 2y - 4x + 5y$	$=$	$8x - 4x + 5y - 2y$	Collect like terms
	$=$	$(8 - 4)x + (5 - 2)y$	Subtract coefficients
	$=$	$4x + 3y$	Combine like terms

2. Simplify: $7p - 3q + 3p + 2q$

Solution

$7p - 3q + 3p + 2q$	$=$	$7p + 3p + 2q - 3q$	Collect like terms
	$=$	$(7 + 3)p + (2 - 3)q$	Add/subtract coefficients
	$=$	$10p - q$	Combine like terms

3. Simplify: $4x + 9 - 3x + 4$

Solution

$4x + 9 - 3x + 4$	$=$	$4x - 3x + 9 + 4$	Collect like terms
	$=$	$(4 - 3)x + (9 + 4)$	Add/subtract coefficients
	$=$	$x + 13$	Combine like terms

4. Simplify the following algebraic expressions:
    a. $12e + 5f - 4e - 2f$
    b. $2m + 5 - 3m - 4$
    c. $11x - 10y - 10x + 12y$
    d. $3u - 3 + 4v - 2u + 7 - 2v$

    Solutions

    a.

$$\begin{aligned} 12e + 5f - 4e - 2f &= 12e - 4e + 5f - 2f && \text{Collect like terms} \\ &= (12 - 4)e + (5 - 2)f && \text{Subtract coefficients} \\ &= 8e + 3f && \text{Combine like terms} \end{aligned}$$

    b.

$$\begin{aligned} 2m + 5 - 3m - 4 &= 2m - 3m + 5 - 4 && \text{Collect like terms} \\ &= (2 - 3)m + (5 - 4) && \text{Subtract coefficients} \\ &= -m + 1 && \text{Combine like terms} \end{aligned}$$

    c.

$$\begin{aligned} 11x - 10y - 10x + 12y &= 11x - 10x + 12y - 10y \\ &= (11 - 10)x + (12 - 10)y \\ &= x + 2y \end{aligned}$$

    d.

$$\begin{aligned} 3u - 3 + 4v - 2u + 7 - 2v &= 3u - 2u + 4v - 2v + 7 - 3 \\ &= (3 - 2)u + (4 - 2)v + (7 - 3) \\ &= u + 2v + 4 \end{aligned}$$

Practice

Simplify the following algebraic expressions:

1. $4y - 3x + 5x - 3y$
2. $9a + 4b - 11a + 3b$
3. $12x - 5 + 2y - 7x + 8$
4. $2a + 5b - 7 + 3a - b$
5. $6m + 11n - 4m + 2n - m + n$
6. $8n + 9m + 4m - 10m - 2n$
7. $4 + 7b - 3a - 3 - 2b + 7a$
8. $m + 2n + p - m + 5n - 2$

Lesson Title: Multiplying Algebraic Expressions	**Theme:** Algebra
Practice Activity: PHM-07-116	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to multiply a constant by an algebraic expression.

Overview

In this lesson, you will multiply a constant by an algebraic expression.

Remember that a coefficient in front of a variable is multiplied: $7 \times x = 7x$

If you multiply a term by an integer, you will simply multiply the coefficient by that integer. For example: $2(4ab) = 2 \times 4ab = 8ab$

If you see a number or variable outside of a bracket, it means to multiply by what is inside the bracket.

An algebraic expression with more than 1 term can also be multiplied by a constant. For example, $2(5x - 4)$. In order to simplify such expressions, we must remove the brackets. In removing brackets, multiply the term outside the bracket by each of the terms inside the bracket. See Solved Example 1. Multiplying a number by the terms in the brackets is also called **expanding** the expression.

We must be very careful with signs when removing brackets. When there is a positive (+) number before the bracket, the sign inside the brackets does not change when the brackets are removed. When there is a negative number ($-$) in front of the brackets, the signs inside the bracket change when the brackets are removed. This is because of the rules of multiplication.

Remember the rules for multiplying negative numbers:

- Negative x Positive = Negative
- Positive x Negative = Negative
- Negative x Negative = Positive

Solved Examples

1. Simplify: $2(5x - 4)$

   Solution
   Multiply 2 by each term inside brackets. The terms inside the brackets are $5x$ and -4.

$$\begin{aligned} 2(5x - 4) &= (2 \times 5x) + (2 \times -4) \qquad \text{Multiply each term by 2} \\ &= 10x - 8 \end{aligned}$$

2. Simplify: $-4(2y-3)$

Solution

This is an example of a problem with a negative number in front of the brackets.

$$\begin{aligned} -4(2y-3) &= (-4\times 2y)+(-4\times -3) \quad \text{Multiply each term by } -4 \\ &= -8y+12 \end{aligned}$$

3. Simplify: $2(x^2-x+5)$

Solution

$$\begin{aligned} 2(x^2-x+5) &= (2\times x^2)+(2\times -x)+(2\times 5) \quad \text{Multiply each term by 2} \\ &= 2x^2-2x+10 \end{aligned}$$

4. Simplify: $-3(2m+3n+4)$

Solution

$$\begin{aligned} -3(2m+3n+4) &= (-3\times 2m)+(-3\times 3n)+(-3\times 4) \quad \text{Multiply each term by } -3 \\ &= -6m-9n-12 \end{aligned}$$

5. Simplify: $-(a+4b)$

Solution

If there is a negative sign in front of the brackets, it is the same as having -1 in front of the bracket. Multiply each term inside brackets by -1. This changes the sign on each term. In other words, the negative sign is distributed to each term inside brackets.

$$\begin{aligned} -(a+4b) &= (-1\times a)+(-1\times 4b) \quad \text{Multiply each term by } -1 \\ &= -a-4b \end{aligned}$$

Practice

Remove brackets and simplify the following algebraic expressions:

1. $5(x-4)$
2. $-7(3y-4)$
3. $-2(m+n)$
4. $3(2v+3)$
5. $-(2x^2-x+7)$
6. $8(-3m+2n)$
7. $-2(-2a-3)$
8. $10(x^2-3x)$

Lesson Title: Dividing Algebraic Expressions	**Theme:** Algebra
Practice Activity: PHM-07-117	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to divide algebraic expressions by a constant.

Overview

In this lesson, you will divide algebraic expressions by a constant. When we divide an algebraic expression by a constant, we divide the coefficient by that constant. The result will have the same variables as the dividend that you are dividing by.

The dividend or the divisor can be negative numbers. Divide the coefficient by the divisor, and follow the rules for dividing negative numbers:

- Negative ÷ Positive = Negative
- Positive ÷ Negative = Negative
- Negative ÷ Negative = Positive

Remember that you can always check the answer to a division problem by multiplying the quotient and divisor.

Solved Examples

1. Divide: $6x \div 2$

   Solution
   Divide the coefficient (6) by 2. The answer will have x, the same variable as the dividend.

   $6x \div 2 = \frac{6}{2}x = 3x$

   Check your answer by multiplying the answer by the divisor:

   $3x \times 2 = (3 \times 2)x = 6x$

   The result is the dividend, so our answer is correct. The answer is $3x$.

2. Divide: $12xy \div 4$

   Solution
   Divide the coefficient (12) by 4.

   $12xy \div 4 = \frac{12}{4}xy = 3xy$

3. Divide $20y \div -5$

   Solution
   Divide the coefficient (20) by -5. The result will be negative because of the rules for dividing negative numbers.

   $20y \div -5 = \frac{20}{-5}y = -4y$

4. Divide: $-48ab \div 6$

   Solution
   Divide the coefficient (-48) by 6. The result will be negative because of the rules for dividing negative numbers.

   $-48ab \div 6 = \frac{-48}{6}ab = -8ab$

Practice

Divide the following:

1. $14a \div 7$
2. $-5x \div -5$
3. $-12y \div 2$
4. $36xy \div -12$
5. $-4ab \div -1$
6. $100x \div -2$
7. $-15xy \div 5$
8. $16xyz \div 2$
9. $-20z \div 4$
10. $-6p \div -2$

Lesson Title: Factorisation	**Theme:** Algebra
Practice Activity: PHM-07-118	**Class:** JSS 1

Learning Outcomes

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

1. Identify common factors in an algebraic expression.
2. Divide common factors from an algebraic expression.

Overview

In this lesson, you will identify that **factorisation** involves using division to break an expression into parts. You will identify and factorise integers that are **common factors** in an algebraic expression.

Factorisation is the **opposite** of expanding a bracket. Remember that we multiply to expand a bracket. For example: $2(x+3) = 2 \times x + 2 \times 3 = 2x + 6$.

In this lesson, you will take an expression like $2x + 6$ and use division to find all its factors. This process is called factorisation. You will use factorisation to get from $2x + 6$ to $2(x + 3)$.

Use these steps to factor an expression:

1. Find the highest common factor (HCF) of the terms in the expression.
2. Write the HCF outside of the empty brackets.
3. Divide each term in the expression by the HCF, and write the result in the brackets.

Always check your result to make sure the expression in the brackets cannot be factorised further. If you choose a factor that is not the HCF, you may need to factorise more than once to complete the factorisation.

Solved Examples

1. Factorise the expression $2x + 6$.

   Solution

   First, look for the HCF of the expression. It is 2. This is the largest number which can divide $2x$ and 6.

   $$\begin{aligned} 2x + 6 &= 2(\quad) && \text{Factor the HCF, 2} \\ &= 2(x + 3) && \text{Divide each term in } 2x + 6 \text{ by 2} \end{aligned}$$

   Answer: $2(x + 3)$

   Check your answer by expanding the brackets:

   $$\begin{aligned} 2(x + 3) &= 2 \times x + 2 \times 3 && \text{Multiply each term in brackets by 2} \\ &= 2x + 6 && \text{Check that this is the original expression} \end{aligned}$$

2. Factorise the expression $12x - 24$.

Solution

Note that the HCF of the expression is 12.

$12x - 24$	$=$	$12(\quad)$	Factor the HCF, 12
	$=$	$12(x - 2)$	Divide each term in $12x - 24$ by 12

Answer: $12(x - 2)$

Check your answer by expanding the brackets:

$12(x - 2)$	$=$	$12 \times x + (12 \times -2)$	Multiply each term in brackets by 12
	$=$	$12x - 24$	Original expression

3. Factorise: $10 + 3y - 2 + y$

Solution

Note that there is no HCF for the 4 terms of this expression. However, there are like terms in the expression. Combine the like terms first, then try to factorise the expression.

$10 + 3y - 2 + y$	$=$	$10 - 2 + 3y + y$	Collect like terms
	$=$	$8 + 4y$	Combine like terms
	$=$	$4(\quad)$	Factor the HCF, 4
	$=$	$4(2 + y)$	Divide each term in $8 + 4y$ by 4

Check your answer by expanding the brackets:

$4(2 + y)$	$=$	$4 \times 2 + (4 \times y)$	Multiply each term in brackets by 4
	$=$	$8 + 4y$	Original expression

4. Factorise $5x^3 + 15x^2 + 35x + 20$

Solution

Note that the HCF of the expression is 5. This expression has higher powers of x. However, the factorisation process is the same. Divide each term by the HCF (5). The result will have the same powers of x.

$$\begin{aligned} 5x^3 + 15x^2 + 35x + 20 &= 5(\quad) && \text{Factor the HCF, 5} \\ &= 5(x^3 + 3x^2 + 7x + 4) && \text{Divide each term by 5} \end{aligned}$$

Check your answer by expanding the brackets:

$$5(x^3 + 3x^2 + 7x + 4) = 5x^3 + 15x^2 + 35x + 20$$

Practice

Factorise the expressions below. Please check all answers.

1. $4x + 12$
2. $7x - 21y$
3. $14 - 2x$
4. $20x + 30$
5. $4y - 6$
6. $10s + 12t - 4t$
7. $9 - 18p + 3$
8. $3x^2 + 12x + 30$
9. $9x^2 - 12$
10. $2x + 40y + 12z + 24$

Lesson Title: Introduction to Linear Equations	**Theme:** Algebra
Practice Activity: PHM-07-119	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to identify and solve linear equations in one variable that requires a single step.

Overview

Remember that a **variable** is a letter in an algebraic expression, like x or y. It is a letter that represents a number we do not know.

A **linear equation** in one variable is an equation with one variable, such as x. The variable may appear more than once. The highest power of the variable in a linear equation is 1. For example, if the variable is squared (x^2), it is **not** a linear equation.

For example, these are all linear equations:

$$x + 5 = 7 \qquad 8 = 3x - 7 \qquad 7y = 2y + 20 \qquad 4 - 7y = 3y + 4$$

The **balancing** method is used to solve for the variable in a linear equation. To use the balancing method, apply the same operation to both sides of an equal to sign. For example, add 3 to both sides of the equation. Our goal is to get the variable by itself.

The **transposition** method is another method to solve for the variable in a linear equation. We transpose terms by bringing them to the opposite side of the equals sign and changing the sign. For example, if you have -5 on the left-hand side, you may change it to $+5$ and move it to the right-hand side.

Both methods are shown in the Solved Examples section.

It is good practice to check the answer by substituting the solution into the equation. The right-hand side (RHS) should be equal to the left-hand side (LHS). You will know when you have made a mistake if you do not get RHS = LHS.

Solved Examples

1. Solve for x in the equation $x + 5 = 7$.

   Solution

   Method 1. To **balance** the equation, subtract 5 from both sides.

$$\begin{aligned} x + 5 &= 7 \\ x + 5 - 5 &= 7 - 5 \quad \text{Subtract 5 from both sides} \\ x + 0 &= 2 \quad \text{Simplify} \\ x &= 2 \end{aligned}$$

Method 2. We can also solve by **transposing** $+5$. Remove $+5$ from the left-hand side, and write -5 on the right-hand side.

$$\begin{aligned} x + 5 &= 7 \\ x &= 7 - 5 \quad \text{Transpose 5} \\ x &= 2 \quad \text{Simplify} \end{aligned}$$

Check your answer by substituting $x = 2$ into the equation:

$$\begin{aligned} x + 5 &= 7 \\ (2) + 5 &= 7 \\ 7 &= 7 \\ LHS &= RHS \end{aligned}$$

The answer is correct, because the LHS and RHS are equal.

2. Solve for y in the equation $y - 2 = 11$.

Solution

Method 1. To **balance** the equation, add 2 to both sides.

$$\begin{aligned} y - 2 &= 11 \\ y - 2 + 2 &= 11 + 2 \quad \text{Add 2 to both sides} \\ y &= 13 \quad \text{Simplify} \end{aligned}$$

Method 2. We can also solve by **transposing** -2. Remove -2 from the left-hand side, and write $+2$ on the right-hand side.

$$\begin{aligned} y - 2 &= 11 \\ y &= 11 + 2 \quad \text{Transpose } -2 \\ y &= 13 \quad \text{Simplify} \end{aligned}$$

Check your answer by substituting $y = 13$ into the equation:

$$\begin{aligned} y - 2 &= 11 \\ (13) - 2 &= 11 \\ 11 &= 11 \\ LHS &= RHS \end{aligned}$$

The answer is correct, because the LHS and RHS are equal.

Practice

Solve for the variable in each equation. Check your answers.

1. $3 + x = 15$
2. $z + 12 = -1$
3. $x - 5 = -3$
4. $y + 2 = -14$
5. $b + 7 = -2$
6. $7 + x = 9 + 4$
7. $12 = y + 2$
8. $-10 = x - 4$
9. $x + 14 = 25$
10. $y - 10 = 42$

Lesson Title: Solving Linear Equations	**Theme:** Algebra
Practice Activity: PHM-07-120	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to solve linear equations in one variable that requires 2 steps.

Overview

This is the second lesson on solving linear equations in one variable. In this lesson, you will use the balancing method to solve problems that involve more than one step.

These are possible steps in using the balancing method:

- Add the same quantity to each side
- Subtract the same quantity from each side
- Multiply each side by the same quantity
- Divide each side by the same quantity

It is important to note that the coefficient on a variable can be canceled by dividing. You must divide the entire equation by the coefficient, both the right-hand side and left-hand side.

You often need to perform multiple operations to get the answer. When balancing, perform addition or subtraction **before** multiplication and division.

Solved Examples

1. Solve: $5y = 40$

   Solution
   This problem can be solved in 1 step. The coefficient on y is 5. Get y by itself by dividing both sides of the equation by 5.

$$\begin{aligned} 5y &= 40 \\ \frac{5y}{5} &= \frac{40}{5} \qquad \text{Divide both sides by } 5 \\ y &= 8 \end{aligned}$$

   Check your answer by substituting it into the equation:

$$\begin{aligned} 5y &= 40 \\ 5(8) &= 40 \\ 40 &= 40 \\ \text{LHS} &= \text{RHS} \end{aligned}$$

   $y = 8$ is the correct answer, because we have LHS = RHS.

2. Solve: $8 = 3x - 7$

Solution

This problem requires multiple steps. Remember to add/subtract before multiplying/dividing.

$$\begin{aligned} 8 &= 3x - 7 \\ 8 + 7 &= 3x - 7 + 7 && \text{Add 7 to both sides} \\ 15 &= 3x \\ \frac{15}{3} &= \frac{3x}{3} && \text{Divide both sides by 3} \\ 5 &= x \end{aligned}$$

Check your answer by substituting it into the equation:

$$\begin{aligned} 8 &= 3x - 7 \\ 8 &= 3(5) - 7 \\ 8 &= 15 - 7 \\ 8 &= 8 \\ \text{LHS} &= \text{RHS} \end{aligned}$$

3. Solve for x if $5x - 3 = 3x + 7$.

Solution

In this problem, there are 2 terms that contain x. We want to combine them. Get them together on one side of the equation, and solve.

$$\begin{aligned} 5x - 3 &= 3x + 7 \\ 5x - 3 - 3x &= 3x + 7 - 3x && \text{Subtract } 3x \text{ from both sides} \\ 2x - 3 &= 7 \\ 2x - 3 + 3 &= 7 + 3 && \text{Add 3 to both sides} \\ 2x &= 10 \\ \frac{2x}{2} &= \frac{10}{2} && \text{Divide both sides by 2} \\ x &= 5 \end{aligned}$$

4. Solve: $7y = 2y + 20$

Solution

$$\begin{aligned} 7y &= 2y + 20 \\ 7y - 2y &= 2y - 2y + 20 && \text{Subtract } 2y \text{ from both sides} \\ 5y &= 20 \\ \frac{5y}{5} &= \frac{20}{5} && \text{Divide both sides by 5} \\ y &= 4 \end{aligned}$$

5. Solve: $4 - 7y = 3y + 4$

Solution

$$
\begin{aligned}
4-7y &= 3y+4 && \\
4-7y-3y &= 3y-3y+4 && \text{Subtract } 3y \text{ from both sides} \\
4-10y &= 4 && \\
4-4-10y &= 4-4 && \text{Subtract 4 from both sides} \\
-10y &= 0 && \\
\frac{-10y}{-10} &= \frac{0}{-10} && \text{Divide both sides by} -10 \\
y &= 0 &&
\end{aligned}
$$

Practice

Solve the following equations:

1. $11+5m=-4$
2. $3n-15=45$
3. $5y-2=18$
4. $2y+7=-5$
5. $x+4=7-2x$
6. $0=10-5y$
7. $3-4x=5x+12$
8. $1+7m=5m+1$
9. $9y-1=7y$

Lesson Title: Introduction to the Cartesian Plane	**Theme:** Algebra
Practice Activity: PHM-07-121	**Class:** JSS 1

Learning Outcomes

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

1. Draw the Cartesian plane.
2. Identify the x- and y-axes and label them with positive and negative values.
3. Identify that this x and y are often variables in linear equations, and the Cartesian plane is used to graph equations.

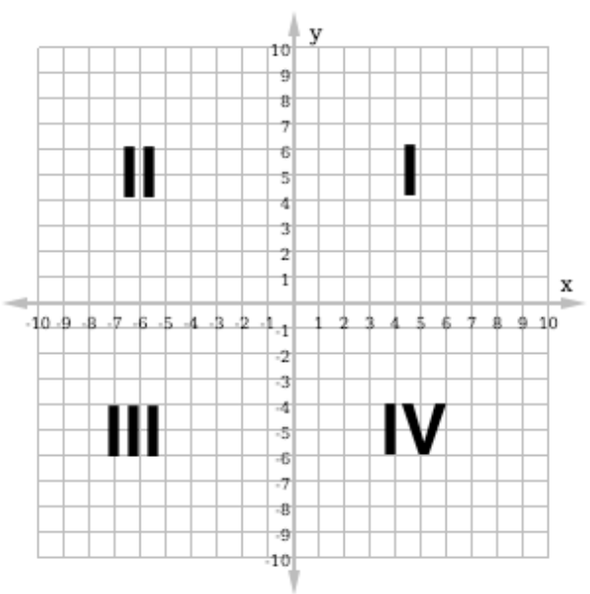
Overview

This lesson is on the Cartesian plane. A plane is any flat surface, like a paper or board. We use the Cartesian plane to draw graphs for equations.

We draw the 2 axes on the Cartesian plane, the x-axis and the y-axis. These 2 axes intersect at a right angle.

The ***x*-axis** goes from left to right and increases in value as shown by the arrow. Only a small part of the axis is shown, from -10 to $+10$. Negative values are to the left of the y-axis. Positive values are to the right of the y-axis.

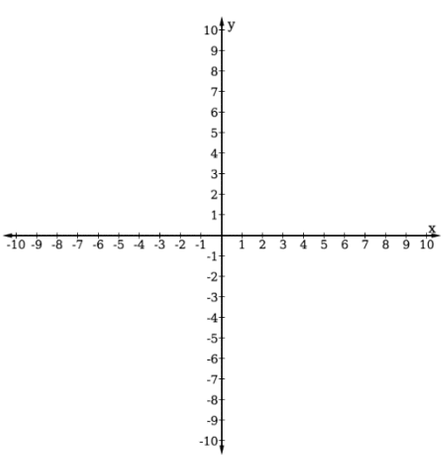
The ***y*-axis** goes from the bottom of the board to the top. It also increases in value in the direction of the arrow. We have shown only the part from -10 to $+10$. Negative values are below the x-axis. Positive values are above the x-axis.



Both axes actually go to infinity in both directions. We draw arrows at the end of the axes to show this.

The 2 axes divide the Cartesian plane into 4 **quadrants**, numbered as shown with Roman numerals.

When you draw a Cartesian plane of your own, it is not necessary to draw the entire grid. You may just draw tick marks on each axis, as shown at right. Make sure all of your tick marks are the same distance apart.



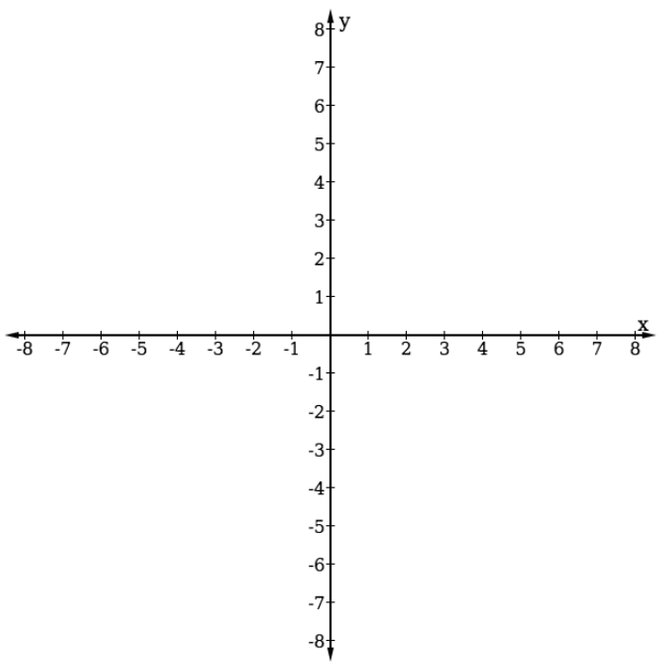
The point where the x-axis and y-axis intersect is called the origin. Both axes are 0 at the origin.

Solved Examples

1. Draw a Cartesian plane with axes from -8 to $+8$.

   Solution

   Your Cartesian plane should look like the one below. Make sure your tick marks are the same distance apart. Label your axes and tick marks.



Practice

1. Draw a Cartesian plane with axes from -12 to $+12$.
2. Draw a Cartesian plane with axes from -5 to $+5$. Label the origin and each of the 4 quadrants.

