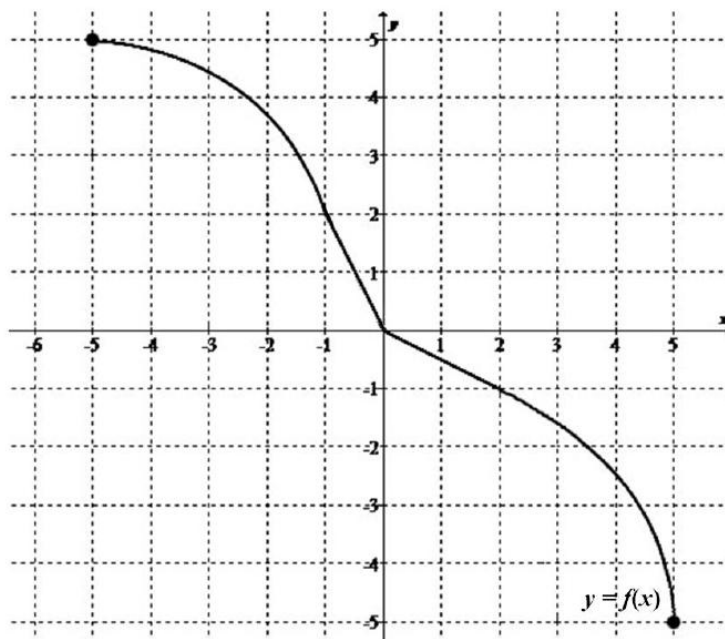


3. Functions

Illustration for tasks 3.1. – 3.4.



The illustration shows the graph of a function f .

Task 3.1. (T 1.2015)

The range of the function f belongs to the following interval:

- A. $\langle -1; 2 \rangle$ B. $\langle 0; 5 \rangle$ C. $\langle -5; 5 \rangle$ D. $\langle -5; 0 \rangle$

Task 3.2. (T 2.2015)

The zero of the function f is

- A. $x = -5$ B. $x = 0$ C. $x = 2$ D. $x = 5$

Task 3.3. (T 3.2015)

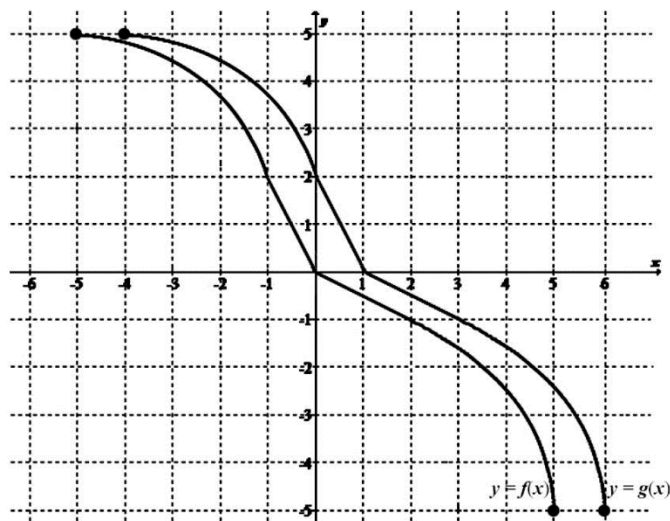
The set of solutions of inequality $f(x) \leq -1$ is the following interval:

- A. $\langle 2; 5 \rangle$ B. $\langle -5; 2 \rangle$ C. $\langle -5; 1 \rangle$ D. $\langle -1; 5 \rangle$

Task 3.4. (T 4.2015)

The graph of the function f is symmetrical about

- A. the OX axis B. the OY axis C. the origin D. the line $y = x$

**Task 3.5. (T 5.2015)**

The function g was plotted by translating the graph of the function f along one of the axes of the coordinate system (see illustration). The function g can be expressed in the following way:

- A. $g(x) = f(x) - 1$ B. $g(x) = f(x + 1)$ C. $g(x) = f(x - 1)$ D. $g(x) = f(x) + 1$

Task 3.6. (T 14.2015 0 – 3 pts)

Given the function f with the formula $f(x) = -x^2 - 2x + 3$, complete the following sentences.

- The function f reaches the maximum value of for x equal to
- The value of the function for $x = -5$ is the same as for x equal to
- The function f has negative values if, and only if, the x values belong to the set..... .

