QUADRATIC FUNCTION

THEORY

1. Forms of quadratic function

   - **General form (Standard form):** $f(x) = ax^2 + bx + c$
   - **Vertex form:** $f(x) = a(x-p)^2 + q$, where $V(p,q)$ is the **vertex** of the parabola.

2. Discriminant

$$\Delta = b^2 - 4ac$$

3. Basic properties

   The value of a has the following attributes:

   - If $a > 0$, parabola opens UP (smiles)
   - If $a < 0$, parabola opens DOWN (frowns)
   - The vertex is the turning point of a parabola; p is the x-coordinate of the vertex and q is the y-coordinate of the vertex.The vertex is a **minimum** if the parabola opens up and a **maximum** if it opens down

4. Properties — the vetrex form $y = a(x-p)^2 + q$

   (a) $\underline{a > 0}$
   - $ZW_f = [q; +\infty)$
   - $f \nearrow$ on $[p; +\infty]$
   - $f \searrow$ on $(-\infty; p]$
   - axis of symmetry of the parabola: $x = p$
   - minimum value: $y = q$ for $x = p$

   (b) $\underline{a < 0}$
   - $ZW_f = (-\infty; q]$
   - $f \searrow$ on $[p; +\infty]$
   - $f \nearrow$ on $(-\infty; p]$
   - axis of symmetry of the parabola: $x = p$
   - maximum value: $y = q$ for $x = p$

5. Factorizing quadratic function - **Factored form**

   (a) if $\Delta \geq 0$ then $x_{1/2} = \frac{-b \pm \sqrt{\Delta}}{2a}$ (quadratic formula) and $f(x) = a(x-x_1)(x-x_2)$

   (b) if $\Delta < 0$ then there are no zeros - impossible to factorize.

6. Exercises

   (a)