ACTIVIDADES: SISTEMAS DE ECUACIONES. INECUACIONES.

1. Resuelve los siguientes sistemas:

$a) \left.\begin{array}{l} \dfrac{2}{x}+\dfrac{3}{y}=7 \\ \dfrac{3}{x}+\dfrac{2}{y}=\dfrac{11}{2} \end{array}\right\}$ $\quad b) \left.\begin{array}{r} 2y-x=4 \\ x^2-y^2=-5 \end{array}\right\}$ $\quad c) \left.\begin{array}{r} x^2-y^2=9 \\ x\cdot y=20 \end{array}\right\}$ $\quad d) \left.\begin{array}{r} x+y=41 \\ \sqrt{x}+\sqrt{y}=9 \end{array}\right\}$

$e) \left.\begin{array}{l} 2^x\cdot 2^y=256 \\ x-y=4 \end{array}\right\}$ $\quad f) \left.\begin{array}{r} 5\cdot 2^{x+y}=80 \\ 9^x=3^{y-1} \end{array}\right\}$ $\quad g) \left.\begin{array}{r} 2^{x+1}+3^y=35 \\ 5\cdot 2^x-2\cdot 3^y=-34 \end{array}\right\}$

$h) \left.\begin{array}{r} 2^x+2^y=24 \\ 2^{x+y}=128 \end{array}\right\}$ $\quad i) \left.\begin{array}{r} 5^x=5^y\cdot 625 \\ 2^x\cdot 2^y=256 \end{array}\right\}$ $\quad j) \left.\begin{array}{r} x+y=22 \\ \log x-\log y=1 \end{array}\right\}$

$k) \left.\begin{array}{l} 2\log x-3\log y=7 \\ \log x+\log y=1 \end{array}\right\}$ $\quad l) \left.\begin{array}{r} \log(x+y)-\log(x-y)=\log 33 \\ 2^x\cdot 2^y=2^{11} \end{array}\right\}$

$m) \left.\begin{array}{l} \log_2 x+3\cdot\log_2 y=5 \\ \log_2 x^2-\log_2 y=3 \end{array}\right\}$ $\quad n) \left.\begin{array}{l} \log x-\log y=5 \\ \log x^3+\log y^2=10 \end{array}\right\}$

2. Aplica el método de Gauss para discutir y resolver los sistemas siguientes:

$a) \begin{cases} x+y+z=6 \\ 2x-y+2z=3 \\ 3x+2y-3z=3 \end{cases}$ $SCD\ (1,3,2)$

$b) \begin{cases} x-y-z=-2 \\ 2x+3y-z=2 \\ 4x+y-3z=-2 \end{cases}$ $SCI\ (4-4t,t,6-5t)$

$c) \begin{cases} x-9y+5z=33 \\ x+3y-z=-9 \\ x-y+z=5 \end{cases}$ $SCI\ (-t-2,t,2t+7)$

$d) \begin{cases} x+3y=2 \\ x+2y+z=1 \\ y-z=-1 \end{cases}$ SI (Sin solución)

$e) \begin{cases} x-2y+3z=4 \\ 2x-y-z=1 \\ x+y-4z=0 \end{cases}$ SI (no tiene solución)

$f) \begin{cases} x+y+z=2 \\ 2x+3y+5z=11 \\ x-5y+6z=29 \end{cases}$ $SCD\ (1,-2,3)$

3. Resuelve los siguientes sistemas de inecuaciones lineales:

$a)\ \left.\begin{array}{r}\dfrac{7-3x}{2}<x+1\\ \dfrac{x+4}{3}\geq x\end{array}\right\}\quad (1,2]$

$b)\ \left.\begin{array}{r}-3\cdot(x-3)\leq x+1\\ \dfrac{-x+2}{3}<1-\dfrac{x+6}{9}\end{array}\right\}\quad [2,+\infty)$

$c)\ \left.\begin{array}{r}3x-1\leq 2x-6\\ 5x+4>x\end{array}\right\}\quad (\emptyset)$

4. Encuentra el conjunto solución de las siguientes inecuaciones cuadráticas y con denominadores:

$a)\ 6x^2-x-1>0\quad \left(-\infty,-\dfrac{1}{3}\right)\cup\left(\dfrac{1}{2},+\infty\right)$