Lesson Title: Identifying Points on the Cartesian Plane	**Theme:** Algebra
Practice Activity: PHM-07-122	**Class:** JSS 1

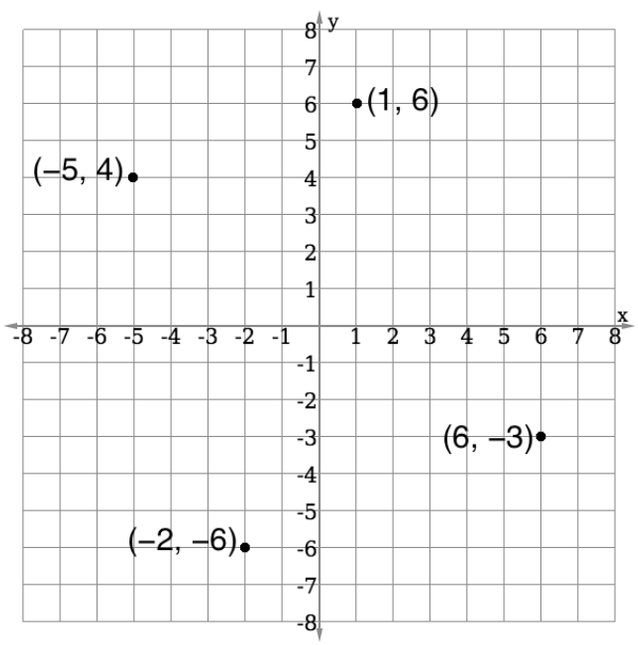
Learning Outcome

By the end of the lesson, you will be able to identify points in each quadrant of the Cartesian plane and write them in the form (x, y).

Overview

We can identify points on the Cartesian plane from their coordinates, or ordered pair (x, y). The x-value of a point's coordinates tells how far to move along the x-axis to reach the point. The y-value the point's coordinates tells how far to move along the y-axis to reach the point.

Examples of a few points on the plane are given below. See the Solved Examples for how to identify points on the Cartesian plane.

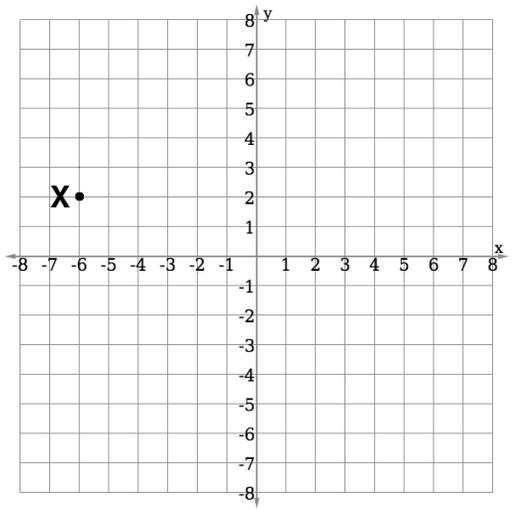


Remember that the origin is where the x-axis and y-axis intersect. It has coordinates (0, 0). Also note the following:

- For points that lie exactly on the x-axis, the y-value is zero. For example: (3,0), (-4,0).
- For points that lie exactly on the y-axis, x-value is zero. For example: (0,2), (0,-6).

Solved Examples

1. Write the coordinates of point X in the diagram below:



Solution

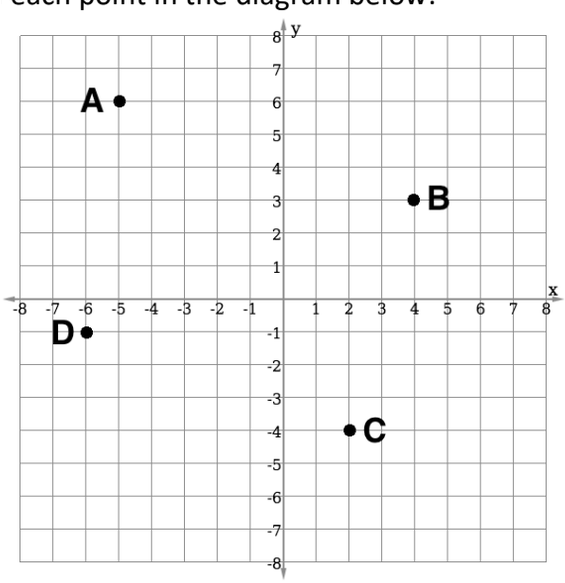
To find the coordinates of X, find the points on the x-axis and y-axis that it corresponds to. In other words, find how many spaces you need to move away from the origin (0, 0) to reach X.

X corresponds to $x = -6$ on the x-axis. You need to move 6 spaces in the negative direction along the x-axis to reach X.

X corresponds to $y = 2$ on the y-axis. You need to move 2 spaces in the positive direction along the y-axis to reach X.

The coordinates of X are $(-6, 2)$.

2. Write the coordinates of each point in the diagram below:



Solution

Remember that each point has an ordered pair (x, y). The x-value tells you its position on the x-axis, and the y-value tells you its position on the y-axis. From each point (A, B, C, D) move along the grid line and find the numbers along the axes that it corresponds to.

Answers: $\mathrm{A}(-5,6)$, $\mathrm{B}(4,3)$, $\mathrm{C}(2,-4)$, $\mathrm{D}(-6,-1)$. Note that each point is given by its letter before the ordered pair.

3. Identify which quadrant each of the following points is in:
   a. $(3,2)$ b. $(-1,-1)$ c. $(-2,4)$

   Solutions

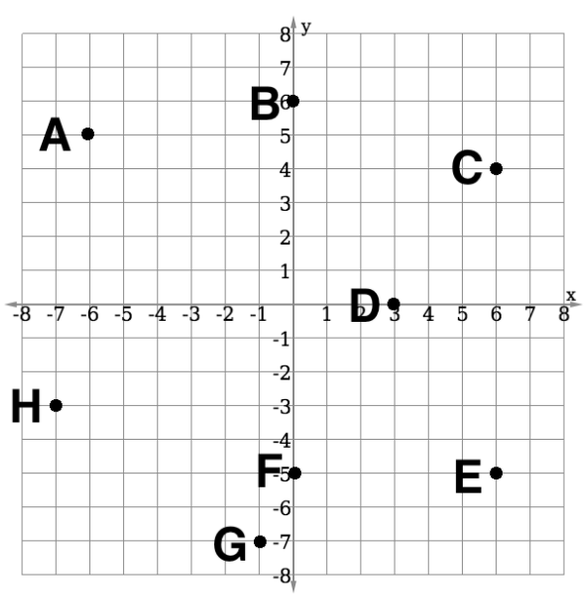
   Look at the axes on the Cartesian plane. You will notice that quadrant I has both x and y positive. Quadrant II has x negative and y positive. Quadrant III has both x and y negative. Quadrant IV has x positive and y positive.

   Use this information to answer the problem:

   a. $(3,2)$ is in quadrant I because both x and y are positive.
   b. $(-1,-1)$ is in quadrant III because both x and y are negative.
   c. $(-2,4)$ is in quadrant II because x is negative and y is positive.

Practice

1. Write the coordinates of each point in the diagram below:



2. Identify which quadrant each of the following points is in:
   a. $(-3,2)$ b. $(-5,-7)$ c. $(1,-3)$

Lesson Title: Plotting Points in the First Quadrant of the Cartesian Plane	**Theme:** Algebra
Practice Activity: PHM-07-123	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to plot given points in the first quadrant of the Cartesian plane.

Overview

In the previous lesson, you wrote the coordinates for points that were plotted on the Cartesian plane. In this lesson, you will plot points in the first quadrant using coordinates.

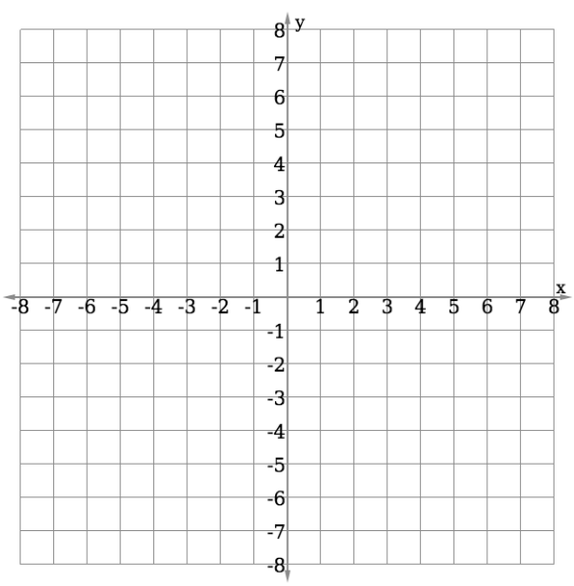
Remember that a set of coordinates is an ordered pair (x, y). The x-value tells you how far to move along the x −axis, and the y-value tells you how far to move along the y-axis. If the x-value is positive, move to the right. If the x-value is negative, move to the left. If the y-value is positive, move up. If the y-value is negative, move down.

Follow these steps to plot any point:

- Start at the origin $(0, 0)$;
- Move along the x-axis x units from the origin, stop;
- Move y units parallel to the y-axis to the required point;
- Mark the point and write it as the ordered pair, (x, y).

Solved Examples

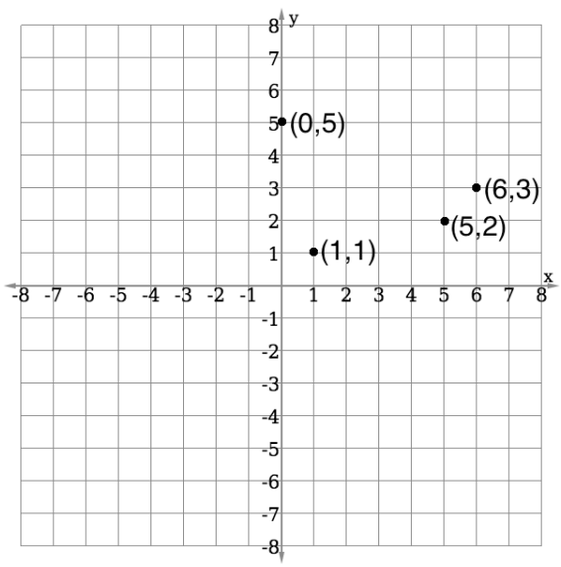
1. Plot each of the given points on the Cartesian plane below:
   a. (1, 1) b. (5, 2) c. (6, 3) d. (0, 5)



Solution

For each point, start at the origin. Move in the x-direction the given number of units, then move in the y-direction the given number of units. Label each point with its coordinates.

The answers are given below:



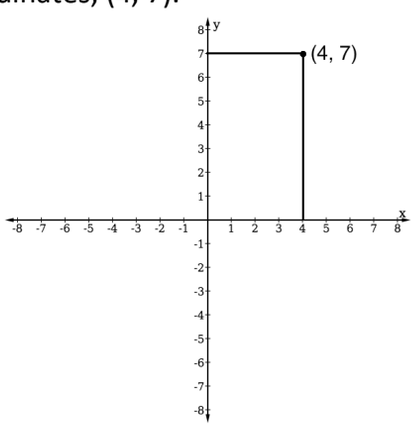
2. Draw a Cartesian plane and plot the point (4, 7).

Solution

To draw your Cartesian plane, you do not need to draw the grid. You can draw only the 2 axes. Make sure the tick marks on your axes are all the same distance apart.

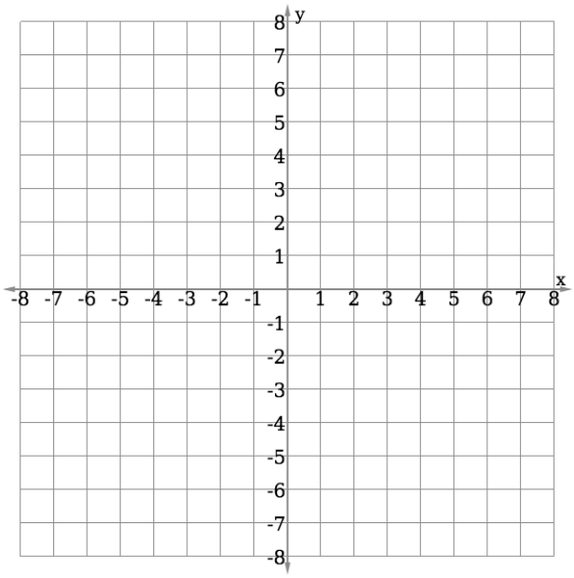
Use a ruler or any type of straight edge (for example, the side of a book) to locate the point. Put your ruler at 4 on the x-axis, and draw a vertical line. Put your ruler at 7 on the y-axis and draw a horizontal line.

Label the point with its coordinates, (4, 7).



Practice

1. Plot each of the given points on the Cartesian plane below:
   a. (1, 4) b. (3, 3) c. (5, 1) d. (2, 7)



2. Draw a Cartesian plane and plot the points (1, 4) and (4, 0).
3. Draw a Cartesian plane and plot the point (7, 7).

Lesson Title: Plotting Points in All Quadrants of the Cartesian Plane	**Theme:** Algebra
Practice Activity: PHM-07-124	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to plot given points in any quadrant of the Cartesian plane.

Overview

In this lesson, you will plot points in all 4 quadrants of the Cartesian plane. You will be able to plot any ordered pair (x, y).

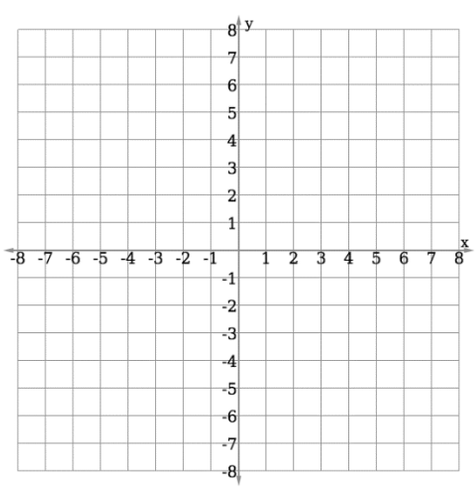
In the previous lesson, you plotted points where both x and y were positive numbers. In this lesson, you will plot points with both positive and negative coordinates. If x or y are negative, move along the correct axis in the negative direction.

Note that the signs on the coordinates tell you which quadrant the point will be in:

- Quadrant I: both positive $(+, +)$
- Quadrant II: negative x, positive y $(-, +)$
- Quadrant III: both negative $(-, -)$
- Quadrant IV: positive x, negative y $(+, -)$

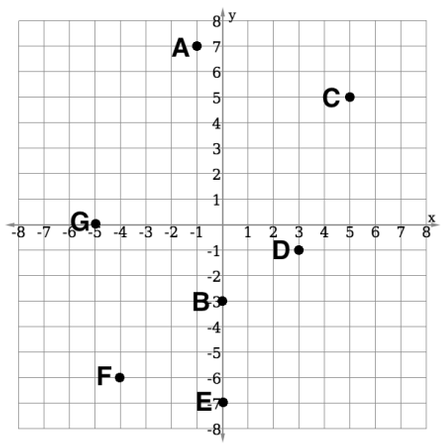
Solved Examples

1. Plot the following points on the Cartesian plane below: $\mathrm{A}(-1,7)$, $\mathrm{B}(0,-3)$, $\mathrm{C}(5,5)$, $\mathrm{D}(3,-1)$, $\mathrm{E}(0,-7)$, $\mathrm{F}(-4,-6)$, $\mathrm{G}(-5,0)$.



Solution

For each point, start at the origin. Move in the x-direction the given number of units, then move in the y-direction the given number of units. Label each point with its letter. It is not necessary to write both the letter and coordinates.



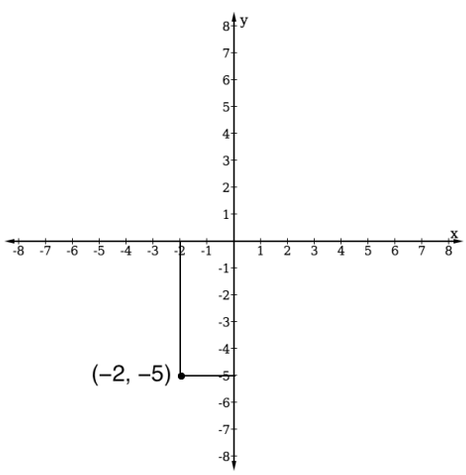
2. Draw a Cartesian plane and plot the point $(-2, -5)$.

Solution

Remember that you do not need to draw the grid. Make sure the tick marks on your axes are all the same distance apart.

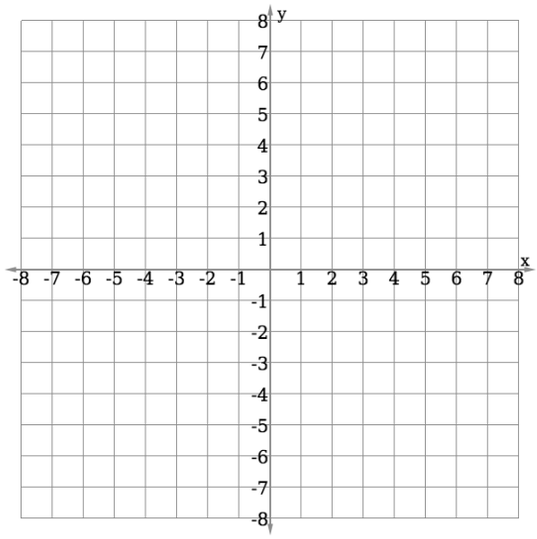
Use a ruler or any type of straight edge (for example, the side of a book) to locate the point. Put your ruler at -2 on the x-axis, and draw a vertical line. Put your ruler at -5 on the y-axis and draw a horizontal line.

Label the point with its coordinates, $(-2, -5)$.

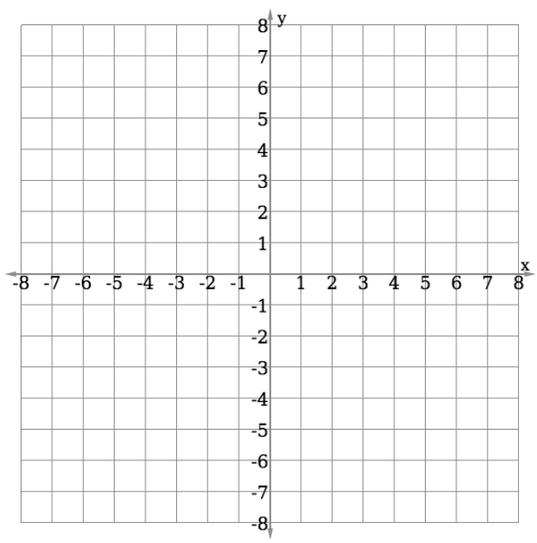


Practice

1. Draw a Cartesian plane and plot the point $(4, -6)$.
2. Draw a Cartesian plane and plot the point $(-3, 7)$.
3. Plot the following points on the Cartesian plane below: $\mathrm{A}(-7,0)$, $\mathrm{B}(0, 6)$, $\mathrm{C}(5, 1)$, $\mathrm{D}(-3, -1)$, $\mathrm{E}(0, -1)$, $\mathrm{F}(7, -6)$, $\mathrm{G}(8, 0)$.



4. Plot the following points on the Cartesian plane below: $\mathrm{T}(-1, -1)$, $\mathrm{U}(7, 7)$, $\mathrm{V}(1, 6)$, $\mathrm{W}(-3, -3)$, $\mathrm{X}(0, -5)$, $\mathrm{Y}(-6, 4)$, $\mathrm{Z}(7, -4)$.



Lesson Title: Practice with the Cartesian Plane	**Theme:** Algebra
Practice Activity: PHM-07-125	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to draw or identify any given point on the Cartesian plane.

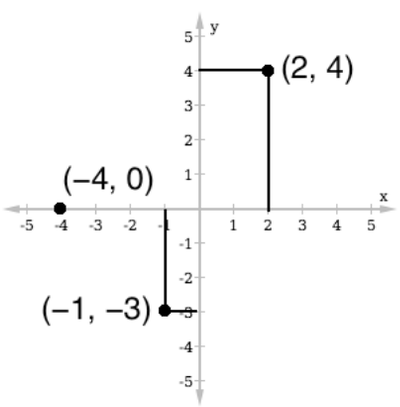
Overview

In this lesson, you will practise plotting points on the Cartesian plane. You should be able to draw an accurate Cartesian plane, with all of the tick marks the same distance apart. You should be able to plot a point anywhere on the plane.

Solved Examples

1. Draw a Cartesian plane with axes from -5 to 5. Plot the following points:
   a. $(-1, -3)$ b. $(2, 4)$ c. $(-4, 0)$

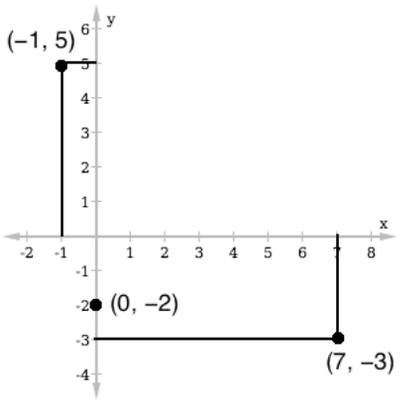
   Solution
   Draw both axes from -5 to 5 and use a straight edge to plot the points:



2. Draw a Cartesian plane with y-axis from -4 to 6 and x-axis from -2 to 8. Plot the following points:
   a. $(0, -2)$ b. $(-1, 5)$ c. $(7, -3)$

Solution

Notice that the axes extend to different numbers on the 2 axes. Make sure your drawing is correct and the tick marks are the same distance apart.



3. Draw a Cartesian plane with a scale of 1 cm to 1 unit on the x-axis, and 1 cm to 2 units on the y-axis. Plot the following points:

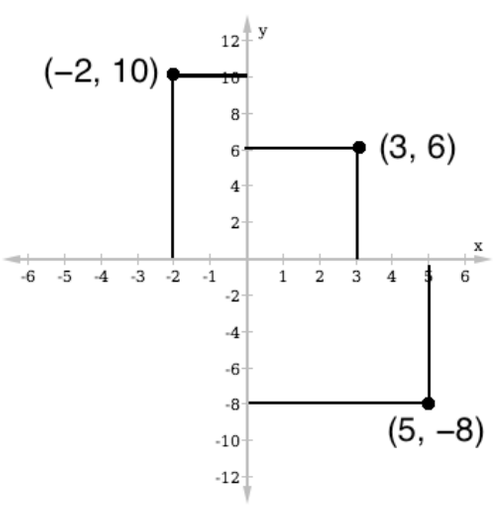
   a. $(5, -8)$ b. $(-2, 10)$ c. $(3, 6)$

Solution

In this problem, you are asked to draw the axes with scale. This tells you the exact size to draw the axes. Use a ruler to mark tick marks 1 cm apart on the x-axis and y-axis. On the x-axis, the scale is 1 cm to 1 unit. Label the tick marks with each unit (1, 2, 3, …). On the y-axis, the scale is 1 cm to 2 units. Label the tick marks by 2's (2, 4, 6, …).

The problem does not tell you how far to extend the axes. Make sure your axes are long enough to plot each of the points given.

The plane below is not the correct size. Make sure your own tick marks are each 1 cm apart.



Practice

1. Draw a Cartesian plane with axes from -5 to 5. Plot the following points:
   a. $(-4, 0)$ b. $(-3, -3)$ c. $(5, -2)$
2. Draw a Cartesian plane with y-axis from -6 to 6 and x-axis from -4 to 8. Plot the following points:
   a. $(7, 6)$ b. $(-2, -5)$ c. $(2, -3)$
3. Draw a Cartesian plane with a scale of 1 cm to 2 units on the x-axis, and 1 cm to 1 units on the y-axis. Plot the following points:
   a. $(12, 5)$ b. $(-10, -2)$ c. $(6, -3)$

Lesson Title: Data Collection	**Theme:** Statistics
Practice Activity: PHM-07-126	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to collect data from class members and display it with tally marks and pictograms.

Overview

In this lesson, you will learn how to collect and display data. Data are any numerical facts, information, or measurements of something.

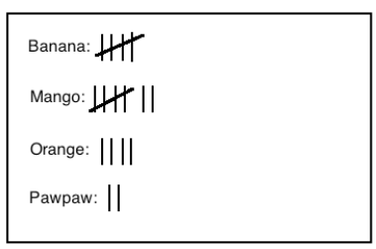
Tally marks are one way to display data. They are strokes which represent the number of times a particular event or item appears. They are grouped in fives. These are tally marks for the first 10 counting numbers:

Tally marks are useful to keep track of the number of objects while you are counting them.

Symbols or pictures can also be used to represent a certain number of items. For example, if you are counting people, you may draw pictures of the people to keep count of them. This is called a **pictogram**. See Solved Example 3 for an example of a pictogram.

Solved Examples

1. All of the pupils in a class are asked to give their favourite fruit. Each pupil comes to the board and writes a tally next to their favourite fruit. The result is given below.



   a. How many pupils responded that mango is their favourite?
   b. How many pupils prefer oranges?
   c. How many pupils prefer bananas?
   d. How many pupils are in the class?

Solutions

a. If you count the tallies for 'mango', you will find that there are 7. 7 pupils responded that mango is their favourite.
b. Four pupils prefer oranges.
c. Five pupils prefer bananas.
d. Add the total number of tallies to find the number of pupils in the class. You can either count all of the tallies, or change the tallies to numbers and add them.

   There are 5 + 7 + 4 + 2 = 18 pupils in the class.

