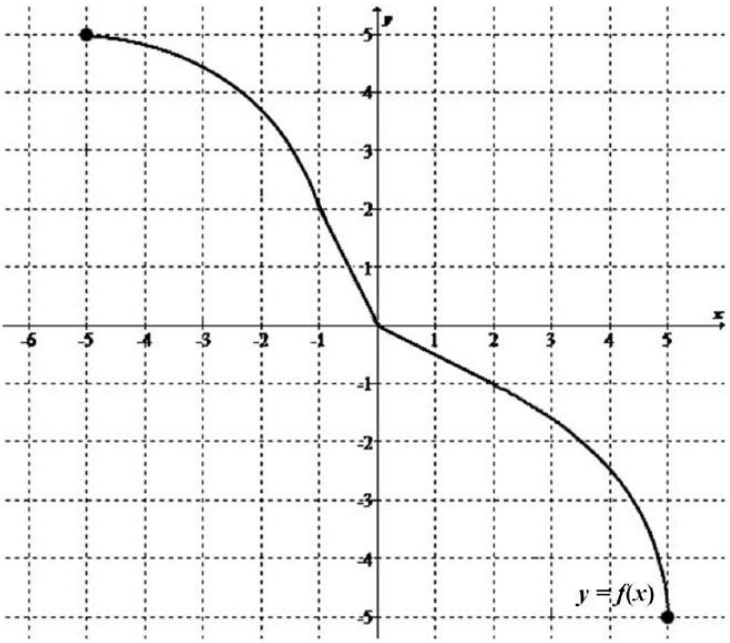
3. Functions

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)

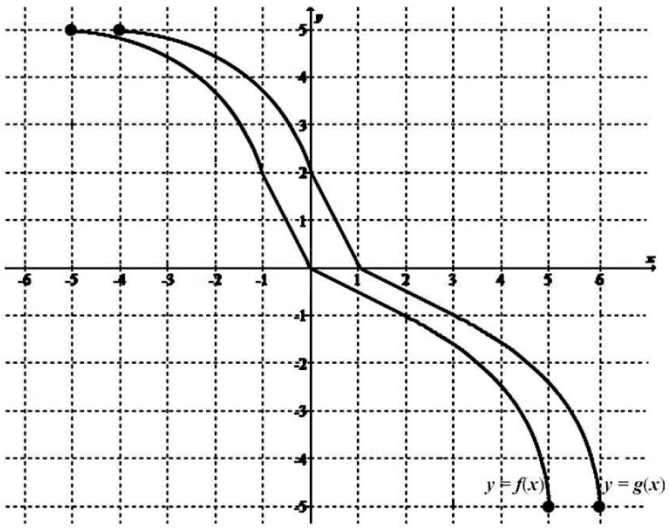
The set of solutions of inequality $f(x) \leq -1$ is the following interval:

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)

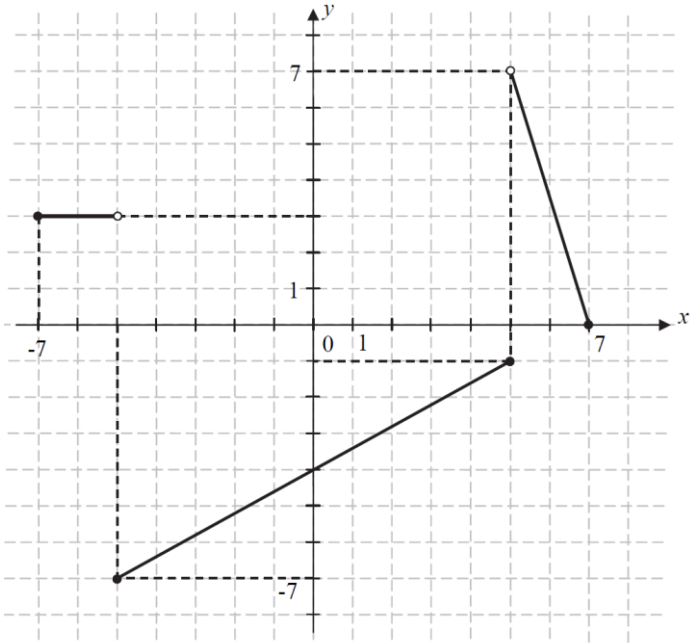
The linear function f has the equation $f(x) = -\frac{1}{2}x + 13$. Complete the following sentences.

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.

a) The domain of the function is the set D = ……

b) The range of the function is Z_w = …… .

c) The longest interval in which the function f decreases is …… .

d) The lowest value of the function f equals …… .

e) The solution set for the inequality $f(x) < -1$ is …… .