$b)\ 6x^2-x-1\leq 0\quad \left[\dfrac{-1}{3},\dfrac{1}{2}\right]$

$c)\ -x^2+2x+3\geq 0\quad [-1,3]$

$d)\ 9x^2-1<0\quad \left(\frac{-1}{3},\frac{1}{3}\right)$

$e)\ x^2-4x+4>0\quad \mathbb{R}-\{2\}$

$f)\ x^2-4x+4<0\quad (\emptyset)$

$g)\ \dfrac{3-x}{x+1}\geq 0\quad (-1,3]$

$h)\ \dfrac{x^2-4}{-2\cdot x}\leq 0\quad [-2,0)\cup[2,+\infty)$

$i)\ \dfrac{x+4}{2x^2+x-3}\leq 0\quad (-\infty,-4]\cup(-\dfrac{3}{2},1)$

$j)\ \dfrac{4x+1}{2x-5}\geq 0\quad (-\infty,-1/4]\cup(\dfrac{5}{2},+\infty)$

$k)\ \dfrac{2}{x^2+4}>0\quad (\mathbb{R})$

$l)\ \dfrac{2}{x^2+4}<0\quad (\emptyset)$

1.- $\left.\begin{array}{l}\dfrac{2}{x}+\dfrac{3}{y}=7\\[2mm] \dfrac{3}{x}+\dfrac{2}{y}=\dfrac{11}{2}\end{array}\right\} \Rightarrow 2y+3x=7xy \Rightarrow 3x=7xy-2y \Rightarrow$

$\Rightarrow 3x=(7x-2)y$

$\Rightarrow \dfrac{3x}{7x-2}=y \quad (I)$

$\Downarrow$

$6y+4x=11xy \xrightarrow{(I)} 6\cdot\left(\dfrac{3x}{7x-2}\right)+4x=11x\cdot\left(\dfrac{3x}{7x-2}\right)$

$\Rightarrow \dfrac{18x}{7x-2}+\dfrac{4x(7x-2)}{7x-2}=\dfrac{33x^2}{7x-2} \Rightarrow 0=5x^2-10x=x(5x-10)$

$x \begin{cases} =0 \\ 5x-10=0 \rightarrow \boxed{x=2}\end{cases}$ x=0 no puede ser válida por estar en un denominador

Por tanto $x=2$, $y=\dfrac{3\cdot 2}{7\cdot 2-2}=\dfrac{6}{12}=\dfrac{1}{2}$ $\boxed{\begin{array}{l}x=2\\ y=1/2\end{array}}$

OTRA FORMA: (Haciendo una reducción doble)

$\left.\begin{array}{l}\dfrac{2}{x}+\dfrac{3}{y}=7\\[2mm] \dfrac{3}{x}+\dfrac{2}{y}=\dfrac{11}{2}\end{array}\right\} \begin{array}{l}\xrightarrow{\cdot(-3)} \cancel{\dfrac{-6}{x}}-\dfrac{9}{y}=-21\\[2mm] \xrightarrow{\cdot 2} \cancel{\dfrac{6}{x}}+\dfrac{4}{y}=11\end{array}$

$-\dfrac{5}{y}=10 \Rightarrow \boxed{y=\dfrac{-5}{-10}=\dfrac{1}{2}}$

$\left.\begin{array}{l}\dfrac{2}{x}+\dfrac{3}{y}=7\\[2mm] \dfrac{3}{x}+\dfrac{2}{y}=\dfrac{11}{2}\end{array}\right\} \begin{array}{l}\xrightarrow{\cdot(-2)} \dfrac{-4}{x}-\cancel{\dfrac{6}{y}}=-14\\[2mm] \xrightarrow{\cdot 3} \dfrac{9}{x}+\cancel{\dfrac{6}{y}}=\dfrac{33}{2}\end{array}$ $\boxed{x=2}$

$\Uparrow$

$\dfrac{5}{x}=-14+\dfrac{33}{2} \Rightarrow \dfrac{5}{x}=\dfrac{-28+33}{2}=\dfrac{5}{2}$

2.- $\left.\begin{array}{l}2y-x=4\\ x^2-y^2=-5\end{array}\right\}$ $x=2y-4$

$(2y-4)^2-y^2=-5 \Rightarrow 4y^2+16-16y-y^2+5=0$

$\Rightarrow 3y^2-16y+21=0 \Rightarrow y=\dfrac{16\pm\sqrt{16^2-4\cdot 3\cdot 21}}{6}=\dfrac{16\pm 2}{6} \begin{cases} 3 \\ \dfrac{14}{6}=\dfrac{7}{3}\end{cases}$

