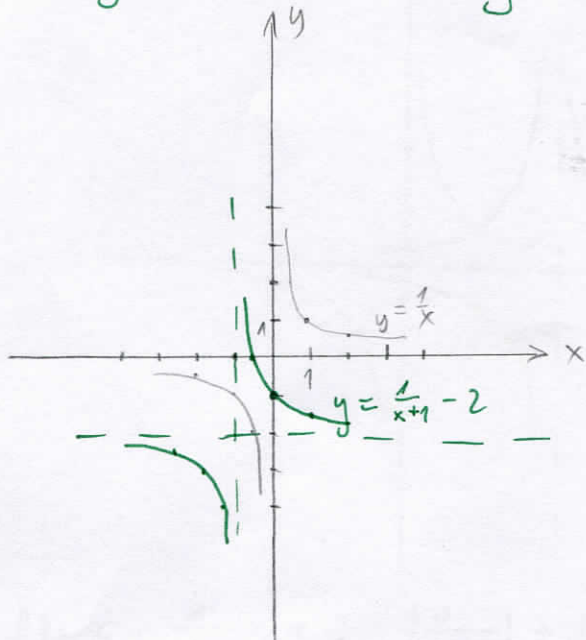


ZAD 1

$$a) y = \frac{-2x-1}{x+1} \quad D = \mathbb{R} \setminus \{-1\}$$

$$y = \frac{-2(x+1)+1}{x+1} = -2 + \frac{1}{x+1}$$

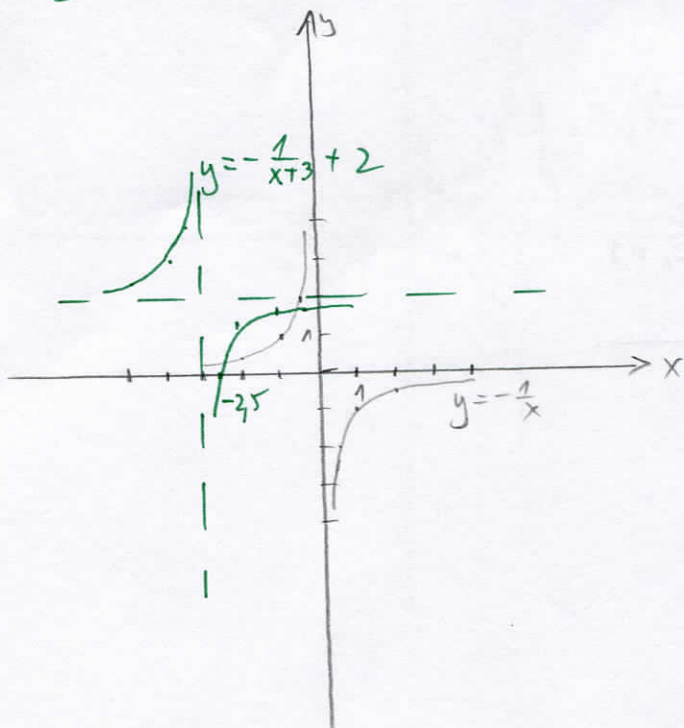
$$y = \frac{1}{x} \xrightarrow{[-1, -2]} y = \frac{1}{x+1} - 2$$