Task 3.7. (T 5.2016)

The linear function $y = (3 - m)x + 6$ has no x -intercepts when

- A. $m = 3$ B. $m = 0$ C. $m = 6$ D. $m = -3$

Task 3.8. (T 6.2016)

The quadratic function f takes negative values for all arguments in the $(-2, 3)$ interval and for no other arguments. The solution set for the inequality $f(x - 3) < 0$ is the interval

- A. $(-5; 0)$ B. $(1; 6)$ C. $(-2, 3)$ D. $(-3; 2)$

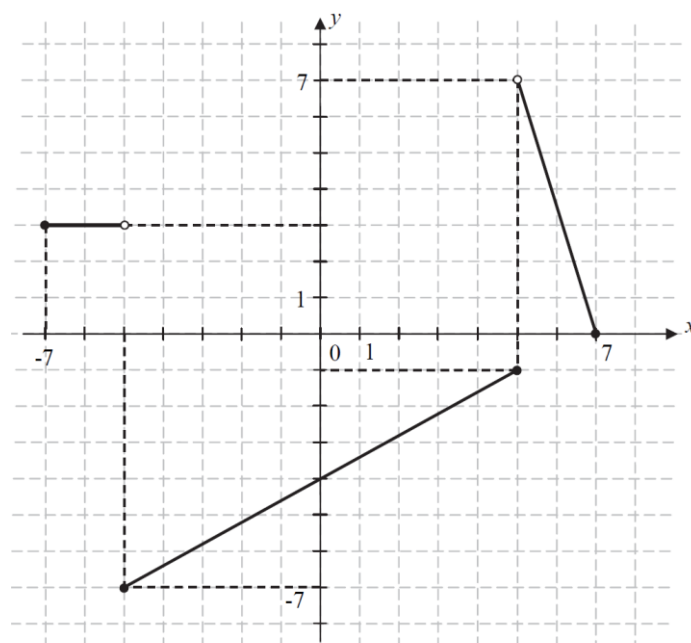
Task 3.9. (T 18.2016, 0 – 2 pts)

The linear function f has the equation $f(x) = -\frac{1}{2}x + 13$. Complete the following sentences.

- a) For the argument -4 , the value of the function f equals
 b) The x -intercept of the function equals

Task 3.10. (T 20.2016, 0 – 5 pts)

The following illustration shows the graph of the function f .



Complete the following sentences based on the illustration.

- The domain of the function is the set $D = \dots\dots\dots$
- The range of the function is $Z_w = \dots\dots\dots$
- The longest interval in which the function f decreases is $\dots\dots\dots$
- The lowest value of the function f equals $\dots\dots\dots$
- The solution set for the inequality $f(x) < -1$ is $\dots\dots\dots$

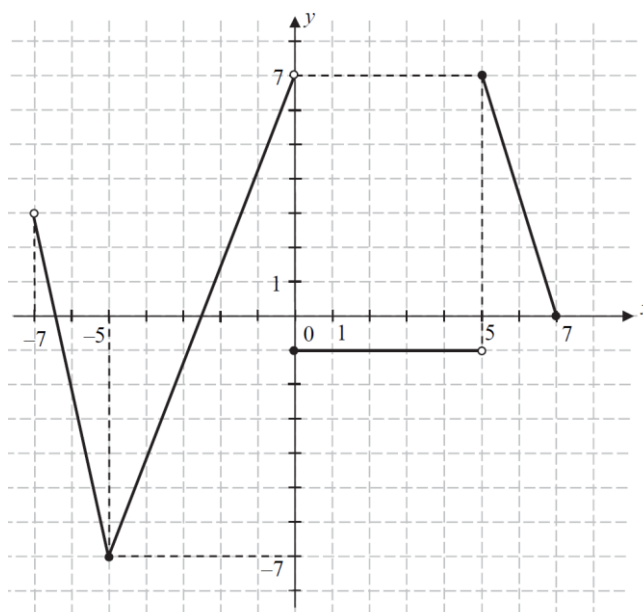
Task 3.11. (T 6. 2017)

The graph of a linear function f is a line which crosses the axes of the coordinate system at $K = (-5, 0)$ and $L = (0, 7)$. Therefore, the equation of function f is:

- A. $f(x) = -\frac{7}{5}x + 7$ B. $f(x) = \frac{7}{5}x + 7$ C. $f(x) = \frac{5}{7}x - 5$ D. $f(x) = -\frac{5}{7}x - 5$

Task 3.12. (T 15.2017, 0 – 5 pts)

The illustration shows the graph of a function f .



