# Writing math with a screen reader in Microsoft Word

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## Purpose

This document describes the steps for writing math expressions with a screen reader in Microsoft Word. We’ll start with NVDA and move to JAWS when we are ready. Maybe Narrator one day.

## Background

This is a work item of the “Reading and Writing Accessible Math” group. We have an email discussion email list which you can join by sending a blank email to math-join@daisylists.org. You can then post to the list math@daisylists.org

## Prerequisites

* Word processor: Microsoft Word for Microsoft 365 version 2305 or later.
* Screen reader: [NVDA](https://www.nvaccess.org/download/) 2023.1 or later.
* Math add-on: [MathCAT](https://addons.nvda-project.org/addons/MathCAT.en.html) version 0.2.6 or later.

## Step-by-step guide

In Word there are many different ways to enter an equation. This guide will focus on entering from the keyboard using the UnicodeMath feature.

### A first math expression

Let’s begin at the beginning with “one plus one equals two”.

In a Word document, place the cursor where you want the equation.

|  |  |
| --- | --- |
| Enter equation mode with alt and = | NVDA says “selected” |
| Now type 1+1=2 | NVDA announces each character as you type it |
| Move off the math with right arrow | The math expression is announced to you by MathCAT |

[Audio demo of “A first math expression”](audio_demo_1.mp3)

### Not your first equation

Next, we want to write “one plus one is not equal to three”. This uses a symbol not on the keyboard, and there are many such symbols used in math. Word provides us with a neat way to enter these from the keyboard using keywords. For “not equals” symbol we can use “\notequals” or “\ne”.

|  |  |
| --- | --- |
| Place the cursor where you want the equation. Enter equation mode with alt and = | NVDA says “selected” |
| Now type 1+1 | NVDA announces each character as you type it |
| Now type \ne and press space | NVDA announces each character as you type it but is silent when you press space. At this point the string “\ne” is changed (built up) to a not equals symbol. |
| Type 3 to complete the expression | NVDA says “3” |
| Move off the math with right arrow | The math expression is announced to you by MathCAT |

Tip: you can use the slash character in front of an operator to negate it. So “/=” is not equals, “/\le” built up to “not less than or equal”.

[Audio demo of “Not your first math expression”](audio_demo_2.mp3)

### Edit as you go

When writing an expression from the keyboard it is possible to stop in the middle to review and edit. You can also edit an existing expression. To do this, use the left and right arrow keys. You can delete and insert characters like how you edit regular text. One thing to remember is to press the space bar after a UnicodeMath keyword for it to convert to the symbol.

In this step, we will change the expression “one plus one is not equal to three” to “one plus one equals two”.

|  |  |
| --- | --- |
| Place the cursor at the expression | NVDA says “one plus one is not equal to three equation” |
| Now move through character by character with the right arrow key | NVDA announces each character as you move “one”, “plus”, “one”, “not equal” |
| Now use the delete key to erase the “not equal” symbol | NVDA announces the expression ““one plus thirteen” |
| Type the “equals” key | NVDA announces “equals” |
| Use the left key to move back one character and hear the complete expression | NVDA announces the revised math expression |
| Use the right key to move forward one character | NVDA announces “3” |
| Use the delete key to erase the “3” | NVDA says “end equation” (because you are at the end) |
| Type “2” | NVDA announces “2” |
| Use the left key to move back one character and hear the complete expression | NVDA announces the revised math expression |
| Move off the math with right arrow | The math expression is announced to you by MathCAT |

Tip: Word refers to the UnicodeMath version of the expression is “Linear” and the built up graphical display as “Professional”. When on an expression you can switch the display modes with “ctrl + shift + =” for Linear and “ctrl + =” for Professional. In either mode you can edit the expression with a screen reader.

### Simple Fractions

Let’s now look at writing fractions. We will start with creating the expression “a equals negative b over a”.

|  |  |
| --- | --- |
| Place the cursor where you want the equation. Enter equation mode with alt and = | NVDA says “selected” |
| Now type a equals minus | NVDA announces “a equals dash” |
| Next you will create the fraction, type “b slash a” | NVDA announces each character as you type it |
| Press space and the fraction will be converted (“built up”) | NVDA announces “space” |
| Use the left key to move back and hear the expression. | NVDA announces “a is equal to negative b over a end denominator” |
| Use the right key to exit the expression and leave math editing mode |  |

### More complex fractions

To make a more complex fraction, enter math mode, enter slash and space. This creates the structure, use the arrow keys to move within the fraction and enter the denominator and numerator. Check your work.