BASIC ALGEBRA

BASIC ALGEBRA

Rosenita binti Yob
Kamal bin Haron

Penerbit
POLITEKNIK NILAI NEGERI SEMBILAN

BASIC ALGEBRA

AUTHORS:

Rosenita binti Yob
Kamal bin Haron

EDITOR

Raja Nadia binti Raja Ahmad

PUBLISHED BY

POLITEKNIK NILAI
Kompleks Pendidikan Nilai 71760,
Bandar Enstek Negeri Sembilan

E-ISBN : 978-967-2742-39-5

First edition 2024

PREFACE

BASIC ALGEBRA: A Student's Handbook serves as a guide for students enrolled in Polytechnics Malaysia's DBM10163: Engineering Mathematics 1. The book includes the following: Examples of exercise questions for Basic Algebra and Simplifying Algebraic Fractions. The notes in this book are produced following the course syllabus and are accompanied by pictures to aid in comprehending the material. Furthermore, the exercises and evaluation methods in this book are designed to meet the requirements of students to help them fully grasp the material and the course.

Authors

Rosenita binti Yob
Kamal bin Haron

APPRECIATION

We would like to thank the Mathematics, Science, and Computer Department of Politeknik Nilai as well as the Jabatan Pendidikan Politeknik dan Kolej Komuniti (JPPKK).

Our original attempt to assist students better grasp the fundamentals of mathematics is this handbook.

In conclusion, we extend our gratitude to all of our friends at Politeknik Nilai who contributed to the success of this e-book.

ABSTRACT

This eBook's goal is to assist polytechnic students’ enrolled in DBM10163: Engineering Mathematics 1 in improving their comprehension of fundamental algebraic concepts. To assess students' comprehension, this e-book contains summary notes and response exercises.

TABLE OF CONTENTS

Title & Author	i
Preface	ii
Appreciation	iii
Abstract	iv
Table of Contents	v
1.0 BASIC ALGEBRA	
1.1 Concepts of Basic Algebra.	1 – 2
1.2 Simplifying Basic Algebraic Involving Addition, Subtraction, Multiplication and Division.	3 – 19
1.3 Simplifying Algebraic Fraction Involving Addition, Subtraction, Multiplication and Division.	20 - 38
1.4 Extra Exercise for Basic Algebraic	39 - 46
References	47


WELCOME!
1.0 BASIC ALGEBRA

1.1 CONCEPTS OF BASIC ALGEBRA

1. Variables:

Variables are symbols (typically letters like (x), (y), or (z)) that represent unknown values. They allow us to generalize mathematical relationships.

2. Algebraic Equations:

An algebraic equation consists of two sides, the left-hand side (LHS) and the right-hand side (RHS), separated by an equal sign. The goal is often to find the variable values that make the equation true.

Types of Equations:

Single-variable equations: Equations with only one variable. Example: ($x + 5 = 10$).

Multi-variable equations: Equations that include two or more variables. Example: ($2x + 3y = 12$).

3. Algebraic Expressions:

An expression is made up of variables, constants, and operations (such as addition, subtraction, multiplication, or division). It does not include an equal sign.

Example of an algebraic expression: ($ax - by + c$).

Algebra serves as a fundamental branch of mathematics that allows us to work with numbers and symbols to solve problems. Here's a breakdown of some key concepts and terms often covered in the basics of algebra:

Key Terminology

1.Variables: Symbols (usually letters like x, y, z) that represent unknown values.

2.Constants: Fixed values or numbers (like 2, 5, -3).

3.Expressions: Combinations of variables and constants using operations, such as (3x + 2).

4.Equations: Statements that two expressions are equal, like (x + 10 = 0).

5.Coefficients: Numbers that multiply variables (in (5x), 5 is the coefficient of x).

6.Terms: Parts of an expression separated by + or − signs (in (3x + 5), both (3x) and (5) are terms).

7.Solving an Equation: Finding the value of the variable that makes the equation true.

Basic Operations

1.Addition (+): Combining two numbers e.g., (a + b).

2.Subtraction (−): Finding the difference between two numbers e.g., (a - b).

3.Multiplication (×): Finding the product of two numbers e.g., (a x b).

4.Division (÷): Splitting a number into equal parts e.g., (a ÷ b).

1.2 SIMPLIFY BASIC ALGEBRA USING ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION

What is simplify ?

Simplify is the process to make the expression into the simplest form.

For FRACTION, it must be end up with ONLY A Fraction.

For any ALGEBRAIC TERM, it must be end up with ONLY ONE TERM for each of similar Algebraic Terms.

A Puzzle

$$\square - 2 = 4$$

$$x - 2 = 4$$

1. ## Thinking????

What is the missing number**?????**

2. ## Conferences

The answer is 6. Because 6 – 2 = 4 (easy).

