Parabolic calculator

While surfing the Internet, Eva found an interesting fact about the graph of a function $f\colon y = x^2$ which is that the graph can be used as a calculator to multiply two numbers a and b.[1] The procedure is as follows:

1. On the x-axis mark the points corresponding to the numbers $-a$ and b.
2. At these points, draw lines perpendicular to the x-axis and construct their intersections with the graph of the function f.
3. The line passing through the newly constructed intersections intersects the y-axis at a point whose distance from the origin is ab.

You can try the procedure in the attached worksheet, its illustrations is also available in GeoGebra. The interactive applet can be found on the website `https://www.geogebra.org/m/sj5cjbaf`.

Exercise. Does the above procedure apply to all pairs of numbers, or only to some? Can this procedure be proved?

[1] In general, graphs that allow us to perform arithmetic operations by geometric constructions are called *nomograms*.

The portal Math4U is developed within the international projects of the Department of Applied Mathematics (VSB-Technical University of Ostrava) and other institutions in Czechia, Poland, Slovakia, and Spain.
Funded by the European Union