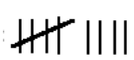
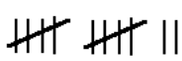
2. A pupil counted the people living in her neighbourhood. She found 9 boys, 12 girls, 21 men, and 18 women. Write each number with tally marks below:

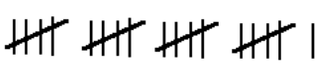
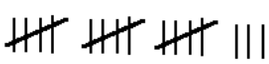
   Boys: _____ Girls: _____

   Men: _____ Women: _____

   Solution

   Remember that tally marks are in groups of 5. The numbers are shown below:

   Boys:  Girls: 

   Men:  Women: 

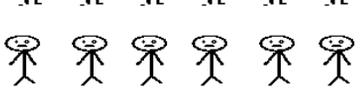
3. Sia counted the members of her family. She counted 7 females and 6 males. Help her record the number of family members with symbols. Use the following symbols for male and female:

   Male:  Female: 

   Solution

   There are 7 females, so the female symbol should be drawn 7 times. There are 6 males, so the male symbol should be drawn 6 times.

   Females: 

   Males: 

   This is a **pictogram** showing the males and females in Sia's family.

Practice

1. Martin is carrying a basket of fruit home for his family. He has 5 oranges, 8 bananas and 3 mangos. Record the number of each fruit that he has using a pictogram. Use the following symbols for the fruit:

   Orange:  Banana:  Mango: 

2. A pupil was sitting in the schoolyard before class. He counted the people he met. He met 12 girls and 16 boys. He met 4 male teachers and 5 female teachers. Help him record these numbers with tally marks:

   Boys: _____ Girls: _____

   Male teachers: _____ Female teachers: _____

3. Take a survey of your classmates. Ask your classmates to tell you their favourite fruit, and record the answers with tally marks below. You may add other fruit if your classmates prefer different fruits that are not listed. After you complete the survey, answer the questions below.

   Banana: _____ Mango: _____

   Orange: _____ Pawpaw: _____

   a. How many of your classmates prefer banana?
   b. How many of your classmates prefer mango?
   c. How many of your classmates prefer orange?
   d. How many of your classmates prefer pawpaw?
   e. How many classmates did you ask in total?

Lesson Title: Lists and Tables	**Theme:** Statistics
Practice Activity: PHM-07-127	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to organise and display collected data in a list and a table.

Overview

In this lesson, you will learn how to organise and display collected data in a table.

In your table of data, you will have 1 column for tally marks. This is to keep count while you are collecting data. The next column is for the number that you counted in with tally marks.

For example, say you want to take a survey of your classmates to understand what subjects are their favourite. You will draw a table with a row for each subject:

SUBJECT	TALLY MARKS	NUMBER OF PUPILS
Mathematics		
English Language		
Social Studies		
Integrated Studies		
Total		

As you survey your classmates, you will keep count of their answers in the “tally marks” column. After you complete the survey, you will write the number of pupils who prefer each subject in the “number of pupils” column. You can find the total number of pupils surveyed, and write the numbers in the last column, for “Total”.

Here is an example of a completed table, for a classroom with 40 pupils:

SUBJECT	TALLY MARKS	NUMBER OF PUPILS
Mathematics	𝍸 |	6
English Language	𝍸 𝍸	10
Social Studies	𝍸 𝍸 𝍸	15
Integrated Studies	𝍸 ||||	9
Total	40	40

Solved Examples

1. The ages of 15 pupils in a class were recorded as follows: 12, 14, 15, 13, 13, 12, 14, 14, 13, 15, 13, 13, 14, 12, 15.

   Use this data to complete the table below:

AGES	TALLY MARKS	NUMBER OF PUPILS
12		
13		
14		
15		
Total		

Solution

For each number in the list, make 1 tally mark in the table. It can help to cross off the ages in the list as you record them. After you record all of the pupils with tally marks, write the total number of pupils of each age in the "number of pupils" column.

~~12~~, ~~14~~, ~~15~~, ~~13~~, ~~13~~, ~~12~~, ~~14~~, ~~14~~, ~~13~~, ~~15~~, ~~13~~, ~~13~~, ~~14~~, ~~12~~, ~~15~~

AGES	TALLY MARKS	NUMBER OF PUPILS
12	|||	3
13	𝍸	5
14	||||	4
15	|||	3
Total	**15**	**15**

2. Below is a list of the marks obtained by pupils in a mathematics quiz worth 10 possible points. Organise the data in a table, then answer the questions.

   Marks: 9, 10, 10, 7, 8, 6, 6, 7, 5, 9, 10, 9, 9, 7, 7, 7, 6, 8, 10, 5, 6, 4, 7, 8, 9, 6, 8, 8.

   a. How many pupils took the maths quiz?
   b. How many pupils obtained 10 marks?
   c. What is the lowest mark obtained by a pupil?
   d. What mark did the greatest number of pupils achieve?

Solutions

First, draw the table. You will have columns for “quiz marks”, “tally marks”, and “number of pupils”. Record the marks in the list in your table:

QUIZ MARKS	TALLY MARKS	NUMBER OF PUPILS
4	|	1
5	||	2
6	𝍸	5
7	𝍸 |	6
8	𝍸	5
9	𝍸	5
10	||||	4
Total	**28**	**28**

Use the information in the table to answer the questions:

a. Twenty-eight pupils took the maths quiz.
b. Four pupils obtained 10 marks.
c. The lowest mark obtained is 4.
d. The mark with the greatest number of pupils is 7 marks.

Practice

1. Fatu is a nurse in a hospital. This morning, she recorded the weights of the babies in the hospital. Help her organise this data in a table, then answer the questions below.

   Weights of babies (kg): 3, 4, 4, 5, 3, 4, 6, 5, 7, 4, 3, 5, 5, 6, 6, 7, 5, 5, 3

   a. How many babies did Fatu weigh?
   b. What is the weight of the heaviest baby?
   c. How many babies weigh 4 kg?
   d. What is the most common weight of the babies?

2. Some pupils in a JSS1 class measured their height to the nearest 5 cm. Their heights are recorded below. Organise this data in a table, then answer the questions below.

   Height of pupils (cm): 160, 155, 155, 170, 165, 165, 155, 150, 160, 155, 165, 170.

   a. How many pupils measured their heights?
   b. What is the height of the tallest pupil?
   c. How many pupils are 160 cm tall?

Lesson Title: Creating Bar Charts	**Theme:** Statistics
Practice Activity: PHM-07-128	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to display collected data in a bar chart.

Overview

This lesson is on drawing bar charts based on data. The data is given in a table similar to the tables you created in the previous lesson. This is called a **frequency table**. The numbers in the table give the frequency, or quantity, of each item.

In a bar chart, the height of each bar tells the frequency. Bar charts are used to compare different quantities.

Solved Examples

1. A teacher surveyed a class to learn the favourite fruits of the class members. The result of the survey is show in the frequency table below. Draw a bar chart for the data.

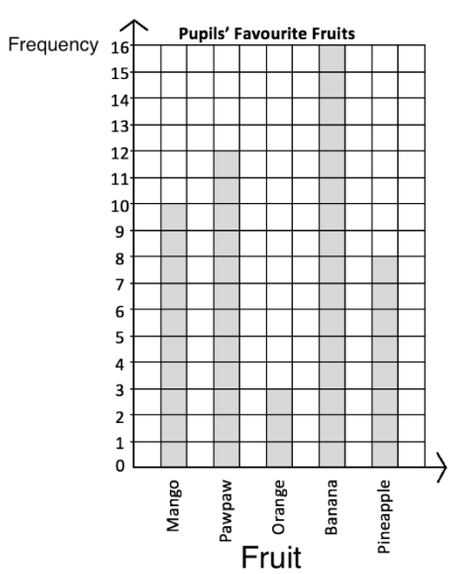
Favourite Fruits	
Fruit	**Frequency**
Mango	10
Pawpaw	12
Orange	3
Banana	16
Pineapple	8

Solution

Each row on the table is 1 bar on the chart.

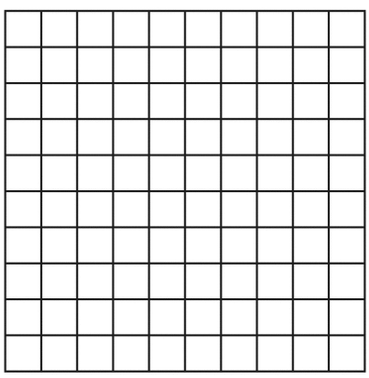
Draw the axes. The 'Frequency' axis should extend to at least 16. The 'Fruit' axis should have the 5 fruits.

Draw the bars. The height of each bar is given in the frequency table.



2. The table below shows the number of JSS pupils that play football on the school team. Using the grid below, draw a bar chart to present the data.

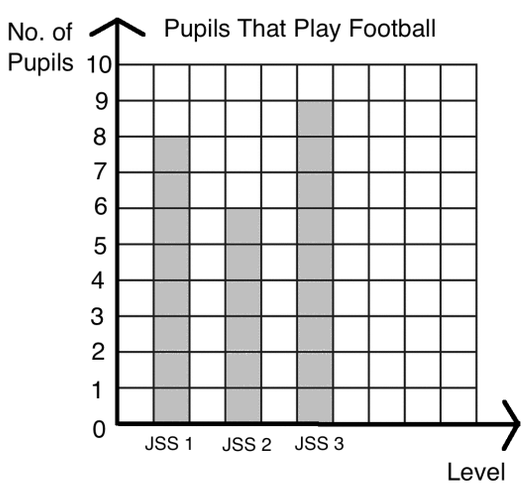
Level	JSS 1	JSS 2	JSS 3
No. of Pupils	8	6	9



Solution

This frequency table is drawn horizontally. It is the same as a frequency table drawn vertically. In this case, each column gives information for a bar on the chart.

In this case, you are given a grid for the bar chart. Draw the axes on it, and label each bar with the correct JSS level.



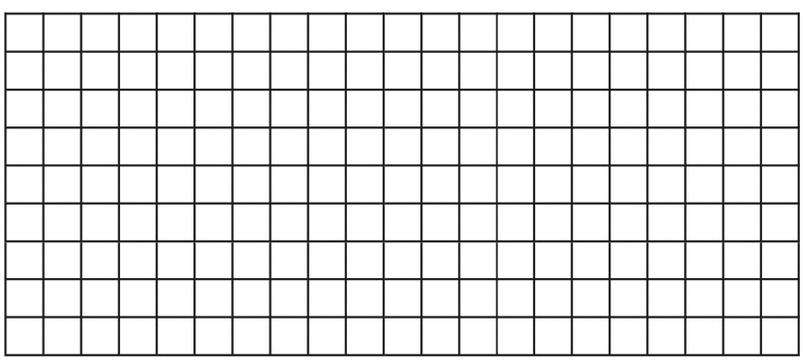
Practice

1. The following is the result of a survey conducted by an NGO on the jobs worked by adults in a community in Kailahun district. Draw a bar chart to show the information.

Job	No.
Farmers	8
Traders	2
Health workers	3
Teachers	5
Other	4

2. The table below shows the marks of pupils who took a test. No pupil scored lower than 40% or higher than 85%. Draw a bar chart for the information using the grid below.

Marks (%)	40	45	50	55	60	65	70	75	80	85
No. of Pupils	1	2	4	3	0	2	5	8	1	2



Lesson Title: Interpreting Bar Charts	**Theme:** Statistics
Practice Activity: PHM-07-129	**Class:** JSS 1

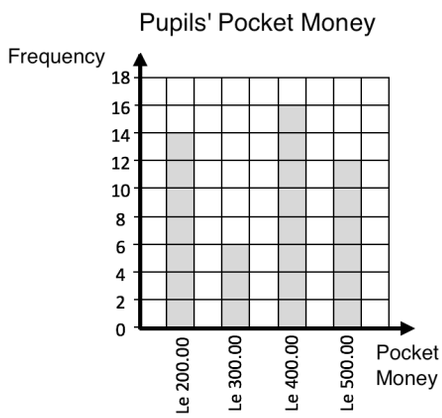
Learning Outcome
By the end of the lesson, you will be able to make comparisons and draw conclusions from bar charts.

Overview

In the previous lesson, you drew bar charts using data in a frequency table. In this lesson, you will be given a bar chart. You will interpret the bar chart and answer questions.

Solved Examples

1. The bar chart below shows the pocket money received by pupils in a class in a week. Use the bar chart to answer the questions below.



   a. Find the total number of pupils in the class.
   b. What is the maximum amount of pocket money that any pupil received in a week?
   c. Which amount of money did the greatest number of pupils receive?
   d. How many pupils received $\text{Le } 200.00$ for a week?
   e. How many pupils received either $\text{Le } 300.00$ or $\text{Le } 500.00$ for a week?

   Solutions

   a. Add the heights of the bars: $14 + 6 + 16 + 12 = 48$ pupils
   b. The maximum amount of money that any pupil received is $\text{Le } 500.00$. It is the greatest number on the “Pocket Money” axis.
   c. The greatest number of pupils received Le 400.00, the amount with the tallest bar.
   d. Fourteen pupils received Le 200.00 for a week. This is the height of the Le 200.00 bar.

e. We want to include all of the pupils who received $\text{Le } 300.00$ and all of the pupils who received $\text{Le } 500.00$. Add the heights of the bars for Le 300.00 and Le 500.00:

$6 + 12 = 18$ pupils

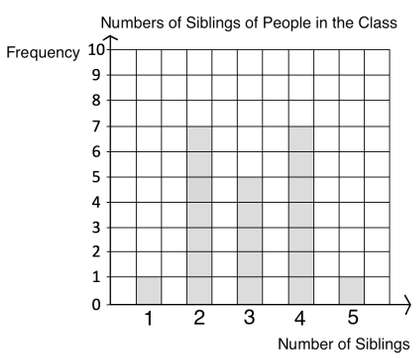
2. Issa took a survey of his classmates to find how many siblings they have. The results of his survey are in the table below. Draw a bar chart to display this data, then use it to answer the questions below.

No. of Siblings	1	2	3	4	5
Frequency	1	7	5	7	1

a. How many people have 2 siblings?
b. How many people have at least 4 siblings?
c. How many more people have 4 siblings than 5 siblings?
d. What is the greatest number of siblings any member of the class has?

Solutions

Your bar chart should look like this:

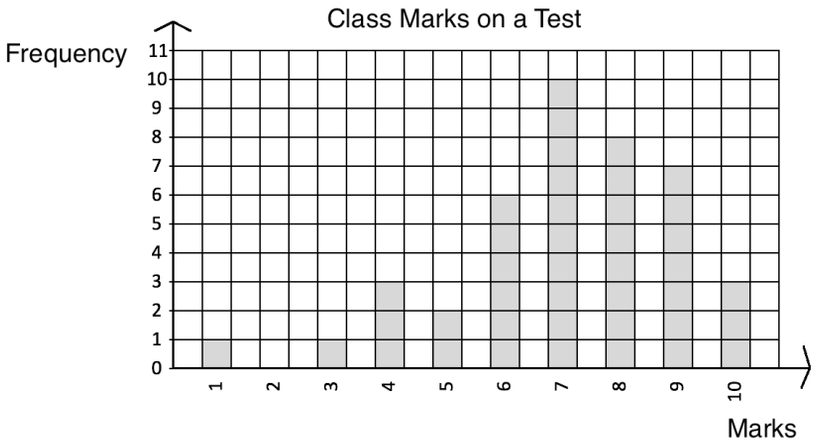


The answers to the questions are:

a. Seven people have 2 siblings.
b. A pupil needs to have 4 or 5 siblings to have at least 4 siblings. Add the heights of the bars for 4 and 5: 7 + 1 = 8 people
c. The words “how many more” tell us to subtract to find the difference. Subtract the number of people with 5 siblings from the number of people with 4 siblings:
   7 – 1 = 6 people
d. The greatest number of siblings that any member of the class has is 5. This is the greatest number on the “Number of Siblings” axis.

Practice

1. The bar chart below shows the marks that a class of pupils received on a test. Use the bar chart to answer the questions below.



   a. How many pupils sat the test?
   b. What was the lowest score on the test?
   c. How many pupils scored 8 marks?
   d. How many pupils scored at least 9 marks?
   e. If pupils need 7 marks or higher to pass, how many pupils passed?
   f. How many pupils failed?

2. Hawa took a survey of her classmates to find their shoe size. The results of her survey are in the table below. Draw a bar chart to display this data, then use it to answer the questions below.

Shoe Size	35	36	37	38	39
Frequency	2	6	7	4	1

   a. How many classmates did Hawa survey?
   b. What is the smallest shoe size in the class?
   c. What is the largest shoe size in the class?
   d. What is the most common shoe size in the class?
   e. How many classmates wear at least size 37?

3. A class teacher asked his pupils to name their favourite colour. The responses of the pupils are shown in the table below. Draw a bar chart to illustrate this data, then use it to answer the questions below.

Favourite colours	Yellow	Blue	Red	Green	White
Frequency	4	6	5	8	2

   a. How many pupils are in the class?
   b. What is the most popular colour in the class?
   c. What is the least popular colour in the class?

Lesson Title: Creating Line Graphs	**Theme:** Statistics
Practice Activity: PHM-07-130	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to display collected data in a line graph.

Overview

In this lesson, you will learn to display collected data in another type of chart, called a **line graph**. To draw a line graph, you need a collection of data that has changed over time. A line graph is a graph that uses points connected by a line to show how something changes in value as time goes by.

In a line graph, the x-axis is time. It can be measured in any unit of time, including minutes, hours, days, weeks, months, or years. The y-axis shows the quantity of something that changes over time.

Solved Examples

1. Mariama wants to show how much weight her dog Billy has gained from when he was a puppy to when he was fully grown. Here is the data she collected on her notepad:

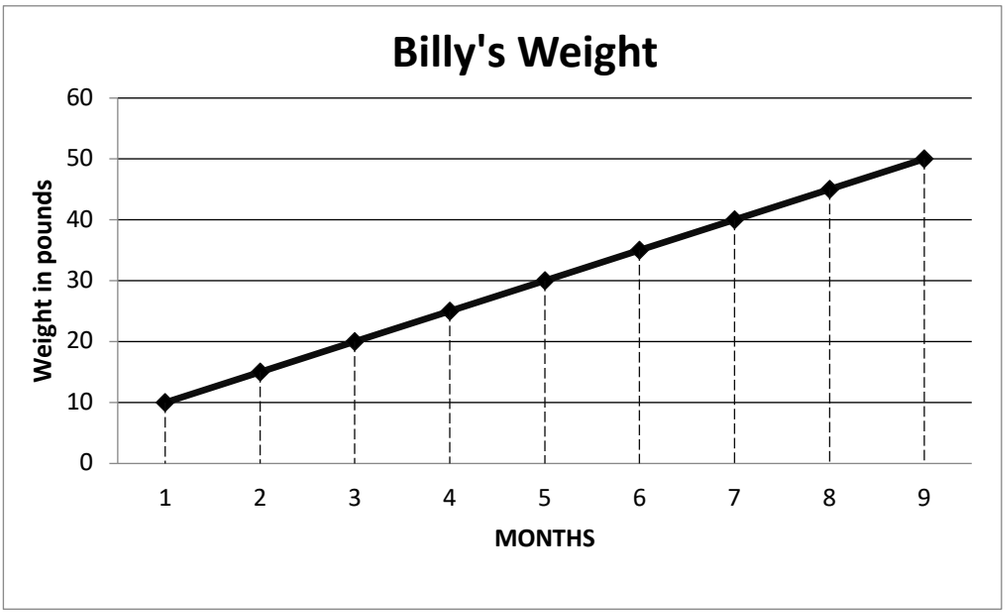
Months	1	2	3	4	5	6	7	8	9
Weight in lbs	10	15	20	25	30	35	40	45	50

   Display the data in a line graph.

   Solution
   Like other graphs, line graphs need two axes, one vertical (y-axis), and one horizontal (x-axis). In this case, the x-axis is the time in months. Each number in the "Months" row of the table should be on the x-axis.

   The y-axis represents the range of Billy's weight in pounds. The dog's lowest weight was 10 lbs and his highest weight was 50 lbs. We will make our y-axis range from 0 to 60 lbs to cover all of its weight. You may count by 5s or 10s on the y-axis.

   Plot each point from the table. Connect each point to the next one with a straight line. You may use a ruler or straight edge.



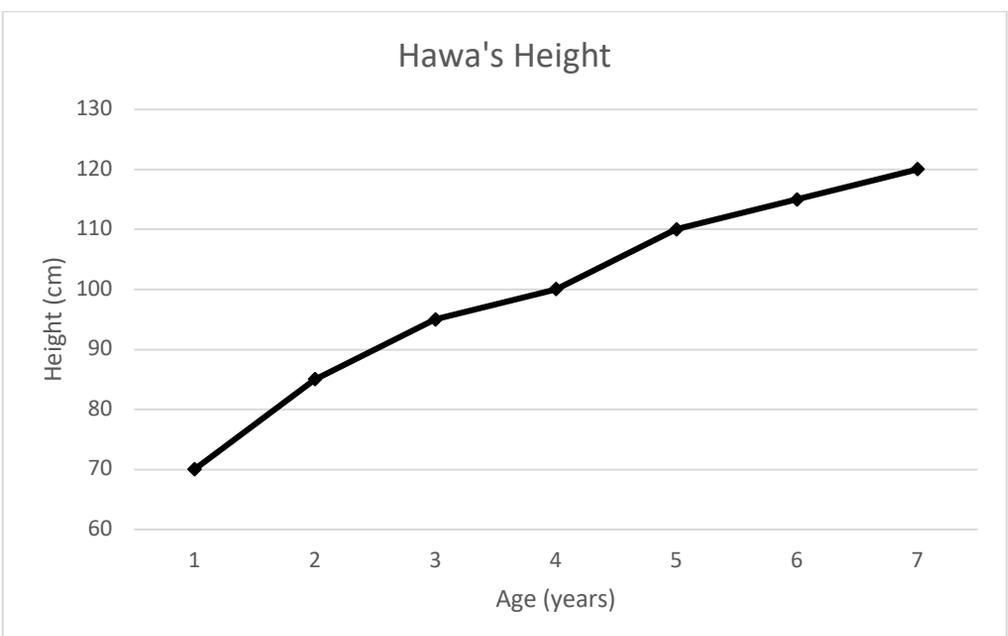
Make sure your line graph has a title, and each axis is labeled.

2. Hawa's parents measured her height each year on her birthday. Her height for 7 years is given in the table below, in centimetres. Draw a line graph for the data.

Age (years)	1	2	3	4	5	6	7
Height (cm)	70	85	95	100	110	115	120

Solution

Draw the two axes. The x-axis is age in years, and the y-axis is height in centimetres. Plot each point from the table. Connect each point to the next with a straight line.



Note that it is not necessary to draw lines from the axes to each point. However, you may draw the lines (as in Solved Example 1) with a straight edge. This can help you plot the points accurately.

Practice

1. The table below shows daily temperatures for London, recorded for 6 days in degrees Celsius. Display the data in a line graph with a y-axis ranging from 15 to 25 degrees.

Day	1	2	3	4	5	6
Temperature (°C)	17	19	18	16	21	23

2. Mustapha sells rice in his shop. He keeps track of the amount of rice he sells each day, in kilogrammes. This helps him to know when to buy more rice for his shop. The amount of rice he sold each day for one week is in the table below. Display the data in a line graph.

Day	1	2	3	4	5	6	7
Rice sold (kg)	3	4	2.5	3.5	5	5.5	3

3. Fatu travels each day for her job. She kept track of the money she spent on transportation this week. Display the data below in a line graph.

Day	1	2	3	4	5
Leones (Le)	4,000.00	2,000.00	1,000.00	6,000.00	5,000.00

Lesson Title: Interpret Line Graphs	**Theme:** Statistics
Practice Activity: PHM-07-131	**Class:** JSS 1

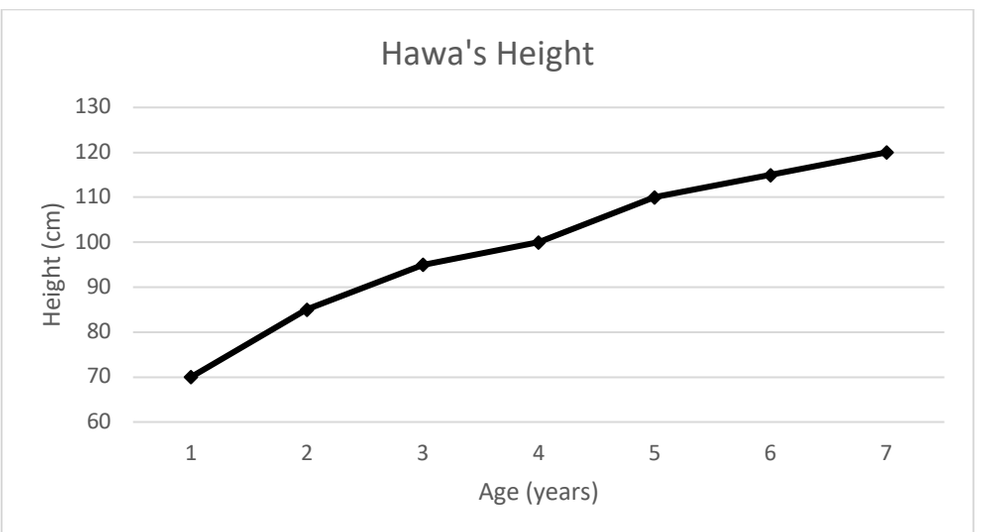
Learning Outcome
By the end of the lesson, you will be able to make comparisons and draw conclusions from line graphs.

