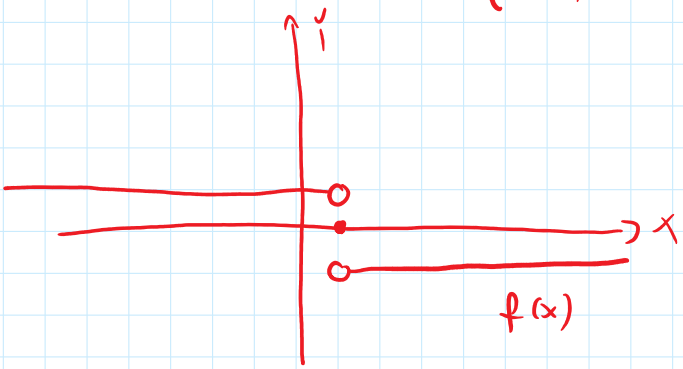
4.107. Naszkicuj wykres funkcji f, jeśli:

a) $f(x)=\operatorname{sgn}(3x+9)$ b) $f(x)=\operatorname{sgn}\left(-\frac{1}{2}x+1\right)$ c) $f(x)=-\operatorname{sgn}(x-1)$

$y=\operatorname{sgn}(x)=\begin{cases}1 & \text{gdy } x\in\mathbb{R}_+\\ 0 & \text{gdy } x=0\\ -1 & \text{gdy } x\in\mathbb{R}_-\end{cases}$

$y=-\operatorname{sgn}(x-1)=\begin{cases}-1 & \text{dla } x-1>0\\ 0 & \text{dla } x-1=0\\ -(-1) & \text{dla } x-1<0\end{cases}=\begin{cases}-1 & ;\ x>1\\ 0 & ;\ x=1\\ 1 & ;\ x<1\end{cases}$

$f(x)=\begin{cases}-1 & x>1\\ 0 & x=1\\ 1 & x<1\end{cases}$



4.108. Korzystając z definicji wartości bezwzględnej, napisz wzór funkcji f bez znaku wartości bezwzględnej. Następnie naszkicuj wykres tej funkcji.

a) $f(x)=|x|-2$ b) $f(x)=-|3x|$

c) $f(x)=|x+3|$ d) $f(x)=-|x+1|+5$

e) $f(x)=|3-x|+x$ f) $f(x)=|x+4|-x$

$|x|=\begin{cases}x & ;\ x\geq 0\\ -x & ;\ x<0\end{cases}$

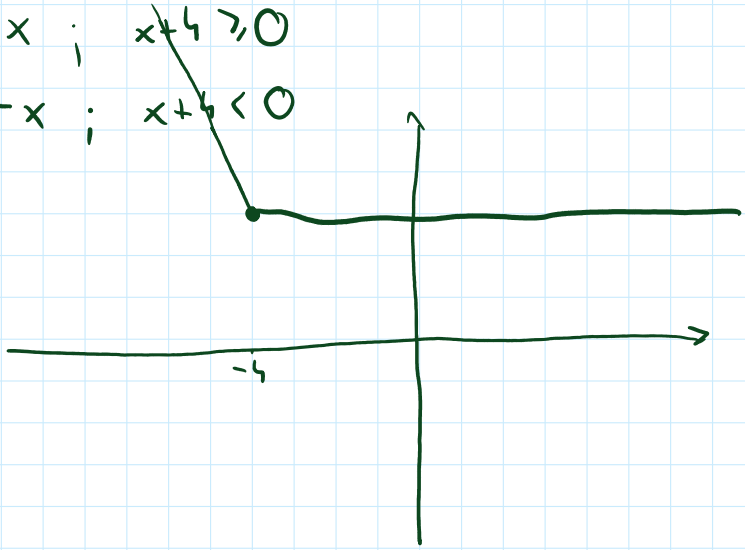
$f(x)=|x+4|-x=\begin{cases}x+4-x & ;\ x+4\geq 0\\ -x-4-x & ;\ x+4<0\end{cases}$