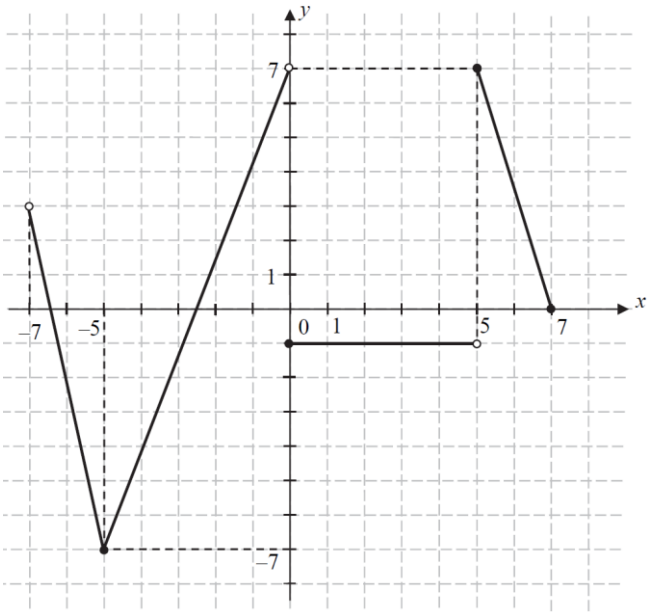
Task 3.11. (T 6. 2017)

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.

a) The domain of function f is the set D = …… .

b) The range of function f is Z_w = …… .

c) The maximum of function f equals …… .

d) The longest interval in which function f is increasing is …… .

e) The number of x-intercepts of function f equals …… .

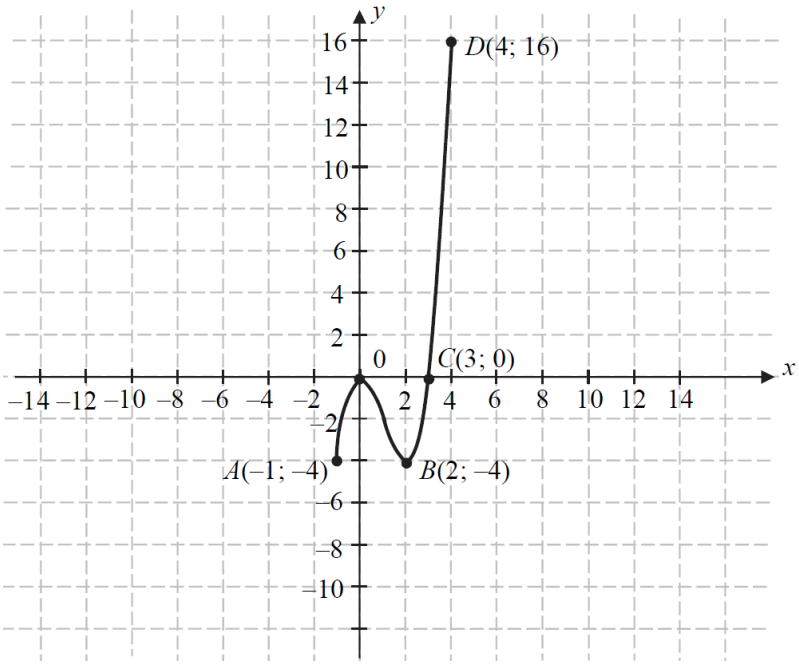
Task 3.13 (T 5.2018)

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. $(-1; 16\rangle$ **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 xs within the interval $(-8,16)$ and for no other xs. 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: $f1, f2, f3, f4$ are defined for all real numbers by the following formulas:

$f_1(x) = x^2 - x + 2019,$ $f_2(x) = (x^2 + 2019)\ (x^2 + 1),$

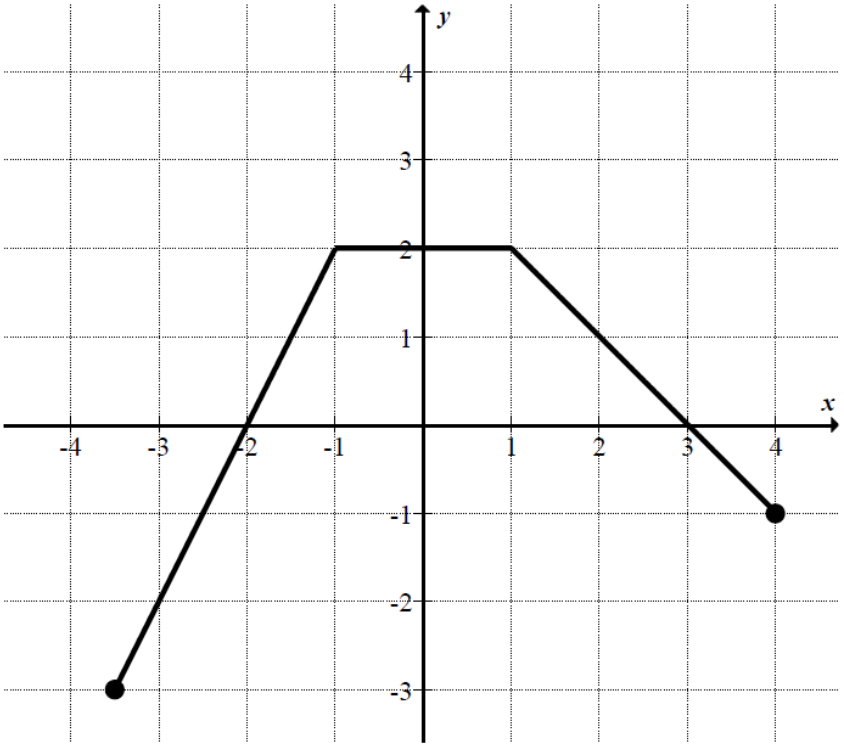
$f_3(x) = -(\ x - 2019)(x^2 + 1),$ $f_4(x) = -x^2 + 11x - 2019$

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)

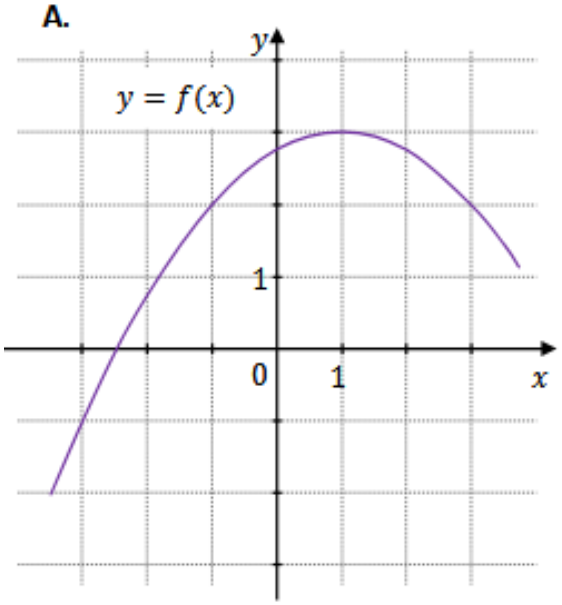
A quadratic function f is given by the formula $f(x) = -\frac{1}{2}(x-1)^2 + 3$

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

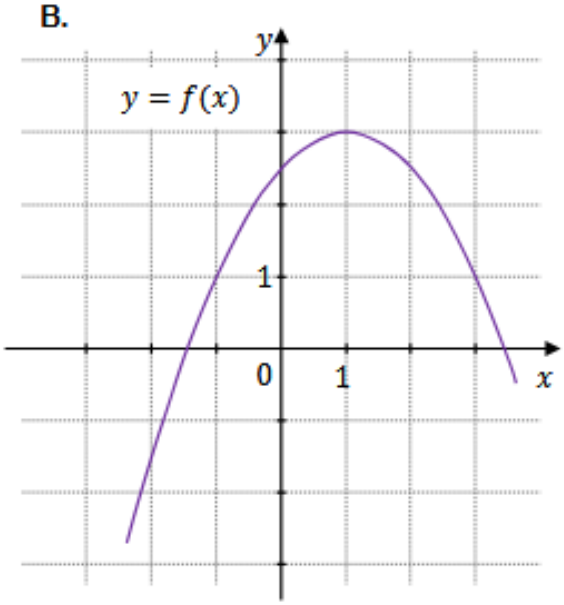
Complete the sentence. Select the correct answer from the options given below.

