



Gymnázium, Brno, Slovanské nám. 7

WORKBOOK

<http://agb.gymnaslo.cz>



Subject: Mathematics

Student:

School year:/.....

Quadratic function

Quadratic functions are any functions that may be written in the form $y = ax^2 + bx + c$ where a , b , and c are real coefficients and $a \neq 0$.

For example, $y = 2x^2$ is a quadratic function

The most simple quadratic function is $y = x^2$

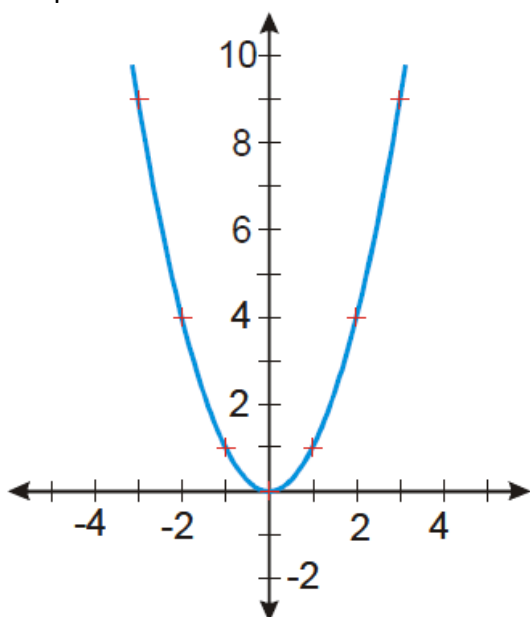


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How looks the graph?
Fill the table:

X	-3	-2	-1	0	1	2	3
y							

Graph:



The graph of a quadratic function is called a **parabola**.

Exercise 1: Decide with the graph the characteristic of quadratic function

The vertex of the graph of a quadratic function

The vertex of the graph of a quadratic function is defined as the point where the graph changes from increasing to decreasing or changes from decreasing to increasing.

Exercise 2: Graph the functions and give the value of the vertex:

- $y = x^2$
- $y = -x^2 + 1$
- $y = (x - 1)^2$
- $y = (x + 1)^2 - 2$
- $y = 2x^2$
- $y = (2x)^2$

Exercise 3: Compare the graphs of the functions $y = 2x^2$ and $y = (2x)^2$. Why are they not the same?

Exercise 4: Draw the graph of the function $y = 0,5(x - 1)^2 + 2$

Exercise 5: Draw the graph of the function $y = (|x| - 1)^2 - 1$

Writing a quadratic function in the form $y = a(x - h)^2 + c$

Exercise 1: Graph the function $y = x^2 - 2x$

Tento postup se nazývá doplnění na čtverec. A patří do červených rámečků, protože ho budeme ještě mockrát potřebovat.

$$y = x^2 - 2x = \overbrace{x^2 - 2x} + \overbrace{1^2 - 1^2} = [x^2 - 2x \cdot 1 + 1^2] - 1^2 = (x - 1)^2 - 1$$

$$A^2 - 2AB + B^2 = A^2 - 2AB + B^2 = (A - B)^2$$

Exercise 2: Arrange the equations of quadratic function and draw the graph:

a) $y = x^2 + 4x$

b) $y = x^2 - 8x$

$$y = x^2 + 4x = \overbrace{x^2 + 4x} + \overbrace{2^2 - 2^2} = [x^2 + 2x \cdot 2 + 2^2] - 2^2 = (x + 2)^2 - 4$$

$$A^2 + 2AB + B^2 = A^2 + 2AB + B^2 = (A + B)^2$$

$$y = x^2 - 8x = \overbrace{x^2 - 8x} + \overbrace{4^2 - 4^2} = [x^2 - 2x \cdot 4 + 4^2] - 4^2 = (x - 4)^2 - 16$$

$$A^2 - 2AB + B^2 = A^2 - 2AB + B^2 = (A - B)^2$$

Exercise 3: Arrange the equations of quadratic function $y = x^2 - 2x + 2$ and draw the graph

$$y = x^2 - 2x + 2 = \overbrace{x^2 - 2x} + \overbrace{1^2 - 1^2} + 2 = [x^2 - 2x \cdot 1 + 1^2] - 1^2 + 2 = (x-1)^2 + 1$$

$$A^2 - 2AB + B^2 = A^2 - 2AB + B^2 = (A-B)^2$$

Exercise 4: Arrange the equations of quadratic function.

