Beautiful Mathematical Notation in Word Documents

Introduction

That's a long title. Basically, this document is a quick crash course in how to use the word equation editor and some of the shortcuts to write the symbols for the class efficiently in word documents. The word equation editor has less of a learning curve that LaTeX but also offers more control. In Word you decide the formatting yourself. In LaTeX formatting is created automatically based on your tags. (Which is nice if you don't like tweaking things yourself!) So if you are deciding which tool to use to describe your mathematical solutions, keep that in consideration.

The Basics

To open the equation editor, just type:

You will get a box in word to enter your equation. Now we will start by creating a simple inequality to get you started:

$$5 \leq 2x + y$$

Just type 5<=2x+y. Notice that less than equals will auto-replace. There are a few shortcuts like this when working on equations.

Next, we would like to get parenthesis to work well in word. The equation editor does a good job of nesting parenthesis and making the outer layers larger but, depending on the method used to create the parenthesis, you may have some issues.

So let's make the following:

$$\bigl(2(x + 2)\bigr)\bigl(3(y + 2)\bigr) = 2$$

My advice is first get your parenthesis structure before putting in the details. So start with the outer parenthesis. Just type () followed by a space character. The equation editor should look something like this:

Now you can move into the box with your cursor and do the same to get the next set of parenthesis. By repeating the process several times, you can end up with the following:

$$((\square))((\square))$$

After this, it should be pretty straightforward to complete the rest of the equation exercise.

Propositional Logic

The first assignment involves propositional logic. So we will introduce how to construct the logical connectives that we just learned. There are several ways to construct connectives. The first, and also the most inconvenient, is to find the symbol in the symbol table at the top of word. You will notice the equation design tools pop up when you start the equation editor:
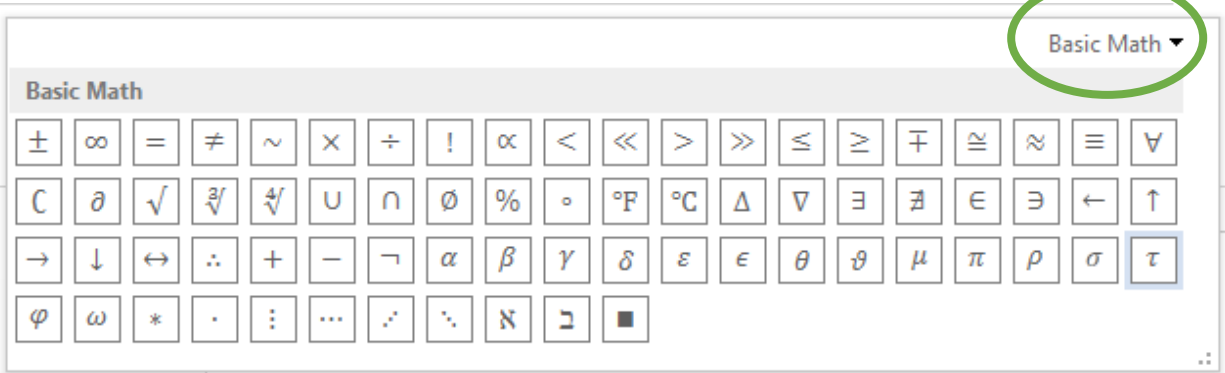

Not all of the symbols are available currently but we can cycle through menus. Just select the lower double arrow here:
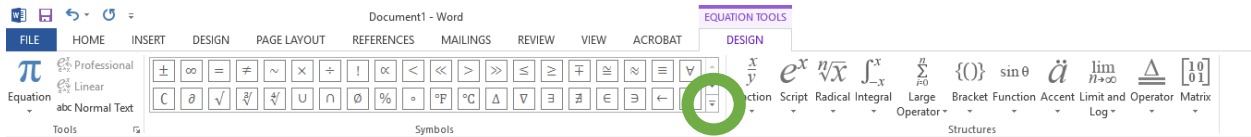
Clicking this symbol will open more options:
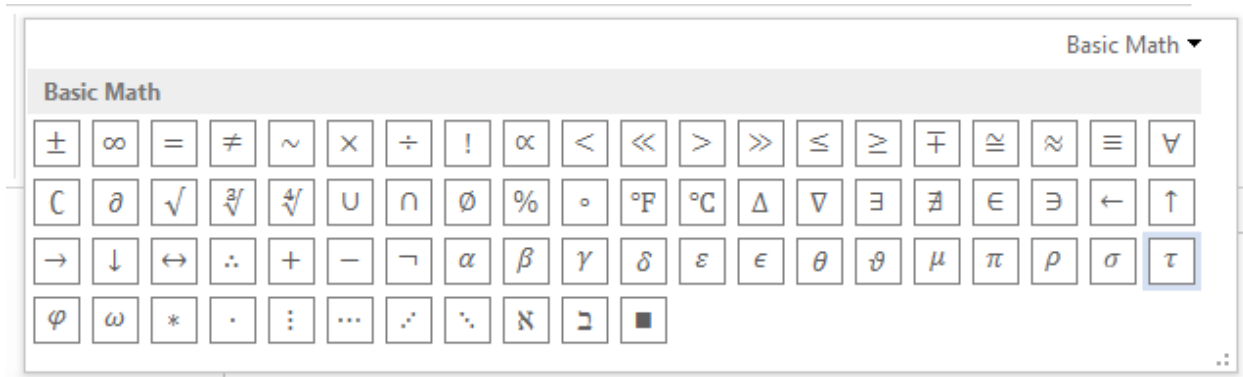
By clicking basic math in the corner, you can select even more options:

