

# Commutativity and Associativity

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| Operation | Commutative?                   | Associative?   |
|-----------|--------------------------------|--|
| +         | yes, $2 + 3 = 3 + 2$           | yes, $(2 + 3) + 5 = 2 + (3 + 5)$                     |
| -         | no, $2 - 3 \neq 3 - 2$         | no, $(2 - 3) - 5 \neq 2 - (3 - 5)$                   |
| $\times$  | yes, $2 \times 3 = 3 \times 2$ | yes, $(2 \times 3) \times 5 = 2 \times (3 \times 5)$ |
| /         | no, $2/3 \neq 3/2$             | no, $(2/3)/5 \neq 2/(3/5)$                           |
| **        | no, $2^3 \neq 3^2$             | no, $(2^1)^3 \neq 2^{(1^3)}$                         |
| <         | no, $2 < 3 \neq 3 < 2$         | doesn't make sense                                   |

# Haskell's Associativity Rules

- ▶ Haskell doesn't have any commutativity rules, because it's never going to switch  $2 + 3$  into  $3 + 2$ .
- ▶ Haskell has associativity rules so that you can use fewer parentheses.  $2 + 3 + 5$  means  $(2 + 3) + 5$  because addition is left associative.
- ▶ Haskell's precedence levels and associativity rules are entirely for the purpose of allowing fewer parentheses.
- ▶ Fewer parentheses are important because expressions with lots of parentheses are hard to read.