

Mechants bons problèmes : Les Fonctions RÉELLES

#1 a) $\text{dom } f = [-8, 2]$ b) $\text{Ima } f = [-4, 5, 3]$ c) zéros: $x = -6, 5$
 $x = -4$
 $x = 1$

d) Max absolu $y = 3$ Min absolu $y = -4, 5$

e) Max relatif $y = 2, 5$ Min relatif $y = -4$

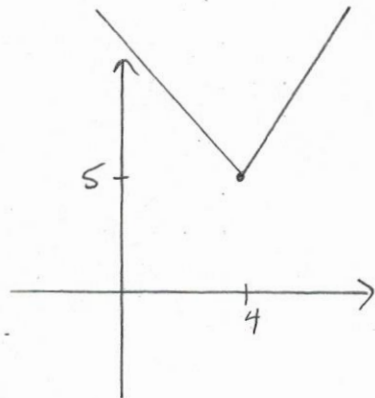
#2 a) $a = 3, b = -2, h = 5, k = 7$ b) $a = 6, b = 0, 5, h = -4, k = -9$

#3 a) $(g \circ f)(x) = g(f(x)) = 2(-3x) - 3 = -6x - 3$

b) $(h \circ g)(x) = h(g(x)) = -6(2x - 3) + 2 = -12x + 20$

#4 $y = \frac{2}{3} |-3(x-4)| + 5$

$y = 2|x-4| + 5$



#5 a) $|x-4| - 1 = -2x + 5$

$|x-4| = -2x + 6$

$\begin{matrix} \oplus & \ominus \end{matrix}$

$x-4 \geq 0$

$x \geq 4$

$x-4 < 0$

$x < 4$

$x-4 = -2x+6$

$3x = 10$

$x = \frac{10}{3}$

$x-4 = 2x-6$

$-x = -2$

$x = 2$

b) $2|x-2| + 2x = 0$

$2|x-2| = -2x$

$|x-2| = -x$

$\begin{matrix} \oplus & \ominus \end{matrix}$

$x-2 \geq 0$

$x \geq 2$

$x-2 < 0$

$x < 2$

$x-2 = -x$

$2x = 2$

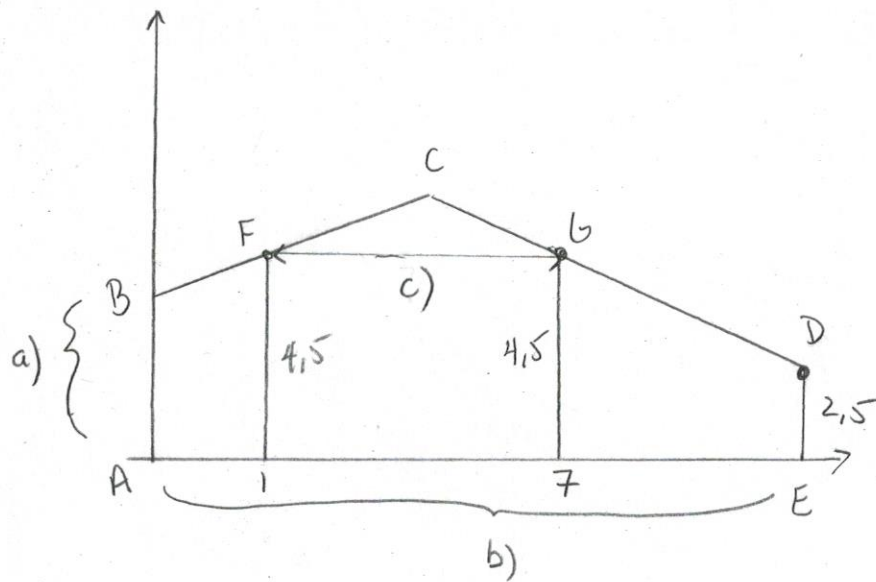
$x = 1$

$x-2 = x$

$0 \neq 2$

$\emptyset$

#6



a) Ordonnée à l'origine $x=0$ $y=?$ $y = -\frac{1}{2}|0-4|+6$ $y = \underline{4m}$

b) $x_D=?$ $2,5 = -\frac{1}{2}|x-4|+6$

$y_D=2,5$ $7 = |x-4|$



$x-4 > 0$

$x-4 < 0$

$x > 4$

$x < 4$

$x-4 = 7$

$x-4 = -7$

$x = 11$

$x = -3$

rep: 11m

c) $x=?$ sig = 4,5

$4,5 = -\frac{1}{2}|x-4|+6$

$-1,5 = -\frac{1}{2}|x-4|$

$3 = |x-4|$



$x-4 > 0$

$x-4 < 0$

$x > 4$

$x < 4$

$x-4 = 3$

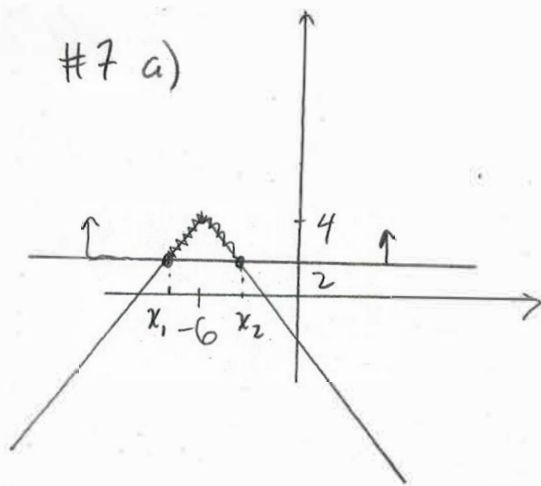
$x-4 = -3$

$x = 7$

$x = 1$

6m

#7 a)



$$x = ? \text{ si } y = 2$$

$$2 = -2|x+6| + 4$$

$$1 = |x+6|$$

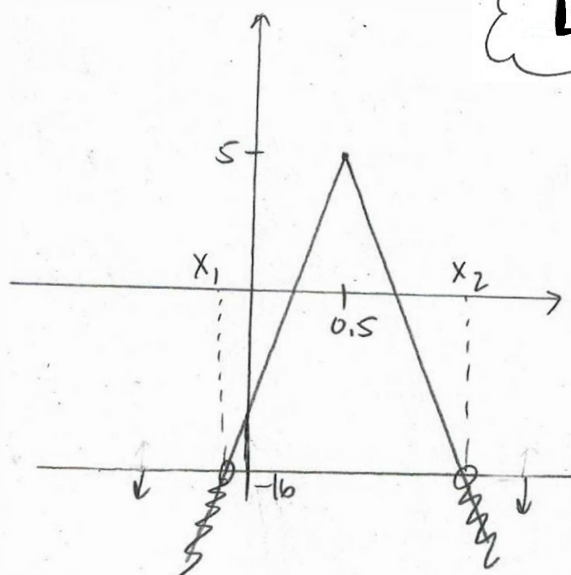
$$\begin{array}{l} \oplus \quad \wedge \quad \ominus \\ x \geq -6 \quad x < -6 \end{array}$$

$$x+6 = 1 \quad x+6 = -1$$

$$x = -5 \quad x = -7$$

$$[-7, -5]$$

b)



$$y = -3|2(x-0.5)| + 5$$

$$y = -6|x-0.5| + 5$$

$$x = ? \text{ si } y = -16$$

$$-16 = -6|x-0.5| + 5$$

$$3.5 = |x-0.5|$$

$$\begin{array}{l} \oplus \quad \wedge \quad \ominus \\ x \geq 0.5 \quad x < 0.5 \end{array}$$

