Order of arithmetic operations: BODMAS

When we need to evaluate an expression like

$$3 + 4 \times 2,$$

we need rules to tell us in which order the operations are to be carried out.

For example if the $+$ is done first then the answer to the above expression is 24, but if the $\times$ is done first the answer is 11. Clearly the solution of any expression must be unambiguous and hence there are a set of rules for ensuring this.

The rules are often summarised as *BODMAS*

B Brackets
O Orders (Powers, Square Roots)
DM Divide and Multiply (left to right)
AS Add and Subtract (left to right)

For the above expression, the BODMAS rule states that the multiplication is carried out before the addition in evaluation of the above expression, so that

$$3 + 4 \times 2 = 3 + 8 = 11.$$

For operators of the same priority, we simply evaluate left-to-right. For example

$$5 + 6 \times 3 \div 9 = 5 + 18 \div 9 = 5 = 2 = 7.$$

Powers (orders) have a higher priority than the other operations. For example

$$7 \times 3^2 = 7 \times 9 = 63.$$

Brackets change or specify the order in which the operations are carried out. Any expression in brackets is evaluated before any other operation.

For example

$$(3 + 4) \times 2 = 12 \times 2 = 24,$$

and

$$(7 \times 3)^2 = 21^2 = 441.$$

For nested brackets, the innermost ones have the highest priority. For example

$$\big((3 + 2) - 4\big) \times (2 + 1) = (5 - 4) \times (2 + 1) = 1 \times (2 + 1) = 1 \times 3 = 3\,.$$