$$b) y = \frac{2x+5}{x+3} \quad D = \mathbb{R} \setminus \{-3\}$$

$$y = \frac{2(x+3)-1}{x+3} = 2 - \frac{1}{x+3}$$

$$y = -\frac{1}{x} \xrightarrow{[-3, 2]} y = -\frac{1}{x+3} + 2$$



uz. zerowe

$$\frac{2x+5}{x+3} = 0$$

$$x = -\frac{5}{2}$$

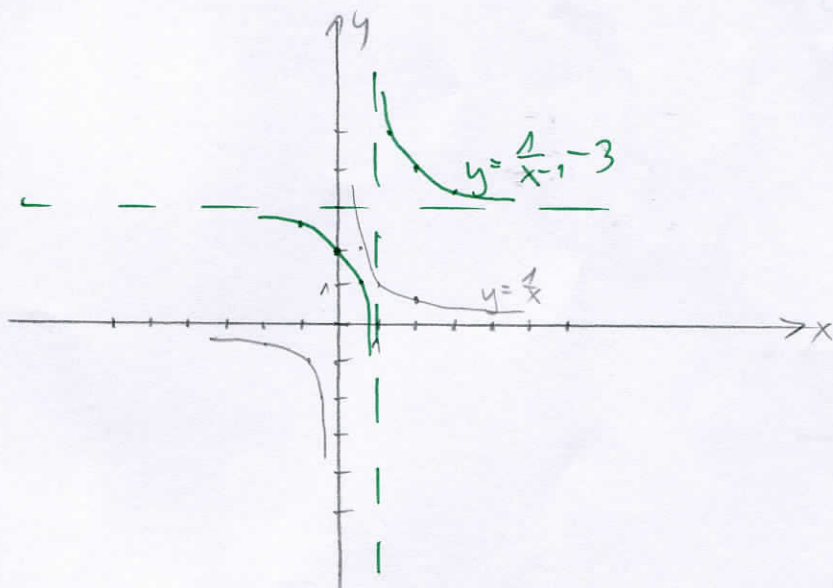
przebieg 2 osią 04

$$y = \frac{2 \cdot 0 + 5}{0 + 3} = \frac{5}{3}$$

$$c) y = \frac{-3x+4}{x-1}, \quad D = \mathbb{R} \setminus \{1\}$$

$$y = \frac{-3(x-1)+1}{x-1} = \frac{1}{x-1} - 3$$

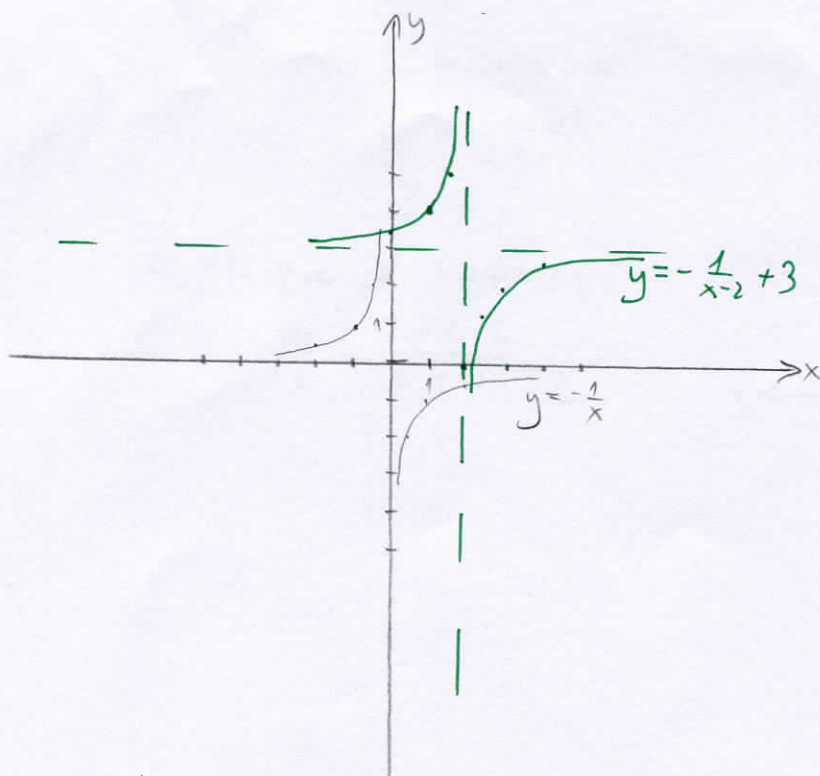
$$y = \frac{1}{x} \xrightarrow{[1, -3]} y = \frac{1}{x-1} - 3$$



