ITSEISARVO

Määritelmä

esim a) $|3| = 3$

b) $|-5| = -(-5) = 5$

$$|x| = \begin{cases} x, & \text{kun } x \geq 0 \\ -x, & \text{kun } x < 0 \end{cases}$$

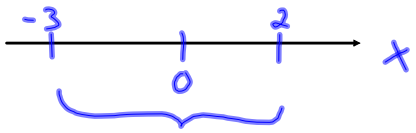
määritelmä

algebrallisesti

esim 2 1a) $|2-\sqrt{7}| = -(2-\sqrt{7})$

($2-\sqrt{7} < 0$) $= \sqrt{7}-2$

esim 3 2a) -3 ja 2



$2-(-3) = 2+3 = 5$

esim 4

4a) $|x-1| = 3$

$\Leftrightarrow x-1 = 3$ tai $x-1 = -$

$x = 4$ tai $x = -2$

Yl: $|4-1| = 3$

$|-2-1| = |-3| = -(-3) = 3$

esim 5. Erittele lauseke $|2x-6|$ ilman

a) itseisarvomerkkejä.

b) Piirrä funktio $f(x) = |2x-6|$.

CAS

abs

Ratk.

a) $|2x-6| = \begin{cases} 2x-6, & x \geq 3 \\ -(2x-6), & x < 3 \end{cases}$

n-pk

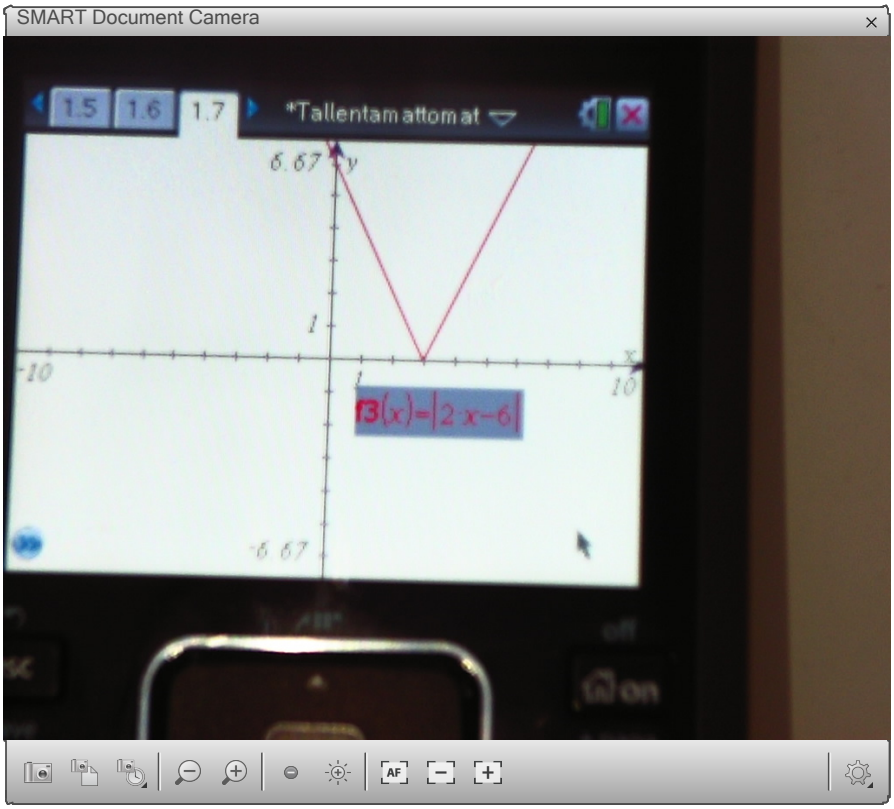
nollakohdat:

$2x-6 = 0$

$2x = 6 \mid :2$

$x = 3$

$= \begin{cases} 2x-6, & x \geq 3 \\ -2x+6, & x < 3 \end{cases}$

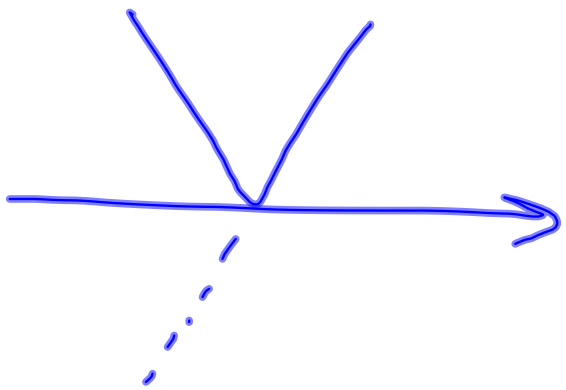

SMART Document Camera
1.5
1.6
1.7
*Tallentam attom at
6.67
y
1
-10
10
x
f3(x)=|2·x-6|
-6.67

Coim 4. $|x| = -5$

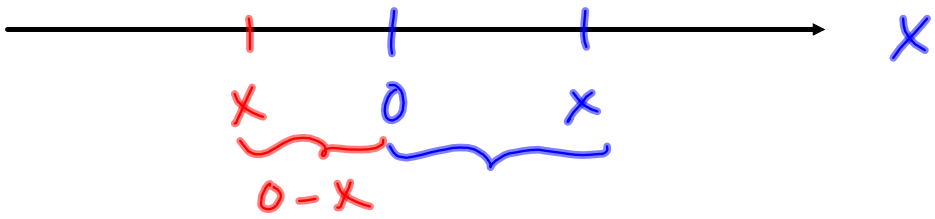
Coim 5 $|7x| = 28$

$f(x) = |$ $|$

$y =$



Itseisarvon määritelmä geometrisesti



$|x| = x - 0 = x$

$|x| = 0 - x = -x$

cont. Esitä

$$-x|10-5x|+5x+1$$

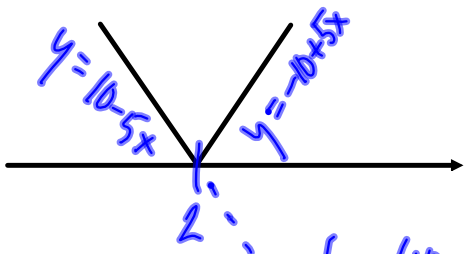
ilman itseisarvomerkkejä.

Ratk. $|10-5x|$

nollakohta: $10-5x=0$

$\vdots$

$x=2$



$$|10-5x| = \begin{cases} -(10-5x), & \text{kun } x>2 \\ 10-5x, & \text{kun } x\le 2 \end{cases}$$

$$= \begin{cases} -10+5x, & \text{kun } x>2 \\ 10-5x, & \text{kun } x\le 2 \end{cases}$$

II tapa taulukoimalla s. 18

Huom! laskusäännöt s. 8

$$-x|10-5x|+5x+1 = \begin{cases} -x(-10+5x)+5x+1, & x>2 \\ -x(10-5x)+5x+1, & x\le 2 \end{cases}$$

$$= \begin{cases} 10x-5x^2+5x+1, & x>2 \\ -10x+5x^2+5x+1, & x\le 2 \end{cases}$$

$$= \begin{cases} -5x^2+15x+1, & x>2 \\ 5x^2-5x+1, & x\le 2 \end{cases}$$

ITSEISARVOYHTÄLÖ

$$|f(x)| = a \Leftrightarrow f(x) = \pm a$$

Esim. Ratkaise yhtälö

$$|9x+4| = \underbrace{10}_{\geq 0}$$

TAPA 1

$9x+4 = 10$ tai $9x+4 = -10$

$9x = 6 \,|:9$ tai $9x = -14 \,|:9$

$x = \frac{2}{3}$ tai $x = \frac{-14}{9}$

II tapa $|9x+4| = 10$ $|\ |^2$ molemmat puolet ei-negat.