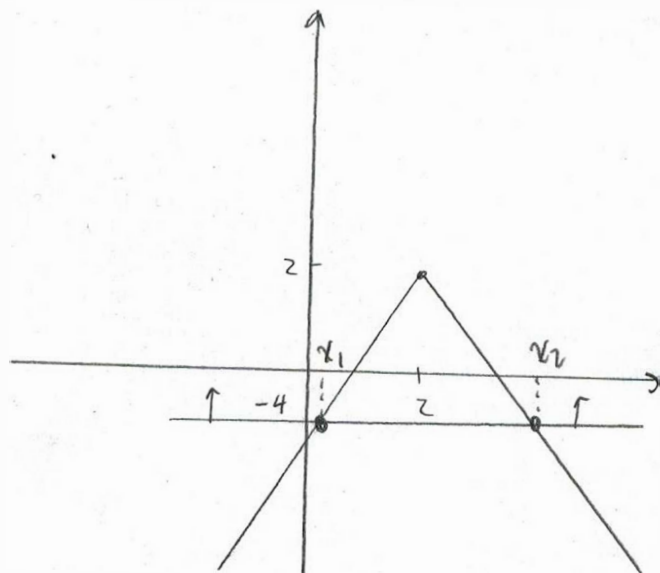
$$x-0.5 = 3.5 \quad x-0.5 = -3.5$$

$$x = 4 \quad x = -3$$

$$(-\infty, -3] \cup [4, +\infty)$$

$$c) y = -2|2(x-2)| + 2$$

$$y = -4|x-2| + 2$$



$$x = ? \text{ si } y = -4$$

$$-4 = -4|x-2| + 2$$

$$1.5 = |x-2|$$

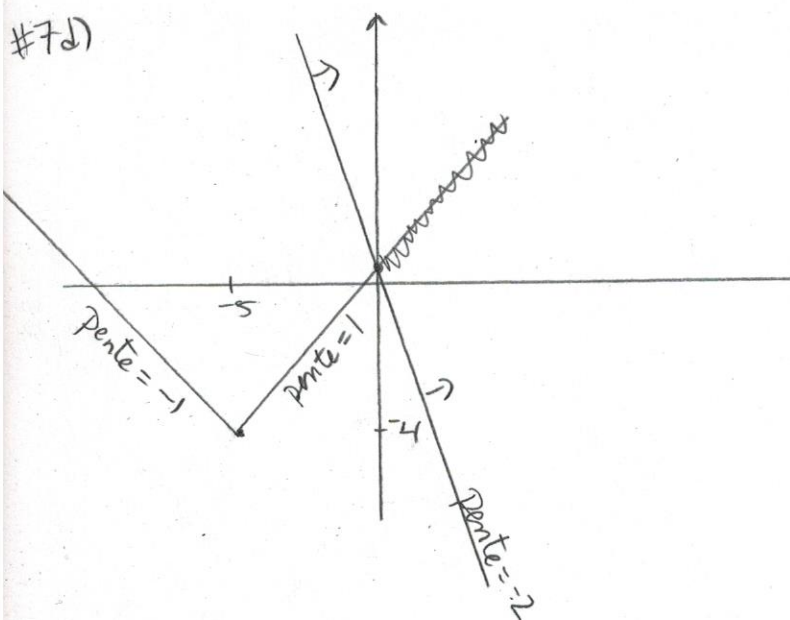
$$\begin{array}{l} \oplus \quad \wedge \quad \ominus \\ x \geq 2 \quad x < 2 \end{array}$$

$$x-2 = 1.5 \quad x-2 = -1.5$$

$$x = 3.5 \quad x = 0.5$$

$$[0.5, 3.5]$$

#7d)



$$|x+5| - 4 = -2x + 1$$

$$|x+5| = -2x + 5$$

$$\begin{array}{cc} \oplus & \ominus \\ x \geq -5 & x < -5 \end{array}$$

$$x+5 = -2x+5$$

$$3x = 0$$

$$x = 0$$

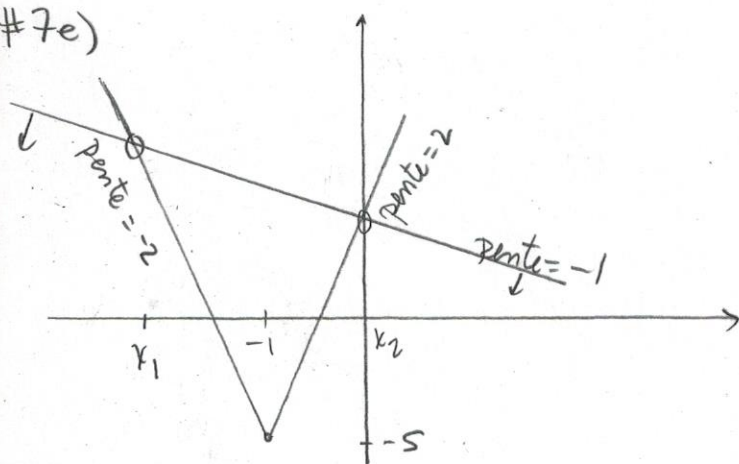
$$x+5 = 2x-5$$

$$-x = -10$$

$$x = 10$$

$$[0, +\infty)$$

#7e)



$$2|x+1| - 5 = -x - 3$$

$$2|x+1| = -x + 2$$

$$|x+1| = -0,5x + 1$$

$$\begin{array}{cc} \oplus & \ominus \\ x \geq -1 & x < -1 \end{array}$$

$$x+1 = -0,5x+1$$

$$1,5x = 0$$

$$x = 0$$

$$x+1 = 0,5x-1$$

$$0,5x = -2$$

$$x = -4$$

$$[-4, 0[$$

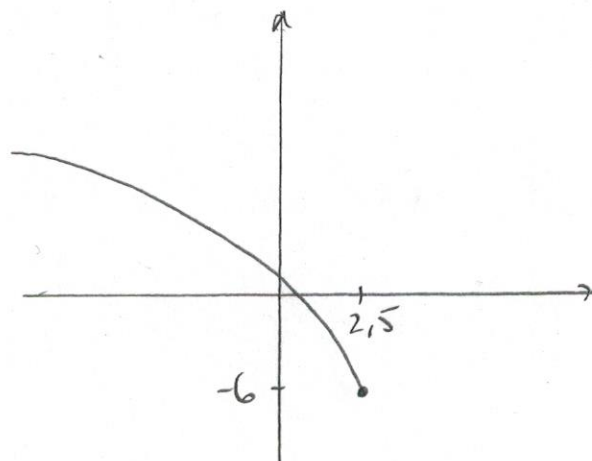
$$\#8 \quad y = 2\sqrt{-2x+5} - 6$$

$$a) \quad y = 2\sqrt{-2(x-2,5)} - 6$$

$$b) \quad a=2 \quad b=-2 \quad h=2,5 \quad k=-6$$

$$c) \quad \text{dom } f = [-\infty, 2,5]$$

$$\text{Ima } f = [-6, +\infty)$$



#9 a) $2\sqrt{x+1} - 1 = 4x - 9$

$2\sqrt{x+1} = 4x - 8$

$\sqrt{x+1} = 2x - 4$ $\begin{array}{l|l} x+1 \geq 0 & 2x-4 \geq 0 \\ x \geq -1 & x \geq 2 \end{array}$