$$d) y = \frac{3x-7}{x-2}, \quad D = \mathbb{R} \setminus \{2\}$$

$$y = \frac{3(x-2)+1}{x-2} = -\frac{1}{x-2} + 3$$

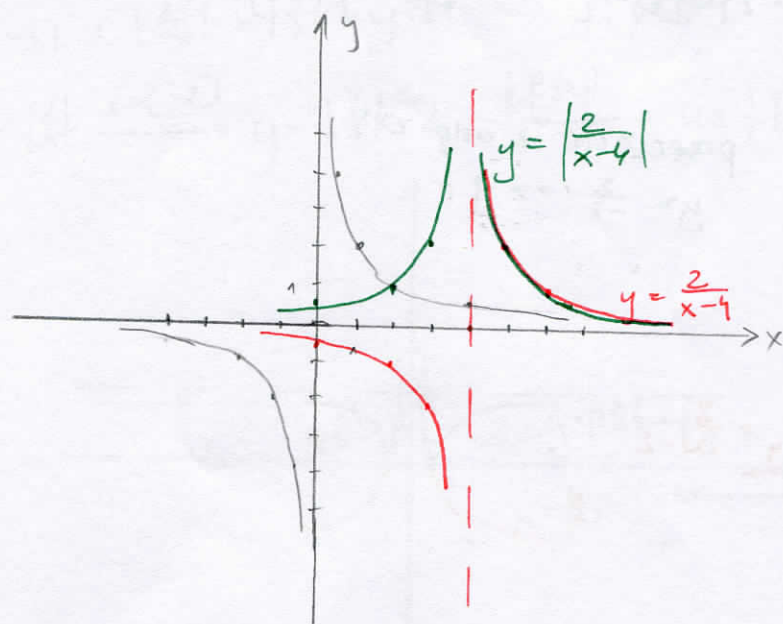
$$y = -\frac{1}{x} \xrightarrow{[2, 3]} y = -\frac{1}{x-2} + 3$$



$$e) y = \frac{2}{|x-4|} \quad D = \mathbb{R} \setminus \{4\}$$

$$y = \left| \frac{2}{x-4} \right|$$

$$y = \frac{2}{x} \xrightarrow{[4,0]} y = \frac{2}{x-4} \xrightarrow{|f(x)|} y = \left| \frac{2}{x-4} \right|$$



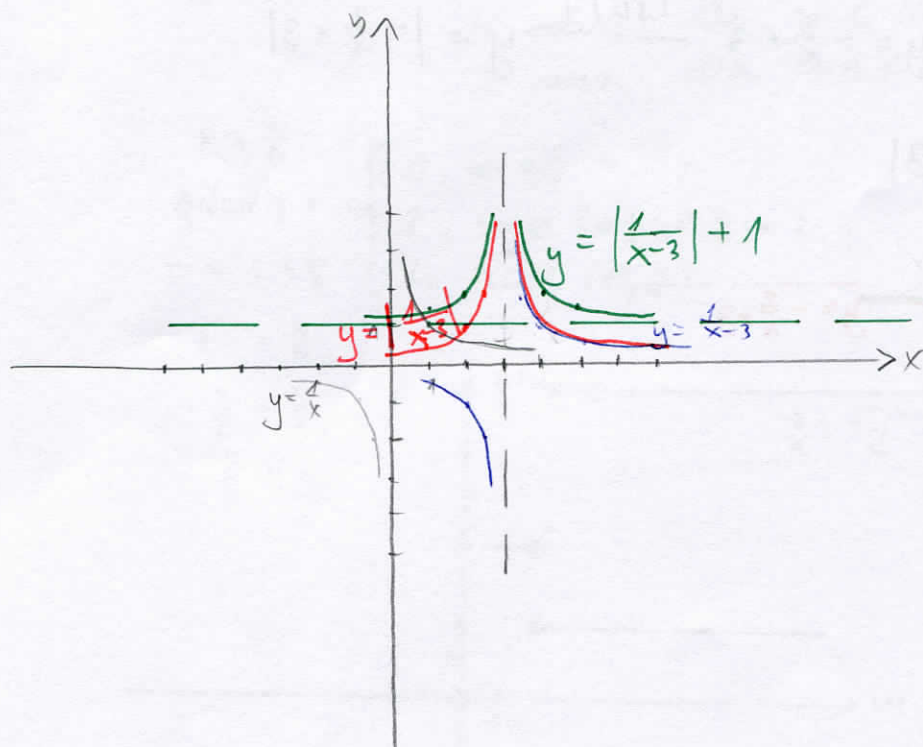
$$y = \frac{2}{x-4}$$

prelupie 2 osia 04

$$y = \frac{2}{0-4} = -\frac{1}{2}$$

$$f) y = \frac{1}{|3-x|} + 1 = \left| \frac{1}{x-3} \right| + 1, \quad D = \mathbb{R} \setminus \{3\}$$