Complete the following sentences.

- The domain of function f is the set $D = \dots\dots\dots$
- The range of function f is $Z_w = \dots\dots\dots$
- The maximum of function f equals $\dots\dots\dots$
- The longest interval in which function f is increasing is $\dots\dots\dots$
- The number of x -intercepts of function f equals $\dots\dots\dots$

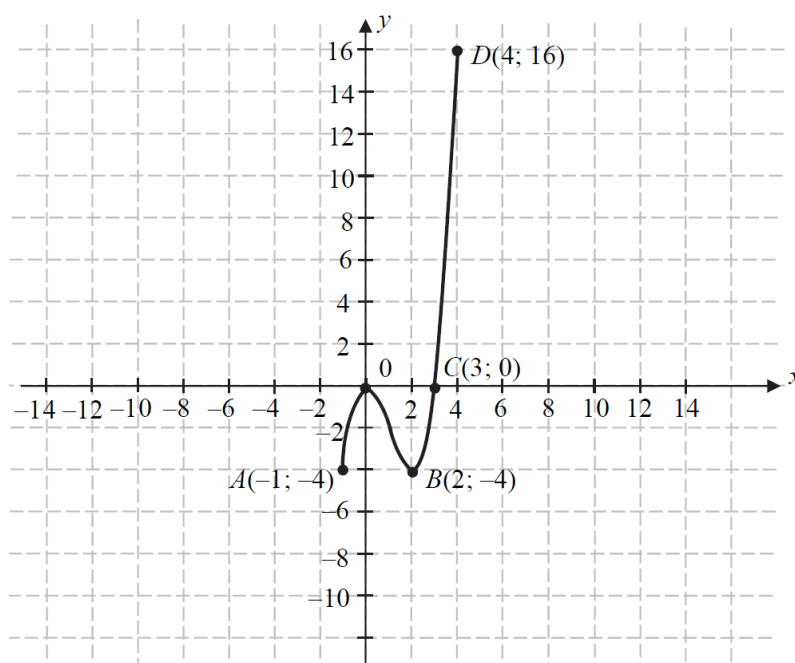
Task 3.13 (T 5.2018)

The exponential function f is given by the equation $f(x) = 2^x$. The graph of a function g is obtained by translating the graph of function f three units upwards along the axis OY . Hence, function g is defined by the equation

- A. $g(x) = 2^{x+3}$ B. $g(x) = 2^x + 3$ C. $g(x) = 2^{x-3}$ D. $g(x) = 2^x - 3$

Information for tasks 3.14 – 3.17.

The illustration shows the graph of a function f . It has two zeros which are both integers.

**Task 3.14. (T 6.2018)**

The domain of the function is the set:

- A. $\langle -1; 16 \rangle$ B. $\langle -4; 16 \rangle$ C. $\langle -1; 4 \rangle$ D. $\langle -1; 3 \rangle$

Task 3.15. (T 7.2018)

The range of the function f is the set:

- A. $\langle -1; 4 \rangle$ B. $\langle -1; 3 \rangle$ C. $\langle 0; 16 \rangle$ D. $\langle -4; 16 \rangle$

Task 3.16. (T 8.2018)

Function f reaches its minimum for:

- A. $x = 0$ and $x = 3$ B. $x = -1$ and $x = 2$
 C. $x = -1$ and $x = -4$ D. $x = 2$ and $x = 4$

Task 3.17. (T 9.2018)

The zeros of the function f are the numbers

- A. 0 and 3 B. -1 and 2 C. -1 and -4 D. 2 and -4

Task 3.18. (T 16.2018, 0 – 3 pts)

A quadratic function f is given by the equation: $f(x) = 2x^2 - 8x - 10$. Complete the following sentences.