Overview

In this lesson, you will learn how to make comparisons and draw conclusions from a line graph. You can use a line graph to answer many different types of questions.

Solved Examples

1. The graph of Hawa's height from the previous lesson is below. Use it to answer the questions below.



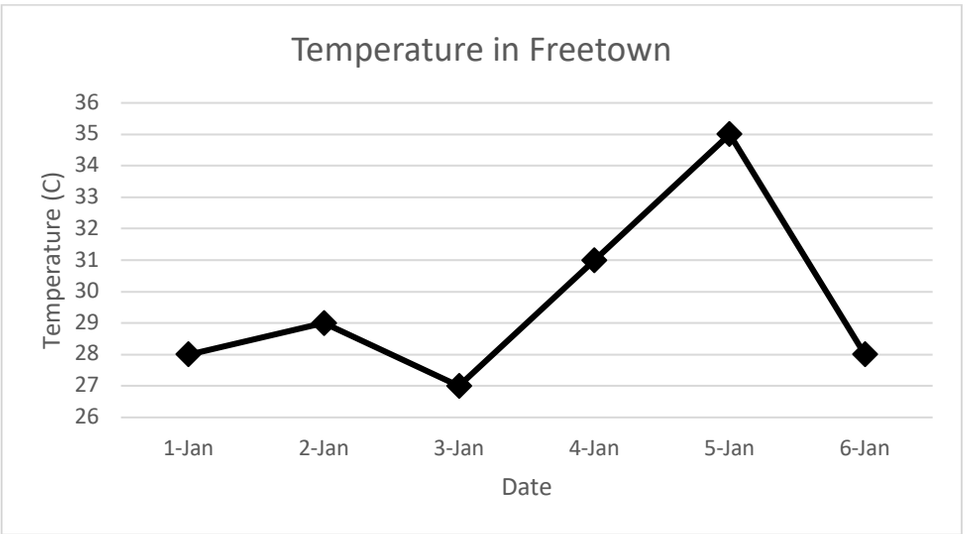
   a. How tall was Hawa on her first birthday?
   b. How tall was Hawa on her third birthday?
   c. How much did Hawa grow between her first birthday and her third birthday?
   d. How much did Hawa grow between her first and seventh birthdays?
   e. In which year of her life did Hawa grow the most?

Solutions

a. On her first birthday, Hawa was 70 cm tall. To find this, start at year 1 on the x-axis. From the point plotted at year 1, find the corresponding value on the y-axis. It is 70 cm.
b. On her third birthday, Hawa was 95 cm tall.
c. To find how much Hawa grew, subtract her height on her first birthday from her height on her third birthday. Hawa's growth: 95 – 70 = 25 cm.

d. Subtract her height on her first birthday from her height on her seventh birthday. Hawa's growth: 120 – 70 = 50 cm.
e. Find the largest change from one year to the next. In this graph, the largest change is from 1 year to 2 years. She grew 15 cm when she was 1 year old.

2. The line graph below gives the temperature in Freetown in degrees Celsius during the first 6 days of the year. Use the graph to answer the questions below.



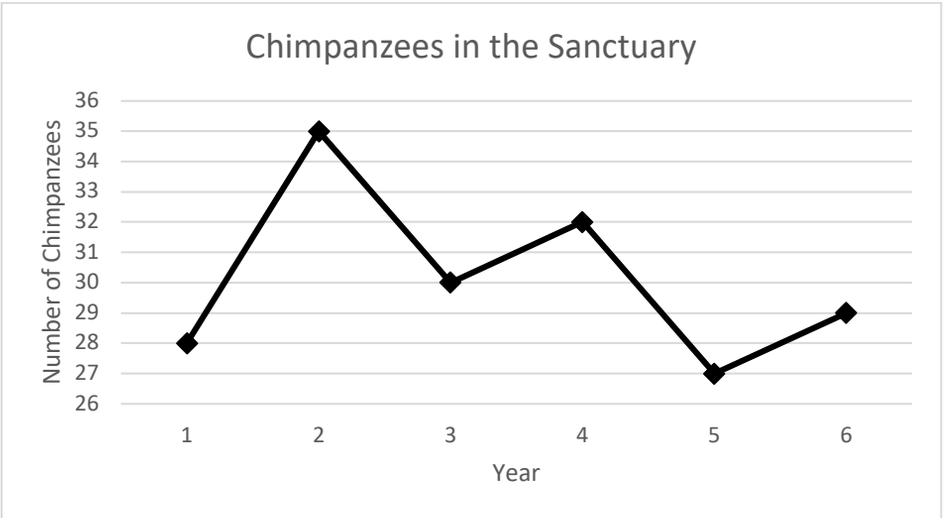
a. Which day was the hottest?
b. Which day was the coldest?
c. What was the temperature difference between the hottest day and coldest day?
d. Were any 2 dates the same temperature? If so, which dates?
e. What was the greatest temperature change from one day to the next?

Solutions

a. January 5 was the hottest day, because it is the highest on the graph at 35 degrees.
b. January 3 was the coldest day, because it is the lowest on the graph at 27 degrees.
c. Subtract to find the temperature difference: 35 – 27 = 8 degrees.
d. Yes, 1 and 6 January were the same temperature, 28 degrees.
e. The greatest temperature change was from January 5 to January 6. The temperature dropped from 35 to 28 degrees, a change of 7 degrees.

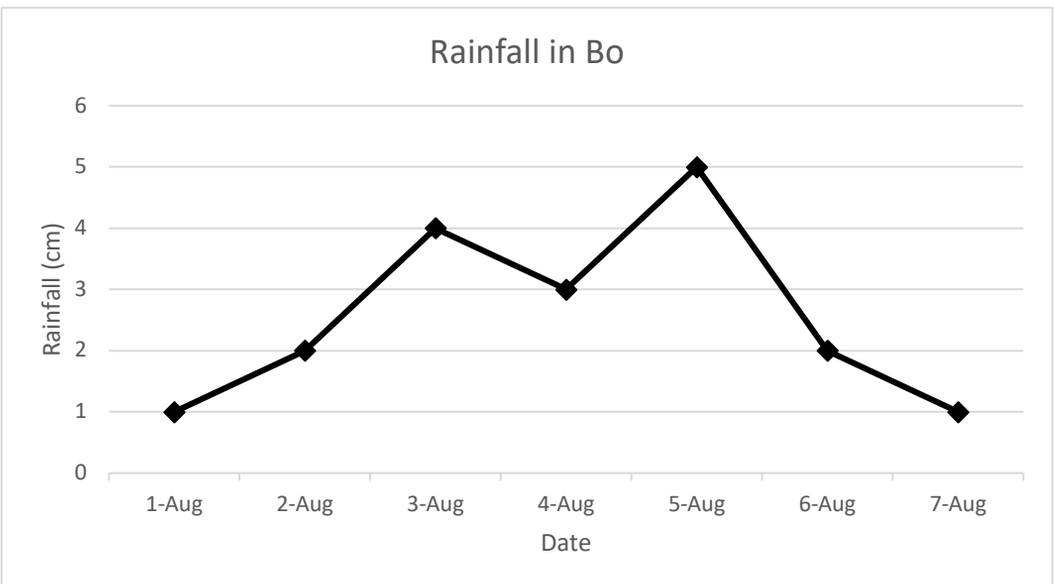
Practice

1. Chimpanzees live at a sanctuary when they cannot survive in the wild. When the chimpanzees are ready, they are released into the wild. The graph below shows how many chimpanzees lived in a certain sanctuary during the first 6 years of operation. Use the graph to answer the questions below.



a. How many chimpanzees lived in the sanctuary during the fourth year of operation?
b. What is the greatest number of chimpanzees that lived in the sanctuary in year 1?
c. In which year did the greatest number of chimpanzees live in the sanctuary?
d. In which year did the lowest number of chimpanzees live in the sanctuary?
e. How many more chimpanzees lived in the sanctuary during the second year than the first year?

2. Emmanuel likes to study the weather. He measured the rainfall in Bo during 1 week in August and recorded it in the graph below. Use the graph to answer the questions.



a. How much did it rain on August 6?
b. On which date did it rain the most?
c. On which date did it rain the least?
d. How much more did it rain on August 5 than on August 4?
e. How much less did it rain on August 7 than on August 5?

Lesson Title: Pie Charts	**Theme:** Statistics
Practice Activity: PHM-07-132	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to interpret information from a pie chart.

Overview

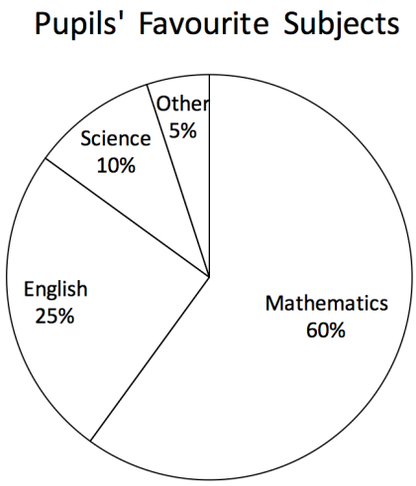
This lesson is on interpreting pie charts and solving problems related to pie charts. A pie chart is a type of graph in which a circle is divided into sectors that each represents a portion of the whole. A pie chart is also known as a circle chart.

In this lesson, parts of the whole will be given as percentages. The percentages in a pie chart always add up to 100%. Remember that 100% is the same as one whole. A bigger percentage takes up more space in the pie chart.

You can find the number of items represented by each sector of a pie chart using the percentage of the whole. You also need to know the total number represented in the chart. See parts c and d of Solved Example 1.

Solved Examples

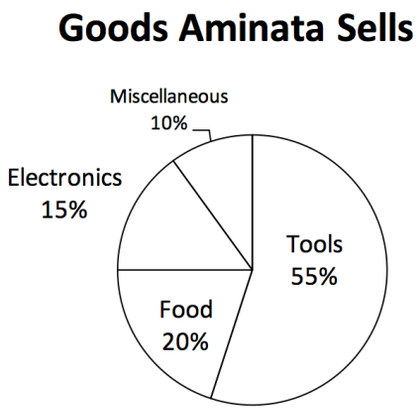
1. The principal of a school conducted a survey of 200 pupils to learn their favourite subjects. The result of the survey is in the pie chart to the right. Use the pie chart to answer the questions:
    a. Which subject was the most popular?
    b. What percentage of pupils prefer English?
    c. How many pupils prefer English?
    d. How many pupils prefer mathematics?



Solutions

a. Mathematics was the most popular subject. It has the largest sector in the pie chart.
b. A total of 25% of pupils prefer English.
c. To find the number of pupils who prefer English, find 25% of 200, the number of pupils surveyed. Number who prefer English $= \frac{25}{100} \times 200 = 25 \times 2 = 50$ pupils.
d. To find the number who prefer mathematics, find 60% of 200. Number who prefer mathematics $= \frac{60}{100} \times 200 = 60 \times 2 = 120$ pupils.

2. This week, Aminata earned Le 2,000,000.00 by selling goods in her shop. The pie chart at right shows the percentage that Aminata has earned this week in each category of goods that she sells. Use the pie chart to answer the questions.



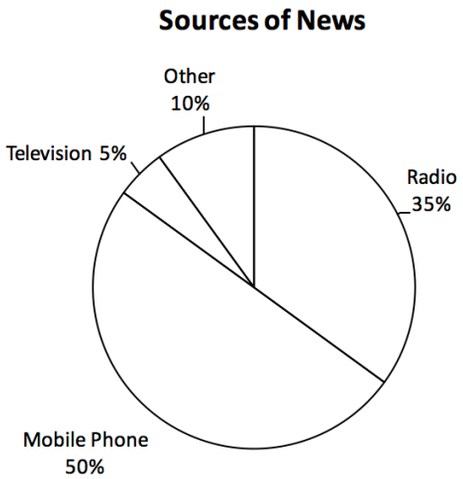
   a. From which category of goods did Aminata earn the most money?
   b. From which category of goods did Aminata earn the least amount of money?
   c. How much did Aminata earn from electronics?
   d. How much did Aminata earn from food?
   e. How much more did Aminata earn from tools than from electronics?
   f. Do you have any business ideas for Aminata?

   Solutions

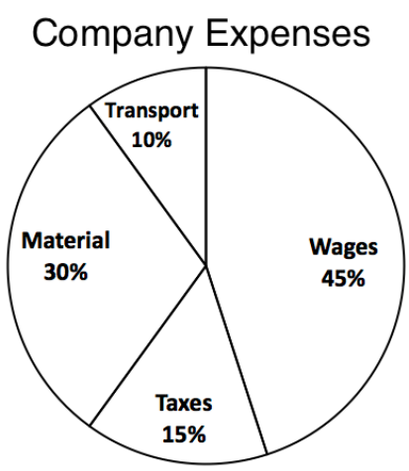
   a. Aminata earned the most money from tools, which has the largest sector.
   b. Aminata earned the least amount of money from "miscellaneous", which has the smallest sector. This is a category that includes everything she sold that is not tools, food, or electronics.
   c. To find how much she earned from electronics, find 15% of Le 2,000,000.00.
      Earned from electronics $= \frac{15}{100} \times \text{Le } 2{,}000{,}000 = 15 \times 20{,}000 = \text{Le } 300{,}000.00$
   d. Earned from food $= \frac{20}{100} \times \text{Le } 2{,}000{,}000 = 20 \times 20{,}000 = \text{Le } 400{,}000.00$
   e. To find how much more she earned from tools than electronics, we need to first know how much she earned from tools.
      Earned from tools $= \frac{55}{100} \times \text{Le } 2{,}000{,}000 = \ 55 \times 20{,}000 = \text{Le } 1{,}100{,}000.00$
      Remember that she earned Le 300,000.00 from electronics (part c).
      Subtract to find the difference: $1{,}100{,}000 - 300{,}000 = \text{Le } 800{,}000$
      Aminata earned Le 800,000.00 more from tools than from electronics.

Practice

1. Fatu conducted a survey of 300 members of her community to learn how people get their news. The results of her survey are in the pie chart at right. Use the chart to answer the following questions:
    a. How do most people get their news?
    b. What is the least common news source?
    c. How many people get their news by radio?
    d. How many people get their news by mobile phone?



2. Abu started a company. He created a pie chart to show his company expenses this week. His company spent a total of Le 4,000,000.00 this week. Use this information to answer the following questions:
    a. What was the company's greatest expense this week?
    b. How much did the company spend on transport?
    c. How much did the company spend on taxes?
    d. How much more money did the company spend on wages than materials?



Lesson Title: Comparing Graphs and Charts	**Theme:** Statistics
Practice Activity: PHM-07-133	**Class:** JSS 1

Learning Outcomes

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

1. Identify that bar charts and line graphs are used to compare different amounts and pie charts are used to compare parts of the whole.
2. Create an appropriate chart for a set of data.

Overview

In this lesson, you will practise the previous lessons on bar charts, line graphs, and pie charts. Remember that these are used to show different types of data. Review their definitions:

- A **bar chart** is used to compare different amounts.
- A **line graph** is used to display and compare information that changes over time.
- A **pie chart** is a type of graph in which a circle is divided into sectors that each represents a proportion of the whole.

In this lesson, you will be given data in a table. You will decide which type of graph or chart is the best for representing the data. Use the definition of each type of chart above to help you decide.

You have not learned how to exactly draw a pie chart. Do your best to draw pie charts with the sectors in the correct sizes. For example, a sector of 60% would be twice as large as a sector with 30%.

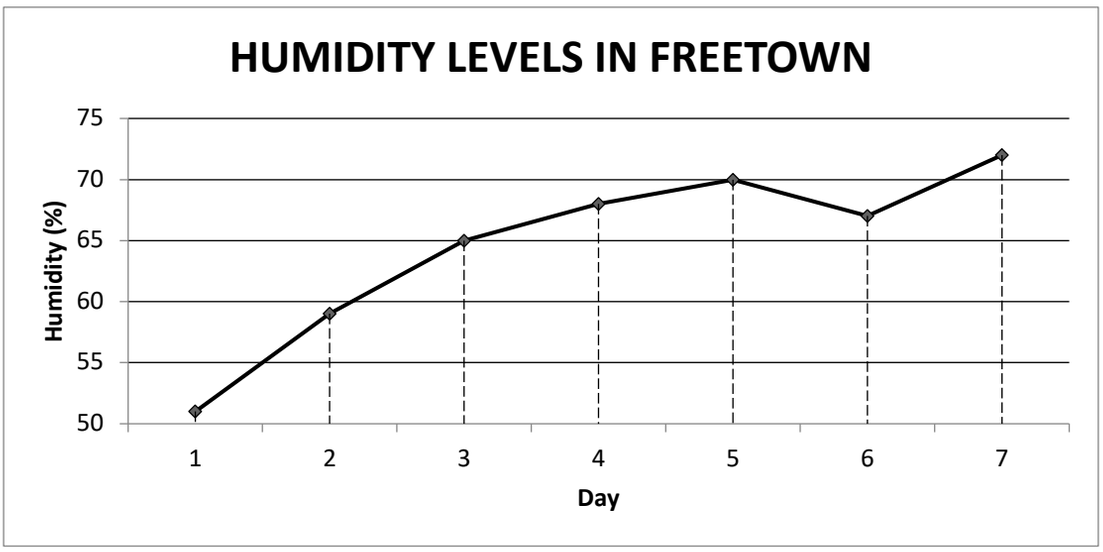
Solved Examples

1. The table below shows the humidity level recorded in Freetown for 7 days. Construct a graph which best demonstrates the humidity level for each day.

HUMIDITY LEVELS IN FREETOWN	
Day	**Humidity Level (%)**
1	51
2	59
3	65
4	68
5	70
6	67
7	72

Solution

Humidity tells us the amount of water vapour, or moisture, in the air. We want to compare different values, and we can see that the data is changing over time. A line graph would be the best choice for displaying this data.



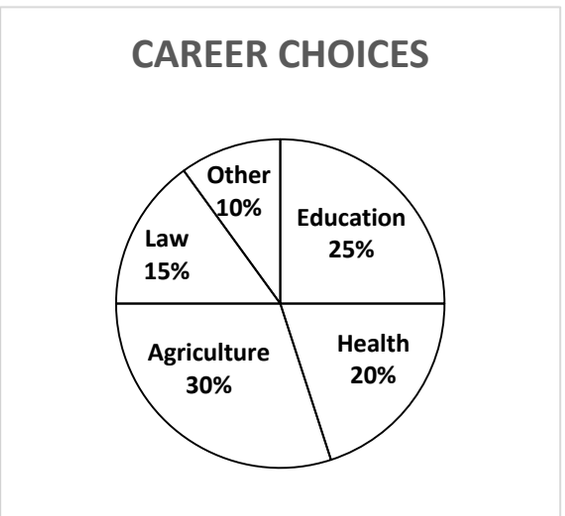
2. Martin took a survey of his classmates to understand what field they want to work in when they finish school. He found that 25% want to work in education, 20% chose health, 30% chose agriculture, 15% chose law, and the rest chose other fields. Display this information in a chart or graph.

Solution

We are dealing with percentages as parts of a whole. We will use a pie chart to represent all of Martin's survey participants. There will be 5 sectors: education, health, agriculture, law and other.

Find the size of 'other' by subtracting the known percentages from 100%:
$100 - 25 - 20 - 30 - 15 = 10\%$

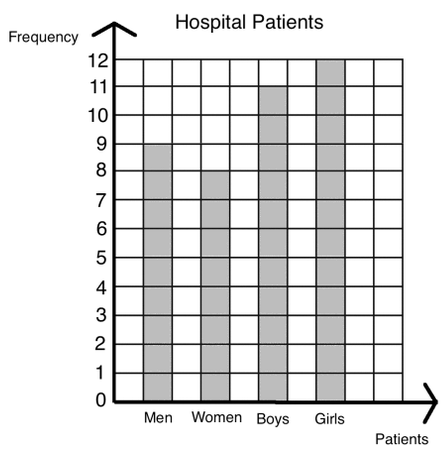
Draw the sectors of your circle according to the size of the percentage. You will estimate the size, but make sure it looks accurate. Agriculture is the largest sector, and 'other' is the smallest.



3. Dr. Bangura wants to create a chart or graph to show the patients admitted to the hospital this week. This week there were 9 men, 8 women, 11 boys and 12 girls admitted to the hospital. Display this information for her.

Solution

Dr. Bangura wants to compare different amounts. A bar chart is the best option. A pie chart could also be used to show parts of the whole. We would need to calculate percentages for each type of patient. The bar chart is shown below:



Practice

1. David kept track of his spending this month. He found that he spent 20% on transportation, 30% on food, 35% on rent, and the rest on entertainment. Draw a graph or chart to show David's spending.
2. The principal of a secondary school collected the data in the table below. Help him display his data in a graph or chart.

Pupil Population	
Class	**Number of Pupils**
JSS 1	35
JSS 2	40
JSS 3	38
SSS 1	34
SSS 2	30
SSS 3	28
SSS 4	25

3. Hawa is interested in studying the weather. She measured the temperature in her village for 6 days and recorded it in the table below. Help her display her data in a graph or chart.

Date	8 May	9 May	10 May	11 May	12 May	13 May
Temperature (°C)	30	31	33	29	30	35

Lesson Title: Community Survey: Collecting Data	**Theme:** Statistics
Practice Activity: PHM-07-134	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to collect information about the community and organise it in a table**.**

Overview

In this lesson, you will learn how to collect information about the community and organise it in a table.

A **survey** is a way of collecting information that you hope represents the views of the whole community or group in which you are interested. If you conduct a survey, you will have a question or a set of questions that you want to answer. You will choose a certain number of people in the community to answer the questions. You could choose everyone in the community, or you could choose part of the community.

A survey is a type of data collection. **Data collection** is the process of gathering and measuring information in a systematic way.

Solved Examples

1. The chief of a village collected information with a survey. He interviewed 100 people to learn what resources people need. Thirty people wanted a new secondary school, 35 people wanted a new health centre, 20 people wanted a new market building and 15 people wanted new roads. Help the chief display this information in a table.

   Solution
   Draw a table with 6 rows. Your table should have a heading, 4 rows for data, and 1 row for the total number of people. See the table below:

Resource	Number of People
Secondary School	30
Health Centre	35
Market Building	20
New Roads	15
Total	**100**

2. Count the number of female and male teachers in your school, and complete the table below. You may use the "Tally Marks" column to keep count.

Teachers in My School		
Gender	**Tally Marks**	**Number of Teachers**
Male		
Female		

Solution

The numbers in your completed table will depend on the teachers in your school. Compare your table with your classmates. Here is an example:

Teachers in My School		
Gender	**Tally Marks**	**Number of Teachers**
Male	𝍸 𝍸 ||	12
Female	𝍸 ||||	9

3. Sia counted the people in her neighbourhood. Her data is in the "Tally Marks" column of the first table. Complete both tables below with Sia's data.

a.

People	**Tally Marks**	**Number**
Adult - Males	𝍸 𝍸 ||	
Adult - Females	𝍸 𝍸	
Children - Boys	𝍸 𝍸 |	
Children - Girls	𝍸 𝍸 ||||	
Total		

b.

People	**Number**
Adults	
Children	
Total	

Solutions

a. Fill the table with the numbers from the problem. Then, add the numbers to find the total:

People	Tally Marks	Number
Adult - Males	𝍸 𝍸 ||	12
Adult - Females	𝍸 𝍸	10
Children - Boys	𝍸 𝍸 |	11
Children - Girls	𝍸 𝍸 ||||	14
Total	47	47

b. Add the adult females and adult males to fill the "Adults" row: 12 + 10 = 22. Add the boys and girls to fill the "Children" row: 11 + 14 = 25.

People	Number
Adults	22
Children	25
Total	47

Practice

1. Count the boy and girl pupils in your class. Complete the table below:

Pupils in my Class		
Gender	**Tally Marks**	**Number of Pupils**
Male		
Female		
Total		

2. Count your own neighbours. How many adult men and women are there? How many boy and girl children are there? Use your information to complete the tables below.

a.

People	Tally Marks	Number
Adult - Males		
Adult - Females		
Children - Boys		
Children - Girls		
Total		

b.

People	Number
Males	
Females	
Total	

3. Ask some of your family members, friends or neighbours if they would rather have a new school or a new health clinic in your community. Use tally marks to keep count, and fill the table below. What would more people prefer?

What Our Community Needs		
Resource	**Tally marks**	**Number**
Health Clinic		
School		

Lesson Title: Community Survey: Displaying Data	**Theme:** Statistics
Practice Activity: PHM-07-135	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to create graphs and charts to display information about the community.

Overview

In the previous lesson, you learned how to collect information about the community and organise it in a table. In this lesson, you will create graphs and charts to display information about the community.

Solved Examples

1. In the previous lesson, you helped a village chief display his data in the table below. Help him display his data on a graph or chart.