$x+1 = (2x-4)^2$

$x+1 = 4x^2 - 16x + 16$

$0 = 4x^2 - 17x + 15$

$\frac{17 \pm \sqrt{289 - 240}}{8}$

$x_1 = 3$

$x_2 = 1,25$ can

b) $4\sqrt{2x-3} = 12 - x$

$\sqrt{2x-3} = 3 - 0,25x$ $\begin{array}{l|l} 2x-3 \geq 0 & 3-0,25x \geq 0 \\ x \geq 1,5 & -0,25x \geq -3 \\ & x \leq 12 \end{array}$

$2x-3 = (3-0,25x)^2$

$2x-3 = 9 - 1,5x + 0,0625x^2$

$0 = 0,0625x^2 - 3,5x + 12$

$\frac{3,5 \pm \sqrt{12,25 - 3}}{0,125}$

$x_1 = 52,33$ à rejeter

$x_2 = 3,67$

c) $3\sqrt{-3x+6} - 5 = 0,5x - 1$

$3\sqrt{-3x+6} = 0,5x + 4$

$\sqrt{-3x+6} = \frac{0,5x+4}{3}$

$\sqrt{-3x+6} = \left(\frac{0,5x+4}{3}\right)^2$

$-3x+6 = \frac{0,25x^2 + 4x + 16}{9}$

$-27x + 54 = 0,25x^2 + 4x + 16$

$0 = 0,25x^2 + 31x - 38$

$\frac{-31 \pm \sqrt{961 + 38}}{0,5}$

$x_1 = 1,21$

$x_2 = -125,21$ can

10 $A_1(t) = A_2(t)$

$$18t + 300 = 90\sqrt{t-4} + 300$$

$$18t = 90\sqrt{t-4}$$

$$0,2t = \sqrt{t-4} \quad \begin{array}{l|l} t-4 \geq 0 & 0,2t \geq 0 \\ t \geq 4 & t \geq 0 \end{array}$$

$$0,04t^2 = t - 4$$

$$0,04t^2 - t + 4 = 0$$

$$\frac{t \pm \sqrt{1 - 0,64}}{0,08} \quad \begin{array}{l} x_1 = 20 \\ x_2 = 5 \end{array}$$

À 5 min, et à 20 min.

11 a) $y = 4\sqrt{9x+27} + 6$

$$x = 4\sqrt{9y+27} + 6$$

$$\frac{x-6}{4} = \sqrt{9y+27} \quad \begin{array}{l|l} \frac{x-6}{4} \geq 0 & 9y+27 \geq 0 \\ x \geq 6 & y \geq -3 \end{array}$$

$$\frac{(x-6)^2}{16} = 9y+27$$

$$\frac{(x-6)^2}{16} - 27 = \frac{9y}{9}$$

$$\boxed{\frac{(x-6)^2}{144} - 3 = y}$$

b) $x = 4\sqrt{-(y-2)} - 8$

$$\frac{x+8}{4} = \sqrt{-(y-2)} \quad \begin{array}{l|l} \frac{x+8}{4} \geq 0 & -(y-2) \geq 0 \\ x \geq -8 & y-2 \leq 0 \\ & y \leq 2 \end{array}$$

$$\frac{(x+8)^2}{16} = -(y-2)$$

$$\frac{(x+8)^2}{-16} = y-2 \Rightarrow \boxed{\frac{(x+8)^2}{-16} + 2 = y}$$

#12 a) $y = \frac{300}{x} + 8$ x : nb d'élèves
 y : coût/élève

b) $x=0$ $y=8$

c) coût minimum = $k = 8 \$$

#13 a) x : altitude en km
 y : pression en kpa

$x=0$ $y=?$ $y = \frac{530}{0+5} = \underline{\underline{106 \text{ kpa}}}$

b) Si $y = \frac{106}{2} = 53$ $x=?$

$53 = \frac{530}{x+5}$

$53(x+5) = 530$

$53x + 265 = 530$

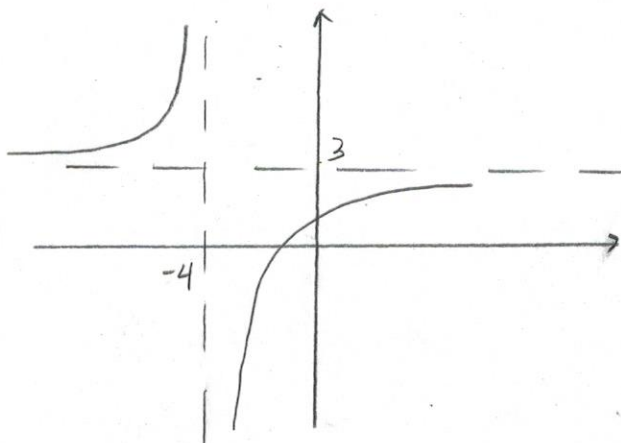
$53x = 265$

$x = 5 \text{ km}$

#14 $y = \frac{3x-5}{x+4}$

$\frac{3x-5}{3x+12} \quad \frac{1x+4}{3}$
 -17

$y = \frac{-17}{x+4} + 3$



dom $f = \mathbb{R} \setminus \{-4\}$

Ima $f = \mathbb{R} \setminus \{3\}$

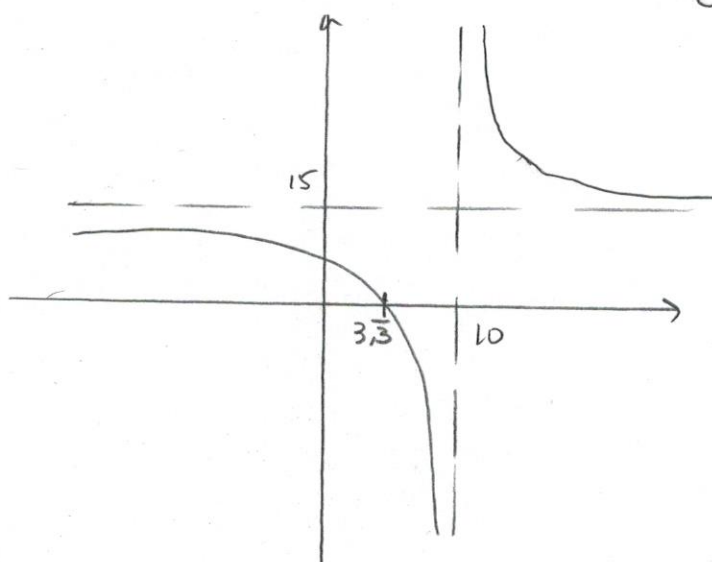
D

#15

$$f(x) = \frac{15x - 50}{x - 10}$$

$$\begin{array}{r} 15x - 50 \quad | \quad x - 10 \\ \underline{15x - 150} \quad | \quad 15 \\ 100 \end{array}$$