Going to operators, we can see several of the symbols discussed in class:

We also have many more symbols, some of which will be covered in class and some will not. By clicking a symbol, it will be inserted in the cursor's position. However, this is slow and tedious. Now I will draw your attention to what happens when you mouse over a symbol. Notice you get a description of the

symbol but also a \something. This something is a shortcut for obtaining the symbol without going through complicated menus. To get the symbol to show up in the equation editor, type the shortcut and then press spacebar.

Note: your cursor must be past the typed shortcut. So usually I just type the symbol I want and hit spacebar to get it to show up in the equation box.

Practice with trying to construct the following compound propositions:

Logical Or (\vee): $p \vee q$

Logical And (\wedge): $p \wedge q$

Negation (\neg): $\neg p$

Logical Xor (\oplus): $p \oplus q$

Implication (\to): $p \to q$

Note: implication can also be created by typing ->. The symbol for implication will automatically resolve.

Bidirection Implication (\leftrightarrow): $p \leftrightarrow q$

Logical Equivalence (\equiv): $p \equiv q$

Tautology Implication (\Rightarrow): $p \Rightarrow q$

Tautology Bi-implication (\Leftrightarrow): $p \Leftrightarrow q$

Now for a quick exercise. Can you recreate this demonstration that $(p \wedge q) \to (p \vee q)$ is a tautology using only the laws of logic?

$$(p \wedge q) \to (p \vee q)$$ Given
$$\equiv \neg(p \wedge q) \vee (p \vee q)$$ by definition of implication
$$\equiv (\neg p \vee \neg q) \vee (p \vee q)$$ by DeMorgan's law
$$\equiv (p \vee \neg p) \vee (q \vee \neg q)$$ by the associative and commutative laws
$$\equiv \mathbf{T} \vee \mathbf{T}$$ by inverse law
$$\equiv \mathbf{T}$$ by domination law

QED

Tip: arrow past the equation editor and hit *tab* several times to align the justifications for each rule applied.

Predicate Calculus (Quantifiers)

The same technique for propositional statements can be used to create quantified statements:

Universal Quantifier (\forall): $\forall x$

Existential Quantifier (\exists): $\exists x$

Rules of Inference

Say you want to construct a typed form of the rules of inference. You usually won't have to create something like this but maybe you want them for a nice typed study guide. So I will show you how I create these when stating the homework questions.

First let's learn a few commands:

Therefore (\therefore): $\therefore$

To type our rules of inference, we need to also know how to use the underbar command. I have yet to find a better way to produce the dividing line between premise and conclusion. If you find something better please see me in office hours!

Let's recreate one of my favorite rules, resolution:

$$\begin{array}{l} p \lor q \\ \underline{\neg p \lor r} \\ \therefore q \lor r \end{array}$$

To create this rule, first create the first premise $p \lor q$ using the technique already learned.

Carriage Return vs Line Feed: So if you don't already know the difference between carriage return and linefeed, I will explain it here. Carriage return is formed in a document when the *enter* key is pressed. It is a way of denoting a new paragraph in a document. But let's say you want to end a line in a paragraph in the middle while still preserving a paragraph. Say, right now!
Then you can press *shift+enter* to obtain a line feed. It breaks the line early but keeps the results in the paragraph. This technique can also be used in the equation editor to produce nice looking equations!

After creating the first premise, use a line feed to start typing the next premise. Right now we want an under bar. This will require a little bit more work. The technique for producing an under bar is similar to the parenthesis technique.

Underbar (\ubar): $\underline{}$

Overbar (\overbar): $\overline{}$

Sidenote: If you have OCD then the inconsistencies between *ubar* and *overbar* will greatly bother you. I am very sorry and it is not my fault. (I am also very sorry for the sudden loss of contractions. That one was my fault.)