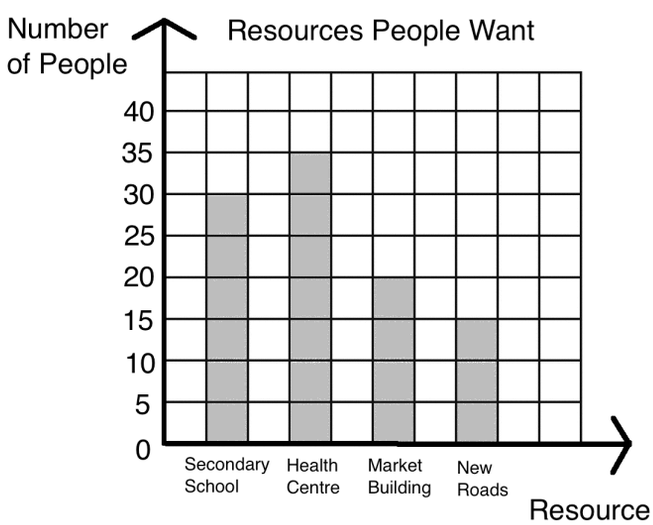
Resource	Number of People
Secondary School	30
Health Centre	35
Market Building	20
New Roads	15
Total	**100**

Solution

First, decide which graph or chart is best for displaying the chief's data. A bar graph will be best, because bar graphs are used to compare different quantities.

Draw the axes, and choose an appropriate scale for the y-axis. In this case, it will be easiest to count by 5's.

Draw each bar the correct height.

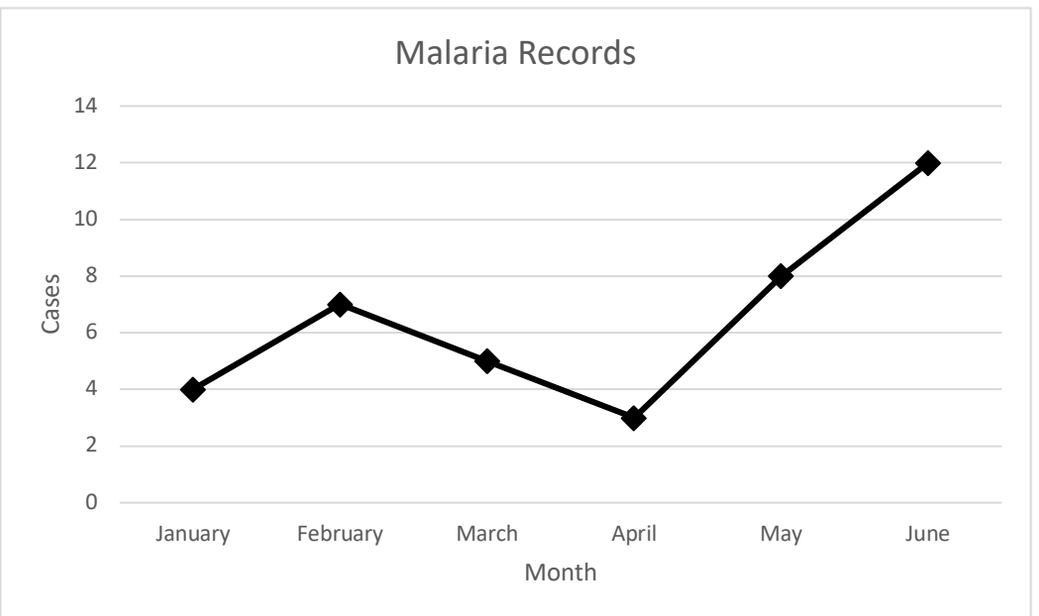


2. To understand the needs of his community, the chief asked the health clinic how many patients were treated for malaria during the previous 6 months. The clinic gave him the table below. Help the chief by displaying this data in a chart or graph.

Malaria Records	
Month	**Number of Cases**
January	4
February	7
March	5
April	3
May	8
June	12

Solution

First, decide which type of graph or chart to draw. In this case, you want to show how the quantity changes over time. Use a line graph.



Practice

1. The chief wanted to understand the population growth of his village. The table below shows the number of births in the village during the previous 5 years. Display this data in a graph or chart.

Year	Number of Births
2013	12
2014	10
2015	9
2016	14
2017	18

2. In problem 2 of the previous lesson, you counted your neighbours. Create a chart or graph to display your data. Include data on the adult males, adult females, boys and girls in your neighbourhood.
3. In problem 3 of the previous lesson, you asked your family members, friends or neighbours if they would rather have a new school or a new health clinic in your community. Display the data you collected in a chart or graph.

Lesson Title: Mean and Median	**Theme:** Statistics
Practice Activity: PHM-07-136	**Class:** JSS 1

Learning Outcomes

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

1. Calculate the mean and median of a list of data generated by the class.
2. Interpret mean and median.

Overview

This lesson is on calculating the mean and median of a list of data.

The **mean** is a number that can tell us where the middle of the data is. It is also commonly known as the 'average'. To find the mean of a set of data, add the numbers together and divide the total by the number of items.

The number in the middle when the numbers are listed in ascending or descending order is called the **median**. When there is an even number of items in the list, there are 2 numbers in the middle. The median is found by calculating the mean of these 2 numbers.

Solved Examples

1. Mustapha has 5 children with ages 10, 6, 7, 4, and 13. Find the mean and median of their ages.

   Solution
   Mean:
   Add the numbers: $10 + 6 + 7 + 4 + 13 = 40$
   Divide by the number of children: $40 \div 5 = 8$
   The mean age of Mustapha's children is 8 years old.

   Median:
   List the numbers in ascending order: 4, 6, 7, 10, 13
   Identify the middle of the list: 7
   The median age of Mustapha's children is 7 years old.

2. Ten pupils received the following scores on their maths exam: 87, 100, 76, 92, 90, 95, 85, 67, 99 and 95. Find the mean and median of the scores.

   Solution
   Mean:
   Add the numbers: $87 + 100 + 76 + 92 + 90 + 95 + 85 + 67 + 99 + 95 = 886$
   Divide by the number of pupils: $886 \div 10 = 88.6$
   The mean score is 88.6.

Median:

List the numbers in ascending order: 67, 76, 85, 87, 90, 92, 95, 95, 99, 100

Identify the middle of the list: 90, 92

Since there is not one number in the middle, find the mean of the 2 numbers in the middle. Add them together and divide by 2: median $= \frac{90+92}{2} = 91$

Practice

1. Agnes received the following scores in examinations in 8 subjects: 67, 75, 80, 56, 77, 68, 98, and 87. Calculate the mean and median of her scores, correct to the nearest whole number.
2. The shoe sizes of five pupils are $10, 9, 10, 11$ and 8.
    a. Find the median shoe size.
    b. Calculate the mean shoe size, correct to 1 decimal place.
3. The number of goals scored by a team in 9 football matches are as follows: $3, 5, 7, 7, 8, 8, 8, 11, 15$. Calculate the median and mean number of goals scored.
4. Write down the ages of 5 of your friends. Calculate the mean and median of their ages.

Lesson Title: Mode and Range	**Theme:** Statistics
Practice Activity: PHM-07-137	**Class:** JSS 1

Learning Outcomes

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

1. Find the mode and range of a list of data generated by the class.
2. Interpret mode and range.

Overview

In the previous lesson, you calculated the mean and median of a list of numbers. In this lesson, you will calculate the mode and range. These can also be calculated from a list.

The **mode** is the number that appears most often in a list. It can often be easily observed. If no number appears more than once, there is no mode. If multiple numbers appear more than once, there are multiple modes.

The **range** is the difference between the highest and lowest numbers. It tells us how spread apart our numbers are. To find the range, subtract the lowest number from the highest number.

Solved Examples

1. Find the mode and range of the list of numbers: 2, 1, 7, 5, 6, 8, 6, 9, 6, 9

   Solution

   It is helpful to write the numbers in ascending order. It becomes easy to see the lowest and highest numbers, and the mode.

   In ascending order, we have: 1, 2, 5, 6, 6, 6, 7, 8, 9, 9.

   Mode:

   The mode is the number that appears most often. The number 6 appears 3 times, so 6 is the mode.

   Range:

   Subtract the lowest number from the highest number: 9 – 1 = 8. The range is 8.

2. The ages of 10 pupils are listed below. Find the mode and range of their ages.

   10, 11, 13, 10, 10, 12, 11, 13, 11, 12

   Solution

   Write the numbers in ascending order: 10, 10, 10, 11, 11, 11, 12, 12, 13, 13

Mode:
The numbers 10 and 11 both appear 3 times. This is the greatest number of times any number appears. There are 2 modes: 10 and 11 years old.

Range:
Subtract the lowest number from the highest number: 13 – 10 = 3. The range is 3 years.

3. Musa has 5 children. Their ages are 2, 4, 8, 11 and 15. Find the mode and range of their ages.

   Solution
   Mode:
   The children are all different ages. No number appears more than once, so there is no mode.

   Range:
   Subtract the age of the youngest child from that of the oldest child: 15 – 2 = 13 years. The range in ages of Musa's children is 13 years.

Practice

1. The heights of 15 pupils are given in centimetres. Calculate the mode and range of the data:
   155, 161, 160, 157, 155, 159, 160, 156, 155, 162, 158, 157, 161, 163, 153

2. Hawa is a doctor. Today she treated 10 children. She recorded the weight of each child in kilogrammes, listed below. Find the mode and range of their weights.
   14, 20, 17, 21, 15, 13, 20, 19, 15, 12

3. Mustapha sells watermelons from his farm. He recorded the number of watermelons that he sold each day for a week. Find the mode and range of the data.
   5, 12, 14, 7, 9, 10, 11

4. Write down the ages of 5 of your friends. Find the mode and range of the data.

Lesson Title: Statistical Calculations from a List of Data	**Theme:** Statistics
Practice Activity: PHM-07-138	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to calculate the mean, median, mode and range of data from a list.

Overview

In this lesson, you will practise what you learned in the previous 2 lessons. You will calculate the mean, median, mode and range of data from a list. It is important that you remember the meaning of each of these measures, and how to calculate it. Here they are again:

- **Mean:** a number that estimates where the middle of the data is. To find the mean, add the numbers together and divide the total by the number of items.
- **Median:** the number in the middle when the numbers are listed in order.
- **Mode:** the number that appears most often.
- **Range:** the difference between the highest and lowest numbers.

You will notice that mean, median and mode are often numbers that are very close to each other. These are called measures of central tendency. They tell us approximately where the centre of the data is.

Solved Examples

1. Eleven pupils estimated the length of a classroom in metres as follows:

   $6, 9, 11, 11, 12, 12, 12, 12, 13, 15, 19$. Find the following for their estimates:

   a. Mode b. Median c. Mean d. Range

   Solutions

   a. The mode is 12 m, since 12 is the most frequent number.
   b. The median is 12 m, which is in the middle of the list.
   c. The mean is $\frac{6+9+11+11+12+12+12+12+13+15+19}{11} = \frac{132}{11} = 12$ m.
   d. The range is $19 - 6 = 13$ m.

2. Foday is a doctor. Today he delivered 7 babies and recorded their weights in kilogrammes: 2.8, 4.0, 3.4, 3.5, 3.5, 2.9, 2.3. Calculate the mean, median, mode and range of the babies' weights.

   Solution

   First, write the numbers in ascending order: 2.3, 2.8, 2.9, 3.4, 3.5, 3.5, 4.0.

   Mean: $\frac{2.3+2.8+\ 2.9+\ 3.4+\ 3.5+\ 3.5+\ 4.0}{7} = \frac{22.4}{7} = 3.2$ kg

Median: The median is 3.4 kg, which is in the middle of the list.

Mode: The mode is 3.5 kg, which appears most often.

Range: Subtract $4.0 - 2.3 = 1.7$ kg.

3. The number of pairs of shoes a trader sells per day for a week are: 2, 5, 6, 3, 6, 9, 4.
    a. Find the median pair of shoes sold per day.
    b. Find the modal pair of shoes sold per day.

    Solutions

    These questions are stated differently, but they are simply asking you to find the median and mode of the numbers.

    List the numbers in ascending order: 2, 3, 4, 5, 6, 6, 9

    a. The median pair of shoes per day is 5 pairs.
    b. The modal pair of shoes per day is 6 pairs.

Practice

1. A group of pupils measured their pepper seedlings in the school garden. They obtained the following results: 10.8 cm,10.9 cm, 10.7 cm, 10.8 cm, 10.8 cm, 10.7 cm, 11.8 cm, 10.7 cm, 10.9 cm and 10.8 cm. Calculate the following, correct to 1 decimal place:
    a. Median b. Mode c. Mean d. Range
2. The marks that 7 pupils obtained on an exam are: 80, 84, 67, 90, 72, 78, 89. Calculate the mean, median, mode and range of their marks.
3. There are 6 boys. Two of them weigh 42 kg, one of them weighs 39 kg, and the other 3 all weigh 45 kg. Calculate the mean, median, mode and range of their weights.
4. The shoe sizes of 10 pupils are: 37, 39, 35, 36, 34, 35, 39, 40, 33, 35. Find the modal shoe size.

Lesson Title: Statistical Calculations from a Bar Chart	**Theme:** Statistics
Practice Activity: PHM-07-139	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to calculate the mean, median, mode and range of data from a bar chart.

Overview

In the previous lessons, you calculated mean, median, mode and range from a list. In this lesson, you will do calculations on data from a bar chart and you will simply use the heights of the bars to make these calculations.

To calculate **mean**, add the heights of the bars and divide by the total number of bars.

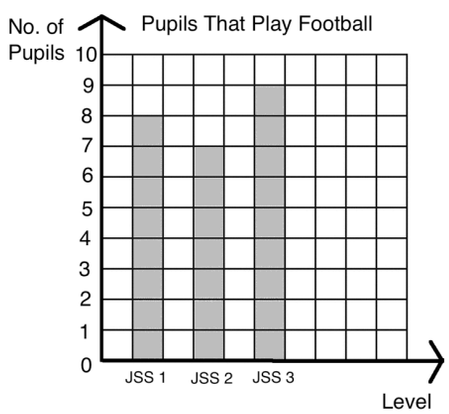
To find the **median**, we need to find the bar with the height in the middle. Write the numbers from the heights of the bars in a list and find the one in the middle.

The **mode** is given by the bar height that appears the greatest number of times.

To find the **range**, subtract the height of the shortest bar from the height of the tallest bar.

Solved Examples

1. The bar chart below gives the number of pupils that play on the school football team in each level. Use the data to calculate the mean, median, mode and range in pupils that play on the team per level.



Solution

First, identify the heights of the 3 bars: 8, 7 and 9. The units are pupils.

Mean: Add the heights of the bars and divide by 3.

$$\text{Mean} = \frac{8+7+9}{3} = \frac{24}{3} = 8 \text{ pupils}$$

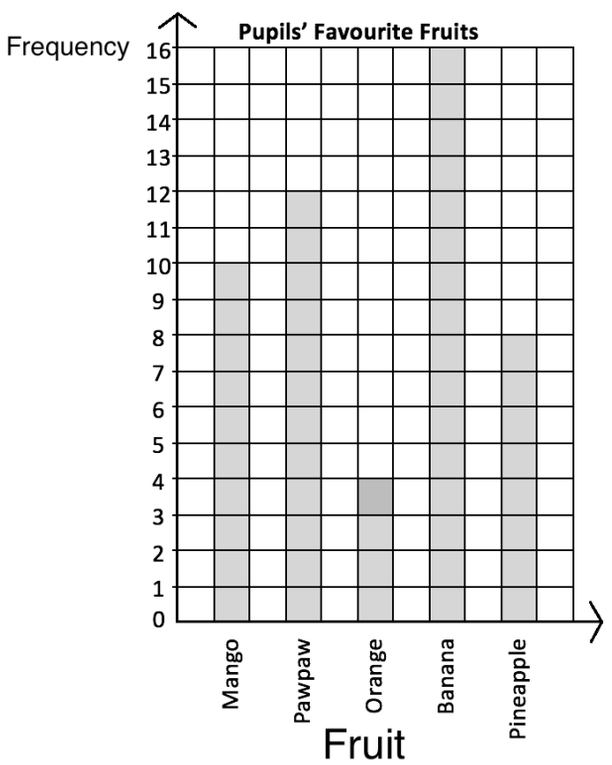
This means that the mean number of pupils on the football team per level is 8.

Median: Find the bar with the height in the middle. You may do this by looking at the chart, or you may write the heights in order 7, 8, 9. The median height is 8. This means that JSS 1 has the median number of pupils, 8.

Mode: There is no mode, because all of the bars are different heights.

Range: Subtract the shortest bar from the tallest bar. Range $= 9 - 7 = 2$ pupils.

2. The bar chart shows the favourite fruits of the pupils in a class. Use this chart to answer the following questions.
    a. How many pupils are there in the class?
    b. What is the mean number of pupils that like each fruit?
    c. What is the median number of pupils that like each fruit?



Solutions

a. Add the heights of the bars to find the number of pupils in the class:

$$10 + 12 + 4 + 16 + 8 = 50$$

There are 50 pupils in the class.

b. Add the heights of the bars and divide by 5, the number of bars.

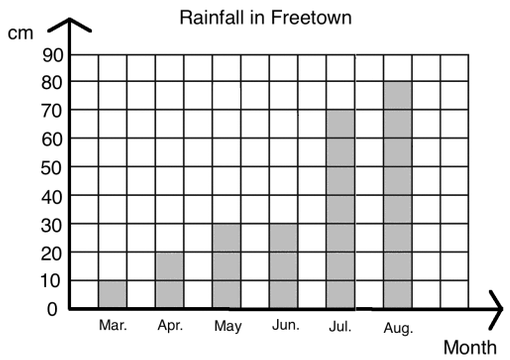
Mean $= \frac{10+12+4+16+8}{5} = \frac{50}{5} = 10$ pupils

The mean number of pupils that prefer each fruit is 10.

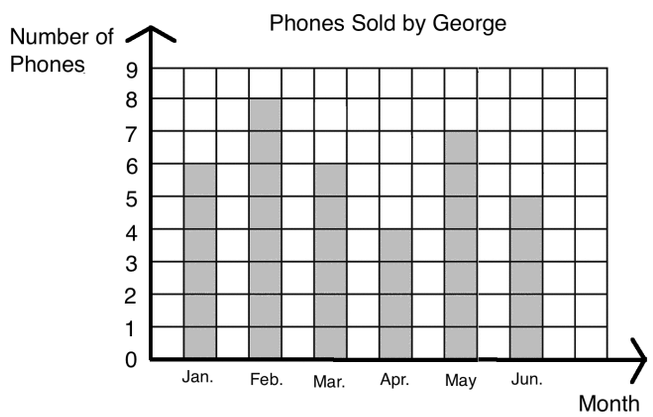
c. The median number of pupils that like each fruit is given by the median bar height. Write the heights of the bars in order: 4, 8, 10, 12, 16. The median is 10. This corresponds to mango.

Practice

1. The bar chart below gives the amount of rain that fell in Freetown during 5 months. Use the bar chart to find the mean, median, mode and range of the amount of rain that fell during these months.



2. George sells phones in his shop. He kept track of the number of phones he sold in 6 months, and displayed the data in the chart below. Use the chart to answer the questions:
    a. How many phones did George sell in 6 months?
    b. What is the **mean** number of phones George sold in a month?
    c. What is the **median** number of phones George sold in a month?
    d. What is the **mode** number of phones George sold in a month?
    e. What is the **range** in the number of phones George sold in a month?



Lesson Title: Statistics Story Problems	**Theme:** Statistics
Practice Activity: PHM-07-140	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to solve story problems involving mean, median, mode and range.

Overview

In this lesson, you will solve story problems involving mean, median, mode and range. You will practise the skills from the previous 2 lessons.

Solved Examples

1. Six football players want to buy new uniforms. They each measured their height to find the correct size. Their heights (in centimetres) were 170, 167, 180, 175, 176, 170. Find the mean, median, mode and range of their heights.

   Solution

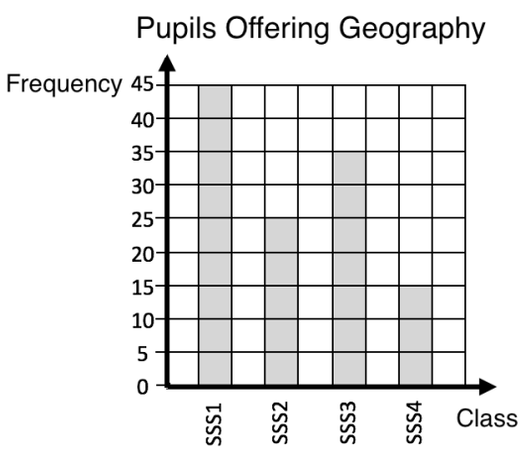
   Mean: Add the heights and divide by 6: $\frac{170+167+180+175+176+170}{6} = \frac{1038}{6} = 173$ cm.

   Median: Write the heights in order: 167, 170, 170, 175, 176, 180. There are 2 heights in the middle: 170 and 175. Find their mean: $\frac{170+175}{2} = \frac{345}{2} = 172.5$ cm.

   Mode: The mode is 170 cm, because it occurs twice.

   Range: Subtract the shortest height from the tallest height. Range $= 180 - 167 = 13$ cm.

2. The principal of a senior secondary school took a survey to understand which pupils were offering geography. The results of his survey are in the bar chart. Help the principal by finding the mean, median, mode and range of the number of pupils offering geography per level.



Solution

Mean: Add the heights of the bars and divide by 4: $\frac{45+25+35+15}{4} = \frac{120}{4} = 30$ pupils.

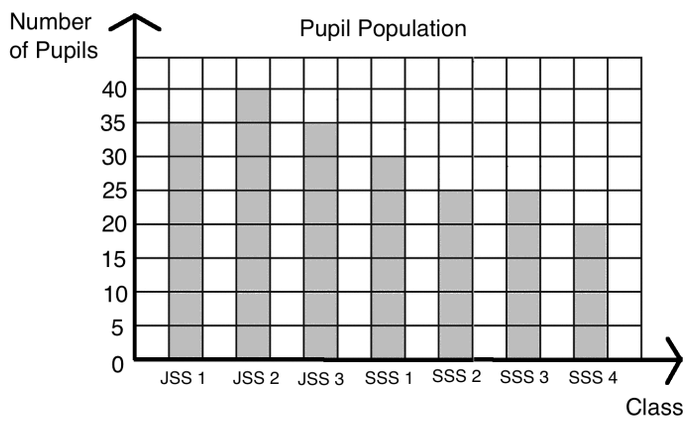
Median: Find the bar with the height in the middle. There are 2 bars with height in the middle: SSS2 and SSS3. Find the average of their heights: $\frac{25+35}{2} = \frac{60}{2} = 30$ pupils.

Mode: There is no mode, because all of the bars are different heights.

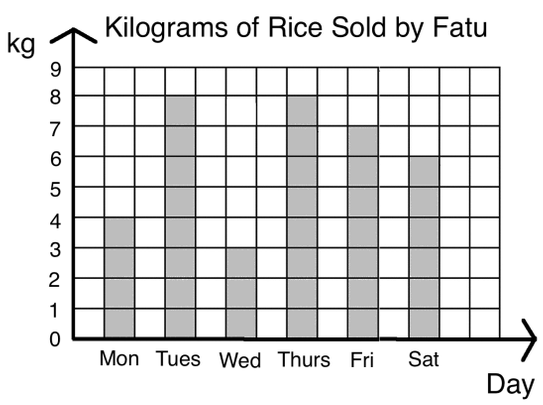
Range: Subtract the shortest bar from the tallest bar. Range $= 45 - 15 = 30$ pupils.

Practice

1. Mustapha plays football with his friends every weekend. He recorded the number of goals he scored each weekend for the previous 10 weeks: 2, 4, 1, 6, 3, 8, 2, 5, 2, 7. Find the mean, median, mode and range.
2. The bar chart below gives the number of pupils attending a certain secondary school. Use the chart to calculate the mean, median, mode and range of the data.



3. Fatu sells rice in her shop. She has kept track of the amount that she sold this week in the graph below. Help Fatu by calculating the mean, median, mode and range of the amount she sold each day.



Lesson Title: Introduction to Probability	**Theme:** Probability
Practice Activity: PHM-07-141	**Class:** JSS 1

Learning Outcomes

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

1. Identify that probability describes the chance of something happening.
2. Discuss the probability of an event happening in words.

Overview

In math, we can study the possibility of something happening. We call this **probability**. In probability, we use numbers and math language to show the chances of something happening. In this lesson, you will describe the probability of different events happening in words.

There are 4 words that you will use in this lesson to describe probability: **Impossible**, **unlikely**, **likely** and **certain**.

These are some words we use to talk about the chances of something happening. Impossible means that something will not happen. Unlikely means that it probably won't happen, and likely means that it probably will happen. Certain means that it will definitely happen.

Solved Examples

1. Determine whether each sentence is impossible, unlikely, likely or certain:
    a. A fish will walk on land.
    b. If you study hard, you will pass the maths exam.
    c. If you travel on the highway you will get into a car accident.
    d. The sun will rise in the morning.

