1 Order of Operations

It is important to recognise in complex calculations what we can do and when. We will first concentrate on combinations of the following operations:

- Addition
- Subtraction
- Multiplication
- Division.

These can happen directly, for example $4 \times 5 + 2$, or with brackets, for example $4 \times (5 + 2)$. These calculations have different results as the order in which the operations take place changes. We will consider the BODMAS hierarchy of operations:

B rackets	We perform calculations inside brackets first
O ther	We will look at other operations later in the book, which take place second
D ivision M ultiplication	Third are Division and Multiplication, which can happen at the same time
A ddition S ubtraction	Finally, Addition and Subtraction take place, which can also happen at the same time

In the examples mentioned this would work as follows:

- $4 \times 5 + 2 = 20 + 2 = 22$. Here we carry out the multiplication first and the addition second.
- $4 \times (5 + 2) = 4 \times 7 = 28$. Here we carry out the addition inside the brackets first and then the multiplication as brackets always go first.

Let's look at some more examples.

Example 1.1.

$3 \times 4 + 6 \div 2$	$=$	$12 + 3$	We carry out the division and multiplication at the same time first
	$=$	15	Next we carry out the addition

Example 1.2.

$7 \times (6 - 4)$	$=$	7×2	We carry out the subtraction inside the brackets first
	$=$	14	Next we carry out the multiplication

Example 1.3.

$(5 - 2) \times (1 + 12)$	$=$	3×13	We carry out the addition and subtraction inside the brackets first
	$=$	39	Next we carry out the multiplication

Example 1.4.

$8\times(7-3)+5\times 2$	$=$	$8\times 4+5\times 2$	We carry out the subtraction inside the brackets first
	$=$	$32+10$	Next we carry out both multiplications
	$=$	42	Finally we carry out the addition

Example 1.5.

$6\times(18-11)-12\div(2\times 2)$	$=$	$6\times 7-12\div 4$	We carry out the addition and multiplication inside the brackets first
	$=$	$42-3$	Next we carry out the multiplication and division at the same time
	$=$	39	Finally we carry out the subtraction

Example 1.6.

$5\times(21-(5+6))$	$=$	$5\times(21-11)$	We carry out the addition inside the inner brackets first
	$=$	5×10	Next we carry out the subtraction inside the remaining brackets
	$=$	50	Finally we carry out the multiplication

1.1 Exercises

1. $3\times 8-9=$
2. $5\times(7-3)=$
3. $(1+3)\times(15-6)=$
4. $2\times(3+7)-18\div(5+4)=$
5. $12\div(1+2)+2\times(3\times 5)=$
6. $3\times(14-(6+2))=$