3. ## Final

However, in Algebra we use a **letter** (usually an x or y) instead of blank boxes. So we would write:

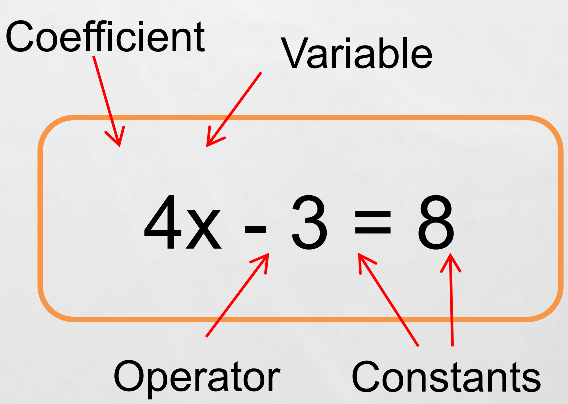
It is really that simple. The letter (in this case an x) just means “*we don’t know this yet*”, and is often called the **unknown** or the **variable**.

BASIC ALGEBRA

A variable - symbol for a number we don't know yet
- Usually a letter like x or y

A coefficient - number multiply a variable
- Ex: 4x (4 times x)
So, 4 is coefficient

An operator - symbol like (+,-, x , etc.) represent an operation

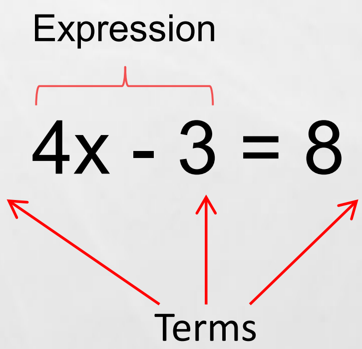


Parts of an equation

A **Term -** is either a single number or a variable, or numbers and variables multiplied together.

An **Expression -** a group of terms (the terms are separated by + or - signs)

Algebraic expressions are simplified by combining the **like terms**. Like terms are the terms with the **same unknown**.



Example 1 : Simplify each of the following.

a) b+b+b

b) -n-n-n-n-n

c) a+a+c+c+c

d) 3y+5x-y+11x

Solution:

a) b+b+b = 3b

b) -n-n-n-n-n = -5n

c) a+a+c+c+c = 2a+3c

d) 3y+5x-y+11x = 2y + 16x

1.2.1 ADDITION AND SUBTRACTION OF TWO OR MORE TERMS

Addition and subtraction are fundamental operations in arithmetic, and they apply to both positive and negative numbers. When dealing with multiple terms, the rules for adding and subtracting depend on the signs (positive or negative) of the terms involved.

Addition of Two or More Terms

1.When both numbers have the same sign (both positive or both negative):

a. Add their absolute values (ignore the signs for now).
b. Keep the sign of the terms.

Example 1:

$5 + 3 = 8$ (both positive, so the result is positive)

Example 2:

$(-5) + (-3) = -8$ (both negative, so the result is negative

2. When the numbers have different signs (one positive and one negative):

a. Subtract the smaller absolute value from the larger absolute value.
b. Keep the sign of the term with the larger absolute value.

Example 3:

$7 + (-5) = 2$ (7 is larger, so the result is positive)

Example 4:

$(-7) + 5 = -2$ (7 is larger, so the result is negative

Addition of more than two terms:

a. Simply follow the same rules for pairs of terms and add/subtract accordingly.

Example 5:

$4 + (-3) + 6$

$4 + (-3) = 1$

$1 + 6 = 7$

The result is 7.

Subtraction of Two or More Terms

Subtraction can be considered as adding the opposite (or negative) of a term.

1. Subtraction of two terms:
    a. To subtract, change the sign of the second term and then add.

Example 1:

$$7 - 3 = 7 + (-3) = 4$$

Example 2:

$$-7 - 3 = -7 + (-3) = -10$$

1. Subtraction of more than two terms:
    a. Apply subtraction one step at a time, changing the sign of each subsequent term as you go.

Example 3:

$$8 - 4 - 3 = 8 + (-4) = 4\ ,\ 4 - 3 = 1$$

Summary of Key Points

a. Same signs: Add absolute values, keep the same sign.
b. Different signs: Subtract absolute values, keep the sign of the larger absolute value.
c. Subtraction: Turn subtraction into addition by changing the sign of the second term.
d. These basic rules apply when adding and subtracting two or more terms, regardless of whether the numbers are whole numbers, fractions, or decimals.

1.2.2 MULTIPLICATION AND DIVISION OF TWO OR MORE TERMS

When multiplying and dividing expressions involving two or more terms, we follow similar steps as for simpler algebraic fractions, but now we deal with binomials or polynomials (expressions with more than one term). Let's break it down into two parts: multiplying and dividing.

1. Multiplication of Two or More Terms

When multiplying expressions with two or more terms, we need to distribute each term from one expression to each term of the other expression. This is called the distributive property.