    Solution

    a. **Impossible**. Fish can't walk.
    b. **Likely**. The more you study, the more likely it is that you will pass the exam.
    c. **Unlikely**. A car accident could happen, but many people travel on the highway everyday without being in an accident.
    d. **Certain**. The sun rises each day.

2. What is the probability that next year is 2007?

    Solution

    It is **impossible**. 2007 is in the past.

3. What is the probability that there will be a Tuesday next week?

   Solution
   It is **certain**. There is a Tuesday in each week.

4. What is the probability that it will rain tomorrow?

   Solution
   The answer depends on the season. If it is currently the rainy season, it is likely that it will rain tomorrow. If it is currently the dry season, it is unlikely that it will rain tomorrow.

Practice

1. Determine whether each sentence is impossible, unlikely, likely or certain:
   a. A mother is younger than her daughter.
   b. Your hair will become grey someday.
   c. The capital city of Sierra Leone is Freetown.
   d. The well is dry in the rainy season.
2. What is the probability that a monkey falls from a tree?
3. What is the probability that there will be a February next year?
4. What is the probability that a dog has 8 legs?
5. Write 1 statement of your own for each of the following probabilities:
   a. Impossible
   b. Unlikely
   c. Likely
   d. Certain

Lesson Title: Probability Experiments	**Theme:** Probability
Practice Activity: PHM-07-142	**Class:** JSS 1

Learning Outcomes

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

1. Conduct simple probability experiments.
2. Use probability terms such as 'experiment,' 'outcome' and 'event'.

Overview

In this lesson, you will learn how we use experiments to understand probability in mathematics. Before we can do calculations with probability, we must understand experiments. It is important to learn the correct words for talking about probability.

In probability, an **experiment** is a situation involving chance. An experiment leads to results called **outcomes**.

For example, I can toss a coin as an experiment. There is a chance that the coin will land on heads, and a chance that it will land on tails. This is an experiment involving chance. There are 2 possible outcomes: heads or tails. An outcome is a single result of an experiment. It is something that could possibly happen.

In probability, the outcomes of an experiment can also be called **events**. Events can involve one outcome or more than one outcome.

For example, consider a situation where you randomly select a number between 1 and 5. Selecting the number 3 is an outcome, and it is also an event. Selecting an even number is also an event. We could select 2 or 4. They are two different outcomes, but they are both even numbers, so in this case we can describe this as one event.

Solved Examples

1. Fatu rolls a 6-sided die. What are the possible outcomes?

   Solution

   A 6-sided die has faces with numbers 1-6. There are 6 possible outcomes when rolling a die: 1, 2, 3, 4, 5 or 6.

2. Foday rolls a 6-sided die. Determine how many possible outcomes there are in each event:
   a. Foday rolls a 1.
   b. Foday rolls an even number.
   c. Foday rolls a number greater than 3.
   d. Foday rolls a 3 or 4.
   e. Foday rolls a 6.

Solutions

a. Rolling 1 is the only 1 possible outcome.
b. There are 3 even numbers on a die: 2, 4 and 6. There are 3 possible outcomes.
c. There are 3 numbers greater than 3 on a die: 4, 5 and 6. There are 3 possible outcomes.
d. There are 2 possible outcomes: 3 or 4.
e. Rolling 6 is the only 1 possible outcome.

3. Hawa, Sia and Martin solved a math problem together as a group. The teacher will randomly select one pupil from their group to write the solution on the board. What are the possible outcomes?

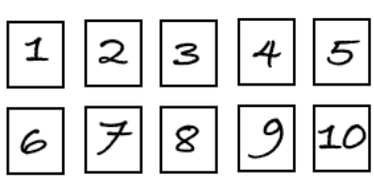
Solution

The experiment is that a teacher will randomly select one pupil from a group. There are 3 possible outcomes:

- The teacher selects Hawa.
- The teacher selects Sia.
- The teacher selects Martin.

Practice

1. Determine whether each of the following is an experiment or an event:
   a. A teacher selects a random pupil from the class.
   b. A coin is tossed.
   c. A teacher selects Fatu.
   d. A die lands on 4.
   e. A coin lands on tails.
   f. Michael rolls a die.
2. In one box, there is a Manchester United jersey, a Chelsea jersey, an Arsenal jersey, and a Real Madrid jersey. Mustapha closes his eyes and selects one at random. What are the possible outcomes?
3. The numbers 1 through 10 are written in pieces of paper and placed in a box. Determine how many possible outcomes there are in each event:
   a. Choosing 3.
   b. Choosing 4 or 6.
   c. Choosing an odd number.
   d. Choosing a number greater than 5.
   e. Choosing a number less than 4.



Lesson Title: Certain and Uncertain Probability	**Theme:** Probability
Practice Activity: PHM-07-143	**Class:** JSS 1

Learning Outcome

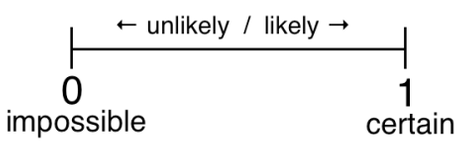
By the end of the lesson, you will be able to identify that a probability of 1 means that an event is certain, and a probability of 0 means that an event is impossible.

Overview

In this lesson, you will learn to identify and discuss certain and impossible events in probability.

If an event is **impossible**, then it definitely won't happen and the probability of it happening is **0**. If an event is **certain**, then it will definitely happen and the probability of it happening is **1**.

We have also discussed likely and unlikely events. Those events might happen, or they might not. If there is a chance of them happening, the probability is between 0 and 1. That is, it is a fraction, or part of a whole.



Solved Examples

1. Give the probability of each event happening as a number:
    a. The sun will rise tomorrow.
    b. A crocodile will fly.
    c. A father is younger than his daughter.
    d. A mother is older than her son.

    Solutions

    For impossible statements, the probability is 0. For certain statements, the probability is 1.

    The answers are:

    a. 1
    b. 0
    c. 0
    d. 1

2. A 6-sided die is rolled. Give the probability of each of the following events as a number. State your reasons.
    a. The outcome is 7.
    b. The outcome is within 1-6.
    c. The outcome is a negative number.

    Solutions
    a. 0. There is no 7 on a 6-sided die.
    b. 1. The 6 sides of the die are 1-6, so the outcome will certainly be within 1-6.
    c. 0. There are no negative numbers on a die.

Practice

1. Give the probability of each event happening as a number:
    a. December will come after November in the calendar year.
    b. Thursday will come before Tuesday in the week.
    c. Next year will be 2007.
    d. A cat has 10 eyes.
    e. The day after Monday will be Tuesday.
2. Five girls solve a maths problem together as a group. The teacher randomly selects 1 group member to write their solution on the board. Give the probability of each of the following events as a number.
    a. The teacher selects a boy from the group.
    b. The teacher selects a girl from the group.
3. Martin and his 3 best friends are all 13 years old. Martin will randomly select 1 of his friends to share his lunch. Give the probability of each of the following events as a number.
    a. The friend he selects is 13 years old.
    b. The friend he selects is 14 years old.

Lesson Title: Likely and Unlikely Events	**Theme:** Probability
Practice Activity: PHM-07-144	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to compare how likely different events are and rank them from unlikely to likely.

Overview

In this lesson, you will learn to identify whether events are likely or unlikely. A likely event has a greater chance of occurring. It will probably happen but we are not certain that it will happen. An unlikely event has less chance of occurring. It is not impossible, but it will probably not happen.

You can determine whether an event is likely based on the total possible outcomes. For example, consider 5 pieces of paper labelled 1-5:

If you choose a paper at random, is it likely that you will choose 1? No. It is **unlikely** that you will choose 1 on the first try, because it is just 1 out of 5 possible outcomes.

If you choose a paper at random, is it likely that you will choose a number from 2 to 5? Yes. It is **likely** that you will choose a number from 2 to 5. The range 2-5 covers 4 of the 5 possible outcomes.

If more than half of the possible outcomes make the event true, then it is a likely event. If less than half of the possible outcomes make the event true, then it is an unlikely event.

Solved Examples

1. The numbers 6 to 10 are written on pieces of paper and placed in a box. If a number is selected at random, is it more likely to be even or odd?

   Solution
   Write down the numbers from 6 to 10: 6, 7, 8, 9, 10.

   There are 2 possible events to consider: selecting an even number, and selecting and odd number. There are 3 even numbers in the list (6, 8, 10) and only 2 odd numbers in the list (7, 9). It is more likely that an even number will be selected.

2. The football coach has a box of jerseys. There are 4 red jerseys, 3 green jerseys, and 5 blue jerseys. A football player randomly selects a jersey from the box. Rank the following events from most likely to least likely:
    a. The player will select a red jersey.
    b. The player will select a green jersey.
    c. The player will select a blue jersey.
    d. The player will select a red or green jersey.
    e. The player will select a green or blue jersey.

    Solutions
    If the event describes a greater number of jerseys from the box, it is a more likely event. If the event describes fewer jerseys, it is more unlikely.

    It can be helpful to list how many possible outcomes are in each event. Then, rank the events from most outcomes to least outcomes.

    The outcomes in each event are:

    a. 4
    b. 3
    c. 5
    d. 4 + 3 = 7
    e. 3 + 5 = 8

    Note that if you see the word “or”, you are considering 2 groups together. For example, in example d. you are considering the group of red and green jerseys. The football player could select any jersey from this larger group, and the event would be true.

    List the events from most outcomes to least outcomes: e., d., c., a., b.

3. There are 10 pupils in a group. Five of them are 11 years old, 2 of them are 12 years old, and the rest are 13 years old. The teacher will select one pupil at random. Rank the following events from least likely to most likely:
    a. The teacher selects an 11-year-old pupil.
    b. The teacher selects a 12-year-old pupil.
    c. The teacher selects a 13-year-old pupil.
    d. The teacher selects either an 11-year-old or a 12-year-old pupil.

Solutions

First, list the number of outcomes in each event:

a. 5
b. 2
c. 10 – 5 – 2 = 3
d. 5 + 2 = 7

In this problem, we want to list the events from least likely to most likely. List the events from fewest number of outcomes to most outcomes: b, c, a, d.

Practice

1. There are 6 red hats and 8 green hats in a box. If a hat is selected at random, is it more likely to be red or green?
2. The numbers 1-5 are written on pieces of paper and placed in a box. If a number is selected at random, is it more likely to be even or odd?
3. There are 6 boys and 5 girls in a group. If a child is selected at random, is it more likely to be a boy or a girl?
4. A dog gave birth to 8 puppies. There was 1 white puppy, 4 brown puppies, and the rest were black. Sam selected a puppy at random to keep as his pet. Rank the following events from most likely to least likely:
    a. Sam selected a white puppy.
    b. Sam selected a brown puppy.
    c. Sam selected a black puppy.
    d. Sam selected a white or brown puppy.
    e. Sam selected a brown or black puppy.

Lesson Title: The Language of Probability	**Theme:** Probability
Practice Activity: PHM-07-145	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to use probability vocabulary in everyday statements.

Overview

You now understand the probability of events happening. In this lesson, you will practise discussing and writing about probability. We often use probability language to explain things in our everyday lives.

Solved Examples

1. There is a family with 5 members. The family has 1 girl, 2 boys, a mother, and a father. A member of the family is selected at random to win a prize. Answer the following questions and give your reasons:
    a. Is it more likely that an adult or child will be selected?
    b. Is it more likely that a male or female will be selected?

    Solutions
    a. It is more likely that a child will be selected. There are more children (3) than adults (2).
    b. It is more likely that a male will be selected. There are more males (3) than females (2).

2. Mustapha will randomly choose a day of the week to wash his clothes. Is it more likely that he will wash his clothes during the week or during the weekend?

    Solution
    There are 5 days during the week (Monday – Friday) and only 2 days during the weekend (Saturday and Sunday). It is more likely that Mustapha will wash his clothes during the week.

3. Write your own probability question using the format:

    If I randomly choose _____, is it more likely that it will be _____ or _____?

    After you write your question, write its answer.

Solution

There are many different possible questions. The answer to the question depends on what you write. These are some examples:

a. If I randomly choose a former president of Sierra Leone, is it more likely that it will be a male or a female?
   Answer: It will **certainly** be a male, because all of the previous presidents were male.

b. If I randomly choose a day of the week, is it more likely that it will be Tuesday or Wednesday?
   Answer: It is **equally** likely to be Tuesday or Wednesday.

Practice

1. In one room, there are 5 boys, 6 girls, 4 adult women, and 3 adult men. One person is selected at random. Answer the following questions and give your reasons:
   a. Is it more likely that an adult or child will be selected?
   b. Is it more likely that a male or female will be selected?
2. There are 14 animals in a yard. There are 3 cats, 1 dog, and the rest are ducks. Hawa wants a new pet, and she selects an animal at random. Describe the probability of each of the following events:
   a. Hawa selects a cat.
   b. Hawa selects a dog.
   c. Hawa selects a duck.
   d. Hawa selects a chicken.
3. Write your own probability question using the format:

   If I randomly choose _____, is it more likely that it will be _____ or _____?

   After you write your question, write its answer.

Lesson Title: Expressing Probability as a Fraction	**Theme:** Probability
Practice Activity: PHM-07-146	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to express the probability of an event happening as a fraction.

Overview

In this lesson, you will learn how to express the probability of an event happening as a fraction.

Any probability can be described using numbers. Remember that in probability, 0 is impossible and 1 is certain. That means that all other likely and unlikely events are expressed with fractions between 0 and 1.

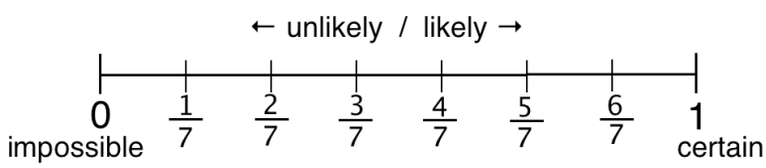
To find the probability of an event occurring, use the formula:

$$\text{probability} = \frac{\text{the number of ways an event can occur}}{\text{total number of possible outcomes}}$$

For example, consider a group of pupils where 3 of them are girls and 4 of them are boys. There are 7 pupils in total. If a pupil is randomly selected from the group, the probability of choosing a girl is $\frac{3}{7}$. There are 3 possible girls that could be selected, and 7 possible pupils in total. Similarly, the probability of choosing a boy is $\frac{4}{7}$.

The bigger a fraction is, the more likely the event is to occur. The smaller the fraction, the less likely. In this example, we have $\frac{4}{7} > \frac{3}{7}$, so it is more likely that we will choose a boy.

This can be displayed with a diagram:



We have special language that we use to discuss probabilities as fractions. For example, if there is a $\frac{4}{7}$ chance of an event occurring, we say, "There is a four in seven chance." For any fraction $\frac{a}{b}$, the probability can be described as, "There is an a in b chance."

After writing your answer as a fraction, simplify the fraction if possible.

Solved Examples

1. A bag contains 3 red balls, 7 blue balls, and 2 yellow balls. If one ball is selected at random, what is the probability of choosing:
    a. A red ball
    b. A blue ball
    c. A yellow ball

    Solutions
    First, find the total number of possible outcomes. This will be the denominator of the fractions. The total number of possible outcomes is the total number of balls that you are choosing from: 3 + 7 + 2 = 12 outcomes.

    a. There are 3 red balls. The probability of choosing one is $\frac{3}{12} = \frac{1}{4}$.
    b. There are 7 blue balls. The probability of choosing one is $\frac{7}{12}$.
    c. There are 2 yellow balls. The probability of choosing one is $\frac{2}{12} = \frac{1}{6}$.

2. In one JSS1 classroom, all of the pupils are between 11 and 13 years old. There are five 11-year-old pupils, twenty 12-year-old pupils, and ten 13-year-old pupils. The teacher selects one pupil at random to solve a maths problem on the board. Find the probability that she selects:
    a. An 11-year-old pupil
    b. A 12-year-old pupil
    c. A 13-year-old pupil

    Solutions
    First, find the total number of possible outcomes. This is the total number of pupils in the class: 5 + 20 + 10 = 35 pupils.

    Write probability of choosing from each age group as a fraction:

    a. $\frac{5}{35} = \frac{1}{7}$
    b. $\frac{20}{35} = \frac{4}{7}$
    c. $\frac{10}{35} = \frac{2}{7}$

Practice

1. In one JSS1 classroom, there are 22 boys and 20 girls. If a pupil is selected at random, find the probability that the pupil:
    a. Is a girl
    b. Is a boy
2. A box contains 3 red jerseys, 12 blue jerseys, 8 yellow jerseys, and 1 black jersey. If a football player selects a jersey at random, find the probability that she selects:
    a. A red jersey
    b. A blue jersey
    c. A yellow jersey
    d. A black jersey
3. The teachers in a certain school are holding a meeting. There are 3 maths teachers, 4 English teachers, 1 French teacher, and 2 social studies teachers present. A teacher is selected at random to lead the meeting. Find the probability that the selected teacher is:
    a. A maths teacher
    b. An English teacher
    c. A French teacher
    d. A social studies teacher

Lesson Title: Probability Fraction Problems	**Theme:** Probability
Practice Activity: PHM-07-147	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to solve probability problems with fractions.

Overview

In this lesson, you will solve probability problems with fractions. In the previous lesson, you learned how to express the probability of an event happening as a fraction.

In this lesson, you will solve probability problems that involve events with **multiple** outcomes. For example, consider the question: What is the probability of drawing a 7 or 8?

This event has 2 possible outcomes: drawing a 7, or drawing an 8. To find the probability of drawing a 7 **or** 8, **add** the probability of drawing a 7 plus the probability of drawing an 8.

When you see 'or' in a probability question, it means there are multiple possible outcomes. 'Or' tells us to **add** the probability fractions together for each possible outcome.

Solved Examples

1. The numbers 1 to 8 are written on pieces of paper and placed in a cup. A piece of paper is selected at random from the cup.
    a. What is the probability of selecting 3?
    b. What is the probability of selecting 3 or 4?
    c. What is the probability of selecting an even number?

    Solutions
    The numbers written on the paper are 1-8. This means that the total number of possibilities is 8. This will be the denominator of each fraction.

    a. There is only one 3, so the probability is $\frac{1}{8}$.
    b. There is one 3 and one 4. Add the probability of choosing 3, plus the probability of choosing 4: $\frac{1}{8}+\frac{1}{8}=\frac{2}{8}=\frac{1}{4}$.
    c. Count the even numbers from 1-8. It helps to list them first: 2, 4, 6, 8. There are 4 even numbers from 1-8. The probability of selecting an even number is $\frac{4}{8}=\frac{1}{2}$.

2. A bag contains 10 red balls, 8 blue balls, and 6 yellow balls. If one ball is selected at random, what is the probability of choosing:
    a. A red ball
    b. A yellow ball
    c. A red or blue ball
    d. A blue or yellow ball

Solutions

Find the total number of balls in the bag: 10 + 8 + 6 = 24. This will be the denominator of the fractions.

a. The probability of choosing a red ball is $\frac{10}{24} = \frac{5}{12}$.
b. The probability of choosing a yellow ball is $\frac{6}{24} = \frac{1}{4}$.
c. Add the probability of choosing a red ball and the probability of choosing a blue ball: $\frac{10}{24} + \frac{8}{24} = \frac{18}{24} = \frac{3}{4}$.
d. Add the probability of choosing a blue ball and the probability of choosing a yellow ball: $\frac{8}{24} + \frac{6}{24} = \frac{14}{24} = \frac{7}{12}$.

Practice

1. The numbers 1 to 10 are written on pieces of paper and placed in a cup. A piece of paper is selected at random from the cup.
    a. What is the probability of selecting 5?
    b. What is the probability of selecting a multiple of 5?
    c. What is the probability of selecting a number greater than 5?
2. In one group, there are 6 girls and 8 boys. If one child is selected at random, find the probability of selecting:
    a. A boy
    b. A girl
    c. A boy or a girl
3. A box contains 7 maths textbooks, 11 English textbooks, and 8 French textbooks. If one book is selected at random, find the probability of choosing:
    a. A maths textbook
    b. An English textbook
    c. A French textbook
    d. A maths or English textbook
    e. An English or French textbook

Lesson Title: Probability as a Percent	**Theme:** Probability
Practice Activity: PHM-07-148	**Class:** JSS 1

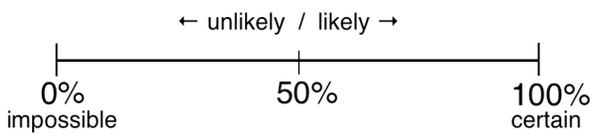
Learning Outcome
By the end of the lesson, you will be able to interpret probability statements involving percent.

Overview

In this lesson, you will learn how to represent probability with percentages. To find the probability that something will occur as a percentage, follow these steps:

- Find the probability as a fraction.
- Convert the fraction to a percentage.

The following diagram shows probability expressed as percentages:



Likely events have a more than 50% chance of occurring. Unlikely events have a less than 50% chance of occurring. 0% is the same as 0, so it means an event is impossible. 100% is the same as one whole, so it means that an event is certain to occur.

Solved Examples

1. Determine whether each statement is impossible, unlikely, likely, or certain:
    a. There is a 30% chance of rain tomorrow.
    b. There is a 0% chance of snow tomorrow.
    c. There is an 80% chance that the building will collapse.
    d. There is a 100% chance that tomorrow is Tuesday.

    Solutions
    a. Unlikely. The percentage is less than 50%.
    b. Impossible. An event with probability 0% will not occur.
    c. Likely. The percentage is greater than 50%.
    d. Certain. An event with a probability of 100% will definitely occur.

2. There are 7 red balls and 3 blue balls in a bag. A ball is selected at random from the bag. Find the following, and express your answers as percentages:
    a. The probability of choosing a red ball.
    b. The probability of choosing a blue ball.

Solutions

Write each probability as a fraction, then convert the fraction to a percentage. Remember that a fraction can be converted to a percentage by multiplying by 100%.

a. Probability of choosing red: $\frac{7}{10} = \frac{7}{10} \times 100\% = \frac{700}{10}\% = 70\%$.
   There is a 70% chance of choosing red.

b. Probability of choosing blue: $\frac{3}{10} = \frac{3}{10} \times 100\% = \frac{300}{10}\% = 30\%$.
   There is a 30% chance of choosing blue.

3. Foday has 20 oranges in a bag. Four of them are spoiled. If he chooses an orange at random, what is the probability that it will be spoiled? Express your answer as a percentage.

Solution

The probability of choosing a spoiled orange is $\frac{4}{20}$. Convert this to a percentage: $\frac{4}{20} = \frac{4}{20} \times 100\% = \frac{400}{20}\% = 20\%$.

There is a 20% probability that Foday will choose a spoiled orange.

Practice

1. Determine whether each statement is impossible, unlikely, likely, or certain:
   a. There is a 50% chance of rain tomorrow.
   b. There is a 20% chance that lessons will be canceled tomorrow.
   c. There is a 90% chance that she has malaria.
   d. There is a 0% chance that the car will start.
2. There are 9 boys and 11 girls in a class. If a pupil is selected at random, what is the probability that it will be a girl? Give your answer as a percentage.
3. In a bag there are 7 green shirts, 8 blue shirts, 9 red shirts and 1 black shirt. A shirt is selected at random. Express the probability of selecting each of the following. Express your answers as percentages:
   a. A green shirt.
   b. A blue shirt.
   c. A red shirt.
   d. A black shirt.

Lesson Title: Solving Probability Story Problems	**Theme:** Probability
Practice Activity: PHM-07-149	**Class:** JSS 1

Learning Outcome

By the end of the lesson, you will be able to solve story problems involving probability of an event happening.

Overview

In this lesson, you will practise solving story problems involving probability. You will use the probability skills that you have learned in the previous lessons.

Give your answers as fractions unless you are asked to give your answers as percentages.

Solved Examples

1. Mohamed has 2 tickets to a football match. He will choose one of his family members to go to the match with him. He has a mother, father, 4 sisters and 2 brothers. Find the probability that he will choose:
    a. His mother
    b. One of his parents
    c. One of his sisters
    d. One of his brothers
    e. A female family member

    Solutions

    First, find the total number of family members Mohamed has. This will be the denominator. Family members $= 1 + 1 + 4 + 2 = 8$ people.

    a. The probability of choosing his mother is $\frac{1}{8}$.
    b. Add the probability of choosing his mother and the probability of choosing his father: $\frac{1}{8} + \frac{1}{8} = \frac{2}{8} = \frac{1}{4}$.
    c. The probability of choosing one of his sisters is $\frac{4}{8} = \frac{1}{2}$.
    d. The probability of choosing one of his brothers is $\frac{2}{8} = \frac{1}{4}$.
    e. Add the probability of choosing his mother to the probability of choosing one of his sisters: $\frac{1}{8} + \frac{4}{8} = \frac{5}{8}$.