$$y = \frac{100}{x - 10} + 15$$



$$a) \text{dom } f = \mathbb{R} \setminus \{10\}$$

$$b) \text{Ima } f = \mathbb{R} \setminus \{15\}$$

$$c) 0 = \frac{15x - 50}{x - 10}$$

$$0 = 15x - 50$$

$$3,3 = x$$

d) Décroissante sur son domaine

$$e) f(x) > 0 \quad -\infty, 3,3[\cup]10, +\infty$$

$$f(x) < 0 \quad]3,3, 10[$$

$$f) x = 10 \quad y = 15$$

$$\#16 a) x = 0 \quad y = ? \quad Q = \frac{5(0) + 150}{0 + 5} = 30 \text{ milliards} = \text{qte initiale}$$

$$1) 15 = \frac{5x + 150}{x + 5}$$

$$15x + 75 = 5x + 150$$

$$10x = 75$$

$$x = 7,5 \text{ heures}$$

$$2) 7,5 = \frac{5x + 150}{x + 5}$$

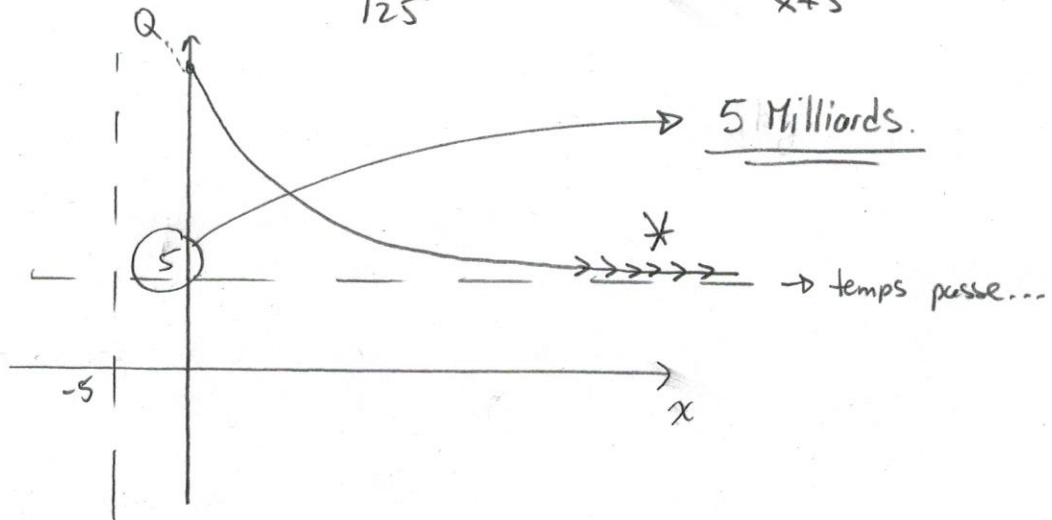
$$7,5x + 37,5 = 5x + 150$$

$$2,5x = 112,5$$

$$x = 45 \text{ heures}$$

b) Demandez :

#16b) Méthode 1: Graphique $\frac{5x+150}{5x+25} \cdot \frac{x+5}{5} \quad y = \frac{125}{x+5} + 5$



SANS DESSIN

Méthode 2: $\lim_{x \rightarrow +\infty} \frac{125}{x+5} + 5 = \frac{125}{+\infty + 5} + 5 = \frac{125}{+\infty} + 5 = 0 + 5 = \underline{\underline{5 \text{ Millions}}}$

Méthode 3: $\lim_{x \rightarrow +\infty} \frac{5x+150}{x+5}$

$\lim_{x \rightarrow +\infty} \frac{x \cdot (5 + \frac{150}{x})}{x \cdot (1 + \frac{5}{x})} = \text{Si } x \neq 0$

$\lim_{x \rightarrow +\infty} \frac{5 + \frac{150}{x}}{1 + \frac{5}{x}} = \frac{5 + \frac{150}{+\infty}}{1 + \frac{5}{+\infty}} = \frac{5+0}{1+0} = \underline{\underline{5 \text{ Millions}}}$

$$\#17 \quad a) \quad |-5+3| = |-5|+|3| \quad (F)$$

$$|-2| = 5+3$$

$$2 \neq 8$$

$$b) \quad \left| \frac{-15}{3} \right| = \frac{|-15|}{|3|} \quad (V)$$

$$|-5| = \frac{15}{3}$$

$$5 = 5$$

$$c) \quad |n-1| = |-n+1| \quad (V)$$

$$|n-1| = |-1(n-1)| \quad (MES)$$

$$|n-1| = |-1| |n-1|$$

$$|n-1| = 1 \cdot |n-1|$$

$$|n-1| = |n-1|$$

$$d) \quad -x = \ominus \quad (F) \quad \text{car si } x \text{ est négatif}$$

$$\text{alors } -x = \oplus$$

$$e) \quad |x| = \ominus \quad (F)$$

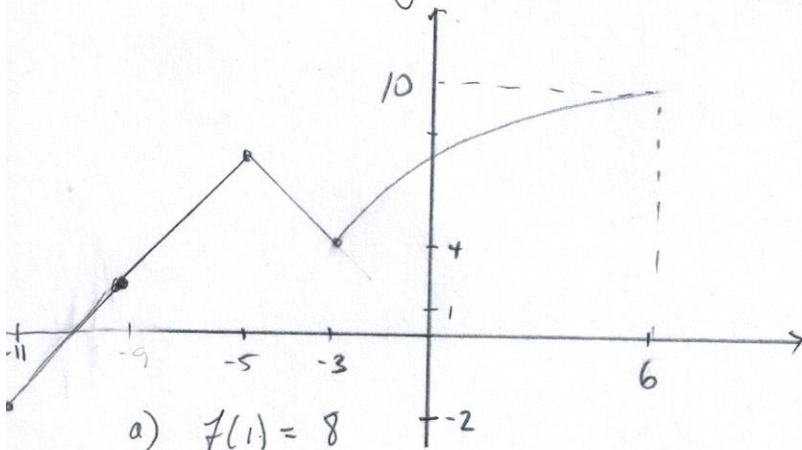
$$\#18 \quad a) \quad a \ominus b \oplus \quad b) \quad a \ominus b \ominus \quad c) \quad a \oplus b \oplus \quad d) \quad a \oplus b \ominus$$

