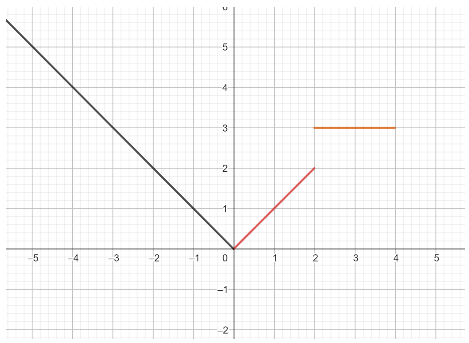
TEST - FUNCTIONS

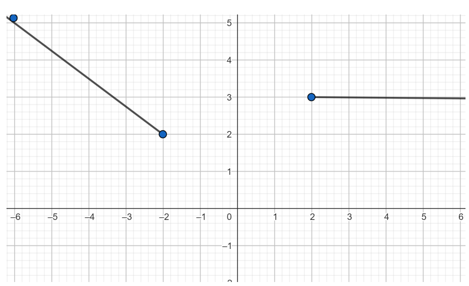
1. Using the pictured graph, what is $f(2)$?



a) -2
b) 0
c) 3
d) 2
Solution: Correct answer: d)

If the answer is wrong: We represent a function as, $y = f(x)$ where x is the input value and for each x we get an output value as y. In our case, we can see from the graph that for $x = 2$, the value of $y = 2$, so $f(2) = 2$.

2. Over what interval is this function constant?



a) $(-\infty, 2)$
b) $(-\infty, 2]$
c) $[2, \infty)$
d) $(2, \infty)$
Solution: Correct answer: c)

If the answer is wrong: A constant function is a function having the same range for different values of the domain. Graphically a constant function is a straight line, which is parallel to the x-axis. In our case, $f(x) = 3$, for $x \geq 2$. So, $x \in [2, \infty)$.

3. What is the domain of the function $y = \frac{x^2}{x^2-25}$?
a) $(-\infty, -5) \cup (-5, \infty)$
b) $(-\infty, 5) \cup (5, \infty)$
c) $(-\infty, -5] \cup [-5, 5] \cup [5, \infty)$
d) $(-\infty, -5) \cup (-5, 5) \cup (5, \infty)$

Solution: Correct answer: d)

If the answer is wrong: The general form of a rational function is $f(x) = \frac{p(x)}{q(x)}$, where $p(x)$ and $q(x)$ are polynomials and $q(x) \neq 0$. Condition: $x^2 - 25 \neq 0$.

If the answer is still wrong: $x^2 - 25 \neq 0 \Leftrightarrow (x-5)(x+5) \neq 0 \Rightarrow x \neq -5$, $x \neq 5$

4. What is the domain of the function $y = -2 + \sqrt{2x-6}$?
a) $[3, \infty)$
b) $(-\infty, 3] \cup [3, \infty)$
c) $(-\infty, -3) \cup (-3, \infty)$
d) $(-\infty, -3] \cup [-3, \infty)$

Solution: Correct answer: a)

If the answer is wrong: The nth root function ($\sqrt[n]{}$) is defined: i) $f : [0, \infty) \to \mathbb{R}$, $f(x) = \sqrt[n]{x}$ if n is even; ii) $f : \mathbb{R} \to \mathbb{R}, f(x) = \sqrt[n]{x}$ if n is odd. Condition: $2x - 6 \geq 0$.

If the answer is still wrong: $2x - 6 \geq 0 \Leftrightarrow 2x \geq 6 \Leftrightarrow x \geq 3$. So, $x \in [3, \infty)$.