$$y = \frac{1}{x} \xrightarrow{[3,0]} y = \frac{1}{x-3} \xrightarrow{|f(x)|} y = \left| \frac{1}{x-3} \right| \xrightarrow{[0,1]} y = \left| \frac{1}{x-3} \right| + 1$$



$$g) y = \frac{2}{|x|-2}$$

$$D: |x|-2 \neq 0$$

$$|x| \neq 2$$

$$x \neq 2 \wedge x \neq -2$$

$$D = \mathbb{R} \setminus \{-2, 2\}$$

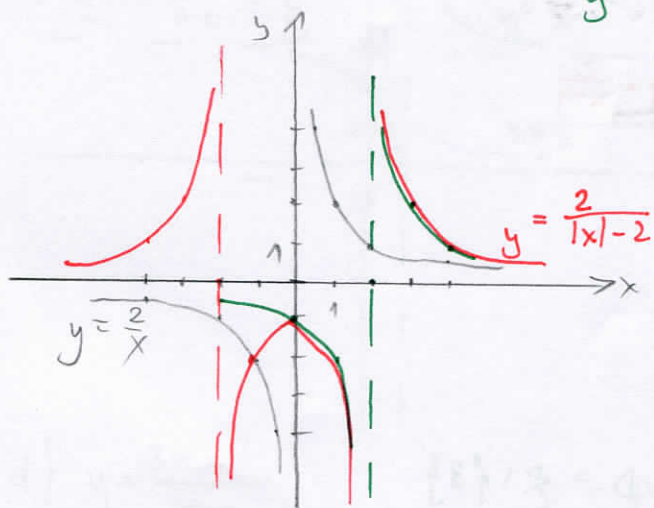
$$y(-x) = \frac{2}{|-x|-2} = \frac{2}{|x|-2} = y(x) \Rightarrow f. \text{ parzysta}$$

dla $x \geq 0 \wedge x \neq 2$

$$y = \frac{2}{x} \xrightarrow{[2, \infty)} y = \frac{2}{x-2}$$

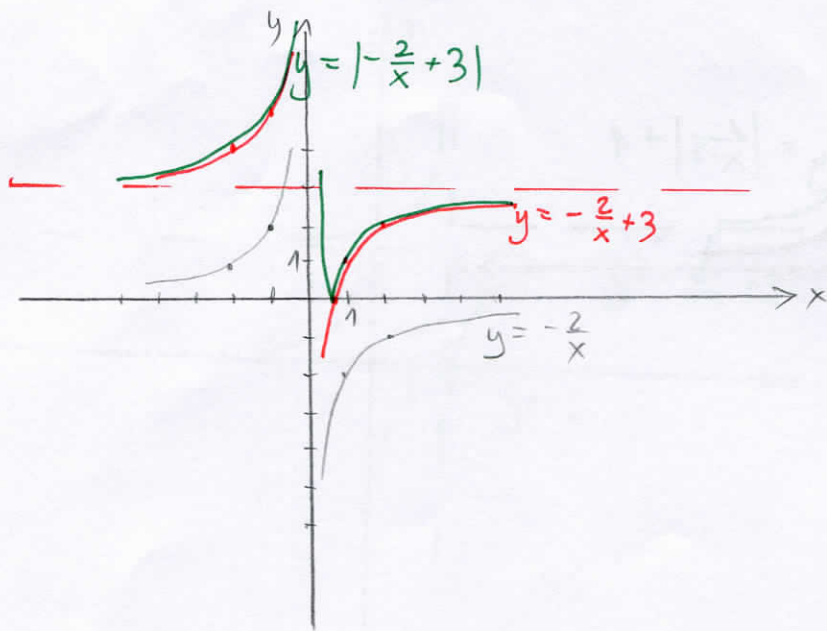
przecięcie z osią OY

$$y = \frac{2}{-2} = -1$$



$$h) y = \left| -\frac{2}{x} + 3 \right| \quad D = \mathbb{R} \setminus \{0\}$$

$$y = -\frac{2}{x} \xrightarrow{[0, 3]} y = -\frac{2}{x} + 3 \xrightarrow{|f(x)|} y = \left| -\frac{2}{x} + 3 \right|$$