- a) The interval in which the function is decreasing is
 b) The range of the function is the interval:
 c) The function assumes non-negative values if and only if the x arguments belong to the set

Task 3.19 (T 4.2019)

The quadratic function f takes positive values for all x s within the interval $(-8, 16)$ and for no other x s. The solution set for the inequality $f(x + 4) > 0$ is the interval:

- A. $(-12; 20)$ B. $(-4; 20)$ C. $(-4; 12)$ D. $(-12; 12)$

Task 3.20 (T 5.2019)

The four functions: f_1, f_2, f_3, f_4 are defined for all real numbers by the following formulas:

$$\begin{aligned} f_1(x) &= x^2 - x + 2019, & f_2(x) &= (x^2 + 2019)(x^2 + 1), \\ f_3(x) &= -(x - 2019)(x^2 + 1), & f_4(x) &= -x^2 + 11x - 2019 \end{aligned}$$

One of these functions has a zero. This function is:

A. f_1

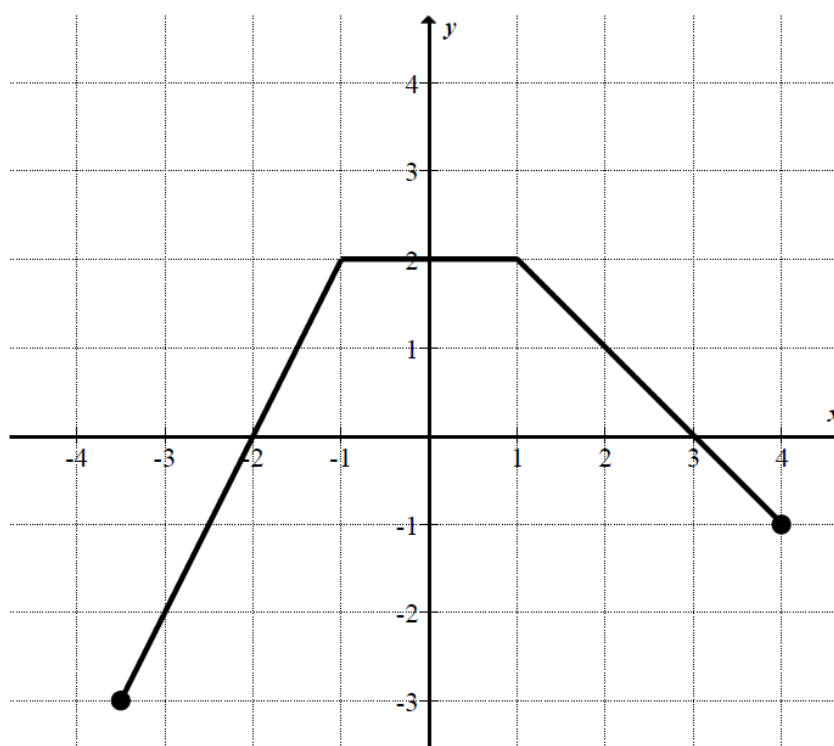
B. f_2

C. f_3

D. f_4

Task 3.21 (T 4.2022)

The graph below shows function f .



Therefore,

A. $f(1) - 2 = f(0)$ B. $f(0) - 2 = f(2)$

C. $f(1) - 2 = f(2)$ D. $f(1) - 2 = f(-1)$

Task 3.22 (T 10.2020)

The function f is given by the formula $f(x) = \left(\frac{9}{4}\right)^x$ for each real number x .

For $x = -\frac{3}{2}$ the function f assumes the value of:

A. $\frac{27}{8}$

B. $\frac{4}{9}$

C. $\frac{8}{27}$

D. $\frac{9}{4}$

Task 3.23 (T 18.2020)

The quadratic function f is given by the formula $f(x) = -2(x + 1)(x - 3)$.

Complete the following sentences.

- a) The axis of symmetry of the graph of the function f is a line given by the equation

..... .

- b) The least value of the function f in the interval $\langle -1, 2 \rangle$ equals

..... .

- c) The area of a triangle whose vertices are the points of intersection of the graph of the function f with the axes of the coordinate system equal

..... .

Task 3.24 (T 5.2021)

The graph of the function $f(x) = (x + 6)(2x - 4)$ is a parabola whose vertex is a point with coordinates

- A. $(-6, 4)$ B. $(6, -4)$ C. $(-6, 2)$ D. $(-2, -32)$

Information for tasks 3.25 – 3.26

A function f assigns to each two-digit number x the remainder of the division of x by 7.