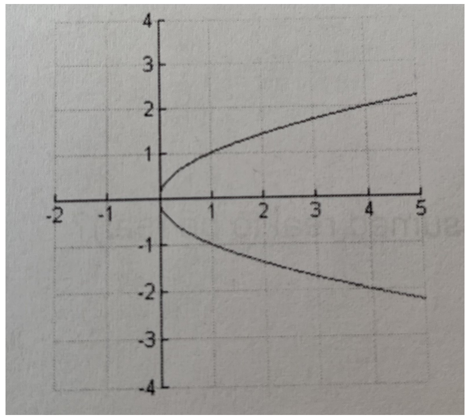
5. Is this an even, odd, or neither function $f(x) = 7x^8 - 9x^2 + 33$
a) even function
b) odd function
c) neither
d) not a function

Solution: Correct answer: a)

If the answer is wrong: A set $D \subset \mathbb{R}$ is symmetric about the origin if $\forall x \in D$ we have $-x \in D$.
Let D be a symmetric set, the function $f : D \to \mathbb{R}$ is even (odd) if $f(-x) = f(x)$ ($f(-x) = -f(x)$), $\forall x \in D$.

If the answer is still wrong: $f(-x) = 7(-x)^8 - 9(-x)^2 + 33 = 7x^8 - 9x^2 + 33 = f(x)$

6. Is the graph an even, odd, or neither function?

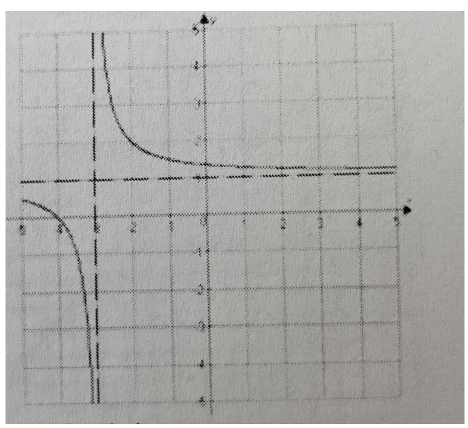


a) even
b) odd
c) neither
d) both

Solution: Correct answer: c)

If the answer is wrong: From the graph we can observe that from $x = y^2$, we have $y = \sqrt{x}$ or $y = -\sqrt{x}$, $x \geq 0$. The functions $f(x) = \sqrt{x}$ and $g(x) = -\sqrt{x}$ they are neither even nor odd function.

7. Is the graph even, odd, or neither?



a) even function
b) odd function
c) neither
d) not a function

Solution: Correct answer: c)

If the answer is wrong: A set $D \subset \mathbb{R}$ is symmetric about the origin if $\forall x \in D$ we have $-x \in D$.
Let D be a symmetric set, if $f : D \to \mathbb{R}$ is an even function, then G_f has the axis of symmetry $y = 0$ or the Ox axis.
Let D be a symmetric set, if function $f : D \to \mathbb{R}$, is an odd function, then G_f is symmetric to the point $O(0, 0)$.

8. Determine whether the following relation is a function $\{(2, 1), (3, 2), (-1, 1), (0, 2)\}$
a) No
b) Yes

Solution: Correct answer: b)

If the answer is wrong: We can consider the function $f(x) = ax^3+bx^2+cx+d$, where a, b, c, d can be determined from the conditions:

$$\begin{cases} f(2) = 1 \\ f(3) = 2 \\ f(-1) = 1 \\ f(0) = 2 \end{cases}$$

9. Evaluate $f(x) = -3x^2 + 2x$ for $f(-2)$.
a) 10
b) -8
c) 12
d) -16
Solution: Correct answer: d)

If the answer is wrong: Replace the x in the function with the input value -2. We obtain, $f(-2) = -3(-2)^2 + 2(-2) = -12 - 4 = -16$.

10. Find $f(1)$ when $f(x) = \frac{x^2-6}{x-3}$
a) 1.5
b) 2
c) 2.5
d) 3

Solution: Correct answer: c)

If the answer is wrong: Replace the x in the function with the input value -2. We obtain, $f(1) = \frac{1^2-6}{1-3} = \frac{-5}{-2}$=2.5.

11. Determine whether the following function is increasing or decreasing, $f(x) = -2x + 5$.
a) increasing
b) decreasing

Solution: Correct answer: b)

If the answer is wrong: A function $f : A \to B$ is increasing (decreasing) if for $x, y \in A$, $x \leq y$, we have $f(x) \leq f(y)$ $(f(x) \geq f(y))$.

12. Given the following set of information, find a linear equation satisfying the conditions, if possible: Passes through $(5, 1)$ and $(3, -9)$.