$\boxed{y=3 \Rightarrow x=2}$

$\boxed{y=\dfrac{7}{3} \Rightarrow x=\dfrac{14}{3}-4=\dfrac{2}{3}}$

c) $\left.\begin{array}{l} x^2-y^2=9 \\ x\cdot y=20 \end{array}\right\} \Rightarrow y=\frac{20}{x}$

$x^2-\frac{20^2}{x^2}=9$

$x^4-9x^2-400=0 \qquad x^2=t$

$t^2-9t-400=0 \Rightarrow t=\frac{9\pm\sqrt{81+1600}}{2}$

$t=\frac{9\pm 41}{2} \begin{cases} 25 \\ -16 \end{cases}$

Si $x^2=25 \Rightarrow x=\pm 5$

$x^2=-16$ no tiene solución

Soluciones: $\boxed{x=5, y=4}$; $\boxed{x=-5 ; y=-4}$

d) $\left.\begin{array}{l} x+y=41 \\ \sqrt{x}+\sqrt{y}=9 \end{array}\right\} \Rightarrow y=41-x$

$\sqrt{x}+\sqrt{41-x}=9 \Rightarrow \sqrt{41-x}=9-\sqrt{x} \Rightarrow$

$\Rightarrow (\sqrt{41-x})^2=(9-\sqrt{x})^2 \Rightarrow 41-x=81+x-18\sqrt{x} \Rightarrow$

$\Rightarrow 18\sqrt{x}=2x+40 \xrightarrow[:2]{} 9\sqrt{x}=x+20$

$(9\sqrt{x})^2=(x+20)^2 \Rightarrow 81x=x^2+40x+400 \Rightarrow 0=x^2-41x+400$

$x \begin{cases} 25 \\ 16 \end{cases}$

$\boxed{x=25 ; y=16}$ válida, pues $\sqrt{25}+\sqrt{16}=9$

$\boxed{x=16 ; y=25}$ válida.

e) $\left.\begin{array}{l} 2^x\cdot 2^y=256 \\ x-y=4 \end{array}\right\} \Rightarrow \left.\begin{array}{l} 2^{x+y}=2^8 \\ x-y=4 \end{array}\right\} \begin{array}{l} x+y=8 \\ x-y=4 \\ \hline 2x=12 \end{array} \Rightarrow \boxed{x=6 ; y=2}$

f) $\left.\begin{array}{l} 5\cdot 2^{x+y}=80 \\ 9^x=3^{y-1} \end{array}\right\} \left.\begin{array}{l} \cancel{5}\cdot 2^{x+y}=\cancel{5}\cdot 2^4 \\ 3^{2x}=3^{y-1} \end{array}\right\} \left.\begin{array}{l} x+y=4 \\ 2x=y-1 \end{array}\right\} \begin{array}{l} x+y=4 \\ 2x-y=-1 \\ \hline 3x=3 \end{array}$

$\boxed{x=1 ; y=3}$

g) $\left.\begin{array}{l} 2^{x+1}+3^y=35 \\ 5\cdot 2^x-2\cdot 3^y=-34 \end{array}\right\} \left.\begin{array}{l} 2\cdot 2^x+3^y=35 \\ 5\cdot 2^x-2\cdot 3^y=-34 \end{array}\right\} \xrightarrow[3^y=z]{2^x=t}$ Cambio de variable

$\left.\begin{array}{l} 2t+z=35 \\ 5t-2z=-34 \end{array}\right\} \Rightarrow \boxed{\begin{array}{l} t=4 \\ z=27 \end{array}}$

$t=2^x=4=2^2 \Rightarrow$ $\boxed{\begin{array}{l} x=2 \\ y=3 \end{array}}$

$z=27=3^3=3^y \Rightarrow$

h) $\left.\begin{array}{l} 2^x+2^y=24 \\ 2^{x+y}=128 \end{array}\right\} \rightarrow 2^{x+y}=2^7 \Rightarrow x+y=7 \Rightarrow y=7-x$