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

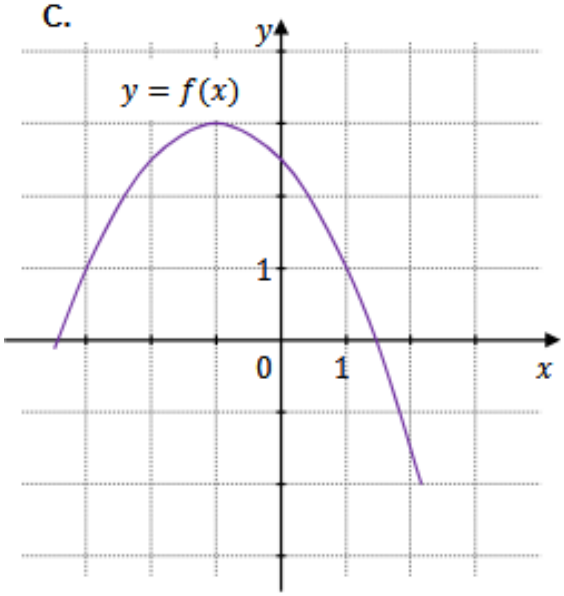
A.



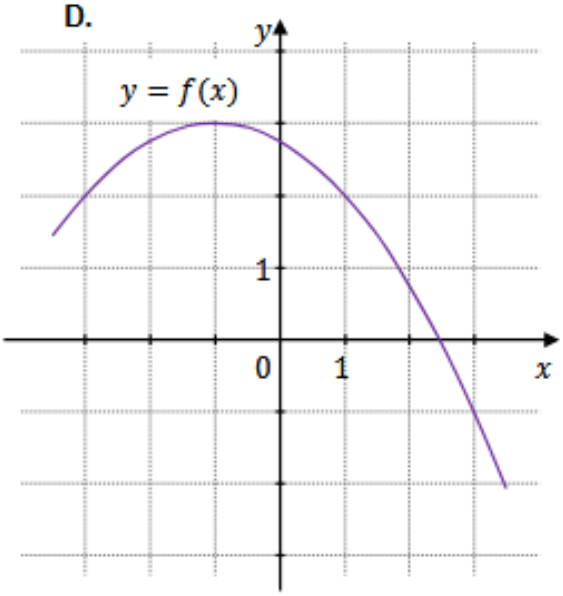
B.



C.



D.



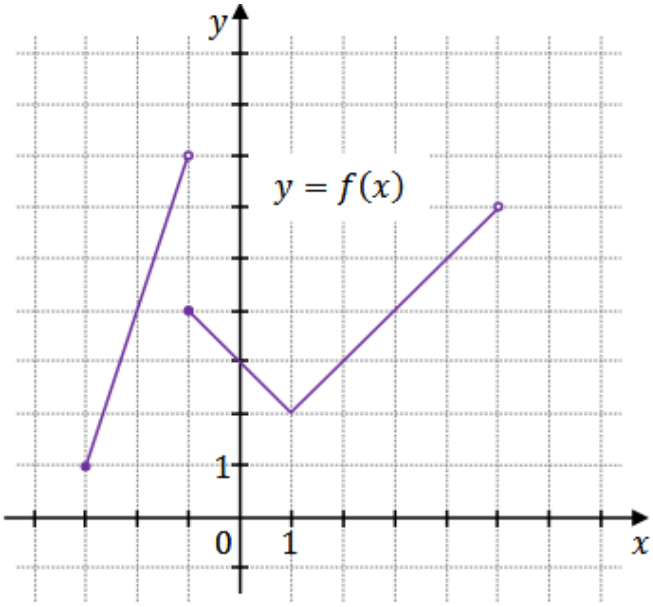
Task 3.29 (T 4 - 4.2.2023)

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.** $f(x) = (x+7)^2 - 36$

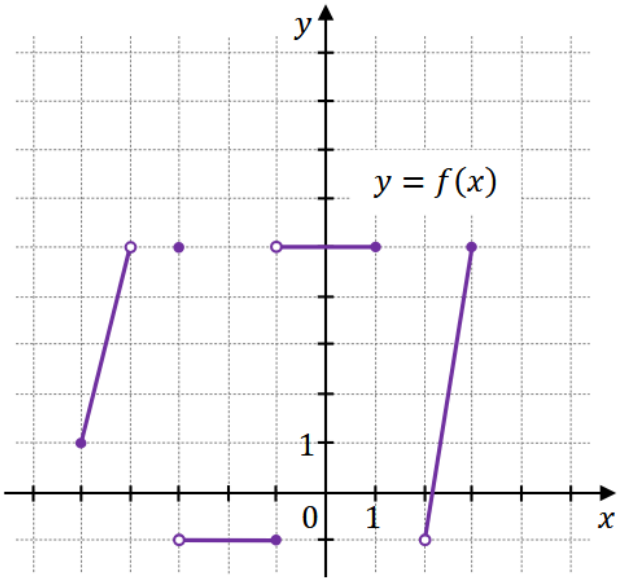
2. The formula of the function f in factored form is

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 ..... .