#19

Soit

$$f(x) = \begin{cases} -1,5|x+5|+7 & \text{si } -11 \leq x \leq -3 \\ 2\sqrt{x+3}+4 & \text{si } -3 \leq x \leq 6 \end{cases}$$

e) Représenter graphiquement cette fonction



- a) $f(1) = 8$
- b) $f(-9) = 1$
- c) Quelle est la v.i. $x=0$ $y = 2\sqrt{3}+4 = 7,46...$
- d) $\text{dom } f = [-11, 6]$
- e) Sur quel intervalle est-elle positive?
- f) Trouver le maximum $y=10$

d) Quel est le domaine $[-11, 6]$ b) Quelle est l'Image $[-2, 10]$ a) Quelle est la valeur de $f(1) = 8$ b) " " $f(-9) = 1$

#20

$$f(x) = \begin{cases} \sqrt{x+4} & x \in [-4, 0] \\ -2,5|x-4| + 12 & x \in [0, 10] \end{cases}$$

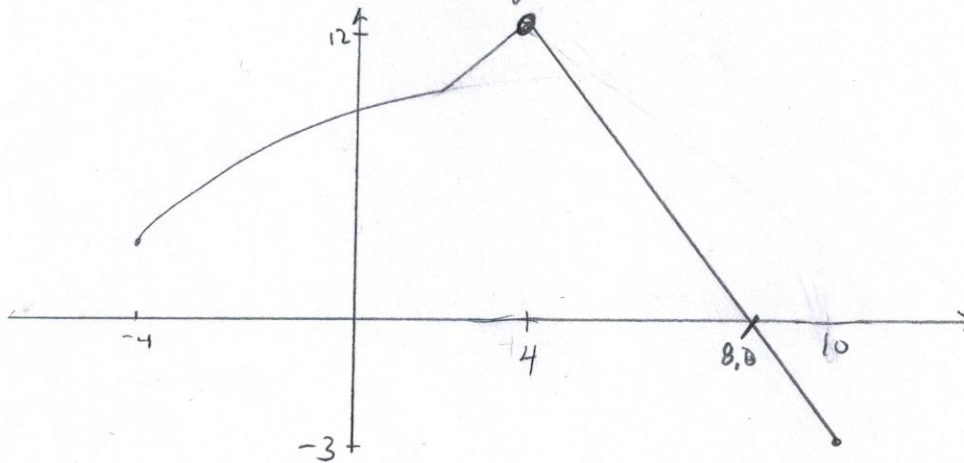
a) $f(-1) = ?$ $(\sqrt{3})$

b) $f(0) = ?$ (2)

c) $f(10) = ?$ (-3)

d) $\text{Dom } f = ?$ $([-4, 10])$

e) Tracez l'esquisse de cette fonction



f) Intervalle positive $[-4, 8,8]$

$$\hookrightarrow 0 = -2,5|x-4| + 12$$

$$4,8 = |x-4|$$

$$x \geq 4 \quad \wedge \quad x < 4$$

$$x-4 = 4,8 \quad x-4 = -4,8$$

$$\underline{x = 8,8} \quad x = 0,8$$

g) Quelle est l'image $[-3, 12]$.

#21

$$f(x) = \begin{cases} \frac{3}{x+1} + 3 & [-4, -1[\\ x+5 & [0, 7] \end{cases}$$

a) $f(-4) = ?$ (2)

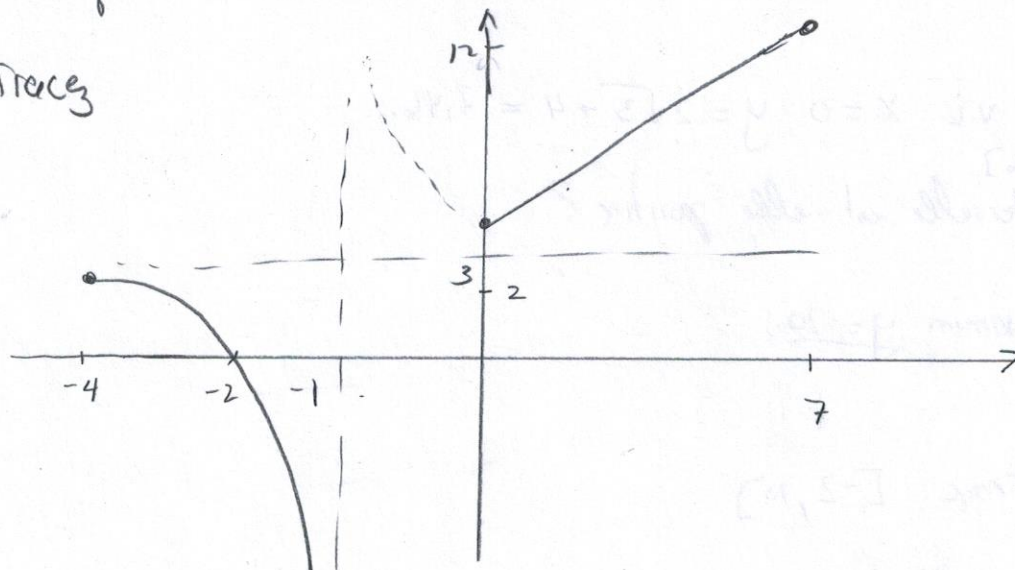
b) $f(6) = ?$ (11)

c) $f(0) = ?$ (5)

d) $f(-0.5) = ?$ ~~7~~

e) $\text{Dom } f = [-4, -1[\cup [0, 7]$

f) Tracez



g) Intervalle $\ominus$ $0 = \frac{3}{x+1} + 3$

$]-2, -1[$

$$-3(x+1) = 3$$

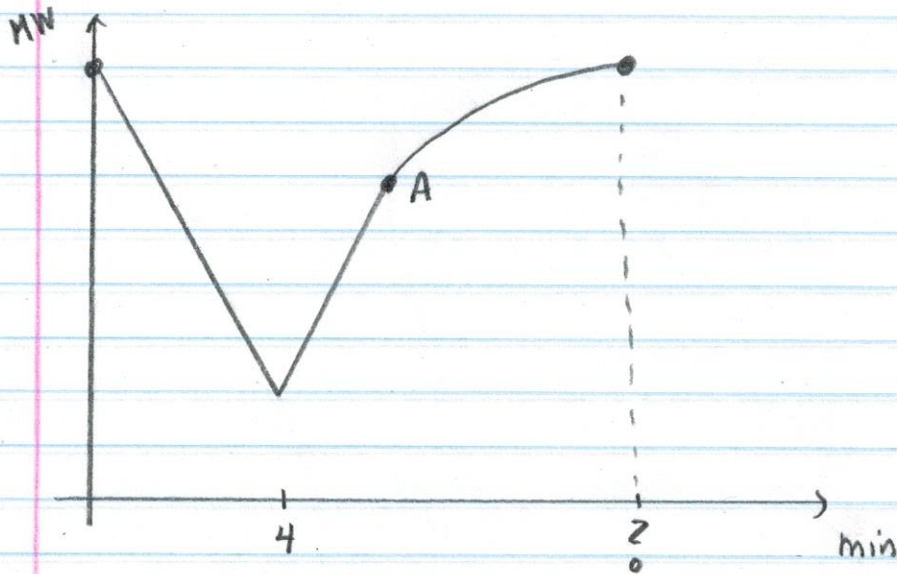
$$x+1 = -1$$

$$x = -2$$

h) Image $-\infty, 3[\cup [5, 12]$

$\hookrightarrow f(0) = 5$

#22



$$1) y_1 = 4|x-4| + k_1, \because (5,8)$$

$$8 = 4|5-4| + k_1$$

$$4 = k_1$$

$$2) y_2 = 1,47\sqrt{x-6,5} + k_2 \quad k_2 = ?$$

$$x_A = 6,5 \quad y_A = ? = k_2$$

$$\left. \begin{array}{l} y_A = 4|6,5-4| + 4 \\ y_A = 10 + 4 = 14 \end{array} \right\} A(6,5; 14)$$