Entonces $2^x+2^{7-x}=24 \Rightarrow 2^x+\frac{2^7}{2^x}=24 \xrightarrow[2^x=t]{}$

$$t+\frac{128}{t}=24 \Rightarrow t^2-24t+128=0 \Rightarrow t=\frac{24\pm\sqrt{64}}{2}$$

$$t=\frac{24\pm 8}{2} < \begin{matrix}16\\ 8\end{matrix}$$

Si $t=2^x=16=2^4 \rightarrow x=4$

Si $t=2^x=8=2^3 \rightarrow x=3$

$$\boxed{\begin{matrix} x=4 \Rightarrow y=3 \\ x=3 \Rightarrow y=4 \end{matrix}}$$ Soluciones.

i) $\left.\begin{matrix} 5^x=5^y\cdot 625 \\ 2^x\cdot 2^y=256 \end{matrix}\right\}$ $\begin{matrix} 5^x=5^y\cdot 5^4 \Rightarrow x=y+4 \\ 2^{x+y}=2^8 \Rightarrow x+y=8 \end{matrix}\Big\}$ $\boxed{\begin{matrix} x=6 \\ y=2 \end{matrix}}$

j) $\left.\begin{matrix} x+y=22 \\ \log x-\log y=1 \end{matrix}\right\}$ $\begin{matrix} y=22-x \\ \log\left(\frac{x}{y}\right)=\log 10 \Rightarrow \frac{x}{22-x}=10 \end{matrix}$

$\Rightarrow x=220-10x \Rightarrow 11x=220 \Rightarrow \boxed{x=20 \quad y=2}$ son válidas

K) $\left.\begin{matrix} 2\log x-3\log y=7 \\ \log x+\log y=1 \end{matrix}\right\} \longrightarrow$ $\begin{matrix} 2\log x-3\log y=7 \\ -2\log x-2\log y=-2 \\ \hline -5\log y=5 \\ \log y=-1 \\ y=10^{-1} \end{matrix}$

$\Downarrow$

$$\begin{matrix} 2\log x-3\log y=7 \\ +3\log x+3\log y=3 \\ \hline 5\log x=10 \end{matrix} \Rightarrow \log x=2 \Rightarrow \boxed{x=10^2}$$

$$\boxed{x=100\ ;\ y=\frac{1}{10}}$$

l) $\left.\begin{matrix} \log(x+y)-\log(x-y)=\log 33 \\ 2^x\cdot 2^y=2^{11} \end{matrix}\right\}$ $\begin{matrix} \frac{x+y}{x-y}=33 \\ x+y=11 \rightarrow y=11-x \end{matrix}$

$11=33(x-11+x)$

$11=33x-363+33x \Rightarrow 374=66x \Rightarrow \boxed{x=\frac{17}{3} \quad y=\frac{16}{3}}$

válida

m) $\left.\begin{array}{l} \log_2 x + 3\log_2 y = 5 \\ \log_2 x^2 - \log_2 y = 3 \end{array}\right\} \quad \left.\begin{array}{l} \log_2 x + 3\log_2 y = 5 \\ 2\log_2 x - \log_2 y = 3 \end{array}\right\} \xrightarrow{\cdot(+3)}$

$$\begin{array}{l} \log_2 x + 3\cancel{\log_2 y} = 5 \\ +6\log_2 x - 3\cancel{\log_2 y} = 9 \\ \hline 7\log_2 x = 14 \end{array} \qquad \log_2 x = 2 \Rightarrow x = 2^2 = 4$$

$2\log_2 x - \log_2 y = 3 \Rightarrow 2\cdot 2 - \log_2 y = 3 \Rightarrow -\log_2 y = 3-4$

$\Rightarrow \log_2 y = 1 \Rightarrow y = 2^1 = 2$ $\boxed{\begin{array}{l} x = 4 \\ y = 2 \end{array}}$

n) $\left.\begin{array}{l} \log x - \log y = 5 \\ \log x^3 + \log y^2 = 10 \end{array}\right\} \quad \left.\begin{array}{l} \log x - \log y = 5 \\ 3\log x + 2\log y = 10 \end{array}\right\}$

$$\xrightarrow{\cdot(2)} \begin{array}{l} 2\log x - 2\cancel{\log y} = 10 \\ 3\log x + 2\cancel{\log y} = 10 \\ \hline 5\log x = 20 \end{array} \Rightarrow \log x = 4 \quad \boxed{x = 10^4}$$

$\log 10^4 - \log y = 5 \Rightarrow 4 - 5 = \log y \Rightarrow -1 = \log y \Rightarrow \boxed{y = 1}$

2.- a) $\left.\begin{array}{l} x + y + z = 6 \\ 2x - y + 2z = 3 \\ 3x + 2y - 3z = 3 \end{array}\right\} \begin{array}{c} \xrightarrow{-2E_1 + E_2 \to E_2} \\ \xrightarrow{-3E_1 + E_3 \to E_3} \end{array} \left.\begin{array}{l} x + y + z = 6 \\ -3y = -9 \\ -y - 6z = -15 \end{array}\right\}$

Despejando: $y = 3$; $z = \frac{-y+15}{6} = \frac{-3+15}{6} = 2$; $x = 6 - y - z = 6 - 3 - 2 = 1$.