$\underbrace{|9x+4|}_{\geq 0} = \underbrace{10}_{>0}$

$|9x+4|^2 = 10^2$

$(9x+4)^2 = 10^2$

$\vdots$

$81x^2 + 72x - 84 = 0$

$\vdots$

Laskimella: MENU 3 1 solve($=0$, -1, x)

$x = \frac{2}{3}$ tai $x = -\frac{14}{9}$

esim 3 $|x+2| = 3x-2$

I tapa $|f(x)| = g(x)$

$f(x) = \pm g(x)$ Huom! $g(x) \geq 0$

II tapa molemmat puolet ei-negat.

I tapa a) $3x-2 \geq 0$ (mj)

$3x \geq 2 \ |:3$

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

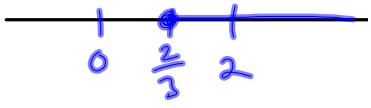
b) $x+2 = 3x-2$ tai $x+2 = -(3x-2)$

$x-3x = -2-2$ tai $x+2 = -3x+2$

$-2x = -4 \ |:(-2)$ tai $x+3x = 2-2$

$x = 2$ tai $4x = 0$

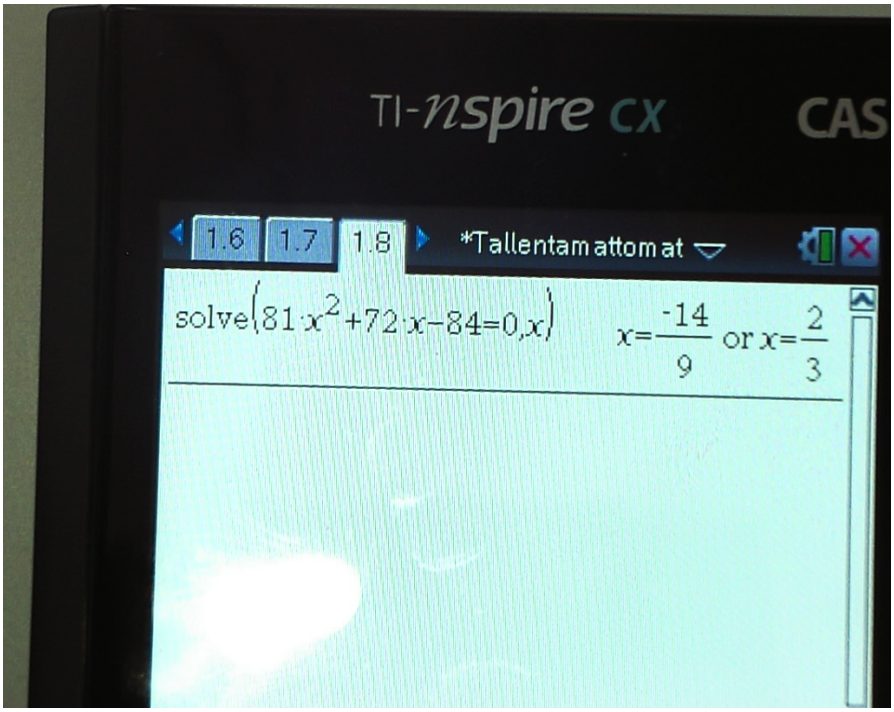
$\in$ mj $x = 0 \notin$ mj



(Huom! Verrataan saatuja vastauksia määrittelyjoukkoon!)

V: $x = 2$

II tapa $|\ \ | = \ \ |(\ )^2$ mj: $x \geq \frac{2}{3}$


TI-nspire CX
CAS
1.6
1.7
1.8
*Tallentamattomat
solve(81·x^2+72·x−84=0,x)
x=-14/9 or x=2/3

5.17

$|f(x)| = |g(x)|$

≥ 0

1 tapa $\quad f(x) = \pm g(x)$

2 tapa $\quad |f(x)| = |g(x)| \quad |\,(\,)^2$

$\geq 0 \qquad \geq 0$

Lause: Jos $a \geq 0$ ja $b \geq 0$

$a = b \quad |\,(\,)^2$

$a^2 = b^2$

esim 26a

$|3x-2| = |4+3x| \quad |\,(\,)^2$

$\geq 0 \qquad \geq 0$

$(3x-2)^2 = (4+3x)^2$

$\vdots$

$-36x - 12 = 0$

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

V: $x = -\frac{1}{3}$