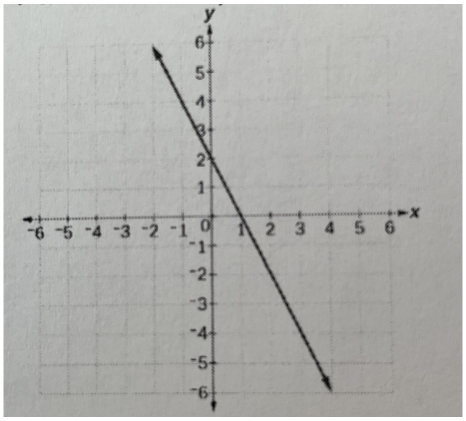
Solution: Correct answer: $y = 5x - 24$

If the answer is wrong: We consider the function $f : \mathbb{R} \to \mathbb{R}$, $f(x) = ax + b$ which checks:

$$\begin{cases} f(5) = 1 \\ f(3) = -9 \end{cases} \Leftrightarrow \begin{cases} 5a + b = 1 \\ 3a + b = -9 \end{cases} \Rightarrow \begin{cases} a = 5 \\ b = -24 \end{cases},$$

$f(x) = 5x - 24$

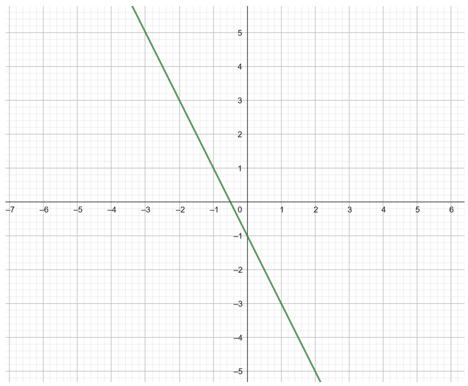
13. Find the slope of the line in the graph below:



Solution: Correct answer: -2

If the answer is wrong: For the linear function $f : A \to B, A \subset \mathbb{R}$, $f(x) = ax + b$, the slope is defined like $m = tg\alpha = \frac{f(x_1) - f(x_2)}{x_1 - x_2}$, where $\alpha = (\widehat{G_f, Ox})$. $m = tg\alpha = \frac{f(1) - f(0)}{1 - 0} = 0 - 2 = -2$

14. Write an equation for line in the graph below:



Solution: Correct answer: $y = -2x - 1$

If the answer is wrong: $f : \mathbb{R} \to \mathbb{R}$, $f(x) = ax + b$, $G_f \cap Ox = \left\{\left(-\frac{1}{2}, 0\right)\right\}$, $G_f \cap Oy = \{(0,1)\}$.

Conditions: $\begin{cases} f\left(-\frac{1}{2}\right) = 0 \\ f(0) = 1 \end{cases} \Leftrightarrow \begin{cases} -\frac{a}{2} + b = 0 \\ b = -1 \end{cases} \Leftrightarrow \begin{cases} b = -1 \\ a = -2 \end{cases}$, $f(x) = -2x - 1$.

15. Does the table below represent a linear function? If so, find a linear equation that models the data:

x	-6	0	2	4
$g(x)$	14	32	38	44

Solution: Raspuns scris de catre student

Correct answers: The points determine a linear function and $g(x) = 3x + 32$.

If the answer is wrong: We check if the 4 points in the table define straight lines that have the same slope (if we get the same slope, then the points are collinear, therefore they define a linear function). The slope is used to measure the inclination of a straight line regarding the abscissa axis (the x-axis). If we have been given two points through which the straight line goes through, we can use the following formula:

$$m = \frac{y_1 - y_2}{x_1 - x_2}$$

If the answer is wrong: In our case:

$$m_1 = \frac{g(-6) - g(0)}{-6 - 0} = \frac{14 - 32}{-6} = 3$$

$$m_2 = \frac{g(2) - g(4)}{2 - 4} = \frac{38 - 44}{-2} = 3$$

$$m_3 = \frac{g(-6) - g(2)}{-6 - 2} = \frac{14 - 38}{-8} = 3$$

$$m_4 = \frac{g(0) - g(4)}{0 - 4} = \frac{32 - 44}{-4} = 3$$

In conclusion the points determine a linear function.

