

Parabolic calculator

Keywords: analytic geometry, parametric equation of line

While surfing the Internet, Eva found an interesting fact about the graph of a function $f: y = x^2$ 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?

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