Example 1: Multiplying Two Binomials
Multiply:

$$(2x+3)(x-4)$$

Step 1: Apply the distributive property (FOIL method)

Multiply each term in the first binomial by each term in the second binomial.

$$(2x)(x)+(2x)(-4)+(3)(x)+(3)(-4)$$

Step 2: Simplify each term

$$2x^2-8x+3x-12$$

Step 3: Combine like terms

$$2x^2-5x-12$$

So, the product of (2x+3)(x−4) is:

$$2x^2-5x-12$$

2. Division of Two or More Terms

Division involves dividing the numerator by the denominator, and you can factor terms to simplify the expression. Let's look at examples of division involving more than one term.

Example 1: Dividing Two Binomials

Divide:

$$\frac{x^2 - 4}{x - 2}$$

Step 1: Factor the numerator

The numerator $x^2 - 4$ is a difference of squares:

$$x^2 - 4 = (x - 2)(x + 2)$$

So the expression becomes:

$$\frac{(x - 2)(x + 2)}{x - 2}$$

Step 2: Cancel out the common factor

Since x − 2 appears in both the numerator and the denominator, you can cancel them out (assuming x ≠ 2):

$$x + 2$$

Thus, the result is:

$$x + 2$$

Key Points for Multiplication and Division of Two or More Terms:

Multiplication:

1.Multiply each term of the first expression by each term of the second (distributive property).

2.For binomials, use the FOIL method (First, Outer, Inner, Last).

3.Combine like terms if applicable.

Division:

1.Simplify by factoring both the numerator and denominator (if possible).

2.Cancel out any common factors from the numerator and denominator (if applicable).

3.If dividing a polynomial by a binomial, use long division to obtain a quotient and remainder.

By following these steps, you can multiply and divide expressions with two or more terms accurately and efficiently.

Example 2 : Simplify each of the following

question	solution	Notes(index law)
a. 2xy (5yz)	=2•5•x•y•y•z =10xy^{2}z	y^1+y^1 = y^{1+1} =y^2
b. $20ab^2c \times \frac{3b^3}{5c}$	$= 20 \times \frac{3}{5} \times \frac{ab^2c \times b^3}{c}$ $= 12ab^5$	$\frac{b^2c \times b^3}{c} = b^{2+3}c^{1-1}$ $= b^5$
c. $4k^2 \div 12k^3l$	$= \frac{4k^2}{12k^3l}$ $= \frac{1}{3kl}$	$\frac{k^2}{k^3} = k^{2-3}$ $= \frac{1}{k}$

Exercise 1

Simplify the following expressions for addition and subtraction:

a) $3a + 5c - a + 2c$ (Ans: $3a + 2c$)

b) $3x + 2x + 3y - y$ (Ans: $5x + 2y$)

c) $3x + 2y - 3x + 4y$ (Ans: $6y$)

d) $p + q + p + q + p$ (Ans: $3p + 2q$)

e) $5p - 3q + 2 - 4p + 5 + 4q$ (Ans: $p + q + 7$)

f) $2xy - 4ac + 5xy + 4ac$ (Ans: $7xy$)

g) $3xy + 4xy - xy$ (Ans: $6xy$)

h) $xy + yx - 2xy + 1$ (Ans: 1)

i) $4y^2 + 5y - 3y^2 - 4y$ (Ans: $y^2 + y$)

j) $2x^2 + 3x - 5x^2 - x + 8$ (Ans: $-3x^2 + 2x + 8$)

Exercise 2

Simplify the following expressions for multiplying and division:

a) $3x^2(-2x)$ (Ans: $-6x^3$)

b) $(2a + 4)(a - 3)$ (Ans: $2a^2 - 2a - 12$)

c) $(3d - 4)^2$ (Ans: $9d^2 - 24d - 16$)

d) $2(x - 2y)(x + y)$ (Ans: $2x^2 - 4xy - 4y^2$)

e) $\frac{4a^2b}{4ab^2}$ (Ans: $\frac{a}{b}$)

f) $\frac{-12m^3n}{20m^2n^2}$ (Ans: $\frac{3m}{5n}$)

g) $\frac{21c^2de^3}{14cde^2}$ (Ans: $\frac{21ce^2}{14}$)

