



# Prefix/Infix/Postfix Notation

# Infix Notation

Hey gamers, you're probably familiar with infix notation.

Take this mathematical expression:

$$5 + \frac{8}{3-1}$$

You can write it in *infix* notation as: `5 + 8 / (3 - 1)`

Just like most programming languages.

# Infix Notation

Hey gamers, you probably know that the order of operations for infix notation is

**PEMDAS**

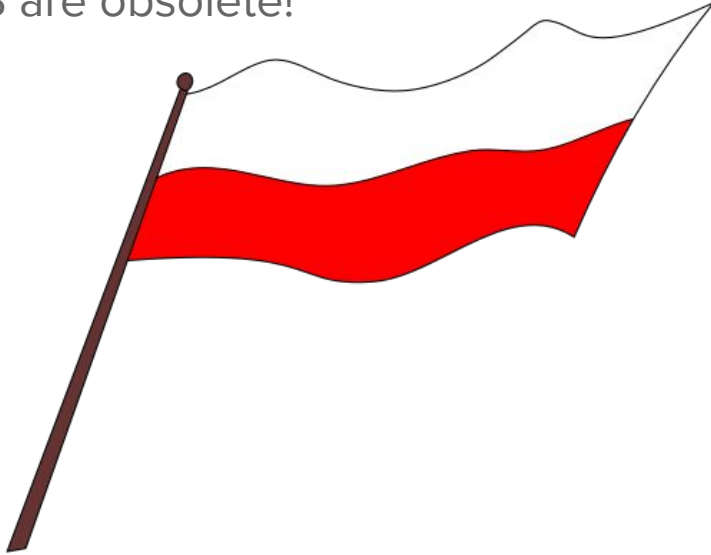
But how would a computer know this?

To solve an infix expression in code, you would have to needlessly create a complex program to adhere to the order of operations.

There is a type of notation that has been invented that does not require the foreknowledge of an order of operations: **PRE- and POSTFIX notation (also known as POLISH or REVERSE POLISH notation)!**

# Prefix Notation (Polish Notation)

Hey gamers, in prefix notation, the operation (+, -, \*, /, ↑) is placed **before** the operands. Every operation has **two** operands, which means that parentheses and PEMDAS are obsolete!



# Prefix Notation (Polish Notation)

Hey gamers, let's convert  $5 + 8 / (3 - 1)$  (infix) to **prefix**! I love math!

It's recommended to convert in the order of PEMDAS.

Starting with the parentheses, our steps can be:

$$5 + 8 / \underline{- 3 1}$$

$$5 + \underline{/ 8} - 3 1$$

$$\underline{+ 5} / 8 - 3 1$$

$+ 5 / 8 - 3 1$  is our final prefix expression.

# Prefix to Infix

Hey gamers, converting back to infix might help your understanding. Start on the inside:

$$+ 5 / 8 \text{ - } \underline{3 \ 1}$$

Think of  $\text{ - } 3 \ 1$  as the quantity  $(3 - 1)$

$$+ 5 / 8 \text{ - } \underline{3 \ 1}$$

Since every operation takes two operands, the division symbol takes  $8$  and  $(3 - 1)$  as operands.  $8 / (3 - 1)$

$$+ 5 / \underline{8 \text{ - } 3 \ 1}$$

The addition symbol takes  $5$  and  $(8 / (3 - 1))$  as operands.  $5 + (8 / (3 - 1))$

We can get rid of unnecessary parentheses, and we restore our original infix expression:

$$5 + 8 / (3 - 1)$$

# Postfix Notation (Reverse Polish Notation)

Hey gamers, postfix notation is the same as prefix, but the operators come after the operands.

Infix:  $5 + 8 / (3 - 1)$

$5 + 8 / \underline{3 - 1}$

$5 + \underline{8} 3 - 1 /$

$\underline{5} 8 3 1 - / \pm$

$5 8 3 1 - / +$  is our final postfix expression.



# Postfix to Infix

Hey gamers, start on the inside:

$$5 \ 8 \ \underline{3 \ 1 \ -} \ / \ + \quad = \ (3 \ - \ 1)$$

$$5 \ 8 \ \underline{3 \ 1 \ -} \ / \ + \quad = \ 8 \ / \ (3 \ - \ 1)$$

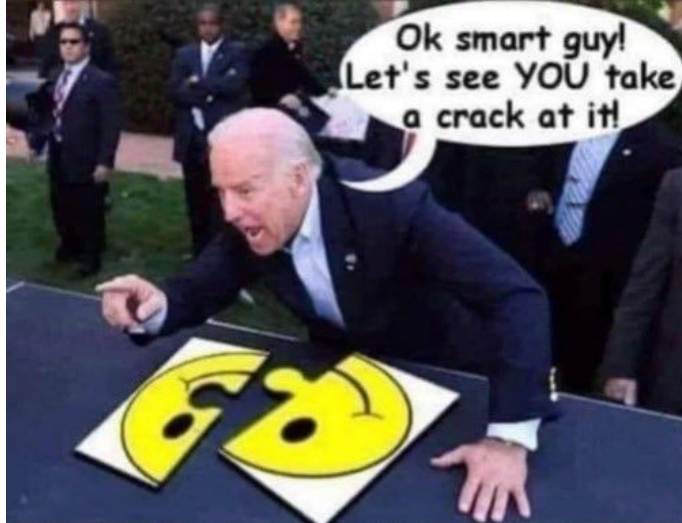
$$5 \ \underline{8 \ 3 \ 1 \ - \ /} \ + \quad = \ 5 \ + \ (8 \ / \ (3 \ - \ 1))$$

$$= \ 5 \ + \ 8 \ / \ (3 \ - \ 1)$$

and there was much rejoicing!!!~!~!~!



# Practice





Hey gamers, let's do variables.

Hey gamers, you can use equal signs in pre/postfix notation as well.

Hey gamers, convert  $X = (A * B - C / D) \uparrow E$  to prefix notation.

$$X = \left( AB - \frac{C}{D} \right)^E$$

A

= X ↑ - \* A B / C D E



Hey gamers, convert  $X = (A * B - C / D) \uparrow E$  to postfix notation.

$$X = \left( AB - \frac{C}{D} \right)^E$$



X A B \* C D / - E ↑ =



Hey gamers, convert the prefix expression  $\uparrow + * 3 4 / 8 2 - 7 5$  to infix.



$$(3 * 4 + 8 / 2) \uparrow (7 - 5)$$



Hey gamers, convert the postfix expression  $3\ 4\ *\ 8\ 2\ /\ +\ 7\ 5\ -\ \uparrow$  to infix.





$(3 * 4 + 8 / 2) \uparrow (7 - 5)$



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