$f(x)=\begin{cases}4 & ;\ x\geq -4\\ -2x-4 & ;\ x<-4\end{cases}$

$(-4,4)$

$(-6,8)$

$(-5,6)$



4.110. Naszkicuj wykres funkcji f, jeśli:

a) $f(x) = \max(-x+1, 2x+7)$

b) $f(x) = \max\left(\frac{2}{3}x, -\frac{1}{2}x\right)$

c) $f(x) = \min\left(2-x, \frac{1}{3}x-2\right)$

d) $f(x) = \max(5x+3, -2)$

e) $f(x) = \min\left(1, -\frac{x}{3}\right)$

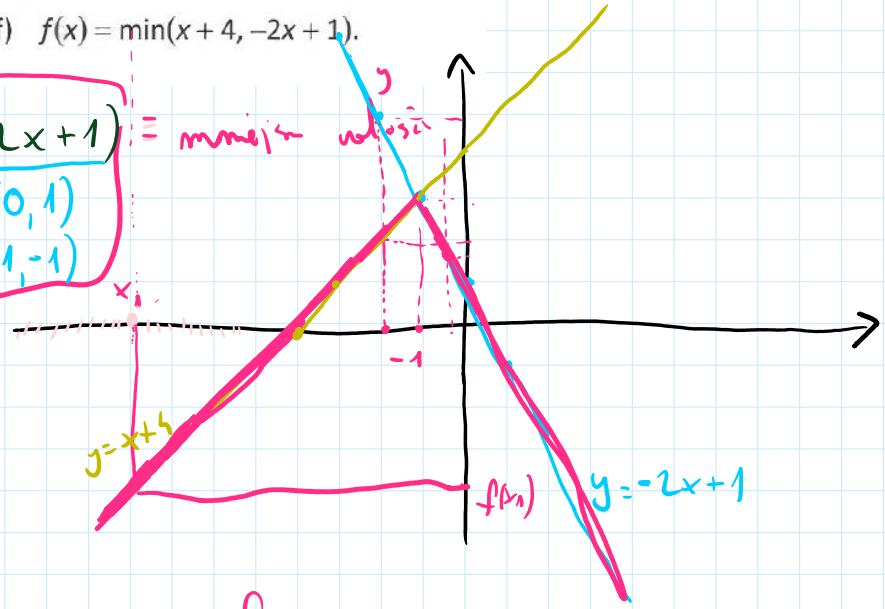
f) $f(x) = \min(x+4, -2x+1)$.

$\min\{a,b\} = \begin{cases} a & a \le b \\ b & a > b \end{cases}$

$\max\{a,b\} = \begin{cases} a & a \ge b \\ b & a < b \end{cases}$

$f(x) = \min(x+4; -2x+1)$ = mniejsza wartość

$x+4$: $(-4,0)$, $(-3,1)$ — $-2x+1$: $(0,1)$, $(1,-1)$



$\min\{-\pi; \sqrt{2}; 2\} = -\pi$

$$f(x) = \min(x+4; -2x+1) = \begin{cases} x+4 & \text{gdy } x+4 \le -2x+1 \\ -2x+1 & \text{gdy } x+4 > -2x+1 \end{cases}$$