EXPANDING BRACKETS

$$a(b+c)=ab+ac$$

$$a(b-c)=ab-ac$$

$$(a+b)^2=(a+b)(a+b)=a^2+2ab+b^2$$

$$(a-b)^2=(a-b)(a-b)=a^2-2ab+b^2$$

$$(a+b)(a-b)=a^2-b^2$$

$$a(b+c)=ab+ac$$

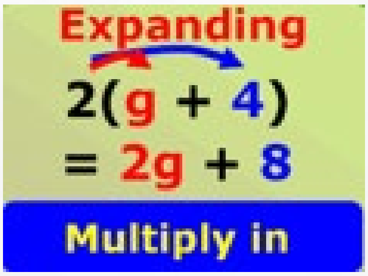
$$a(b-c)=ab-ac$$

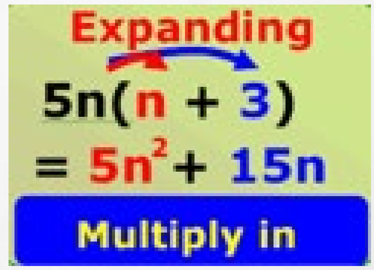
$$(a+b)^2=(a+b)(a+b)=a^2+2ab+b^2$$

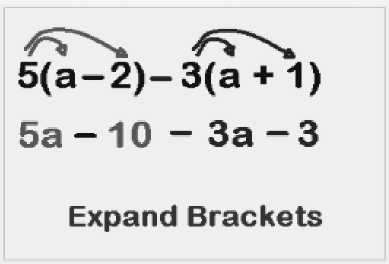
$$(a-b)^2=(a-b)(a-b)=a^2-2ab+b^2$$

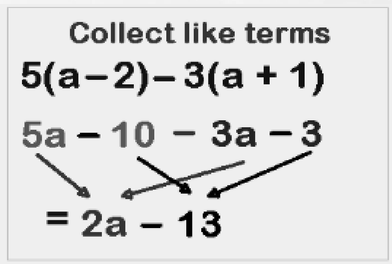
$$(a+b)(a-b)=a^2-b^2$$

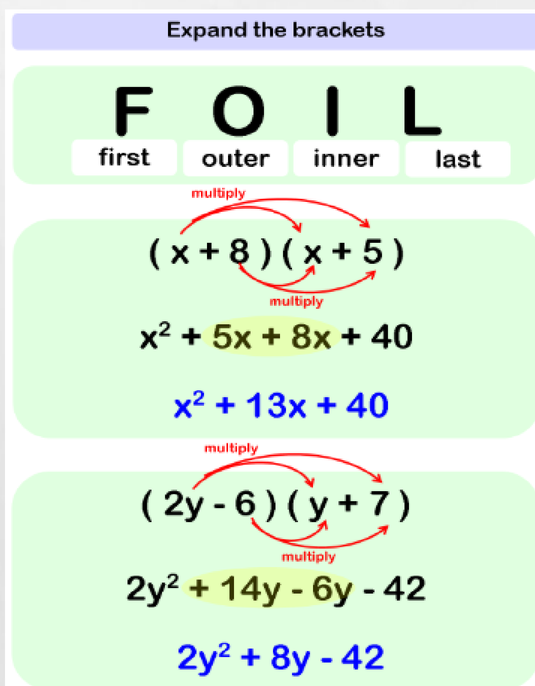
EXPANDING


Expanding
2(g + 4)
= 2g + 8
Multiply in


Expanding
5n(n + 3)
= 5n² + 15n
Multiply in


5(a – 2) – 3(a + 1)
5a – 10 – 3a – 3
Expand Brackets


Collect like terms
5(a – 2) – 3(a + 1)
5a – 10 – 3a – 3
= 2a – 13


Expand the brackets
F O I L
first
outer
inner
last
multiply
(x + 8) (x + 5)
multiply
x² + 5x + 8x + 40
x² + 13x + 40
multiply
(2y - 6) (y + 7)
multiply
2y² + 14y - 6y - 42
2y² + 8y - 42

Exercise 3

Expand the brackets and simplify where possible:

a) $2(3p + 2) – 3(2p – 3)$ (Ans: 13)

b) $3(2p - 5) – 2(3p – 3)$ (Ans: 0)

c) $x(x^2 - 2y) – 3x^2 (x + 2y)$ (Ans: $2x^3 – 2xy – 6x^2y$)

d) $2(x – 2y)(x + y)$ (Ans: $2x^2 – 2xy – 4y^2$)

e) $a(a + 2b -3c) + 3c (a – 2b + 3c) – 2b (a – b – 3c)$ (Ans: $a^2 – 2b^2 – 9c^2$)

f) $3a (2b – 3c + 4d) – 2a(3b – c + 6d)$ (Ans: $-7ac$)

g) $6 + 4(3 – x)$ (Ans: $18 – 4x$)

h) $6 + (2x + 6)$ (Ans: $12 + 2x$)

i) $2x^2(4xy – 5) – 8yx^3 + 9x^2$ (Ans: $-x^2$)

j) $x (x^2 – 2y) (3x^2(x + 2y)$ (Ans: $x(2x + 4y)$

1.3 SIMPLIFYING ALGEBRA FRACTION USING ADDITION, SUBTRACTION, MULTIPLICATION AND DIVISION

To simplify an algebraic fraction using addition, subtraction, multiplication, and division, let's break down the process into a few key steps and use examples for each operation:

1. Simplifying a Fraction (involving addition or subtraction)

When adding or subtracting algebraic fractions, the key is to first get a common denominator. Once the denominators are the same, you can combine the numerators.

