

## *Steps into Numeracy*

# What Do I Do First? BODMAS

*This guide helps you to understand what to do first when attempting a calculation and introduces the common acronym BODMAS.*

## Introduction

It is common, when attempting a calculation in mathematics or science to ask yourself 'where do I start?' or 'what do I do first?'. There is a set sequence in which you should do the basic **operations of arithmetic** (adding, subtracting, multiplying and dividing). The acronym BODMAS helps you remember this sequence.

## What is BODMAS?

BODMAS stands for **B**rackets, **O**rder, **D**ivide, **M**ultiply, **A**dd, **S**ubtract and tells you the sequence to carry out operations in arithmetic.

|          |   |              |
|----------|---|--------------|
| BRACKETS | } | First Level  |
| ORDER    | } | Second Level |
| DIVIDE   |   |              |
| MULTIPLY |   |              |
| ADD      | } | Third Level  |
| SUBTRACT |   |              |

As you can see there are three levels. Any bracketed calculations are carried out first with these calculations also following the rules of BODMAS. Calculations sometimes contain brackets within brackets – in mathematics these brackets are called **nested** brackets. In these cases you begin with the calculations in the innermost bracket and work your way outwards. When you have completed a calculation within a bracket you should have a single number, that set of brackets can then be removed.

When attempting a calculation which does not contain any brackets, the second level of operations should be carried out initially. Order, division and multiplication have equal priority but you should still perform *order* first, then *divide* and then *multiply*. The word *order* relates to operations containing powers or indices such as squaring or square rooting. If you *only* have divisions and/or multiplications to perform, these are completed from *left-to-right*.

The third level relates to addition and subtraction. These operations should be carried out last in any mathematical calculation.

BODMAS is one of many similar acronyms to help you remember the sequence of arithmetic operations; others you may know are BIDMAS (where *order* is replaced by *index*), BEDMAS (common in Canada, where *order* is replaced by *exponent*) and PODMAS (common in the United States where *brackets* are called *parenthesis*).

*Example:* What is  $4 + 6 \times 5$ ?

As you read from left-to-right it is natural to perform the addition before the multiplication. So  $4 + 6 = 10$  and then multiply by 5 to get  $10 \times 5 = 50$ . This is WRONG. BODMAS tells you that the multiplication (level 2) is performed before the addition (level 3) so:

$$4 + 6 \times 5 = 4 + 30 = 34$$

*Example:* What is  $(4 + 6) \times 5$ ?

This looks similar to the previous example as it contains the same mathematical operations of multiplication and addition and the same numbers. However brackets have been introduced and BODMAS tells you to perform the mathematics inside brackets first. In the bracket you have  $4 + 6$  which is 10; you then multiply 10 by 5 to get the answer. Written as mathematics you find:

$$(4 + 6) \times 5 = (10) \times 5 = 10 \times 5 = 50$$

a different answer to that of the first example.

*Example:* Calculate  $(16 \div (2 + 6))^2$ .

Here you have nested brackets. The mathematics in the innermost bracket is performed first. So  $(2 + 6) = (8)$ . As you only have a number in the brackets, the brackets can be removed. You now have  $(16 \div 8)^2$ . BODMAS tells you to perform the bracketed mathematics first to give  $(16 \div 8) = (2) = 2$ . You now perform the squaring to get  $2^2 = 4$ .

*Example:* Calculate  $12 \div 6 \times 2$ .

Here you only have divisions and multiplications and so the mathematics proceeds from left-to-right. In this case the division is performed before the multiplication to find that:

$$12 \div 6 \times 2 = 2 \times 2 = 4$$

*Example:* Calculate  $8 \div 4 \div 2$ .

It may seem here that, as you have two divisions to carry out, it does not matter which you do first. In fact it does, if you calculate  $8 \div 4$  first you get a different answer than if you calculate  $4 \div 2$  first. To get the correct answer you proceed from left-to-right:

$$8 \div 4 \div 2 = 2 \div 2 = 1$$

## **BODMAS and calculators**

All computer software and scientific calculators follow the rules of BODMAS. Your calculator or computer does exactly what you tell it to do but misunderstandings of BODMAS can lead to incorrect calculations.

*Example:* Calculate the square of  $-5$ ?

Using a calculator input  $-5$  and press the squaring button. The correct answer is 25 but many calculators give the answer as  $-25$ . What these calculators are doing is

following BODMAS. The mathematics you have typed in is  $-5^2$  so the calculator is performing the squaring first then making the answer negative by multiplying by  $-1$ . An understanding of BODMAS will help you avoid this mistake by typing in the correct piece of mathematics you want to perform. Inputting  $-5$  in brackets and then pressing the squaring button gives 25. Mathematically this is written as  $(-5 \times -5)$  which is  $-5$  squared.

Being aware of *exactly* what you want to calculate is especially important in complicated scientific calculations which contain many steps. You may find it useful to introduce brackets at suitable places when inputting the numbers. Try writing out the calculation on a piece of paper first and deciding where the brackets can be correctly placed. Breaking the calculation down into smaller parts and saving the results in the calculator memory may also be useful. Some newer calculators automatically introduce brackets where needed.



## Want to know more?

If you have any further questions about this topic you can make an appointment to see a [Learning Enhancement Tutor](#) in the [Student Support Service](#), as well as speaking to your lecturer or adviser.

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