2. Fatu went to the store to buy a new exercise book. At the store there are 3 blue exercise books, 8 red exercise books, 9 black exercise books and 5 yellow exercise books. She will choose an exercise book at random. Find the probability that she will choose the following. Give your answer as a percentage.

    a. A blue exercise book
    b. A black exercise book
    c. Either a blue or red exercise book
    d. Either a black or yellow exercise book

    Solutions

    First, find the total number of exercise books. This will be the denominator. Exercise books $= 3 + 8 + 9 + 5 = 25$

    a. The probability of choosing a blue exercise book is $\frac{3}{25} = \frac{3}{25} \times 100\% = \frac{300\%}{25} = 12\%$.
    b. The probability of choosing a black exercise book is $\frac{9}{25} = \frac{9}{25} \times 100\% = \frac{900\%}{25} = 36\%$.
    c. Add the probability of choosing a blue exercise book and the probability of choosing a red exercise book: $\frac{3}{25} + \frac{8}{25} = \frac{11}{25} = \frac{11}{25} \times 100\% = \frac{1100\%}{25} = 44\%$.
    d. Add the probability of choosing a black exercise book and the probability of choosing a yellow exercise book: $\frac{9}{25} + \frac{5}{25} = \frac{14}{25} = \frac{14}{25} \times 100\% = \frac{1400\%}{25} = 56\%$.

Practice

1. In a classroom, there are 3 male teachers and 2 female teachers. There are also 23 male pupils and 22 female pupils. The principal will choose 1 person at random to help him move a desk. Find the probability that she will choose:
    a. A teacher
    b. A pupil
    c. A male
    d. A female
    e. Either a male teacher or a female pupil

2. Hawa has a farm. On her farm, she has a pen of chickens, with 10 brown chickens, 12 white chickens and 18 black chickens. She will choose one at random to cook. Find the probability that she will choose the following:
    a. A brown chicken
    b. A white chicken
    c. A brown chicken or a white chicken
    d. A white chicken or a black chicken

3. Martin will randomly select a necktie to wear to his graduation ceremony. In a box, he has 3 red neckties, 8 blue neckties, 4 green neckties and 5 orange neckties. Find the probability that he will select each of the following. Give your answer as a percentage:

    a. A red necktie
    b. Either a red or a blue necktie
    c. Either a blue or a green necktie
    d. Either a green or an orange necktie

Lesson Title: Writing Probability Story Problems	**Theme:** Probability
Practice Activity: PHM-07-150	**Class:** JSS 1

Learning Outcome
By the end of the lesson, you will be able to write story problems involving the probability of an event happening.

Overview

In this lesson, you will write your own story problems involving the probability of an event happening. We can talk about the probability of many different types of events happening in our lives. Some are impossible, and others are certain. There are also likely and unlikely events. We now know how to do calculations on different types of events.

These are characteristics of a good probability problem:

- It has enough detail to find the probability of a certain event (colour, type, characteristics of items).
- We can find the **total** number of items for the denominator of the probability fraction.
- We can identify if a statement is impossible or certain.
- It gives all of the information needed to answer each question asked.

Find the solution to each story problem you write. Ask your classmates or teacher to check your probability problems and solutions.

Solved Examples

1. Write a probability story problem that involves red, blue and yellow balls. Find the solution to your problem.

   Solution
   You may write any story problem involving balls of the 3 given colours. Make sure you give the number of each colour of balls. Make sure the question can be answered with the information in your problem.

   Example problem: There are 3 red balls, 7 blue balls and 5 yellow balls in a bag. If a ball is selected at random, what is the probability that it is either blue or yellow?

   Answer: Add the probability of choosing a blue ball and the probability of choosing a yellow ball: $\frac{7}{15} + \frac{5}{15} = \frac{12}{15} = \frac{4}{5}$

2. Write a probability story problem that involves male and female pupils. Find the solution to your problem.

   Solution

   You may write any story problem involving male and female pupils. Make sure you give the number of each gender of pupils. Make sure the question can be answered with the information in your problem.

   Example problem: There are 3 boy pupils and 2 girl pupils working in a group. If the teacher randomly selects one pupil to write the solution on the board, what is the probability that she selects a boy?

   Answer: Find the probability of selecting a boy: $\frac{3}{5}$

Practice

1. Write a probability story problem that involves red and blue bicycles. Find the solution to your problem.
2. Write a probability story problem that involves male and female teachers. Find the solution to your problem.
3. Write a probability story problem that involves maths books, science books and geography books. Find the solution to your problem.
4. Write your own probability story problem on any topic, and find the solution.

Answer Key – JSS 1 Term 3

Lesson Title: Identifying Number Patterns
Practice Activity: PHM-07-106

1. a. Yes, common difference 8; b. Yes, common difference 3; c. No; d. Yes, common difference 2; e. No.
2. 24, 30, 36, 42, 48; Yes.

Lesson Title: Rules in Number Patterns
Practice Activity: PHM-07-107

1. 3, 8, 13, 18, 23, 28, 33
2. 10, 16, 22, 28, 34
3. 10, 5, 0, –5, –10, –15
4. 3, 6, 9, 12, 15, …
5. 30, 26, 22, 18, 14, …
6. 0, –2, –4, –6, –8, …
7. 50, 54, 58, 62, 66, …

Lesson Title: Completing Number Patterns
Practice Activity: PHM-07-108

1. a. 0, –5, –10, –15; b. 0, 3, 6, 9; c. 22, 28, 34, 40; d. 2, 0, –2, –4
2. a. Common difference: 6; Pattern: 6, 12, 18, 24, 30, 36, 42, 48
   b. Common difference: 3; Pattern: 3, 6, 9, 12, 15, 18
   c. Common difference: 5; Pattern: 35, 40, 45, 50, 55, 60, 65

Lesson Title: Variables
Practice Activity: PHM-07-109

1. a. r, h; b. m, n; c. x, u, t, a.
2. a. $x - 12$; b. $x + 5$
3. a. $x = 4$; b. $x = 4$; c. $x = 2$; d. $x = 3$; e. $x = 9$

Lesson Title: Solving for a Variable
Practice Activity: PHM-07-110

1. $x = 13$
2. $z = 6$
3. $x = 8$
4. $x = 11$
5. $t = -4$
6. $y = 4$
7. $x = 13$
8. $p = 6$
9. $b = 29$
10. $a = 2$

Lesson Title: Coefficients
Practice Activity: PHM-07-111

1. a. $-5x$, coefficient: -5; b. $12z$, coefficient: 12; c. $4x$, coefficient: 4; d. $7p$, coefficient: 7
2. a. Coefficients: $-5, 6$, Constant term: -10; b. Coefficients: $\frac{4}{5}, -1$, Constant term: 7; c. Coefficients: $1, -1$, Constant term: 10
3. a. $60x$; b. $100y$; c. $2x + 9$

Lesson Title: Solving for a Variable with a Coefficient
Practice Activity: PHM-07-112

1. $x = 4$
2. $y = 10$
3. $x = -4$
4. $p = 3$
5. $a = 3$
6. $x = 10$
7. $a = 25$
8. $x = -4$
9. $z = 3$
10. $x = 2$

Lesson Title: Like Terms
Practice Activity: PHM-07-113

1. Circled terms: $2y, 7y, -13y, y$
2. Circled terms: $-7x^3, 10x^3, -x^3$
3. Example answers: a. $-x^2, 3x^2, -2x^2, 2x^2, -x^2$; b. $2z, -z, 9z, 10z, -3z$; c. $y, 4y, 7y, -2y, -21y$
4. 18 and 9; $6x^2$ and $-x^2$; $-x$ and $7x$.

Lesson Title: Combining Like Terms
Practice Activity: PHM-07-114

1. x
2. $16y$
3. $-5x$
4. $3ab$
5. $-9x$
6. $80z$
7. $-4xy$
8. $2x$
9. $-9x$
10. 0

Lesson Title: Simplifying Algebraic Expressions
Practice Activity: PHM-07-115

1. $2x + y$
2. $-2a + 7b$
3. $5x + 2y + 3$
4. $5a + 4b - 7$
5. $m + 14n$
6. $3m + 6n$
7. $4a + 5b + 1$
8. $7n + p - 2$

Lesson Title: Multiplying Algebraic Expressions
Practice Activity: PHM-07-116

1. $5x - 20$
2. $-21y + 28$
3. $-2m - 2n$
4. $6v + 9$
5. $-2x^2 + x - 7$
6. $-24m + 16n$
7. $4a + 6$
8. $10x^2 - 30x$

Lesson Title: Dividing Algebraic Expressions
Practice Activity: PHM-07-117

1. $2a$
2. x
3. $-6y$
4. $-3xy$
5. $4ab$
6. $-50x$
7. $-3xy$
8. $8xyz$
9. $-5z$
10. $3p$

Lesson Title: Factorisation
Practice Activity: PHM-07-118

1. $4(x + 3)$
2. $7(x - 3y)$
3. $2(7 - x)$
4. $10(2x + 3)$
5. $2(2y - 3)$
6. $2(5s + 4t)$
7. $6(2 - 3p)$
8. $3(x^2 + 4x + 10)$
9. $3(3x^2 - 4)$
10. $2(x + 20y + 6z + 12)$

Lesson Title: Introduction to Linear Equations
Practice Activity: PHM-07-119

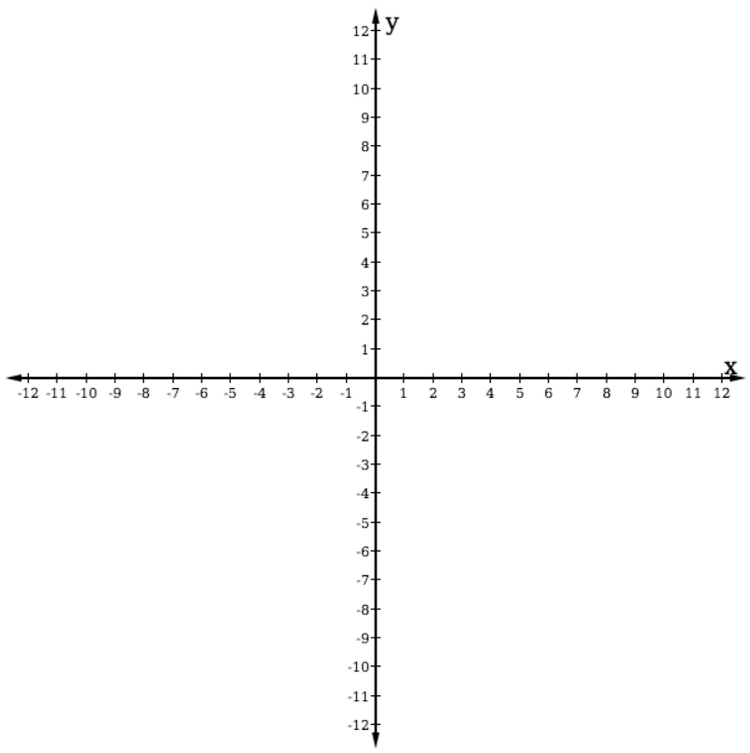
1. $x = 12$
2. $z = -13$
3. $x = 2$
4. $y = -16$
5. $b = -9$
6. $x = 6$
7. $y = 10$
8. $x = -6$
9. $x = 11$
10. $y = 52$

Lesson Title: Solving Linear Equations
Practice Activity: PHM-07-120

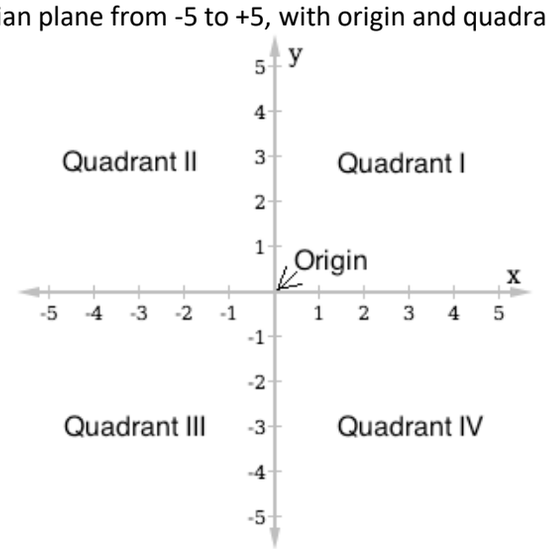
1. $m = -3$
2. $n = 20$
3. $y = 4$
4. $y = -6$
5. $x = 1$
6. $y = 2$
7. $x = -1$
8. $m = 0$
9. $y = \frac{1}{2}$

Lesson Title: Introduction to the Cartesian Plane
Practice Activity: PHM-07-121

1. Cartesian plane from -12 to +12:



2. Cartesian plane from -5 to +5, with origin and quadrants labeled:

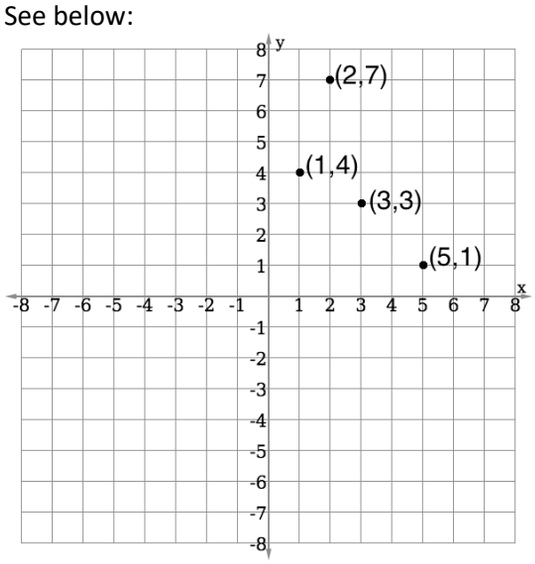


Lesson Title: Identifying Points on the Cartesian Plane
Practice Activity: PHM-07-122

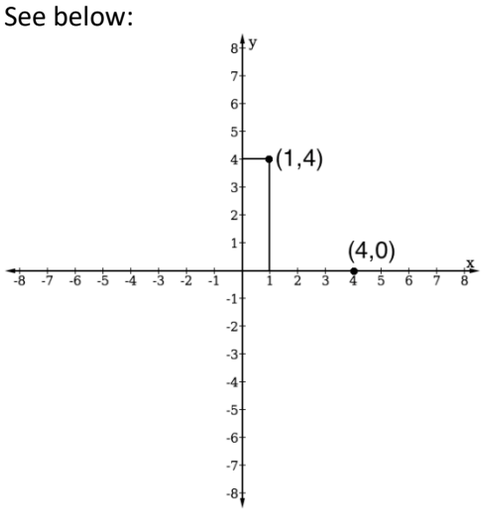
1. $A(-6,5)$, $B(0,6)$, $C(6,4)$, $D(3,0)$, $E(6,-5)$, $F(0,-5)$, $G(-1,-7)$, $H(-7,-3)$
2. a. Quadrant II; b. Quadrant III; c. Quadrant IV

Lesson Title: Plotting Points in the First Quadrant of the Cartesian Plane
Practice Activity: PHM-07-123

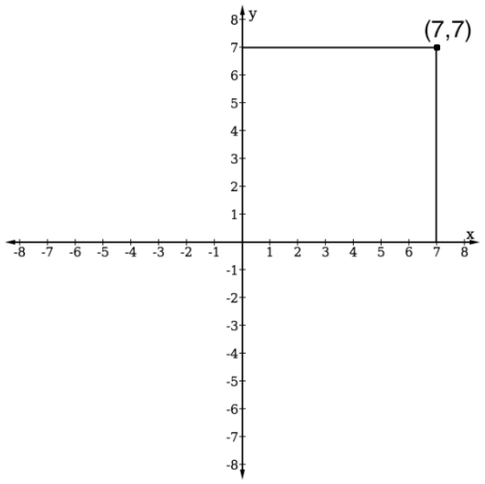
1. See below:



2. See below:

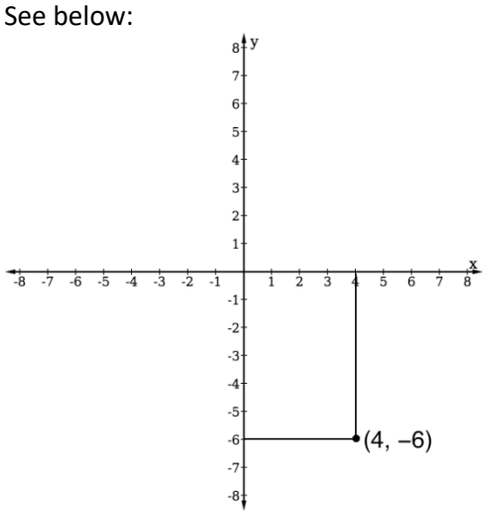


3. See below:

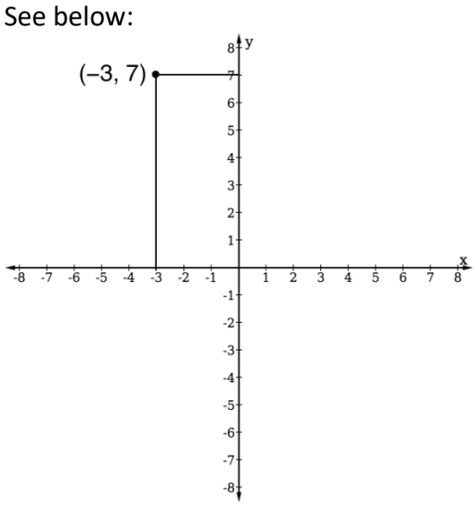


Lesson Title: Plotting Points in All Quadrants of the Cartesian Plane
Practice Activity: PHM-07-124

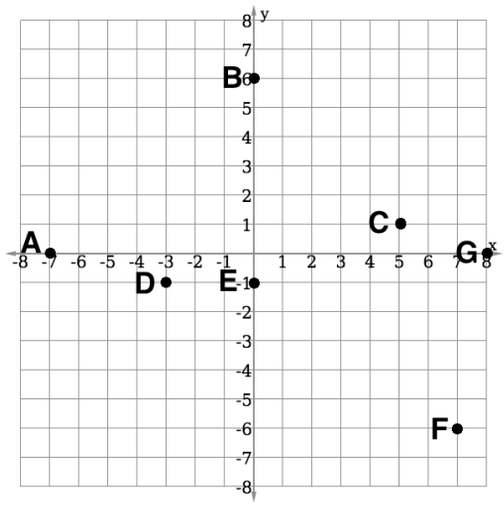
1. See below:



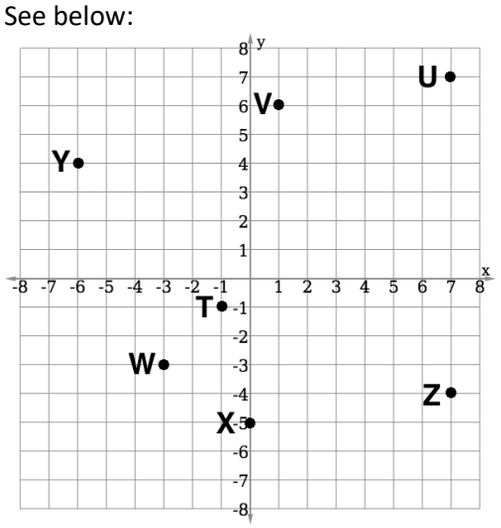
2. See below:



3. See below:

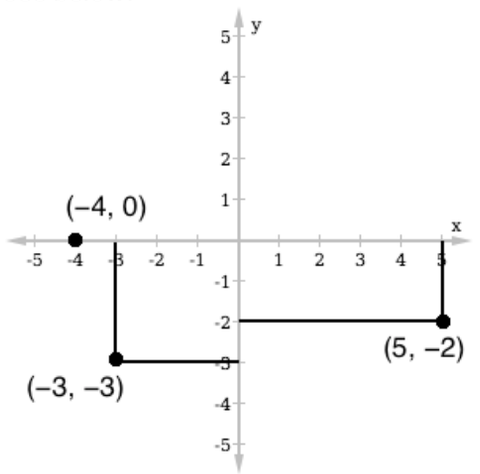


4. See below:

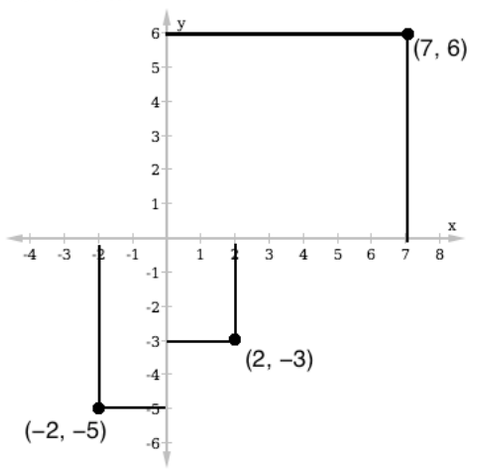


Lesson Title: Practice with the Cartesian Plane
Practice Activity: PHM-07-125

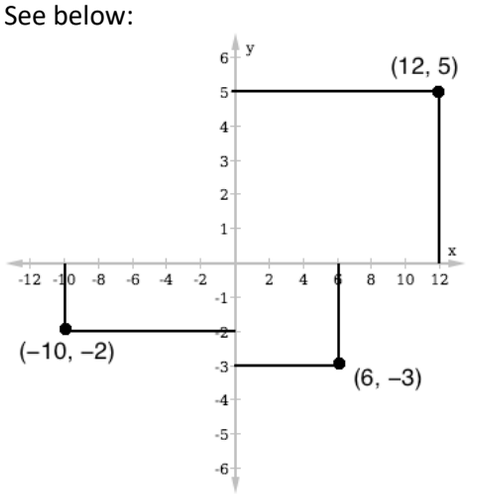
1. See below:



2. See below:



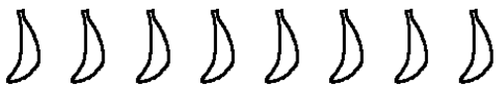
3. See below:

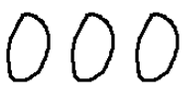


Lesson Title: Data Collection
Practice Activity: PHM-07-126

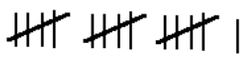
1. Pictogram of Martin's fruit:

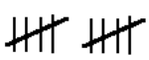
   Orange: 

   Banana: 

   Mango: 

2. Tally marks:

   Boys: 

   Girls: 

   Male teachers: 

   Female teachers: 

3. The answers will depend on the results of your own survey.

Lesson Title: Lists and Tables
Practice Activity: PHM-07-127

1. See table below; a. 19 babies; b. 7 kg; c. 4 babies; d. 5 kg

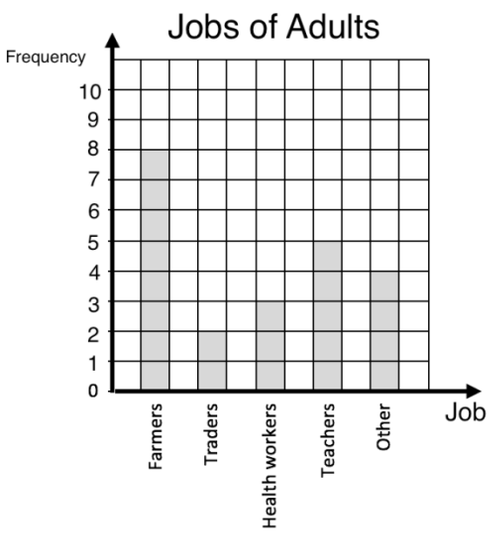
WEIGHT (KG)	TALLY MARKS	NUMBER OF BABIES
3	||||	4
4	||||	4
5	𝍸 |	6
6	|||	3
7	||	2
Total	**19**	**19**

2. See table below; a. 12 pupils; b. 170 cm; c. 2 pupils

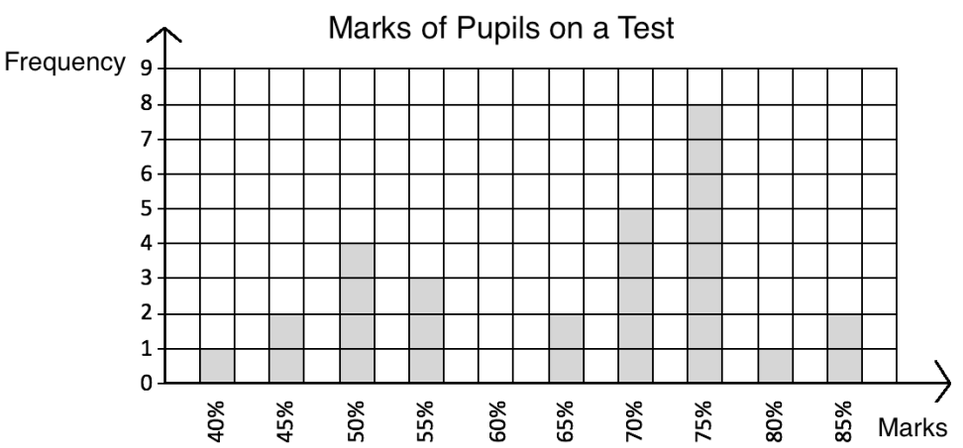
HEIGHT (CM)	TALLY MARKS	NUMBER OF PUPILS
150	|	1
155	||||	4
160	||	2
165	|||	3
170	||	2
Total	**12**	**12**