$$y = -\frac{2}{x} + 3$$

u. zerowe

$$-\frac{2}{x} + 3 = 0$$

$$-\frac{2}{x} = -3$$

$$\frac{x}{2} = \frac{1}{3}$$

$$x = \frac{2}{3}$$

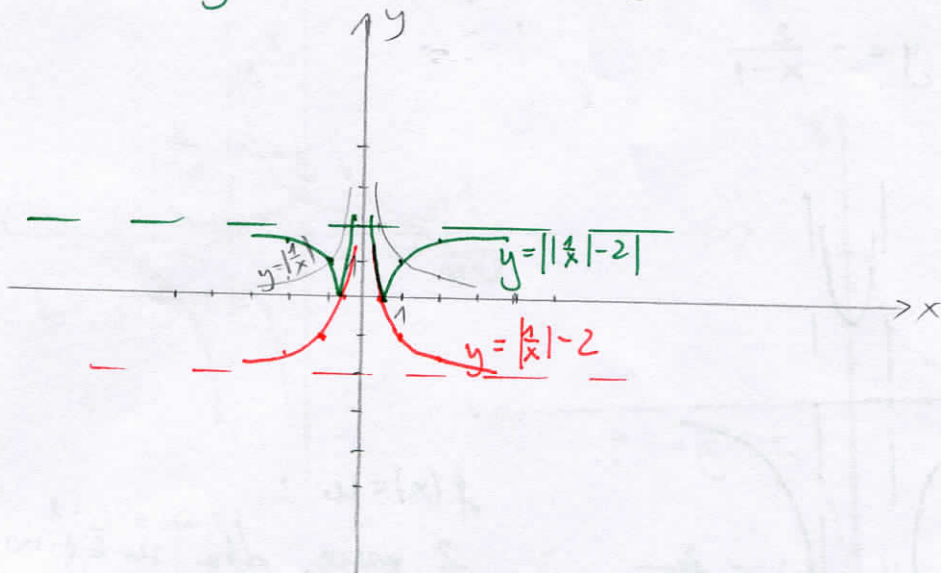
ZAD 2

a) $f(x) = \left| \frac{1}{|x|} - 2 \right| \quad D = \mathbb{R} \setminus \{0\}$

$y = \frac{1}{|x|} = \left| \frac{1}{x} \right|$

$y(-x) = \left| \frac{1}{-x} \right| = \left| \frac{1}{x} \right| = y(x) \Rightarrow f. \text{ parzysta}$

$y = \left| \frac{1}{x} \right| \xrightarrow{[2, -2]} y = \left| \frac{1}{x} \right| - 2 \xrightarrow{|f(x)|} y = \left| \left| \frac{1}{x} \right| - 2 \right|$