Sistema Compatible Determinado: $\boxed{x = 1;\ y = 3;\ z = 2}$

b) $\left.\begin{array}{l} x - y - z = -2 \\ 2x + 3y - z = 2 \\ 4x + y - 3z = -2 \end{array}\right\} \begin{array}{c} \xrightarrow{-2E_1 + E_2 \to E_2} \\ -4E_1 + E_3 \to E_3 \end{array} \begin{array}{l} x - y - z = -2 \\ \left.\begin{array}{l} 5y + z = 6 \\ 5y + z = 6 \end{array}\right\} \text{Son iguales.} \end{array}$

Por tanto el sistema es COMPATIBLE INDETERMINADO, tendrá infinitas soluciones que dependen de una incógnita:

Consideremos $\left.\begin{array}{l} x - y - z = -2 \\ 5y + z = 6 \end{array}\right\} \xrightarrow[\text{parámetro}]{\text{Sea } y = t} \left.\begin{array}{l} x - z = -2 + t \\ z = 6 - 5t \end{array}\right\}$

Entonces: $x-(6-5t)=-2+t \rightarrow x-6+5t=-2+t \Rightarrow x=4-4t$

Con ello, la solución tiene la forma: $\boxed{\begin{array}{l} x=4-4t \\ y=t \\ z=6-5t \end{array} ;\ t\in\mathbb{R}}$

c) $\left.\begin{array}{l} x-9y+5z=33 \\ x+3y-z=-9 \\ x-y+z=5 \end{array}\right\} \xrightarrow[-E_1+E_3\rightarrow E_3]{-E_1+E_2\rightarrow E_2} \left.\begin{array}{l} x-9y+5z=33 \\ 12y-6z=-42 \\ 8y-4z=-28 \end{array}\right\} \xrightarrow[E_3/4]{E_2/6}$

$\rightarrow \left.\begin{array}{l} x-9y+5z=33 \\ 2y-z=-7 \\ 2y-z=-7 \end{array}\right\}$ iguales

Sistema Compatible Indeterminado.

Sea $\left.\begin{array}{l} x-9y+5z=33 \\ 2y-z=-7 \end{array}\right\} \begin{array}{l} \rightarrow x+5z=33+9y \\ \rightarrow -z=-7-2y \end{array}$ Sea $y=t$ parámetro.

$\left.\begin{array}{l} x+5z=33+9t \\ z=7+2t \end{array}\right\} \begin{array}{l} x+5(7+2t)=33+9t \\ x+35+10t=33+9t \Rightarrow x=-5-t \end{array}$

$\boxed{\begin{array}{l} x=-5-t \\ y=t \\ z=7+2t \end{array} ;\ t\in\mathbb{R}}$

d) $\left.\begin{array}{l} x+3y=2 \\ x+2y+z=1 \\ y-z=-1 \end{array}\right\} \xrightarrow{-E_1+E_2\rightarrow E_2} \left.\begin{array}{l} x+3y=2 \\ -y+z=-1 \\ y-z=-1 \end{array}\right\} \begin{array}{l} y-z=1 \\ y-z=-1 \end{array}$

las dos últimas ecuaciones son incompatibles; luego el sistema es Incompatible.

e) $\left.\begin{array}{l} x-2y+3z=4 \\ 2x-y-z=1 \\ x+y-4z=0 \end{array}\right\} \xrightarrow[-E_1+E_3]{-2E_1+E_2} \left.\begin{array}{l} x-2y+3z=4 \\ 3y-7z=-7 \\ 3y-7z=-4 \end{array}\right\}$ Incompatible.