Lesson Title: Creating Bar Charts
Practice Activity: PHM-07-128

1. See below:

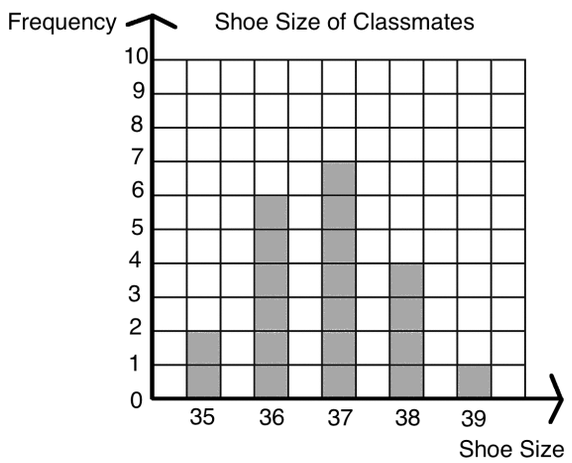


2. See below:

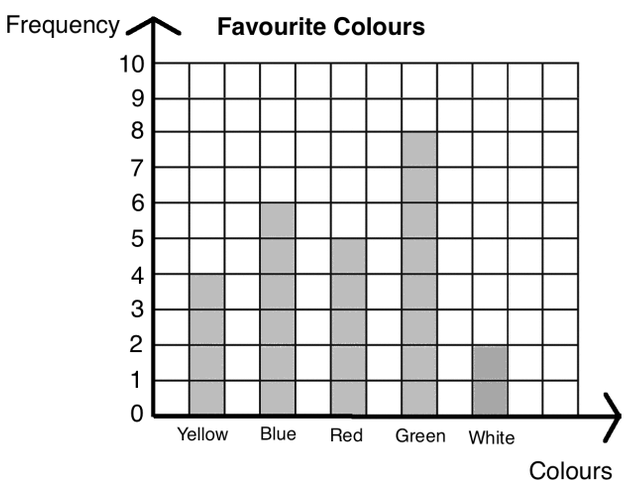


Lesson Title: Interpreting Bar Charts
Practice Activity: PHM-07-129

1. a. 41 pupils; b. 1 mark; c. 8 pupils; d. 10 pupils; e. 28 pupils; f. 13 pupils
2. See bar chart below; a. 20 classmates; b. size 35; c. size 39; d. size 37; e. 12 classmates

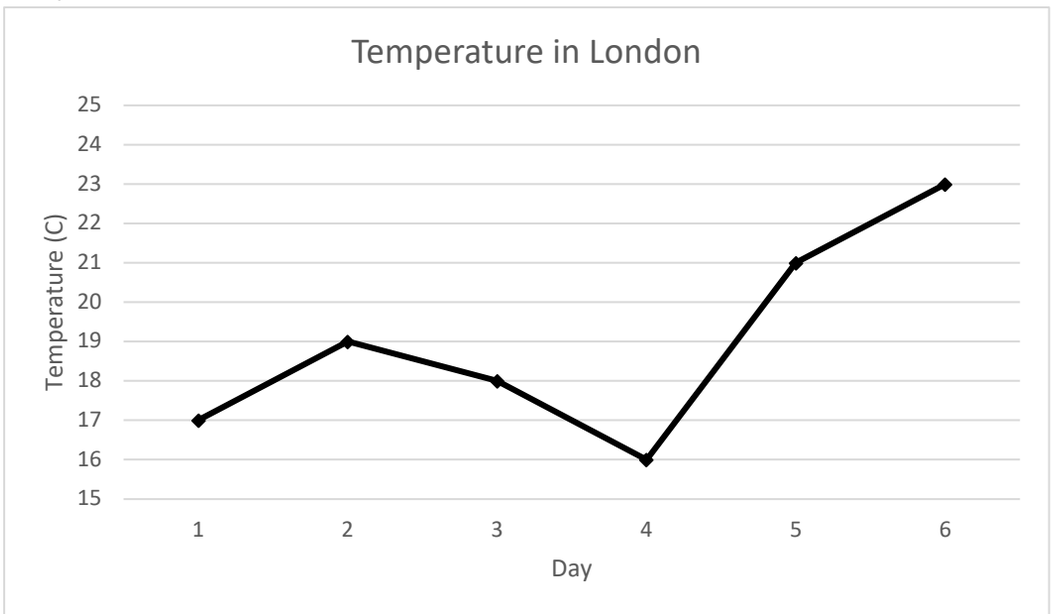


3. See bar chart below; a. 25 pupils; b. green; c. white.

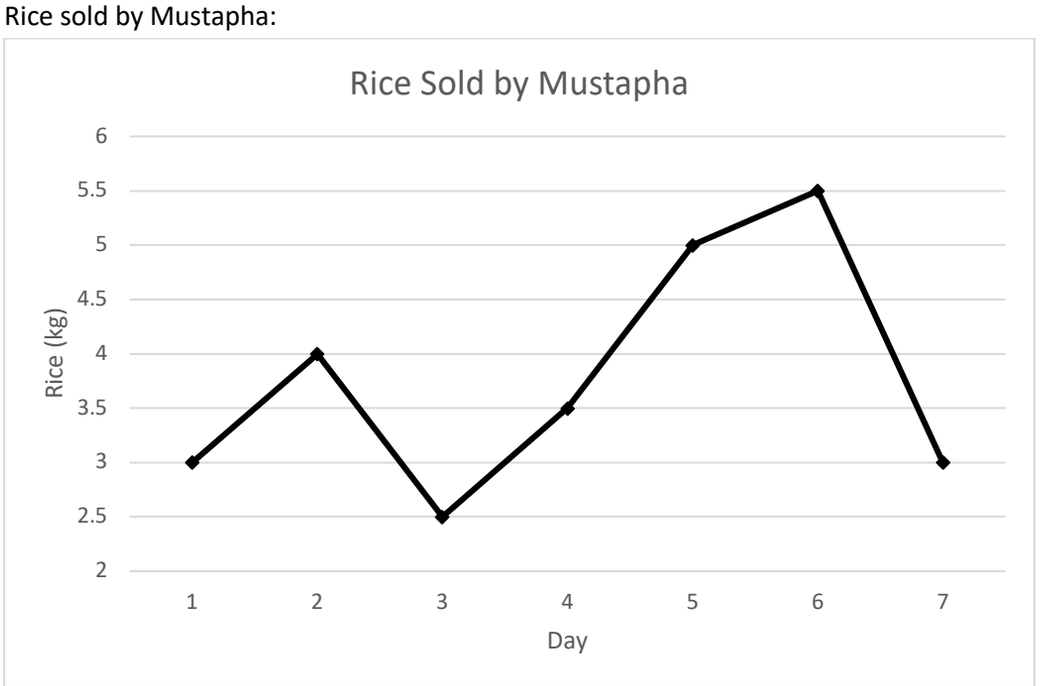


Lesson Title: Creating Line Graphs
Practice Activity: PHM-07-130

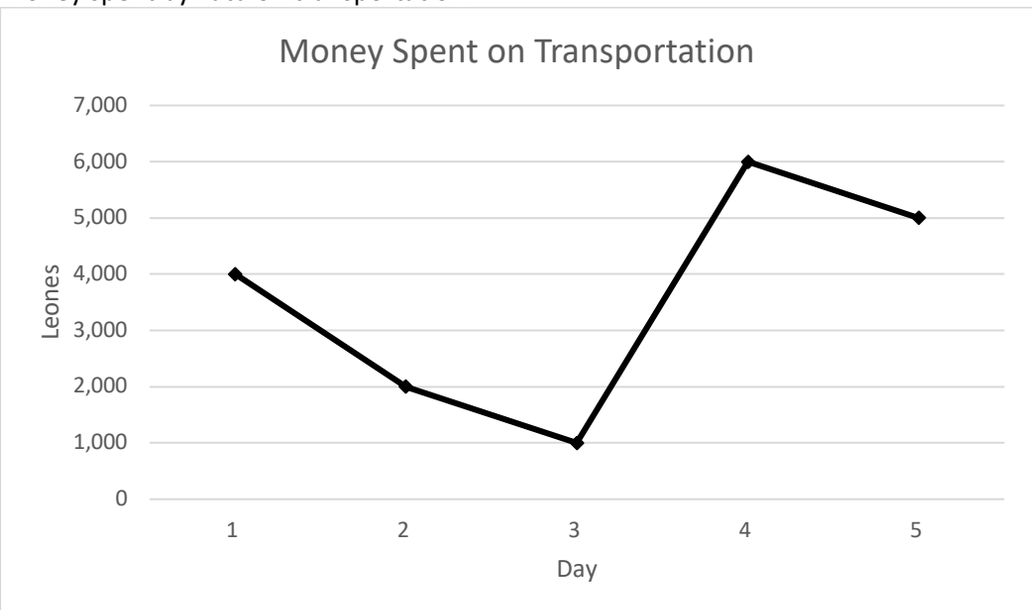
1. Temperatures in London:



2. Rice sold by Mustapha:



3. Money spent by Fatu on transportation:



Lesson Title: Interpret Line Graphs
Practice Activity: PHM-07-131

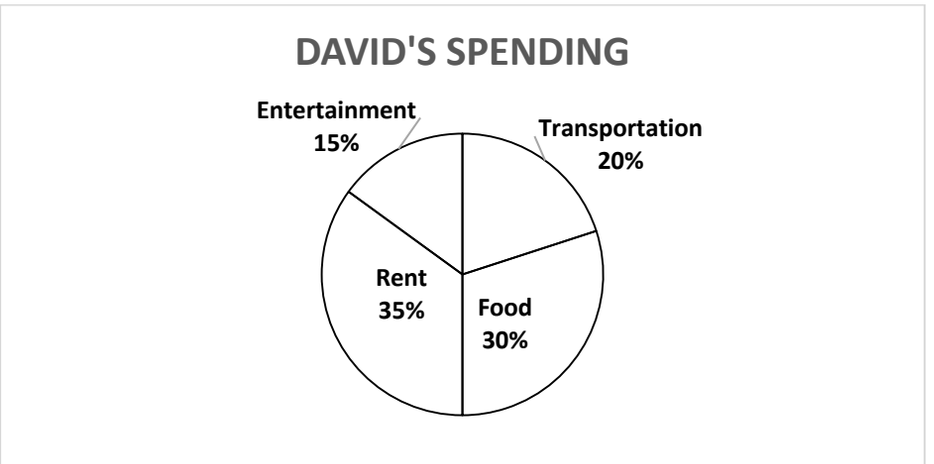
1. a. 32 chimpanzees; b. 28 chimpanzees; c. the second year; d. the fifth year; e. 7 chimpanzees
2. a. 2 cm; b. 5 August; c. 1 August **and** 7 August; d. 2 cm; e. 4 cm

Lesson Title: Pie Charts
Practice Activity: PHM-07-132

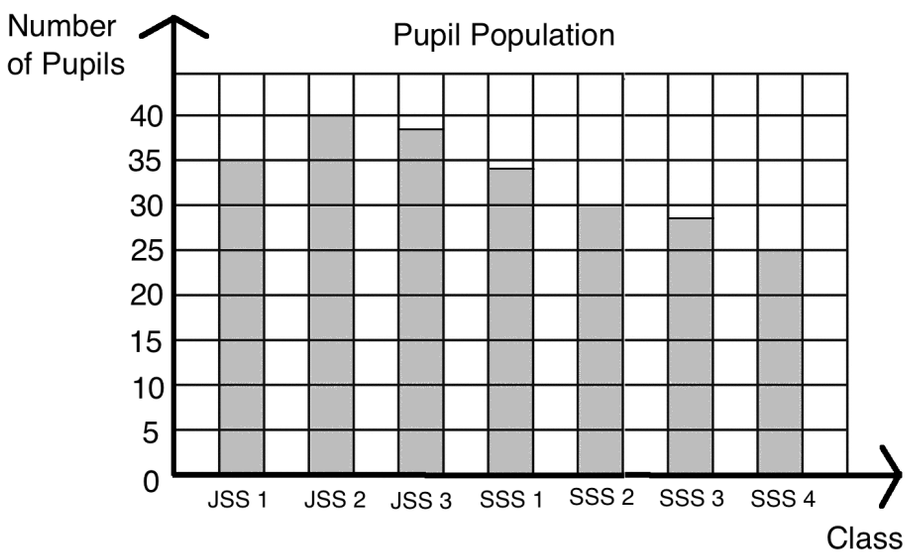
1. a. mobile phone; b. television; c. 105 people; d. 150 people
2. a. wages; b. Le 400,000.00; c. Le 600,000.00; d. Le 600,000.00

Lesson Title: Comparing Graphs and Charts
Practice Activity: PHM-07-133

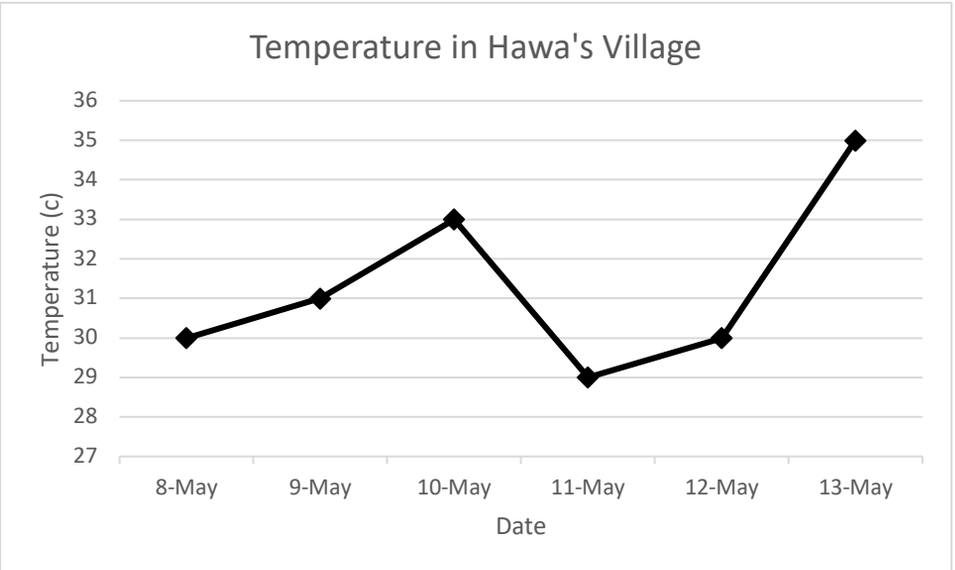
1. Pie chart:



2. Bar chart:



3. Line graph:



Lesson Title: Community Survey: Collecting Data
Practice Activity: PHM-07-134

These are example solutions. Your own tables will have different numbers depending on the numbers in your own school and community.

1. Compare your table with your classmates.

Pupils in my Class		
Gender	**Tally Marks**	**Number of Pupils**
Male	𝍸 𝍸 𝍸 𝍸	20
Female	𝍸 𝍸 𝍸 𝍸 ||	22
Total		42

2. Your answers depend on your neighbours. Add the total number of males and females from the first table to fill the second table.

a.

People	Tally Marks	Number
Adult Males	𝍸 𝍸	10
Adult Females	𝍸 ||||	9
Boys	𝍸 |||	8
Girls	𝍸 𝍸	10
Total		37

b.

People	Number
Males	18
Females	19
Total	37

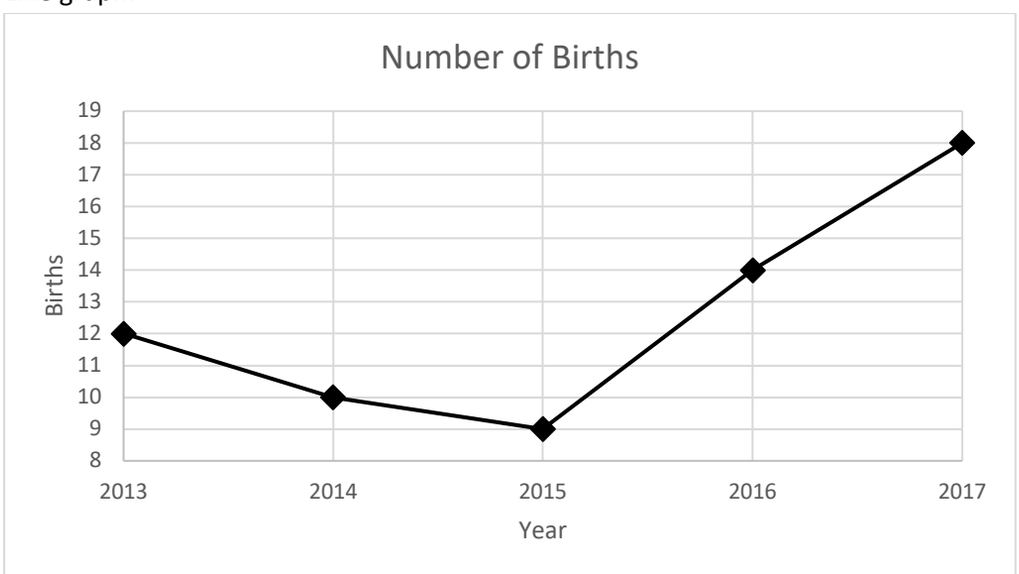
3. Your answers depend on the survey responses you collect.

What Our Community Needs		
Resource	**Tally marks**	**Number**
Health Clinic	𝍸 𝍸 ||||	14
School	𝍸	5

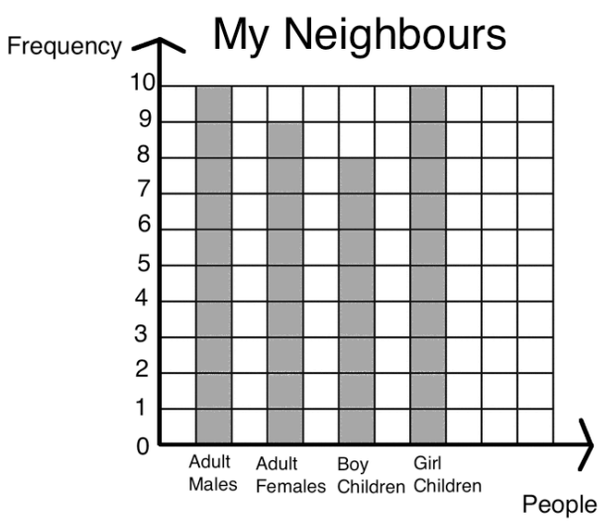
Lesson Title: Community Survey: Displaying Data
Practice Activity: PHM-07-135

The answers to problems 2 and 3 are example bar charts. Your own bar charts will be different depending on your community.

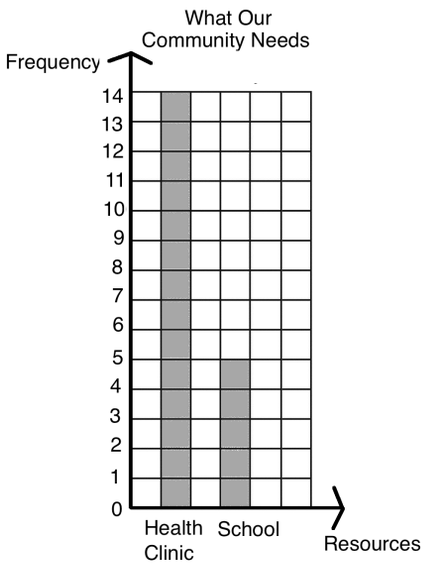
1. Line graph:



2. Bar chart:



3. Bar chart:



Lesson Title: Mean and Median
Practice Activity: PHM-07-136

1. Mean: 76 marks; Median: 76
2. a. Size 10; b. Size 9.6
3. Mean: 8 goals; Median: 8 goals
4. The answer depends on the ages of the friends that you write down. The median and mean of the ages should be around the middle of the numbers that you wrote down.

Lesson Title: Mode and Range
Practice Activity: PHM-07-137

1. Mode: 155 cm; Range: 10 cm
2. Mode: 15 kg and 20 kg; Range: 9 kg
3. Mode: none; Range: 9 watermelons
4. The mode and range of the data depend on the ages of your friends.

Lesson Title: Statistical Calculations from a List of Data
Practice Activity: PHM-07-138

1. a. 10.8 cm; b. 10.8 cm; c. 10.9 cm; d. 1.1 cm
2. Mean: 80 marks; Median: 80 marks; Mode: None; Range: 23 marks
3. Mean: 43 kg; Median: 43.5 kg; Mode: 45 kg; Range: 6 kg
4. Size 35

Lesson Title: Statistical Calculations from a Bar Chart
Practice Activity: PHM-07-139

1. Mean: 40 cm; Median: 30 cm; Mode: 30 cm; Range: 70 cm
2. a. 36 phones; b. 6 phones; c. 6 phones; d. 6 phones; e. 4 phones

Lesson Title: Statistics Story Problems
Practice Activity: PHM-07-140

1. Mean: 4 goals; Median: 3.5 goals; Mode: 2 goals; Range: 7 goals
2. Mean: 30 pupils; Median: 30 pupils; Mode: 35 pupils and 25 pupils; Range: 20 pupils
3. Mean: 6 kg; Median: 6.5 kg; Mode: 8 kg; Range: 5 kg

Lesson Title: Introduction to Probability
Practice Activity: PHM-07-141

1. a. Impossible; b. Likely; c. Certain; d. Unlikely
2. Unlikely
3. Certain
4. Impossible
5. You will write statements of your own. The example statements are:
    a. Impossible: A cat has 3 heads.
    b. Unlikely: A pupil gets lost on her way home from school.
    c. Likely: You will pass to JSS2.
    d. Certain: Your mother gave birth to you.

Lesson Title: Probability Experiments
Practice Activity: PHM-07-142

1. a. Experiment; b. Experiment; c. Event; d. Event; e. Event; f. Experiment
2. There are 4 possible outcomes: choosing Manchester United, choosing Chelsea, choosing Arsenal, or choosing Real Madrid.
3. a. 1; b. 2; c. 5; d. 5; e. 3

Lesson Title: Certain and Uncertain Probability
Practice Activity: PHM-07-143

1. a. 1; b. 0; c. 0; d. 0; e. 1
2. a. 0; b. 1
3. a. 1; b. 0

Lesson Title: Likely and Unlikely Events
Practice Activity: PHM-07-144

1. It's more likely to be green.
2. It's more likely to be odd.
3. It's more likely to be a boy.
4. e, d, b, c, a

Lesson Title: The Language of Probability
Practice Activity: PHM-07-145

1. a. It is more likely that a child will be selected, because there are more children than adults.; b. It is more likely that a female will be selected, because there are more females than males.
2. a. It is unlikely that Hawa will select a cat.; b. It is unlikely that Hawa will select a dog.; c. It is likely that Hawa will select a duck.; d. It is impossible that Hawa will select a chicken.
3. The answer depends on the question you write. See Solved Example 3 for example questions and answers.

Lesson Title: Expressing Probability as a Fraction
Practice Activity: PHM-07-146

1. a. $\frac{10}{21}$; b. $\frac{11}{21}$
2. a. $\frac{1}{8}$; b. $\frac{1}{2}$; c. $\frac{1}{3}$; d. $\frac{1}{24}$
3. a. $\frac{3}{10}$; b. $\frac{2}{5}$; c. $\frac{1}{10}$; d. $\frac{1}{5}$

Lesson Title: Probability Fraction Problems
Practice Activity: PHM-07-147

1. a. $\frac{1}{10}$; b. $\frac{1}{5}$; c. $\frac{1}{2}$
2. a. $\frac{4}{7}$; b. $\frac{3}{7}$; c. 1
3. a. $\frac{7}{26}$; b. $\frac{11}{26}$; c. $\frac{4}{13}$; d. $\frac{9}{13}$; e. $\frac{19}{26}$

Lesson Title: Probability as a Percent
Practice Activity: PHM-07-148

1. a. Neither unlikely or likely, there is an equal chance that it will rain or not rain; b. unlikely; c. likely; d. impossible
2. 55%
3. a. 28%; b. 32%; c. 36%; d. 4%

Lesson Title: Solving Probability Story Problems
Practice Activity: PHM-07-149

1. a. $\frac{1}{10}$; b. $\frac{9}{10}$; c. $\frac{13}{25}$; d. $\frac{12}{25}$; e. $\frac{1}{2}$
2. a. $\frac{1}{4}$; b. $\frac{3}{10}$; c. $\frac{11}{20}$; d. $\frac{3}{4}$
3. a.15%, b.55%, c.60%, d.45%

Lesson Title: Writing Probability Story Problems
Practice Activity: PHM-07-150

The problems and solutions here are examples. Write your own original problems and find the solutions.

1. Martin will buy a new bicycle. There are 3 red bicycles and 4 blue bicycles at the store. If he selects one at random, what is the probability that it is red? (Answer: $\frac{3}{7}$)
2. There are 12 male teachers and 10 female teachers in a school. If the principal randomly selects one to lead the teacher meeting, what is the probability that she selects a male? (Answer: $\frac{6}{11}$)
3. There are 3 maths books, 4 science books and 5 French books in a pile. If Fatu selects one at random, what is the probability that it is either a maths book or a French book? (Answer: $\frac{2}{3}$)
4. Write a problem on any topic of your choice.

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