Computer Form versus Traditional Form

The *Traditional Algebra Form* has developed over the past thousand years and is the most common way for people to write mathematical equations and expressions. It is the form used in your textbook and will be called *Traditional Form* in this class. Traditional Form utilizes single Latin letters or Greek letters to represent variables, which are often not very descriptive of intended meaning or content of the variable. Multiple symbols can be used to represent each of the standard algebraic operators as described in the center column of Table 1. Note that three different operator symbols can be used to represent multiplication or division. Superscripts represent an exponential power. Three different grouping symbols can be used to specify order of operation. If two or more letters are combined they represent multiplication of the variables. For example $Area = A \cdot r \cdot e \cdot a = A \times r \times e \times a$

The *Computer Algebra Form* has developed over the past fifty years by computer programmers as a method to type mathematical expressions using standard computer keyboards. It is the form most often used by calculators and computer software and will be called *Computer Form* in this class. Computer Form has some advantages, because each algebraic operator has only one symbol as described in the right column of Table 1. Variable names can be more descriptive using sequences of letters or whole words, because multiplication is never implied between letters and multiplication is explicitly described using the * symbol. The area of circle formula $A = \pi r^2$ could instead be expressed as Area=Pi*Radius^2

Table 1: Standard Algebraic Operators

Operations	Traditional Algebra Form	Computer Algebra Form
Addition	$a + b$	a+b
Subtraction	$a - b$	a-b
Multiplication	$a \times b \quad a \cdot b \quad ab$	a*b
Division	$a \div b \quad \frac{a}{b} \quad a/b$	a/b
Negative Sign	$-a + (-b)$	(-)a+(-)b
Exponent	x^2	x^2
Variable Subscript	x_1	x_1
Equality	$a(b + c) = ab + ac$	a*(b+c) = a*b + a*c
Inequality	$a > b; a \geq b; a < b; a \leq b$	a>b a>=b a<b a<=b
Order of Operation	$2[3a + \{4(b + c)\} + 1] = 0$	2*(3*a+(4*(b+c))+1)=0

It is very useful to understand and translate between both Traditional Form and Computer Form to communicate with people and computing devices such as calculators. The source of many mistakes on mathematics exams is the incorrect conversion and entry into a calculator of a Traditional Algebra Form equation. Computer Algebra Form can be also useful for communicating mathematics via email or in online conferencing. If you learn how to program a computer in a different course you will be using the Computer Algebra Form. The implicit order of operation remains the same for both forms: exponent, then multiplication and division, then addition and subtraction. Explicit order of operation is defined using nested grouping symbols [{()}] in Traditional Form or nested parenthesis in Calculator Form.

Below is a collection of equations and common formulas that are represented in both Traditional Form and Calculator Form.

Traditional Algebra Form	**Computer Algebra Form**
$3x^2 + 2x + 4 = 0$	`3*x^2 + 2*x + 4 = 0`
$3(-5)^2 + 2(-5) + 4$	`3*((-)5)^2 + 2*((-)5) + 4`
$3 \times 5^2 + 2 \times 5 + 4$	`3*5^2 + 2*5 + 4`
$A = lw$	`Area = Length * Width`
$3(5 - 2) = 3 \cdot 5 - 2 \cdot 3$	`3*(5 – 2) = 3*5 – 2*3`
$\frac{3x}{4(x+2)}$	`3*x/(4 * (x + 2))`
$\frac{(x+1)(x-2)}{(x-1)(x+1)}$	`((x+1)*(x+2))/((x-1)*(x+1))`
$\frac{\cancel{(x+1)}(x-2)}{(x-1)\cancel{(x+1)}}$	`(~~(x+1)~~*(x+2))/((x-1)*~~(x+1)~~)`
$C = 2\pi r$	`Circumference = 2 * Pi * Radius`
$A = \frac{1}{2}bh$	`Area = 1/2 * base * height`