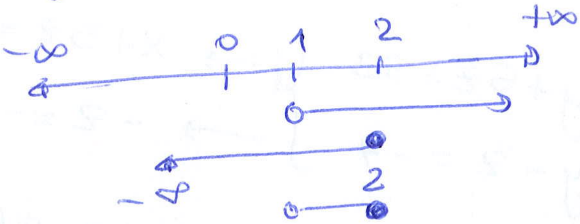
Sistema Incompatible. No hay solución.

f) $\left.\begin{aligned} x+y+z &= 2 \\ 2x+3y+5z &= 11 \\ x-5y+6z &= 29 \end{aligned}\right\} \begin{aligned} &\xrightarrow{-2E_1+E_2 \to E_2} \\ &-E_1+E_3 \to E_3 \end{aligned} \quad \left.\begin{aligned} x+y+z &= 2 \\ y+3z &= 7 \\ -6y+5z &= 27 \end{aligned}\right\} \xrightarrow{6E_2+E_3}$

$\left.\begin{aligned} x+y+z &= 2 \\ y+3z &= 7 \\ 23z &= 69 \end{aligned}\right\} \begin{aligned} x &= 1 \\ y &= -2 \\ z &= 3 \end{aligned}$ S. Compatible Determ.

3.- a) $\left.\begin{aligned} &\frac{7-3x}{2} < x+1 \\ &\frac{x+4}{3} \geq x \end{aligned}\right\} \begin{aligned} &\Rightarrow 7-3x < 2x+2 \Rightarrow -5x < -5 \Rightarrow 5x > 5 \\ &\Rightarrow x+4 \geq 3x \Rightarrow -2x \geq -4 \Rightarrow 2x \leq 4 \end{aligned}$

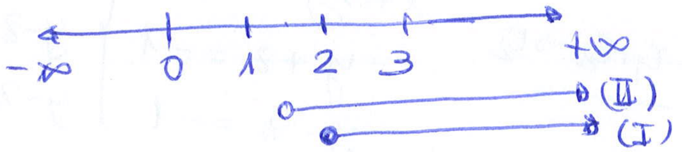
$\Rightarrow \left.\begin{aligned} x &> 1 \\ x &\leq 2 \end{aligned}\right\}$



Solución: $(1,2]$.

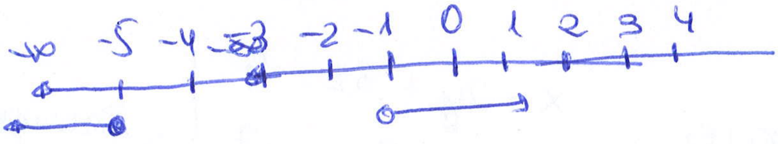
b) $\left.\begin{aligned} &-3(x-3) \leq x+1 \\ &\frac{-x+2}{3} < 1 - \frac{x+6}{9} \end{aligned}\right\} \begin{aligned} &\Rightarrow -3x+9 \leq x+1 \Rightarrow -4x \leq -8 \Rightarrow 4x \geq 8 \Rightarrow x \geq 2 \ (I) \\ &\Rightarrow 3(-x+2) < 9-(x+6) \Rightarrow -3x+6 < 9-x-6 \Rightarrow \end{aligned}$

mcm=9 $\Rightarrow -2x < \underbrace{9-6-6}_{-3} \Rightarrow -2x < -3$
$2x > 3$
$x > 3/2$ (II)



$S=[2,+\infty)$

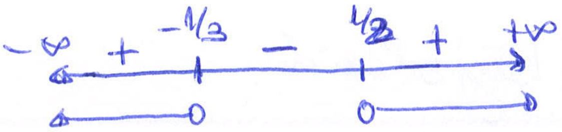
c) $\left.\begin{aligned} &3x-1 \leq 2x-6 \\ &5x+4 > x \end{aligned}\right\} \begin{aligned} &\Rightarrow 3x-2x \leq -6+1 \Rightarrow x \leq -5 \qquad x \leq -5 \\ &\Rightarrow 5x-x > -4 \Rightarrow 4x > -4 \qquad x > -1 \end{aligned}$



$S=\emptyset$.

4.- a) $6x^2-x-1>0$ Calculemos sus raíces: $6x^2-x-1=0$

$x = \frac{1 \pm \sqrt{1+24}}{12} = \frac{1 \pm 5}{12} \begin{cases} 1/2 \\ -1/3 \end{cases}$



$S=\left(-\infty,-\frac{1}{3}\right) \cup \left(\frac{1}{2},+\infty\right)$

b) $6x^2 - x - 1 \le 0$.