Task 3.25 (T 6.2021)

The set of values of the function f consists of

- A. 10 elements B. 90 elements C. 7 elements D. 13 elements

Task 3.26 (T 7.2021)

The number of zeros of the function f is equal to

- A. 10 elements B. 90 elements C. 7 elements D. 13 elements

Task 3.27 (T 8.2021)

The number of positive integers which belong to the set of values of the function

$g(x) = -x^2 - 4x + 21$ is

- A. 10 B. 3 C. 25 D. 2

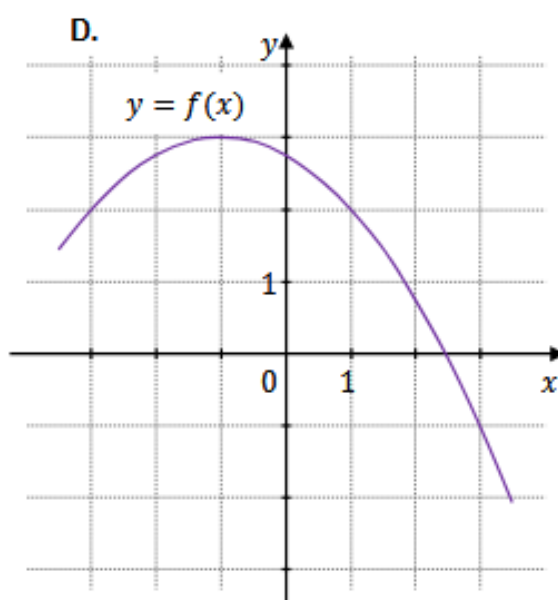
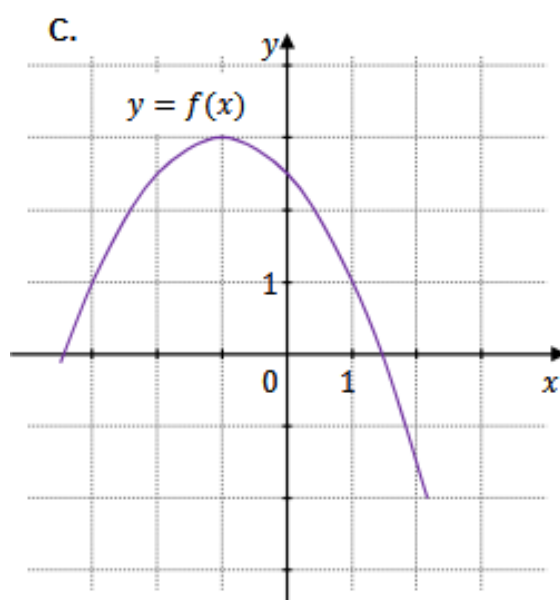
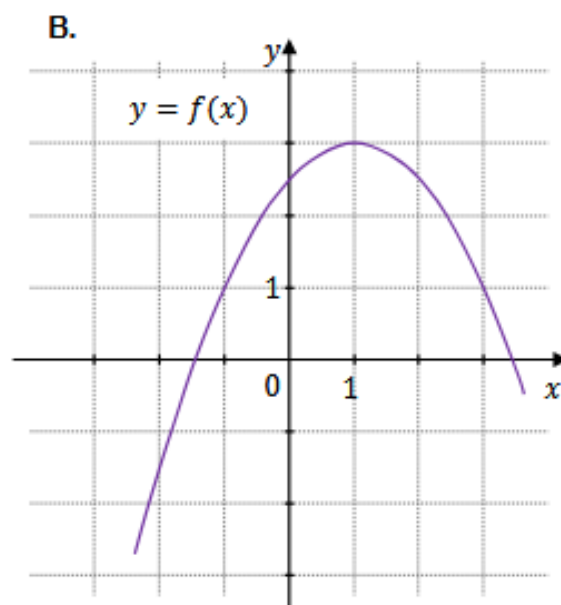
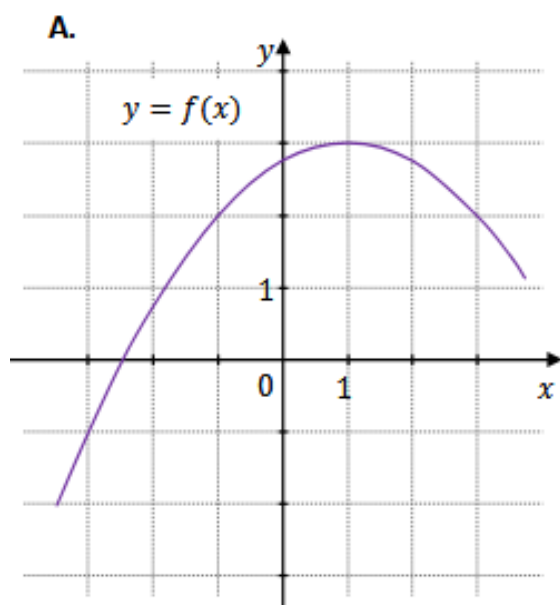
Task 3.28 (T 4 - 4.1.2023)