$$\left.\begin{array}{l} g(x) = m_1 x + b = 3x + b \\ g(0) = 32 \Rightarrow b = 32 \end{array}\right\} \Rightarrow g(x) = 3x + 32$$

16. Determine whether the lines given by the equations below are: $y = \frac{3}{4}x - 9$, $-4x - 3y = 8$.

a) parallel

b) perpendicular

c) neither parallel nor perpendicular

Solution: Correct answer: b)

If the answer is wrong: Function $f : A \to B, A \subset \mathbb{R}, f(x) = ax + b$ has the slope equal by a.
Two straight lines **are parallel** if they have the same slope.
Two straight lines **are perpendicular** if the product of the slopes is -1.

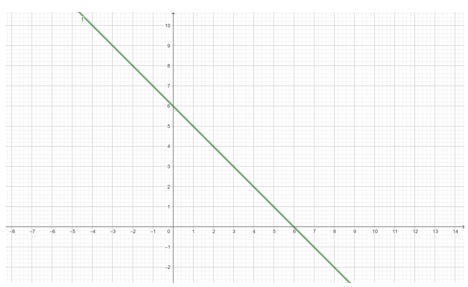
If the answer is still wrong: $y = \frac{3}{4}x - 9 \Rightarrow m_1 = \frac{3}{4}$ $-4x - 3y = 8 \Rightarrow y = -\frac{4}{3}x - \frac{8}{3} \Rightarrow m_2 = -\frac{4}{3}$. We obtain that $m_1 \neq m_2 \Rightarrow$ the straight lines are not

parallel, $m_1 \cdot m_2 = -1 \Rightarrow$ the straight lines are perpendicular.

17. Graph the linear function $f(x) = -x + 6$.

Solution: Studentul va trasa graficul functiei in Geogebra/il va reprezenta pe foaie

Feedback1:



Feedback2: $G_f \cap Ox : y = 0, x = 6 \Rightarrow A(6, 0)$ $G_f \cap Oy : x = 0, y = f(0) = 6 \Rightarrow B(0, 6)$

18. Identify the slope (m) and y-intercept (b) in the following linear function: $y = -3x - 7$.

a) $m = -3$, $b = -7$

b) $m = -7$, $b = -3$

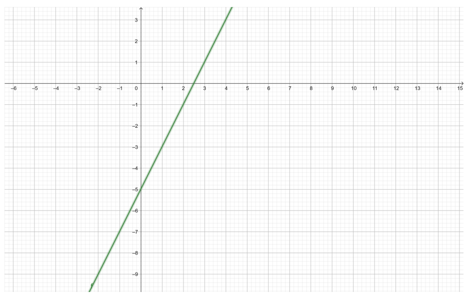
c) $m = -3$, $b = 7$

d) $m = 3$, $b = 7$

Solution: Correct answer: a)

If the answer is wrong: If we know the equation of the straight line, $y = mx + b$, the slope value will be m.

19. Identify the equation for the linear function represented by the graph:



a) $y = 2x - 5$
b) $y = 5x - 2$
c) $y = 2x + 5$
d) $y = 5x + 2$

Solution: Correct answer: a)
If the answer is wrong: Form the graph of the function $f(x) = ax + b$, $x \in \mathbb{R}$ we can observe the following points: $(0, -5)$ and $(2, -1)$. We have:

$$\begin{cases} f(0) = b = -5 \\ f(2) = 2a + b = -1 \end{cases} \Rightarrow \begin{cases} b = -5 \\ a = 2 \end{cases} \Rightarrow f(x) = 2x - 5$$

20. If $f(x) = -2x - 5$ and $g(x) = x^2 + 1$, find $f(g(x))$.
a) $-2x^2 - 7$
b) $-2x^2 + 3$
c) $4x^2 + 20x + 26$
d) $4x^2 + 26$
e) $-2x^2 - 5$
Solution: Correct answer: a)

If the answer is wrong: If $f : A \to B$ and $g : C \to D, B \subseteq C$ then we can define the function $g \circ f : A \to D$, $(g \circ f)(x) = g(f(x))$
If the answer is still wrong: $f(g(x)) = -2g(x) - 5 = -2x^2 - 7$