$y = \left| \frac{1}{x} \right| - 2$
m. zerowe

$\left| \frac{1}{x} \right| - 2 = 0$

$\left| \frac{1}{x} \right| = 2$

$\frac{1}{x} = 2 \vee \frac{1}{x} = -2$

$x = \frac{1}{2} \vee x = -\frac{1}{2}$

$f(x) = m$

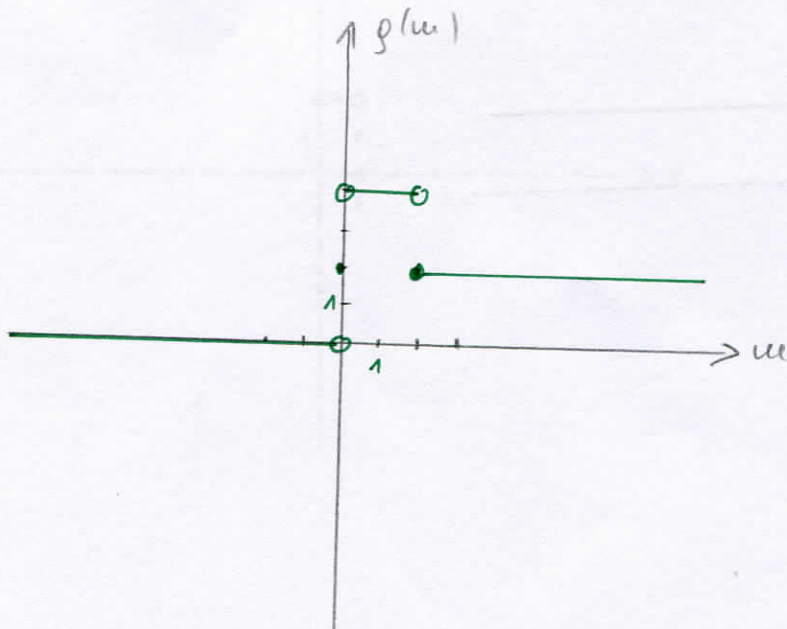
0 wzw. dla $m \in (-\infty, 0)$

2 wzw. dla $m = 0$

4 wzw. dla $m \in (0, 2)$

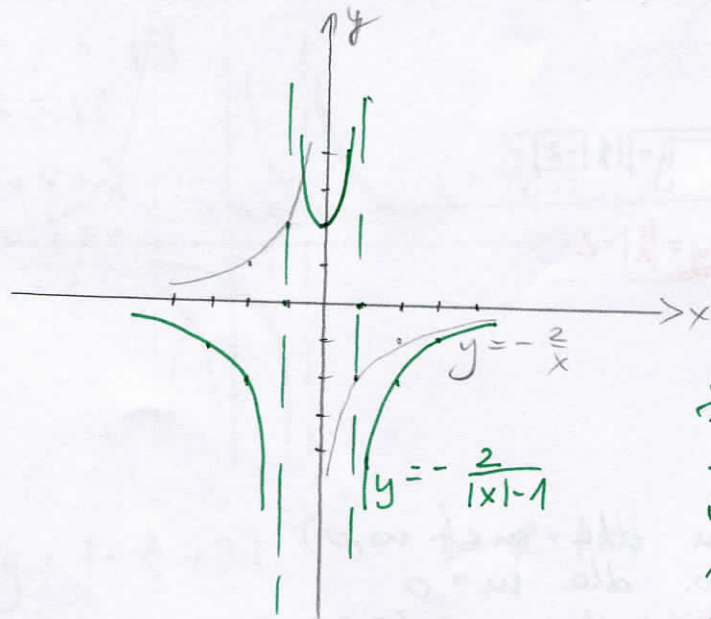
2 wzw. dla $m \in [2, \infty)$

$g(m) = \begin{cases} 0, & m \in (-\infty, 0) \\ 2, & m \in \{0\} \cup [2, \infty) \\ 4, & m \in (0, 2) \end{cases}$



b) $f(x) = -\frac{2}{|x|-1}$, D: $|x|-1 \neq 0$
 $|x| \neq 1$
 $x \neq 1 \vee x \neq -1$

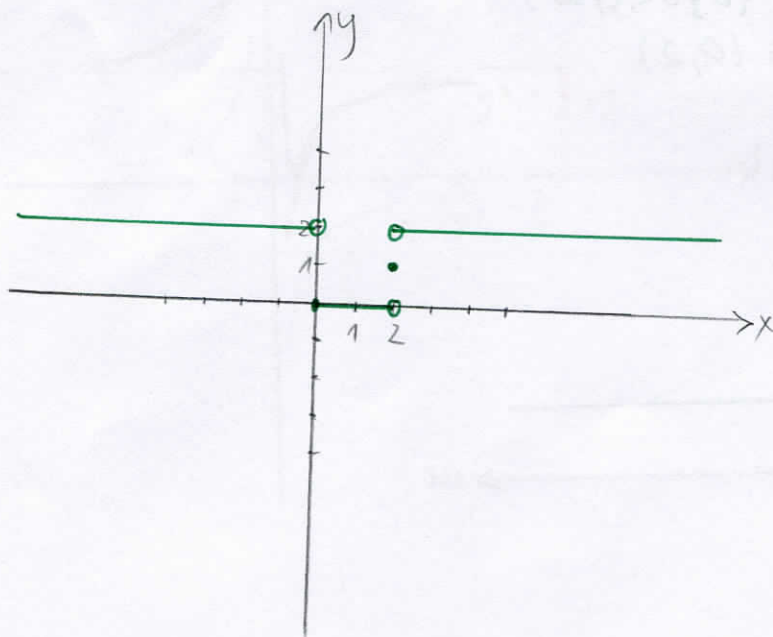
~~$y = \frac{2}{|x|}$~~ $\xrightarrow{[1,1]}$
 $\forall x \in D \quad -x \in D \wedge$
 $f(-x) = -\frac{2}{|-x|-1} = -\frac{2}{|x|-1} = f(x) \Rightarrow f.$ parzysta
 dla $x > 0 \wedge x \neq 1$
 $y = -\frac{2}{x} \xrightarrow{[1,0]}$ $y = -\frac{2}{x-1}$