A quadratic function f is given by the formula $f(x) = -\frac{1}{2}(x - 1)^2 + 3$

One of the figures (A-D) below shows a part of the graph of the function f in the Cartesian coordinate system (x, y) .

Complete the sentence. Select the correct answer from the options given below.

The part of the graph of the function f is shown in figure.

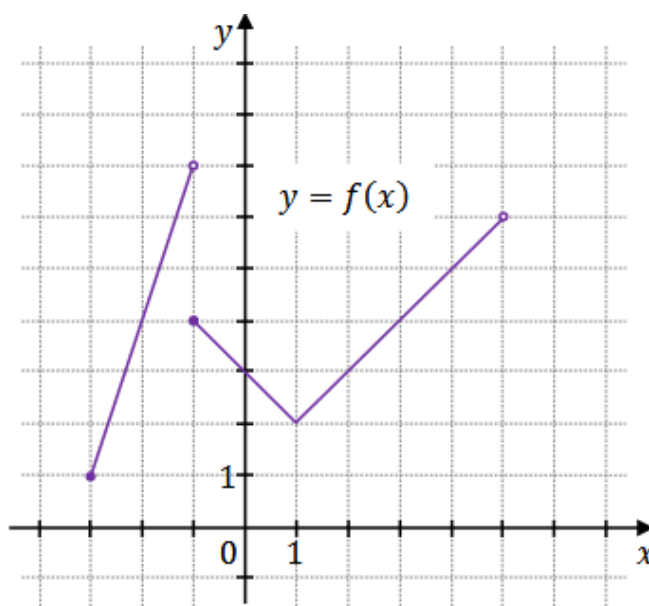
**Task 3.29 (T 4 - 4.2.2023)**

Complete the sentence so that it is true.

The zeroes of the function f are the numbers and

Task 3.30 (T 5 – 5.1.2023)

The figure shows the graph of a function f in the Cartesian coordinate system (x, y) .



Complete the sentence. Select the correct answer from the options given below.

The set of all solutions of the inequality $f(x) < 4$ is

- A. $[1, 4)$ B. $[-3, 3)$ C. $[-3, -2) \cup (-1, 3)$ D. $(-2, -1) \cup (3, 5)$

Task 3.31 (T.5 – 5.2.2023)

Complete the following sentences so that they are true.

1. The domain of the function f is the interval
2. The range of the function f is

Task 3.32 (T.11.2023)

A linear function g is given by the formula $g(x) = -2x + 6$. The graph of a linear function f passes through the point $P = (2, 3)$ and is perpendicular to the graph of the function g .

Complete the sentence. Select the correct answer from the options given below.

The formula of the function f is

- A. $f(x) = -2x + 3$ B. $f(x) = -2x + 7$ C. $f(x) = \frac{1}{2}x + 3$ D. $f(x) = \frac{1}{2}x + 2$

Task 3.33(T 3.2024)

A polynomial W is given by the formula $W(x) = x^6 - x^4 + 3x^2 - 3$.

Complete the sentence. Choose the correct answer from the options given below.

One of the zeroes of this function is the number

- A. 3 B. $-\frac{1}{3}$ C. -1 D. $\frac{1}{3}$

Task 3.34 (T 4 – 4.1.2024)

A quadratic function f is given by the formula $f(x) = -x^2 + 14x - 13$.

Decide if the following statements are true or false. Select ‘T’ if the statement is true, or ‘F’ if it is false.

The range of the function f is the interval $(-\infty, 36]$.	T	F
The function f has no zeroes.	T	F

Task. 3.35 (T 4 – 4.2.2024)

Complete the sentences. Select the correct answer from options A–D and E–H.