$$3) x=0 \quad y=?$$

$$y = 4|0-4| + 4$$

$$y = 4(4) + 4$$

$$y = 20$$

$$4) x=? \text{ si } y=20$$

$$20 = 1,47\sqrt{x-6,5} + 14$$

$$6 = 1,47\sqrt{x-6,5}$$

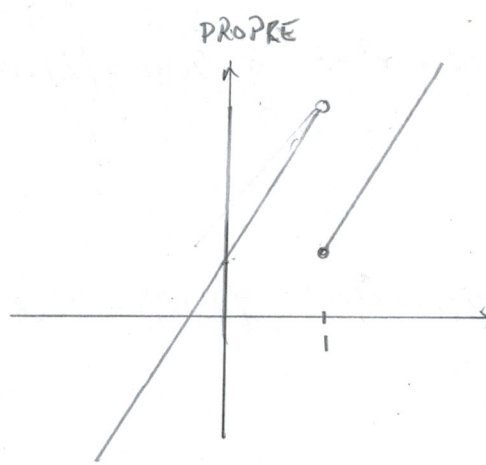
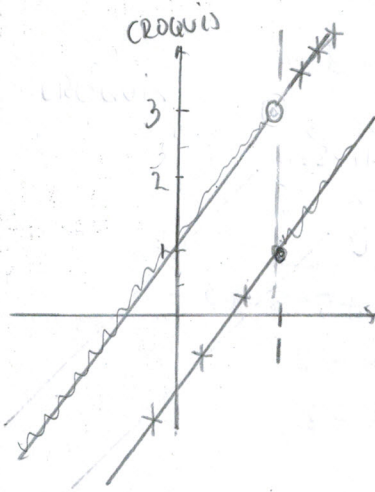
$$4,0816 = \sqrt{x-6,5} \quad x-6,5 \geq 0$$

$$16,6597... = x-6,5 \quad x \geq 6,5$$

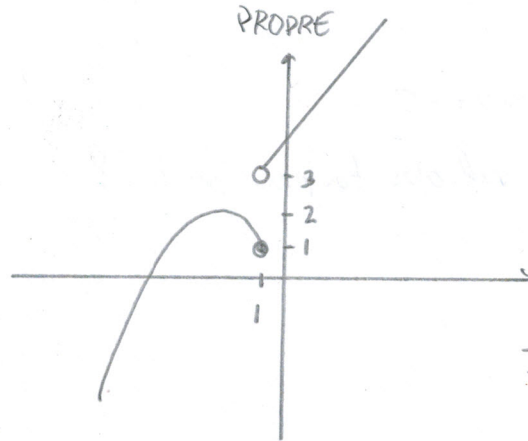
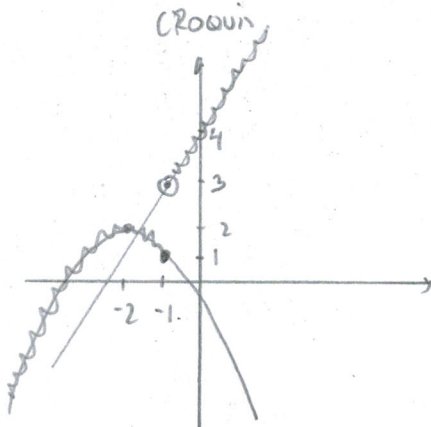
$$23,16 = x$$

23,16 min

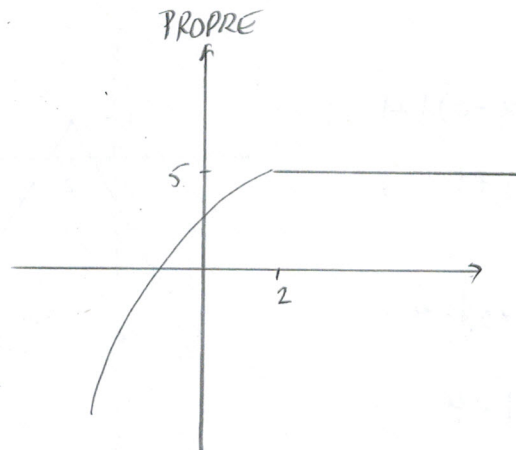
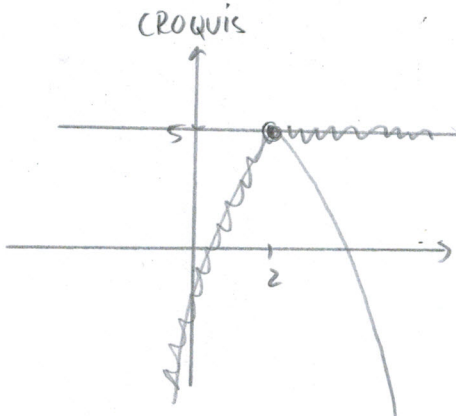
#23

Domaine $\mathbb{R}$.

#24

Ima : $-\infty, 2] \cup]3, +\infty$

#25

continue

#26 $y = -4x^2 - 5$

$x = -4y^2 - 5$

$\frac{x+5}{-4} = y^2$

$\pm \sqrt{\frac{x+5}{-4}} = y$

$$\#27 \quad f(x) = 2x-1 \quad g(x) = x^2-3 \quad g(f(x)) = g(2x-1) = (2x-1)^2-3$$

$$= 4x^2-4x+1-3$$

$$= \underline{\underline{4x^2-4x-2}}$$

$$\#28 \quad f(x) = \sqrt{x-5}+2 \quad g(x) = 4x+5 \quad f(g(x)) = f(4x+5) = \sqrt{4x+5-5}+2$$

$$= \sqrt{4x}+2$$

$$= 2\sqrt{x}+2$$

$$\#29 \quad 4|-10| = 4 \times 10 = 40$$

$$\#30 \quad a) \quad |x| = 5 \quad x = 5 \text{ ou } x = -5$$

b) $|x| = -2$ $\emptyset$ car val. abs. toujours positive!

