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:

В	rackets ther	We perform calculations inside brackets first We will look at other operations later in the book,
D M	ivision ultiplication	which take place second Third are Division and Multiplication, which can happen at the same time
A	ddition 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 Next we carry out the addition

Example 1.2.

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

Example 1.3.

$$(5-2) \times (1+12) = 3 \times 13$$
 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.
$$3 \times (14 - (6 + 2)) =$$