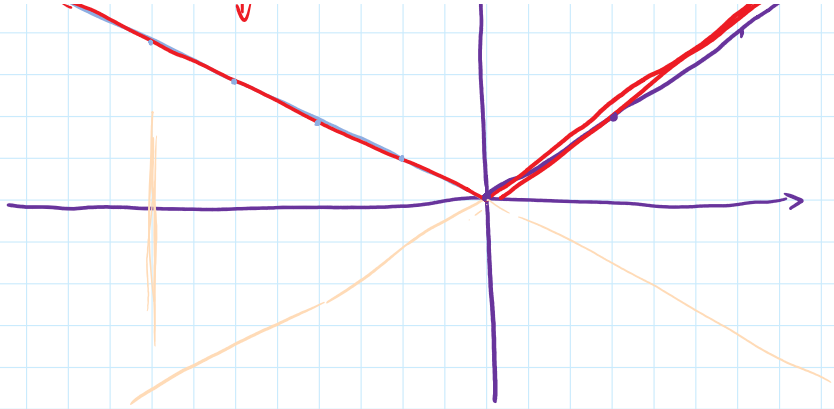
$x+4 \le -2x+1$
$3x \le -3$
$x \le -1$

$$f(x) = \min(x+4; -2x+1) = \begin{cases} x+4 & x \le -1 \\ -2x+1 & x > -1 \end{cases}$$

b) $f(x) = \max\left(\underbrace{\frac{2}{3}x}_{a}, \underbrace{-\frac{1}{2}x}_{b}\right) = \begin{cases} \frac{2}{3}x & \text{dla } \frac{2}{3}x \ge -\frac{1}{2}x \\ -\frac{1}{2}x & \text{dla } \frac{2}{3}x < -\frac{1}{2}x \end{cases}$

$4x \ge -3x$
$7x \ge 0$
$x \ge 0$

$$f(x) = \begin{cases} \frac{2}{3}x & \text{dla } x \ge 0 \quad (0,0)(3,2) \\ -\frac{1}{2}x & \text{dla } x < 0 \quad (0,0)(-2,1) \end{cases}$$



4.111. Naszkicuj wykres funkcji f, jeśli:

a) $f(x) = [x]$, gdzie $x \in \langle 0, 4)$

b) $f(x) = -2[x]$, gdzie $x \in \langle -1, 3\rangle$

c) $f(x) = [x + 2]$, gdzie $x \in \langle -6, 1)$

d) $f(x) = -[x] + 3$, gdzie $x \in \langle -2, 5\rangle$.

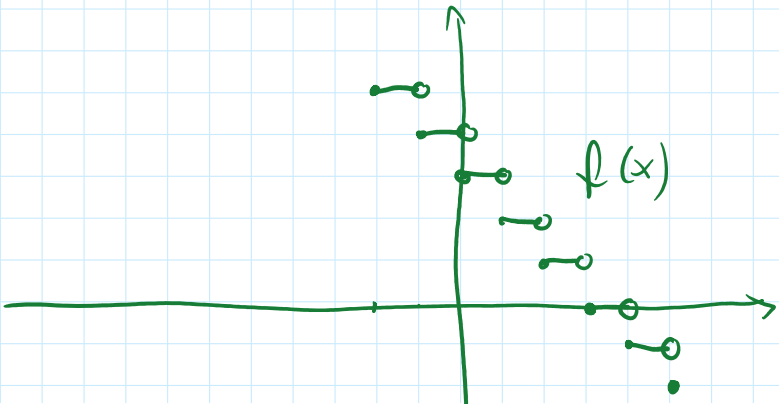
$f(x) = -[x] + 3 =$

$\mathcal{D}: x \in \langle -2, 5\rangle$

$$\begin{cases} -(-2) + 3 = 5 & x \in \langle -2, -1) \\ -(-1) + 3 = 4 & x \in \langle -1; 0) \\ -0 + 3 = 3 & x \in \langle 0, 1) \\ -1 + 3 = 2 & x \in \langle 1, 2) \\ -2 + 3 = 1 & x \in \langle 2, 3) \\ -3 + 3 = 0 & x \in \langle 3, 4) \\ -4 + 3 = -1 & x \in \langle 4, 5) \\ -5 + 3 = -2 & x \in \{5\} \end{cases}$$

$\Rightarrow$ $[-1,5] = -2$, $[-1,9] = -2$, $[-1,1] = -2$

$[5] = 5$



4.107 – 4.113