Example 1: Adding Algebraic Fractions

Simplify the expression:

$$\frac{3}{x+2}+\frac{4}{x-2}$$

Step 1: Find the common denominator

•The common denominator here would be (x+2)(x−2)

Step 2: Rewrite each fraction with the common denominator

$$\frac{3}{x+2}=\frac{3(x-2)}{(x+2)(x-2)}$$
$$\frac{4}{x-2}=\frac{4(x+2)}{(x+2)(x-2)}$$

Step 3: Combine the fractions

$$\frac{3(x-2)}{(x+2)(x-2)}+\frac{4(x+2)}{(x+2)(x-2)}=\frac{3(x-2)+4(x+2)}{(x+2)(x-2)}$$

Step 4: Simplify the numerator

$$=\frac{3x-6+4x+8}{(x+2)(x-2)}=\frac{7x+2}{(x+2)(x-2)}$$

Thus, the simplified expression is:

$$\frac{7x+2}{(x+2)(x-2)}$$

Example 2: Subtracting Algebraic Fractions

Simplify the expression:

$$\frac{5}{x+1} - \frac{2}{x-1}$$

Step 1: Find the common denominator

The common denominator is (x+1)(x−1).

Step 2: Rewrite each fraction

$$\frac{5}{x+1} = \frac{5(x-1)}{(x+1)(x-1)}$$

$$\frac{2}{x-1} = \frac{2(x+1)}{(x+1)(x-1)}$$

Step 3: Combine the fractions

$$\frac{5(x-1)}{(x+1)(x-1)} - \frac{2(x+1)}{(x+1)(x-1)} = \frac{5(x-1) - 2(x+1)}{(x+1)(x-1)}$$

Step 4: Simplify the numerator

$$= \frac{5x - 5 - 2x - 2}{(x+1)(x-1)} = \frac{3x-7}{(x+1)(x-1)}$$

simplified expression is:

$$\frac{3x-7}{(x+1)(x-1)}$$

2. Multiplying Algebraic Fractions

When multiplying fractions, you simply multiply the numerators together and the denominators together, then simplify if possible.

Example: Multiply Algebraic Fractions

Simplify the expression:

$$\frac{3}{x+1} \times \frac{x-2}{5}$$

Step 1: Multiply the numerators and the denominators

$$= \frac{3(x-2)}{5(x+1)}$$

Step 2: Simplify (if possible)

Since there are no common factors to cancel out, the simplified result is:

$$\frac{3(x-2)}{5(x+1)}$$

3. Dividing Algebraic Fractions

To divide fractions, multiply by the reciprocal of the second fraction.

Example: Divide Algebraic Fractions

Simplify the expression:

$$\frac{3}{x+1} \div \frac{x-2}{5}$$

Step 1: Multiply by the reciprocal

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

Step 2: Multiply the numerators and the denominators

$$= \frac{3 \times 5}{(x+1)(x-2)} = \frac{15}{(x+1)(x-2)}$$

So, the simplified result is:

$$\frac{15}{(x+1)(x-2)}$$

4. Factoring Expressions Before Simplifying (if needed)

Sometimes, you may need to factor both the numerators and denominators before performing operations like multiplication or division. For example:

Example: Factor and Simplify

$$\frac{x^2-4}{x^2-2x}$$

Step 1: Factor the numerator and denominator

$x^2 - 4$ is a difference of squares: $(x-2)(x+2)$

$x^2 - 2x$ can be factored as $x(x-2)$

So the expression becomes:

$$\frac{(x-2)(x+2)}{x(x-2)}$$

Step 2: Cancel common factors

You can cancel out the (x−2) term from both the numerator and denominator (as long as x ≠ 2):

$$\frac{x+2}{x}$$

Thus, the simplified result is:

$$\frac{x+2}{x}$$

Operation In Algebraic Fraction

Addition

$$\frac{a}{b}+\frac{c}{d}=\frac{ad+b}{bd}$$

Multiplying

$$\frac{a}{b}\times\frac{c}{d}=\frac{ac}{bd}$$

Subtraction

$$\frac{a}{b}-\frac{c}{d}=\frac{ad-b}{bd}$$

Division

$$\frac{a}{b}\div\frac{c}{d}=\frac{a}{b}\times\frac{d}{c}=\frac{ad}{bc}$$

a) Addition

To add fraction, there is simple rule:

$$\frac{a}{b}+\frac{c}{d}=\frac{ad+bc}{bd}$$

Example :

Solve each of the following.

a) $\frac{7a}{m}+\frac{2a}{m}$

a) $\frac{7a}{m}+\frac{2a}{m} = \frac{7a+2a}{m}$

$= \frac{9a}{m}$

These denominators are common (the same).

