

Task. What is the new quadratic equation if the original equation, $y = 2x^2 - 6$, is translated up 4 units.

Solution. Let $A = (x_0, y_0)$ be the point belonging to the graph of the function $y = 2x^2 - 6$. This means that $y_0 = 2x_0^2 - 6$. If we translate A up 4 units, then we obtain a point $B = (x_0, y_0 + 4)$. Then the coordinates of $B = (x_1, y_1) = (x_0, y_0 + 4)$, i.e.

$$x_1 = x_0, \quad y_1 = y_0 + 4$$

satisfy the following equation

$$\begin{aligned} y_0 &= 2x_0^2 - 6 \\ y_1 - 4 &= 2x_1^2 - 6 \\ y_1 &= 2x_1^2 - 6 + 4 \\ y_1 &= 2x_1^2 - 2. \end{aligned}$$

Hence the equation of the new quadratic equation is

$$y = 2x^2 - 2.$$