(Uprav zadané kvadratické funkce doplněním na čtverec tak, aby bylo možné snadno nakreslit jejich graf.)

a) $y = x^2 - 6x + 3$

b) $y = x^2 + 4x + 3$ and draw the graph

a)

$$y = x^2 - 6x + 3 = \overbrace{x^2 - 6x} + \overbrace{3^2 - 3^2} + 3 = [x^2 - 2x \cdot 3 + 3^2] - 3^2 + 3 = (x-3)^2 - 6$$

$$A^2 - 2AB + B^2 = A^2 - 2AB + B^2 = (A-B)^2$$

b)

$$y = x^2 + 4x + 3 = \overbrace{x^2 + 4x} + \overbrace{2^2 - 2^2} + 3 = [x^2 + 2x \cdot 2 + 2^2] - 2^2 + 3 = (x+2)^2 - 1$$

$$A^2 + 2AB + B^2 = A^2 + 2AB + B^2 = (A+B)^2$$

Exercise 5: Uprav kvadratickou funkci $y = x^2 - 4x + 4$ doplněním na čtverec tak, aby bylo možné snadno nakreslit její graf.

$$y = x^2 - 4x + 4 = \overbrace{x^2 - 4x} + \overbrace{2^2 - 2^2} + 4 = [x^2 - 2x \cdot 2 + 2^2] - 2^2 + 4 = (x-2)^2$$

$$A^2 - 2AB + B^2 = A^2 - 2AB + B^2 = (A-B)^2$$

Exercise 6: Arrange the equations of quadratic function $y = x^2 + 3x - 1$

(Uprav kvadratickou funkci $y = x^2 + 3x - 1$ doplněním na čtverec tak, aby bylo možné snadno nakreslit její graf.)

$$y = x^2 + 3x - 1 = x^2 + 2x \cdot \frac{3}{2} + \overbrace{\left(\frac{3}{2}\right)^2 - \left(\frac{3}{2}\right)^2}^0 - 1 = \left[x^2 + 2x \cdot \frac{3}{2} + \left(\frac{3}{2}\right)^2 \right] - \frac{9}{4} - 1 = \left(x + \frac{3}{2}\right)^2 - \frac{13}{4}$$

$$A^2 + 2AB + B^2 \qquad \qquad \qquad = A^2 + 2AB + B^2 \qquad \qquad \qquad = (A+B)^2$$

Exercise 7: Arrange the equations of quadratic function

a) $y = x^2 - x + 1$

b) $y = x^2 - \frac{3}{2}x - 2$ and draw the graph.

a)

$$y = x^2 - x + 1 = x^2 - 2x \cdot \frac{1}{2} + \overbrace{\left(\frac{1}{2}\right)^2 - \left(\frac{1}{2}\right)^2}^0 + 1 = \left[x^2 - 2x \cdot \frac{1}{2} + \left(\frac{1}{2}\right)^2 \right] - \left(\frac{1}{2}\right)^2 + 1 = \left(x - \frac{1}{2}\right)^2 + \frac{3}{4}$$

$$A^2 - 2AB + B^2 \qquad \qquad \qquad = A^2 - 2AB + B^2 \qquad \qquad \qquad = (A-B)^2$$

b)

$$y = x^2 - \frac{3}{2}x - 2 = x^2 - 2x \cdot \frac{3}{4} + \overbrace{\left(\frac{3}{4}\right)^2 - \left(\frac{3}{4}\right)^2}^0 - 2 = \left[x^2 - 2x \cdot \frac{3}{4} + \left(\frac{3}{4}\right)^2 \right] - \frac{9}{16} - 2 = \left(x - \frac{3}{4}\right)^2 - \frac{41}{16}$$

$$A^2 - 2AB + B^2 \qquad \qquad \qquad = A^2 - 2AB + B^2 \qquad \qquad \qquad = (A-B)^2$$

Exercise 8: Uprav kvadratickou funkci $y = -x^2 + 4x + 2$ doplněním na čtverec tak, aby bylo možné snadno nakreslit její graf.

Problém: Předpis funkce nezačíná x^2

Řešení: Vytkneme mínus před závorku a uvnitř máme to, co už umíme.

$$y = -x^2 + 4x + 2 = -(x^2 - 4x) + 2 = -(x^2 - 2x \cdot 2 + 2^2 - 2^2) + 2 = -\left[(x - 2)^2 - 4\right] + 2 =$$

$$= -(x - 2)^2 + 4 + 2 = -(x - 2)^2 + 6$$

Exercise 9: Arrange the equations of quadratic function and draw the graph
(Uprav zadané kvadratické funkce doplněním na čtverec tak, aby bylo možné snadno nakreslit jejich graf.)

a) $y = 2x^2 + 6x + 4$

b) $y = 0,5x^2 + x + 1$

Uses: www.realisticky.cz





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