

**SOLVING SIMULTANEOUS EQUATIONS****SE in *two* unknowns**

There are more possible ways how to solve these equations algebraically. One of them is a combination of **elimination** and **substitution**.

E.g. find the values of a and b that satisfy the equations:

$$2a + b = 19 \quad \Rightarrow b = 19 - 2a$$

$$\underline{3a + 4b = 26}$$

$$3a + 4(19 - 2a) = 26$$

$$3a + 76 - 8a = 26$$

$$-5a = -50$$

$$\underline{a = 10}$$

$$\underline{b = -1}$$

Another method is the **addition method**, i.e. we will eliminate one variable by making the coefficients of a or b the opposite in both equations, and then we add these equations.

E.g.  $2a + b = 19 \quad /(-4)$

$$\underline{3a + 4b = 26}$$

$$-8a - 4b = -76$$

$$\underline{3a + 4b = 26}$$

$$-5a = -50$$

$$\underline{a = 10}$$

$$2 \cdot 10 + b = 19$$

$$\underline{b = -1}$$

**SE in *three* unknowns**

The solution is an ordered triplet of numbers. We may solve these equations by arranging them into a triangular shape, i.e. we need to multiply the first equation by such real numbers to eliminate the unknown x from the remaining two equations after their addition with the first one. From the last equation we then need to eliminate the y – unknown.

E.g.:

$$x + 2y - 3z = -1 \quad /3, (-2)$$

$$-3x + y - 2z = 2$$

$$\underline{2x + 3y + 2z = 11}$$

$$\begin{array}{r}
 x + 2y - 3z = -1 \\
 7y - 11z = -1 \\
 \hline
 -y + 8z = 13 \quad / 7 \\
 x + 2y - 3z = -1 \\
 7y - 11z = -1 \\
 \hline
 45z = 90 \\
 z = 2 \\
 y = 3 \\
 x = -1
 \end{array}$$

When arranging the simultaneous equations into the triangular shape, we in fact work only with the coefficients of the unknowns. The whole procedure can be notated in the form of a **matrix**.

$$\begin{pmatrix}
 1 & \dots & 2 & \dots & -3 & \dots & -1 \\
 -3 & \dots & 1 & \dots & -2 & \dots & 2 \\
 2 & \dots & 3 & \dots & 2 & \dots & 11
 \end{pmatrix}$$

We try to arrange this matrix into the triangular shape and then the result occurs in the last column.