TOI-OHOMAI Institute of Technology	**COMP.5202 Fundamentals of Programming and Problem Solving**	**Mathematics Algebra**

Basic Algebra - Terms

Overview

The document will cover some basic algebraic terms.

PART A: BASIC ALGEBRAIC TERMS

1. General Terms

Variable	Represents a quantity or value that can vary.
Constant	Represents a quantity or value that is fixed.
Superscript	A character or symbol is placed to the right and slightly higher than another character or symbol. eg. x^3 the "3" is a superscript.
Subscript	A character or symbol is placed to the right and slightly lower than another character or symbol. eg. x_4 the "4" is a subscript.
Numerator	The top line of a fraction. $\frac{a}{b}$ the "a" is the numerator.
Denominator	The bottom line of a faction. $\frac{a}{b}$ the "b" is the denominator.
Algebraic expressions	An expression made up of letters, symbols and arithmetic symbols, eg. + - / x etc. Note: In programming an "*" is often used to denote multiplication.

2. BEDMAS

Brackets, Exponents, Division, Multiplication, Addition and Subtraction. This is the order of operations you need to follow when solving an equation.

http://mathsfirst.massey.ac.nz/Algebra/OrderOfOp/orderofop.htm

B rackets and Parentheses	*First Priority*
E xponents	*Second Priority*
D ivision	*Third Priority*
M ultiplication	*Third Priority*
A ddition	*Fourth Priority*
S ubtraction	*Fourth Priority*

If an expression involves two or more operations at the *same level of priority*, those operations are done from *left to right*.

3. Index/Indices

When talking about powers (or indices) we have an index and a base
In the expression a^3

- the index is "3"
- the base is "a"

The plural of the word "index" is "indices".

4. Multiplication

ax *can also be written as* $a \times x$ *or even as* $a.x$ $(in\ programming\ a * x)$

5. To the "Power Of"

x^3 *can also be written as* $x \times x \times x$ $(in\ programming\ x * x * x)$

6. Expanding

a. $2^2 = 2 \times 2 = 4$

b. $(-4)^2 = (-4) \times (-4) = 16$

c. $-4^2 = -(4 \times 4) = -16$

d. $xy^2 = x \times y \times y$ $(or\ x * y * y)$

e. $(xy)^2 = x \times x \times y \times y$ $(or\ x * x * y * y)$

7. Simplify (ie. remove the brackets)

a. $7b(2b) = 7b \times 2b = 14b^2$

b. $6(x+5) = (6 \times x) + (6 \times 5) = 6x + 30$

c. $$\begin{aligned}(1-x)(2-x) &= 1 \times 2 + 1 \times (-x) + (-x) \times 2 + (-x) \times (-x) \\ &= 2 + (-x) + (-2x) + x^2 \\ &= 2 + (-3x) + x^2 \\ &= 2 - 3x + x^2\end{aligned}$$

d. $$\begin{aligned}(2x-3)(x+2) &= 2x \times x + 2x \times 2 + (-3) \times x + (-3) \times 2 \\ &= 2x^2 + 4x + (-3x) + (-6) \\ &= 2x^2 + x - 6 \\ &= 2x^2 - 3x + x^2\end{aligned}$$

8. Solve to find x

$3x + 2x = 15$

$5x = 15$ group like terms

$\frac{5x}{5} = \frac{15}{5}$ divide both sides by 5

$x = 3$

9. Factors

Factors of 12	1 x 12	2 x 6	3 x 4		
Factors of 15	1 x 15	3 x 5			
Factors of 36	1 x 36	2 x 18	3 x 12	4 x 9	6 x 6
Factors of 35	1 x 35	5 x 7			

PART B: MORE BASIC ALGEBRAIC TERMS

1. Monomial

An algebraic expression consisting of one term.

2. Polynomial

An algebraic expression consisting of several terms. An expression of more than two algebraic terms, especially the sum of several terms that contain different powers of the same variable(s).

3. Binomial

An algebraic expression consisting of two terms.

4. Trinomial

An algebraic expression of three terms.

PART C: MONOMIALS AND POLYNOMIALS

Monomials

A monomial is a number, a variable or a product of a number and a variable where all exponents are whole numbers.

- Examples of monomials (they fulfil the criteria):

$$42 \qquad 5x \qquad 14x^{12} \qquad 2pq$$

- Examples that are not monomials (they do not fulfil all the criteria):

$$4 + y \qquad \frac{5}{y} \qquad 14^{x} \qquad 2pq^{-2}$$

Degree of the Monomial

The degree of the monomial is the sum of the exponents of all included variables. Constants have the monomial degree of 0.

If we look at our examples above we can see that

Monomial	**Degree**
42	0
5x	0 + 1 = 1
$14x^{12}$	0 + 12 = 12
2pq	0 + 1 + 1 = 2

Polynomials

A polynomial is a sum of monomials where each monomial is called a term. The degree of the polynomial is the greatest degree of its terms.

A polynomial is usually written with the term with the highest exponent of the variable first and then decreasing from left to right.

The first term of a polynomial is called the leading coefficient.

$$4\,x^5 + 2x^2 - 14x + 12$$

Polynomial just means that we've got a sum of many monomials.

Reminder: Binomial and Trinomial
If we have a polynomial consisting of only two terms we could instead call it a **binomial** and a polynomial consisting of three terms can also be called a **trinomial**.