b) $\dfrac{x+y}{y}+\dfrac{2x-y}{3y}$

The denominators are not same

$$=\frac{3(x+y)}{3y}+\frac{2x-y}{3y}$$

$$=\frac{3(x+y)+2x-y}{3y}$$

$$=\frac{3x+3y+2x-y}{3y}$$

$$=\frac{5x+2y}{3y}$$

Exercise 4

Solve each of the following:

a) $\frac{3x}{2} + \frac{4x}{5}$ (Ans: $\frac{23x}{10}$)

b) $\frac{x}{2} + \frac{4x}{5}$ (Ans: $\frac{13x}{10}$)

c) $\frac{x}{2} + \frac{x}{5}$ (Ans: $\frac{7x}{10}$)

d) $\frac{6}{2xy} + \frac{2}{x}$ (Ans: $\frac{3+2y}{xy}$)

e) $\frac{4x}{2} + \frac{x}{6}$ (Ans: $\frac{13x}{6}$)

b) Subtraction

Subtracting fractions is very similar to adding, except that the + is now –.

$$\frac{a}{b} - \frac{c}{d} = \frac{ad - bc}{bd}$$

Example:

Solve each of the following.

a) $$\frac{2}{y} - \frac{2}{3}$$

$$= \frac{(2)(3) - 2(y)}{3y}$$

$$= \frac{6 - 2y}{3y}$$

b. $$\frac{c+2d}{2c}-\frac{c-d}{c} = \frac{(c+2d)-2(c-d)}{2c}$$

$$= \frac{c+2d-2c+2d}{2c}$$

$$= \frac{-c+4d}{2c}$$

Exercise 5

Simplify the difference of algebraic fractions:

a) $\frac{1}{a}$ - $\frac{1}{4}$ (Ans: $\frac{4-9}{4a}$)

b) $\frac{c+2d}{2c}$ - $\frac{c+d}{c}$ (Ans: $\frac{-c}{2c}$)

c) $\frac{5}{xy}$ - $\frac{4}{y}$ (Ans: $\frac{5-4x}{xy}$)

d) $\frac{12}{pq}$ - $\frac{3}{q}$ (Ans: $\frac{12-3p}{pq}$)

e) $\frac{2x-1}{y}$ - $\frac{3x}{2y}$ (Ans: $\frac{x-2}{2y}$)

c) Multiplying

Multiplying fractions is the easiest one of all, just multiply the tops together, and bottoms together:

$$\frac{a}{b} \times \frac{c}{d} = \frac{ac}{bd}$$

Example:

Solve each of the following:

a) $\frac{2}{m} \times \frac{3}{n} = \frac{6}{mn}$

b) $\frac{5}{m-2} \times \frac{4}{3+m} = \frac{20}{(m-2)(3+m)}$

c) $(6x+8y)\times\frac{y}{4x}$

$$= 2(3x+4y)\times\frac{y}{4x}$$

$$= \frac{y(3x+4y)}{2x}$$

Factorize and simplify.

Exercise 6

Simplify each of the following:

a) $\frac{7}{3-k} \times \frac{3}{k+4}$ (Ans: $\frac{21}{(3-k)(k+4)}$)

b) $\frac{4}{p} \times \frac{1}{q}$ (Ans: $\frac{4}{pq}$)

c) $\frac{5}{xy} \times \frac{y}{4}$ (Ans: $\frac{5y}{4xy}$)

d) $\frac{6}{2xy} \times \frac{2}{3x}$ (Ans: $\frac{2}{x^2y}$)

e) $\frac{8x}{3} \times \frac{9}{2y}$ (Ans: $\frac{12}{y}$)

d) Division

To dividing fractions, first “*flip*” the fraction you want to divide by, and then use the same methodas for multiplying.

$$\frac{a}{b} \div \frac{c}{d} = \frac{a}{b} \times \frac{d}{c}$$

Example:

Solve each of the following:

a) $\frac{4}{h} \div \frac{3}{k} = \frac{4}{h} \times \frac{k}{3}$

$$= \frac{4k}{3h}$$

b) $\dfrac{9x}{10y^2} \div \dfrac{3}{xy} = \dfrac{9x}{10y^2} \times \dfrac{xy}{3}$

$$= \frac{9x(xy)}{3(10)y^2}$$

$$= \frac{3x^2y}{10y^2}$$

$$= \frac{3x^2}{10y}$$

Exercise 7

Simplify each of the following:

a) $\frac{3}{x+1} \div \frac{2}{x+2}$ (Ans: $\frac{3(x+2)}{2(x+1)}$)

b) $\frac{a}{b-2} \div \frac{b}{b-3}$ (Ans: $\frac{a(b-3)}{b(b-2)}$)

c) $\frac{3m}{n+3} \div \frac{5n}{n-4}$ (Ans: $\frac{3m(n-4)}{5n(n+3)}$)

d) $\frac{p-2}{2q+5} \div \frac{2q}{3p-4}$ (Ans: $\frac{3p^2-10p+8}{4q^2+10q}$)

e) $\frac{6r}{s-3t} \times \frac{5r-s}{r+2t}$ (Ans: $\frac{6r^2+12rt}{(s-3t)(5r-s)}$)