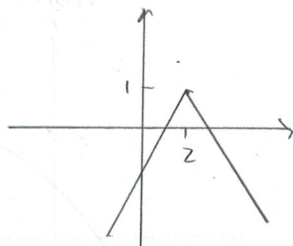
$$\#31 \quad \left| \frac{-6}{2} \right| \equiv \frac{|-6|}{|2|}$$

$$|-3| \equiv \frac{6}{2}$$

$$3 \equiv 3$$

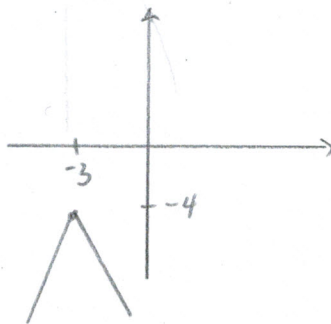
$$\#32 \quad a) \quad y = -2 \overset{3}{|} -3(x-2) | + 1$$

$$y = -6|x-2|+1$$



$$b) \quad y = -\frac{1}{2} \overset{1}{|} -(x+3) | - 4$$

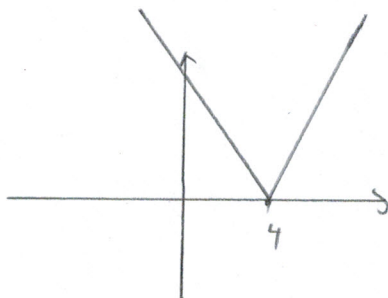
$$y = -\frac{1}{2}|x+3|-4$$



$$\#33 \quad y = |-2x+8|$$

$$y = |-2(x-4)|$$

$$y = 2|x-4|$$



$$\underline{\underline{-\infty, 4]}}$$

#34 a) $2|-x+3|+5=7$

$2|-(x-3)|+5=7$

$2|x-3|+5=7$

$2|x-3|=2$

$|x-3|=1$

$x \geq 3 \quad \oplus \quad x < 3 \quad \ominus$

$x-3=1 \quad x-3=-1$

$\underline{x=4} \quad \underline{x=2}$

b) $4|x+2|+9=5$

$4|x+2|=-4$

$|x+2|=-1$

$\emptyset \quad \downarrow \quad 0$

c) $-\frac{1}{3}|x-2|+5=3$

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

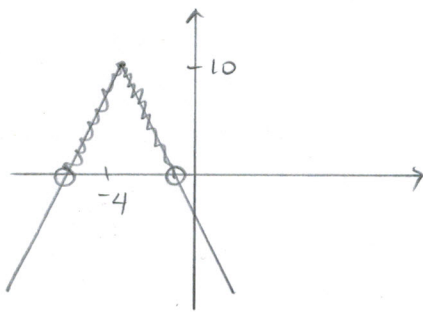
$|x-2|=6$

$x \geq 2 \quad \oplus \quad x < 2 \quad \ominus$

$x-2=6 \quad x-2=-6$

$\underline{x=8} \quad \underline{x=-4}$

#35 $f(x) = -2|x+4|+10$



$-2|x+4|+10=0$

$-2|x+4|=-10$

$|x+4|=5$

$x \geq -4 \quad \oplus \quad x < -4 \quad \ominus$

$x+4=5 \quad x+4=-5$

$x=1 \quad x=-9$

$\underline{\underline{]-9, 1[}}$

#36 $y = a|x-h|+k$

$y = a|x+1|+4 \quad (-2, 1)$

$1 = a|-2+1|+4$

$1 = a|-1|+4$

$1 = a+4$

$-3 = a$

$\underline{y = -3|x+1|+4}$

#37 a) $2\sqrt{9 \times 7} = 2 \cdot 3\sqrt{7} = 6\sqrt{7}$

b) $7\sqrt{720} = 7\sqrt{36 \cdot 20} = 7 \cdot 6\sqrt{20} = 42\sqrt{20} = 42\sqrt{4 \times 5} = 42 \cdot 2 \cdot \sqrt{5} = 84\sqrt{5}$

c) $\sqrt{512} = \sqrt{16 \times 32} = 4\sqrt{32} = 4\sqrt{16 \times 2} = 4 \cdot 4 \cdot \sqrt{2} = 16\sqrt{2}$

d) $4\sqrt{288} = 4\sqrt{144 \times 2} = 4 \cdot 12\sqrt{2} = 48\sqrt{2}$

$$\#38 \ a) \ \frac{5}{2\sqrt{3}} \cdot \frac{\sqrt{3}}{\sqrt{3}} = \frac{5\sqrt{3}}{2 \cdot \sqrt{3}\sqrt{3}} = \frac{5\sqrt{3}}{2 \cdot 3} = \frac{5\sqrt{3}}{6}$$

$$b) \ \frac{4}{\sqrt{x}} \cdot \frac{\sqrt{x}}{\sqrt{x}} = \frac{4\sqrt{x}}{x}$$

$$c) \ \frac{5}{\sqrt{x}+4} \cdot \frac{\sqrt{x}-4}{\sqrt{x}-4} = \frac{5\sqrt{x}-20}{x-16}$$

$$\#39 \ d) \ \frac{2x}{3-\sqrt{3}} \cdot \frac{3+\sqrt{3}}{3+\sqrt{3}} = \frac{6x+2x\sqrt{3}}{9-3} = \frac{6x+2x\sqrt{3}}{6} = \frac{2(3x+x\sqrt{3})}{6} = \frac{3x+x\sqrt{3}}{3}$$