Utilizando el diagrama de a) $-\infty \quad + \quad -1/3 \quad - \quad 1/2 \quad + \quad +\infty$

$S = \left[-\frac{1}{3}, \frac{1}{2}\right]$

* Otra forma: usando una tabla como la que sigue:

$$6x^2 - x - 1 = 6\left(x+\frac{1}{3}\right)\left(x-\frac{1}{2}\right) = (3x+1)(2x-1)$$

	$(-\infty, -1/3)$	$(-1/3, 1/2)$	$(\frac{1}{2}, +\infty)$
$3x+1$	$-$	$+$	$+$
$2x-1$	$-$	$-$	$+$
$(3x+1)(2x-1)$	$+$	$-$	$+$

c) $-x^2 + 2x + 3 \geq 0$

$-(x+1)(x-3) \geq 0$

Raíces de $-x^2+2x+3$:

$-x^2+2x+3 = 0 \Rightarrow x = \frac{-2 \pm \sqrt{4+12}}{-2} = \frac{-2 \pm 4}{-2} \begin{cases} -1 \\ 3 \end{cases}$

$-\infty \quad - \quad -1 \quad + \quad 3 \quad - \quad +\infty$ o bien

	$(-\infty, -1)$	$(-1, 3)$	$(3, +\infty)$
-1	$-$	$-$	$-$
$x+1$	$-$	$+$	$+$
$x-3$	$-$	$-$	$+$
	$-$	$+$	$-$

$S = [-1, 3]$

d) $9x^2 - 1 < 0$

Raíces: $9x^2 - 1 = 0 \Leftrightarrow x^2 = \frac{1}{9} \Rightarrow x = \pm\frac{1}{3}$.

$-\infty \quad + \quad -1/3 \quad - \quad 1/3 \quad + \quad +\infty$

$S = \left(-\frac{1}{3}, \frac{1}{3}\right)$

e) $x^2 - 4x + 4 > 0$

$(x-2)^2 > 0$

Raíces: $x^2 - 4x + 4 = 0 \Rightarrow x = 2$ doble

$-\infty \quad + \quad 2 \quad + \quad +\infty$

$S = (-\infty, 2) \cup (2, +\infty) = \mathbb{R} - \{2\}$.

f) $\underline{x^2 - 4x + 4} < 0$

↳ Nunca es negativo, luego $S = \emptyset$.

g) $\frac{3-x}{x+1} \geq 0$

- Raíces del numerador: $3 - x = 0 \Leftrightarrow x = 3$
- Raíces del denominador: $x + 1 = 0 \Leftrightarrow x = -1$

$-\infty \quad - \quad -1 \quad + \quad 3 \quad - \quad +\infty$

$S = (-1, 3]$.

h) $\frac{x^2-4}{-2x} \leq 0$

$x^2-4=0 \Leftrightarrow x=\pm 2$

$-2x=0 \Leftrightarrow x=0$

$-\infty \quad + \quad -2 \quad - \quad 0 \quad + \quad 2 \quad - \quad +\infty$

$S=[-2,0)\cup[2,+\infty)$

i) $\frac{x+4}{2x^2+x-3} \leq 0 \Rightarrow$

$x+4=0 \Rightarrow x=-4$

$2x^2+x-3=0 \Rightarrow x=\frac{-1\pm\sqrt{1+24}}{4}=\frac{-1\pm 5}{4} \begin{cases} 1 \\ -3/2 \end{cases}$

$-\infty \quad -5 \quad -4 \quad -3 \quad -3/2 \quad -2 \quad -1 \quad 0 \quad 1 \quad 2 \quad +\infty$

$- \qquad + \qquad - \qquad +$

$S=(-\infty,-4]\cup\left(-\frac{3}{2},1\right)$

j) $\frac{4x+1}{2x-5} \geq 0$

$4x+1=0 \rightarrow x=-1/4$

$2x-5=0 \Rightarrow x=5/2$

$-\infty \quad + \quad -1/4 \quad 0 \quad - \quad 5/2 \quad + \quad +\infty$

$S=\left(-\infty,-\frac{1}{4}\right]\cup\left(\frac{5}{2},+\infty\right)$

k) $\frac{2}{x^2+4} > 0$

No hay raices

$+$

$S=\mathbb{R}$

l) $\frac{2}{x^2+4} < 0$

↳ Nunca es negativo

$S=\emptyset$