1.4 EXTRA EXERCISE FOR BASIC ALGEBRAIC

Exercise 8

Simplify each expression:

a) $(5a^2 + 7\text{b} + 3) - (3a^2 - 4\text{b} + 7)$ (Ans: $2a^2 + 11\text{b} - 4$)

b) $\frac{3}{5}(3x^4 - 4y^2 - 2x^4 + 4x^4 - y^2)$ (Ans: $3x^4 - 3y^2$)

c) $5(q^2 + 2\text{qr} - s^2) - q^2 + s^2 - \text{qr} - 2s^2$ (Ans: $4q^2 + 9\text{qr} - 6s^2$)

d) $3c^6 - 2d + 3(15c^6 - 4c^6 + 3d)$ (Ans: $36c^6 + 7d$)

e) $4ab^4 - 7 - 3\text{ac} + 1) - (5ac + 6ab^4 - 4)$ (Ans: $-2ab^4 - 8\text{ac} - 2$)

f) $2m^2n - \text{n} + 3(m^2\text{n} + \text{n} - 2) - 3$ (Ans: $5m^2n + 2\text{n} - 9$)

g) $\frac{1}{2}(6xyz - 2xy + 8) + 3xyz + 10xy$ (Ans: $6xyz + 9xy + 4$)

h) $\frac{3}{2}[(4a^3 - 2b^2 + 1) - (2c - 1 - 2b^2)]$ (Ans: $6a^3 - 3c + 3$

Exercise 9

Simplify each expression:

a) $3(7r^{10} - 4r^{9} - 5r^{10})$ (Ans: $6r^{10} - 12r^{9}$)

b) $11c^5 - 9c^6 + 15c^5 - 13c^6 + 5c^6$ (Ans: $26c^5 - 17c^6$)

c) $\frac{3x+5}{x+5} + \frac{15+x}{x+5}$ (Ans: 4)

d) $\frac{2r}{r^2} + \frac{5r}{r^2}$ (Ans: $\frac{7}{r}$)

e) $\frac{3m}{m^2-4} - \frac{6}{m^2-4}$ (Ans: $\frac{3}{m+2}$)

f) $\frac{15}{2t^3} - \frac{3}{2t^3}$ (Ans: $\frac{6}{t^3}$)

g) $\frac{2}{k^2+5k+6} - \frac{1}{k^2+4k+4}$ (Ans: $\frac{k+1}{(k+2)^2(k+3)}$)

h) $2 - \frac{5q}{q+5}$ (Ans: $\frac{-3q+10}{q+5}$)

Exercise 10

Simplify multi variable expression:

a) $8abc^2+abc^2+3-1)$ (Ans: $9abc^2$+2)

b) $4y^4-2z^2-z^2+4y^4$ (Ans: $8y^4-3z^2$)

c) $8rs-2p^2q-3p^2q-4rs$ (Ans: $4rs-5p^2q$)

d) $-6x^2yz+4y^2z+7y^2z+11x^2yz$ (Ans: $5x^2yz+11y^2z$)

e) $\frac{(p+q+r)^2-(p+q-r)^2}{4r}$ (Ans: $p+q$)

f) $\frac{\mathrm{n}^2-2\mathrm{n}-15}{(\mathrm{n}+4)(\mathrm{n}+3)} \div \frac{(n+7)(n-11)}{n^2+11n+28}$ (Ans: $\frac{n-5}{n-11}$)

g) $\frac{(n+2)^2(n+6)}{(n+4)^2-4}$ (Ans: $n+2$)

Exercise 11

Simplify each expression:

a) $\frac{2p^2q}{3q^2} \div \frac{16q}{21q^2}$ (Ans: $\frac{7p^2}{8}$)

b) $\frac{z+1}{z-1} \times \frac{5z-5}{z+1}$ (Ans: 5)

c) $\frac{m^2}{4m-8} \div \frac{2m^2}{12}$ (Ans: $\frac{3}{2(m-2)}$)

d) $\frac{12v-12}{(v-1)^2} \times \frac{u}{6}$ (Ans: $\frac{2u}{v-1}$)

e) $\frac{9p^2-16q^2}{p^2-16} \times \frac{p-4}{3p-4q}$ (Ans: $\frac{3p+4q}{p+4}$)

f) $\frac{s^3+8}{s^2-2s+4} \times \frac{s^2-2s-20}{s-5}$ (Ans:$(s+2)(s+4)$)

g) $\frac{24+30}{9m^2-24mn+16n^2} \div \frac{12m+15}{3m-4n}$ (Ans:$\frac{2}{3m-4n}$)