$$\#39 \ y = 5\sqrt{-16x+32} - 3$$

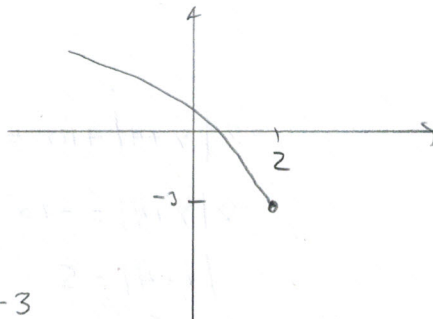
$$y = 5\sqrt{-16(x-2)} - 3$$

$$y = 20\sqrt{-(x-2)} - 3$$

$$a = 5 \ b = -16 \ h = 2 \ k = -3$$

or

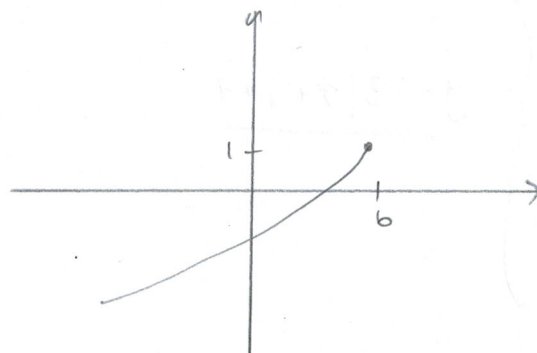
$$a = 20 \ b = -1 \ h = 2 \ k = -3$$



$$\#40 \ y = -\sqrt{-3(x+4)} + 2 \quad h = -4 \ k = 2$$

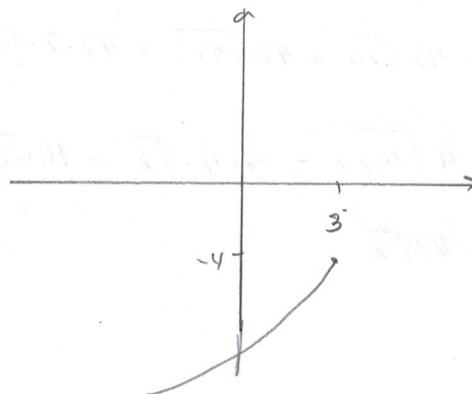
$$\#41 \ y = -\sqrt{-x+6} + 1$$

$$y = -\sqrt{-(x-6)} + 1$$



$$\#42 \ y = -2\sqrt{-9x+27} - 4$$

$$y = -2\sqrt{-9(x-3)} - 4$$



$$\text{Dom } f = (-\infty, 3]$$

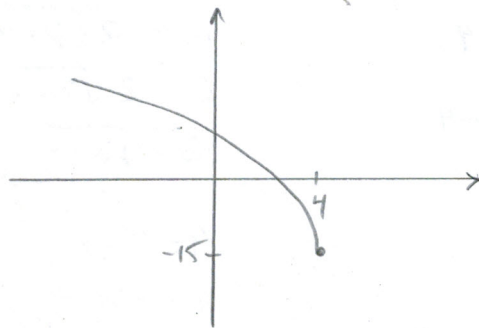
$$\text{Imag } f = (-\infty, -4]$$

$$\nearrow \text{run } (-\infty, 3]$$

$$\text{Max } y = -4$$

#43 $y = 3\sqrt{-10x+40} - 15$

$y = 3\sqrt{-10(x-4)} - 15$



dom $f : -\infty, 4]$

Ima $f [-15, +\infty)$

#44 a) $0 = -3\sqrt{x-2} - 12$

$12 = -3\sqrt{x-2}$

$-4 = \sqrt{x-2}$

$\emptyset$ can $\sqrt{=} \oplus !$

b) $0 = -4\sqrt{9-4x} + 6$

$1,5 = \sqrt{9-4x}$

$\rightarrow 9-4x \geq 0$

$2,25 = 9-4x$

$-4x \geq -9$

$-6,75 = -4x$

$x \leq 2,25$

$\boxed{1,6875 = x}$

#45 $y = a\sqrt{b(x-h)} + k$

$y = a\sqrt{b(x+1)} - 5$ $(-37, -3)$ $b = -1 !$

$-3 = a\sqrt{-1(-37+1)} - 5$

$-3 = a\sqrt{-1(-36)} - 5$

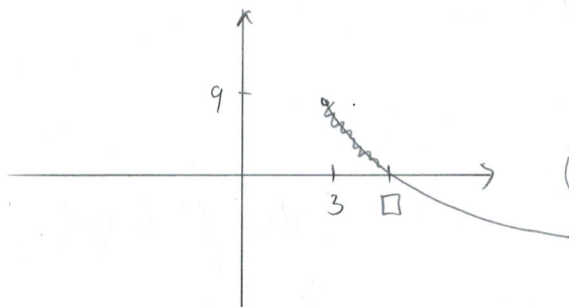
$2 = a\sqrt{36}$

$2 = a(6)$

$\frac{1}{3} = a$

$y = \frac{1}{3}\sqrt{-1(x+1)} - 5$

#46 $y = -3\sqrt{4(x-3)} + 9$



$0 = -3\sqrt{4x-12} + 9$

$3 = \sqrt{4x-12}$

$\rightarrow 4x-12 \geq 0$

$9 = 4x-12$

$x \geq 3$

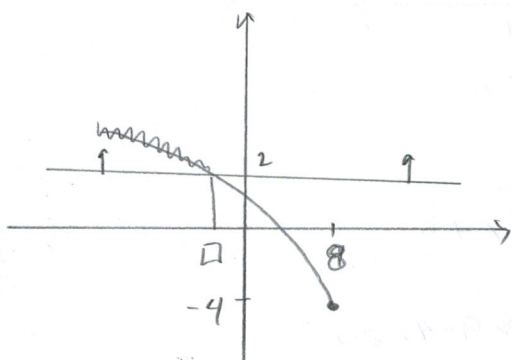
$21 = 4x$

$\boxed{5,25 = x}$

$\boxed{[3; 5,25[}$

#47 $y = 2\sqrt{-x+8} - 4$

$y = 2\sqrt{-1(x-8)} - 4$



$2 = 2\sqrt{8-x} - 4$

$6 = 2\sqrt{8-x}$

$3 = \sqrt{8-x}$

$\rightarrow 8-x \geq 0$

$9 = 8-x$

$-x \geq -8$

$1 = -x$

$x \leq 8$

$-1 = x$

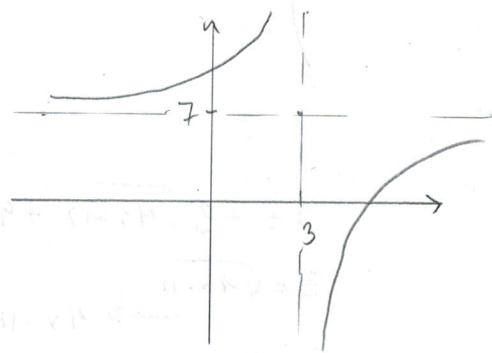
$[-\infty, -1]$

#48 $y = \frac{-12}{4(x+2)} - 1$

$y = \frac{-3}{x+2} - 1$ $a = -3$ $h = -2$ $k = -1$

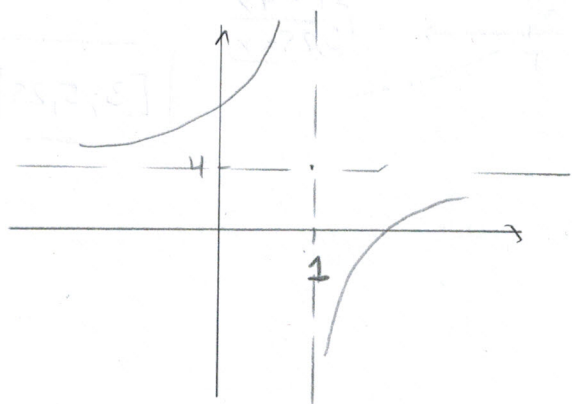
#49 $y = \frac{5}{2(x-4.5)} + 3$ $x = 4.5$ et $y = 3$

#50 $y = \frac{5}{-4(x-3)} + 7$



(croissante !)

#51 $y = \frac{-10}{x-1} + 4$



dom $f: \mathbb{R} \setminus \{1\}$

Ima $f: \mathbb{R} \setminus \{4\}$

$$\#52 \quad 0 = \frac{-13}{3x-6} - 5$$

$$5 = \frac{-13}{3x-6}$$

$$15x - 30 = -13$$

$$15x = 17$$

$$\boxed{x = \frac{17}{15}}$$

$$\#54 \quad \begin{array}{r} 6x+1 \overline{) -3x+5} \\ \underline{6x-10} \\ -11 \end{array}$$

$$y = \frac{11}{-3x+5} - 2$$

$$y = \frac{-11}{-3(x-5/3)} - 2$$

$$y = \frac{11/3}{x-5/3} - 2$$