By typing \ubar and resolving (I'll call the *ctrl + tab* technique resolving for convenience), you obtain an under bar and a box to place information to contain in the under bar. Now cursor into the underbar and type the second premise of resolution:

$$p \lor q$$
$$\underline{\neg p \lor r}$$

Looks ok, but we really want that line to go farther to make things look good. Cursor to the end of the line and mash the space key until you have a satisfactory looking under bar!

$$p \lor q$$
$$\underline{\neg p \lor r \qquad}$$

Much better! Now we can use a line feed to type our conclusion:

$$p \lor q$$
$$\underline{\neg p \lor r \qquad}$$
$$\therefore q \lor r$$

Superscripts and Subscripts

It's important to note that superscripts and subscripts have shortcuts as well. Let's say we want to type the equation:

$$x^2 + x = y$$

In order to get the exponent, type ^2. Resolving after the exponent will visualize the superscript. As you will see with the set notation below, you can use superscript in a variety of ways (not just exponents).

When defining things like sequences, it is common to use subscripts. This is done in the same manner as superscript but with a _ instead of a ^ character. Practice by creating the following script:

$$a_i$$

Set Theory

Here are the common commands for set theory:

Common Sets

Natural Numbers (\doubleN): $\mathbb{N}$

Integers (\doubleZ): $\mathbb{Z}$

Positive Integers (\doubleZ^+): $\mathbb{Z}^+$

Non-negative Integers (\doubleZ^*): $\mathbb{Z}^*$

Negative Integers (\doubleZ^-): $\mathbb{Z}^-$

Rational Numbers (\doubleQ): $\mathbb{Q}$

Real Numbers (\doubleR): $\mathbb{R}$

Complex Numbers (\doubleC): $\mathbb{C}$

Empty Set (\emptyset): $\emptyset$

Universal Set (\scriptU): $\mathcal{U}$

Operators and Functions

Element of (\in): $\qquad\qquad\qquad\qquad\qquad$ $x \in A$

Not an Element of (\notin): $\qquad\qquad\qquad\qquad$ $x \notin A$

Knight based Element of (\ni): $\qquad\qquad\qquad$ $A \ni x$

Subset (\subseteq): $\qquad\qquad\qquad\qquad\qquad$ $A \subseteq B$

Proper Subset (\subset): $\qquad\qquad\qquad\qquad$ $A \subset B$

Power Set (\wp): $\qquad\qquad\qquad\qquad\qquad$ $\wp(A)$

Cartesian Product (\times): $\qquad\qquad\qquad$ $A \times B$

Not Equal (\neq): $\qquad\qquad\qquad\qquad\qquad$ $A \neq B$

Complement (\ubar): $\qquad\qquad\qquad\qquad$ $\overline{A}$

Cardinality (|A|): $\qquad\qquad\qquad\qquad\qquad$ $|A|$

Set Intersection (\cap): $\qquad\qquad\qquad\qquad$ $A \cap B$

Set Union (\cup): $\qquad\qquad\qquad\qquad\qquad$ $A \cup B$

Set Difference (A-B): $\qquad\qquad\qquad\qquad$ $A - B$

Alternate Set Difference (\setminus): $\qquad$ $A \setminus B$

Symmetric Difference (\oplus): $\qquad\qquad$ $A \oplus B$

Super Set (\superseteq): $\qquad\qquad\qquad\qquad$ $A \supseteq B$

I don't know the negated subset operator shortcuts nor can I find them online. If you figure them out please tell me. You can access the negated subset and other negated relations from the dropdown menu under negated relations.

Not a Subset: $\qquad\qquad\qquad\qquad\qquad$ $A \nsubseteq B$

Not a Proper Subset: $\qquad\qquad\qquad\qquad$ $A \not\subset B$

Set builders can also be created by using a similar procedure to parenthesis:

$$\{ \ \ | \ \ \}$$

Type {|} then hit space. You will get two boxes to fill in the information relevant for the set you are building. Here is the set of all ordered pairs formed from non-negative integers that sum to 10:

$$\{(x, y) \mid x \in \mathbb{Z}^*, y \in \mathbb{Z}^*, x + y = 10\}$$

Additional Resources

This document is meant to be a crash course in the Word equation editor and focuses on the symbols taught in COT 3100. If you want a more in depth guide, you can find one here:

http://www.iun.edu/~mathiho/useful/Equation%20Editor%20Shortcut%20Commands.pdf

http://unicode.org/notes/tn28/UTN28-PlainTextMath-v2.pdf

https://support.office.com/en-us/article/Linear-format-equations-and-Math-AutoCorrect-in-Word-2e00618d-b1fd-49d8-8cb4-8d17f25754f8

For those of you that missed the Monty Python Joke:
https://en.wikipedia.org/wiki/Knights_who_say_Ni