Exercise 12

Divide by factorization method:

a) $\frac{(x+y)(8x-16y)}{x^2-xy-\ 2y^2}$ (Ans: 8)

b) $\frac{6n^2-\ 5n^2-54n+45}{n+3}$ (Ans:$(n-3)(6n-5)$)

c) $\frac{12p^4-\ 36p^3+\ 27p^2}{2p-3}$ (Ans: $3p^2(2p-3)$)

d) $\frac{(s-3r)^2(s+4r)}{s^2+rs+12^2}$ (Ans: $s-3r$)

e) $\frac{(5d^2+23d-7)(d+7)}{d^2+14d+49}$ (Ans: $5d-1$)

f) $\frac{3u^5+\ 75u^3}{(u+5)(u-5)}$ (Ans: $3u^3$)

g) $\frac{2h^3-\ 7h^2-10h+35}{h^2-5}$ (Ans: 2h −7)

Exercise 13

Factorize each expression and reduce to its lowest term.

a) $\frac{(4z-5)(-9z-6)}{12x^2-7z-10}$ (Ans: -3)

b) $\frac{-11a- a^2+60}{a^2-23a+76}$ (Ans: $\frac{-(a+15)}{a-19)}$)

c) $\frac{2m^2+13m+18}{3m^2+17m+22}$ (Ans: $\frac{2m+9}{3m+11}$)

d) $\frac{4t^3- 19t^2+21t}{16t^3+49t}$ (Ans: $\frac{t-3}{4t+7}$)

e) $\frac{19q-48-q^2}{80-q^2-11q}$ (Ans: $\frac{q-3}{q+5}$)

f) $\frac{(x+2)(5-x)}{x^2+17x-110}$ (Ans: $\frac{-(x+2)}{x+22)}$)

g) $\frac{36c^3+ 60c^2+25c}{6c^2+5c}$ (Ans: $6c + 5$)

Exercise 14

Factorize each binomial.

a) $2ab + 4c$ (Ans: 2(ab+2c))

b) $t^3 - ts$ (Ans: $t(t^2 - s)$)

c) $3n - 6m$ (Ans: $3(n - 2m)$)

d) $6t + 12uv$ (Ans: $6(t + 2uv)$)

e) $3p^2 - 15q$ (Ans: $3(p^2 - 5q)$)

f) $16uv + 8uw$ (Ans: $8u(2v + w)$)

g) $9m^3 + 18n^3$ (Ans: $9(m^3 + 2n^3)$)

Exercise 15

Simplify each expression:

a) $3(4x-5)-2(3x+7)+4(2x-8)$ (Ans: $14x-21$)

b) $(2m^3+4m^2)(2m^2+5m^3)$ (Ans: $8m^4+24m^5+10m^6$)

c) $10s^7+2(s^6-5s^9)-s(4s^6+8)$ (Ans: $-10s^9+6s^7+2s^6-8s$)

d) $3(15d^2-10d^2+7d^3)-25d^2+2d^2+8d^3$ (Ans: $29d^3-8d^2$)

e) $\frac{4}{3}(8x^2+9x^3-2x^2)-\frac{12}{5}(5x^3+10)$ (Ans: $8x^2-24$)

f) $\frac{1}{2}(-8x^7+2x^9-6x^7+4x^9-10)$ (Ans: $3x^9-7x^7-5$)

g) $\frac{3}{2}(2a^2+6a^3-9a^5+8a^2-3a^5+2a^3)$ (Ans: $-18a^5+12a^3+15a^2$)

REFERENCES

Swokowski E. W. and Cole J. A.,. 2005. *Algebra And Trigonometry With Analytic Geometry.* Canada: Thomson Learning, Inc.

Aznul R.R., Norhalidah Y., Noor Azizah I., Ruhana M. K., Lee K.T., and Jamaliah A. (2012). *Engineering Mathematics 1 for Polythecnics*. Port Dickson: Mathematics, Science, and Computer Department.

Zuraidah M.R., Norihan M., Suhana A.A., and Syarifah Hana S.Z (2015). *Engineering Mathematics Vol.1 A Problem-Solving Approach*. Pasir Gudang: Mathematic, Science and Computer Department.

Math Worksheets @ www.mathworksheets4kids.com

At Politeknik Malaysia, Basic Algebra (A Student's Handbook) is designed for diploma students enrolled in DBM 10163: Engineering Mathematics 1. Use simply basic algebra as your focus topic.

For ease of understanding, the note and exercise examples are presented straightforwardly. As an illustration Questions and answers, Students can prepare for their exams using the final year end-of-chapter materials.

e ISBN 978-967-2742-39-5

9 789672 742395