$y = -\frac{2}{x-1}$
 przecięcie z osią OY
 $y = -\frac{2}{0-1} = 2$

$f(x) = u$:
 2 rozwiązania dla $u \in (-\infty, 0) \cup (2, \infty)$
 0 rozwiązań dla $u \in (0, 2)$
 1 rozwiązanie dla $u = 2$

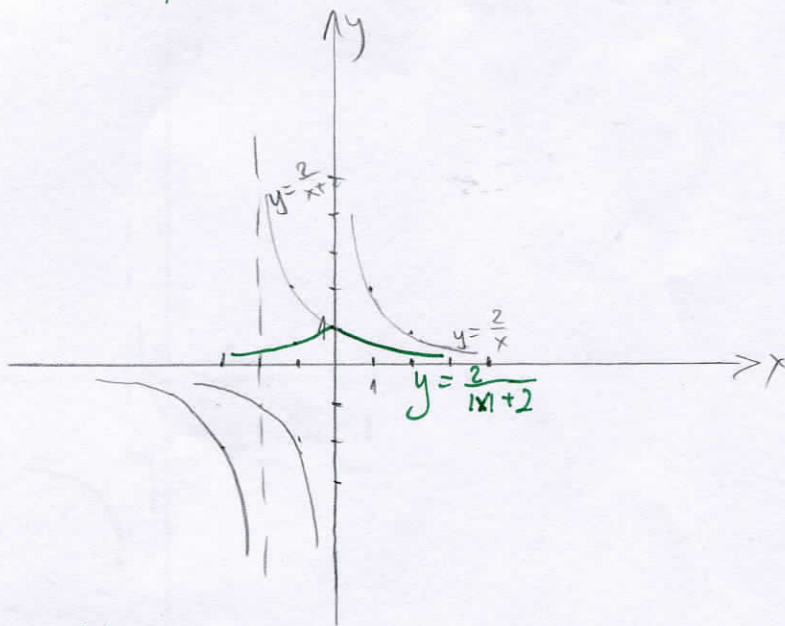
$g(u) = \begin{cases} 0, & u \in (0, 2) \\ 1, & u = 2 \\ 2, & u \in (-\infty, 0) \cup (2, \infty) \end{cases}$



$$c) f(x) = \frac{2}{|x|+2} \quad D = \mathbb{R}$$

$$\forall \begin{matrix} -x \in D \\ x \in D \end{matrix} \wedge f(-x) = \frac{2}{|-x|+2} = \frac{2}{|x|+2} = f(x) \Rightarrow f. \text{ parzysta}$$

$$f(x) = \frac{2}{x+1/24} \xrightarrow{[-2,0]} f(x) = \frac{2}{x-(-2)} = \frac{2}{x+2} \quad \#$$



$$f(x) = u:$$

0 rozwiązań dla $u \in (-\infty, 0) \cup (1, \infty)$

2 rozwiązania dla $u \in (0, 1)$

1 rozwiązanie dla $u = 1$

$$g(u) = \begin{cases} 0, & u \in (-\infty, 0) \cup (1, \infty) \\ 1, & u \in (0, 1) \cup u = 1 \\ 2, & u \in (0, 1) \end{cases}$$