1. The formula of the function f in vertex form is

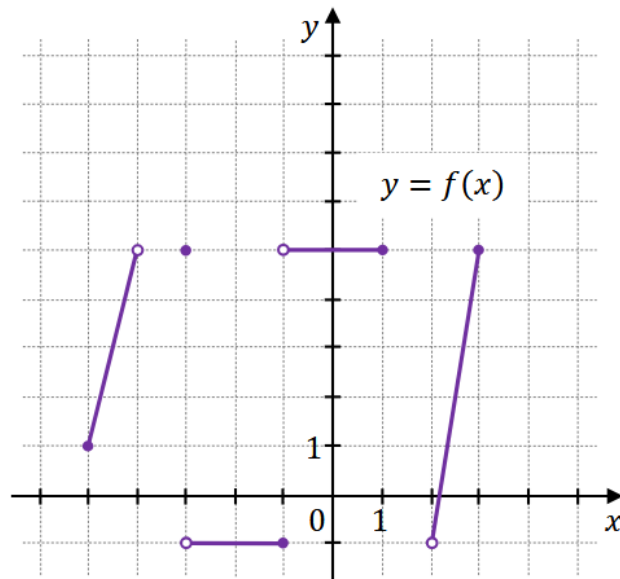
- A. $f(x) = (x - 7)^2 + 36$ B. $f(x) = -(x + 7)^2 - 36$
 C. $f(x) = -(x - 7)^2 + 36$ D. $f(x) = (x + 7)^2 - 36$

2. The formula of the function f in factored form is

- E. $f(x) = (x - 13)(x - 1)$ F. $f(x) = (x + 1)(x + 13)$
 G. $f(x) = -(x + 13)(x + 1)$ H. $f(x) = -(x - 1)(x - 13)$

Task 3.36 (T 5 – 5.1.2024)

The figure shows the graph of a function f in the Cartesian coordinate system (x, y) .



Complete the sentence. Choose the correct answer from the options given below.

The function f has a value of 5 for

- | | |
|-----------------------------|-------------------------------------|
| A. exactly one argument. | B. exactly two arguments. |
| C. exactly three arguments. | D. an infinite number of arguments. |

Task 3.37 (T 5 – 5.2.2024)

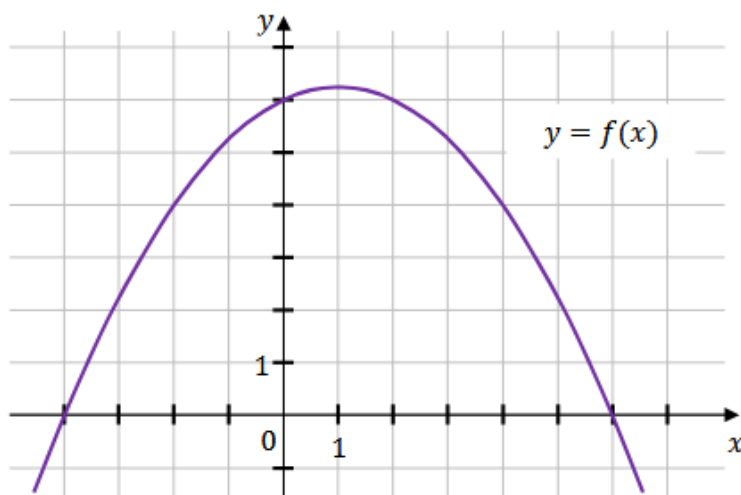
Complete the sentence so that it is true. Write the correct numbers in the blanks.

The smallest value of the function f is , and the largest value of this function is

..... .

Task 3.38 (T 6.2025)

The figure shows a part of the graph of a quadratic function f in the Cartesian coordinate system (x, y) . The coordinates of each point at which the graph intersects the axes of the coordinate system are integers.

**Task 3.38.1 (T 6.1 2025)**

Let the line k be the axis of symmetry of the graph of the function f .

Complete the sentence so that it is true.

The general form of the equation of the line k is

Task 3.38.2 (T 6.2 2025)

Complete the sentence. Choose the correct answer from the options given below.

The set of all arguments for which the function f takes values less than 6 is

A. $(-\infty, -4) \cup (6, +\infty)$

B. $(-\infty, 6)$.

C. $(-\infty, 0) \cup (2, +\infty)$

D. $(0, 2)$