

Exercícios

1)

$$a) 3 - x < 5 + 3x$$

$$+3 - 3 - x < 5 - 3 + 3x \quad (-3) \text{ de ambos os lados}$$

$$-x < 2 + 3x \quad (-3x) \text{ de ambos os lados}$$

note o sinal

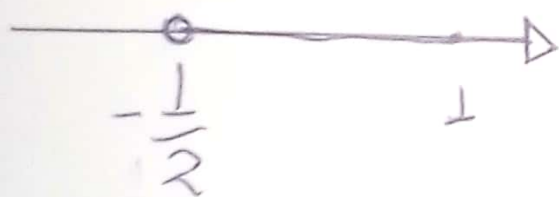
$$-x - 3x < 2 + 3x - 3x$$

$$-4x < 2$$

$\times (-1)$ multiplicar

$$4x > -2$$

$$x > -\frac{2}{4} = x = -\frac{1}{2}$$



$$\left(-\frac{1}{2}, +\infty\right)$$

$$b) 2x - 5 < \frac{1}{3} + \frac{3x}{4} + \frac{1-x}{3}$$

m m c

$$\begin{array}{r|l} 3 & 4 \\ 3 & 2 \\ 3 & 1 \\ 1 & 1 \end{array} \quad \begin{array}{l} 2 \\ 2 \\ 3 \\ 12 \end{array}$$

$$2x \cdot 12 - 5 \cdot 12 < \frac{1}{3} \cdot 12 + \frac{3x}{4} \cdot 12 + \frac{1-x}{3} \cdot 12$$

$$24x - 60 < 4 + 9x + 4(1-x)$$

$$24 - 60 < 4 + 9x + 4 - 4x$$

$$24x - 60 + 60 < 8 + 5x + 60$$

$$24x < 8 + 5x + 60$$

$$24x - 5x < 68$$

$$19x < 68 \quad \div 19$$

$$\frac{19x}{19} < \frac{68}{19}$$

$$x < \frac{68}{19} \quad \left(-\infty, \frac{68}{19} \right)$$

$$c) 27 - 3 - 3x \geq -7$$

$$3 + 27 - 3 + 3 - 3x \geq -7 + 3 \quad (+3)$$

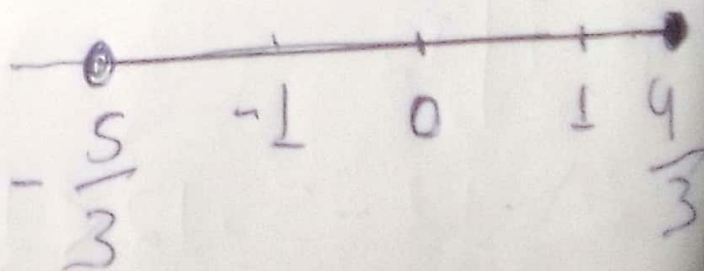
$$57 - 3x \geq -4 \quad \cdot (-1)$$

$$-5 < +3x \leq +4 \quad (\div 3)$$

$$-\frac{5}{3} < \frac{+3x}{3} \leq \frac{+4}{3}$$

$$-\frac{5}{3} < x \leq \frac{4}{3}$$

$$\left(-\frac{5}{3}, \frac{4}{3} \right]$$



$$d) \frac{5}{x} < \frac{3}{4}$$

$$\frac{5}{x} - \frac{3}{4} < 0$$

$$\frac{20 - 3x}{4x} < 0$$

1ª Equação

$$20 - 3x < 0$$

$$-3x < -20 \quad (-1)$$

$$3x > 20$$

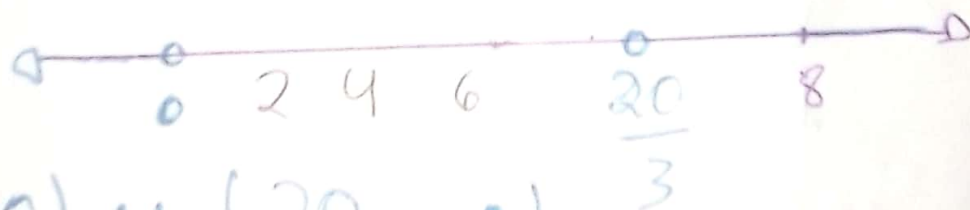
$$x > \frac{20}{3}$$

2ª Equação

$$4x < 0$$

$$x < \frac{0}{4}$$

$$x < 0$$



$$(-\infty, 0) \cup \left(\frac{20}{3}, +\infty\right)$$

$$e) x^2 \leq 9$$

$$x \leq \pm \sqrt{9}$$

$$x \leq \pm 3$$

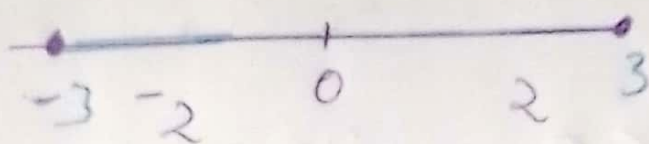
$$\sqrt{x^2} = |x| \quad \boxed{\text{Regra Formas}}$$

$$\sqrt{x^2} \leq \sqrt{9}$$

$$|x| \leq 3$$

$$-3 \leq x \leq +3$$

$$[-3, 3]$$



$$8) x^2 - 3x + 2 > 0$$

$$x^2 - 3x + 2 = 0$$

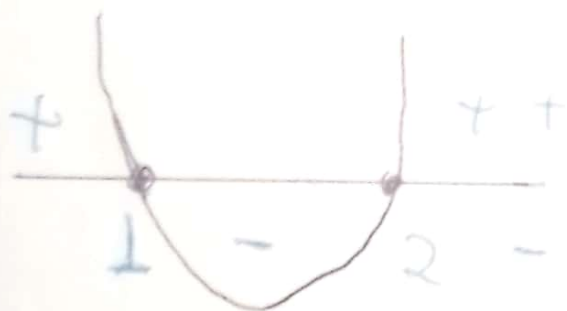
$$S = -\frac{b}{a}$$

$$P = \frac{c}{a}$$

$$S = -\frac{(-3)}{1} \rightarrow 3$$

$$P = \frac{2}{1} \rightarrow 2$$

1 e 2



$x < 0$

$$(-\infty, 1) \cup (2, +\infty)$$

$$9) 1 - x - 2x^2 \geq 0$$

$$1 - x - 2x^2 = 0$$

$$\Delta = b^2 - 4ac$$

$$\Delta = 1^2 - 4(-2) \cdot 1$$

$$\Delta = 1 + 8$$

$$\Delta = 9$$

$$\frac{-b \pm \sqrt{\Delta}}{2 \cdot a}$$

$$\frac{-(-2) \pm \sqrt{9}}{2(-2)} = \frac{1+3}{-4} = \frac{4}{-4} = -1 \quad x_1$$

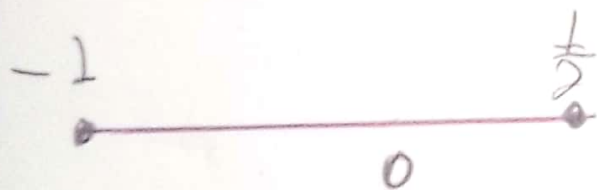
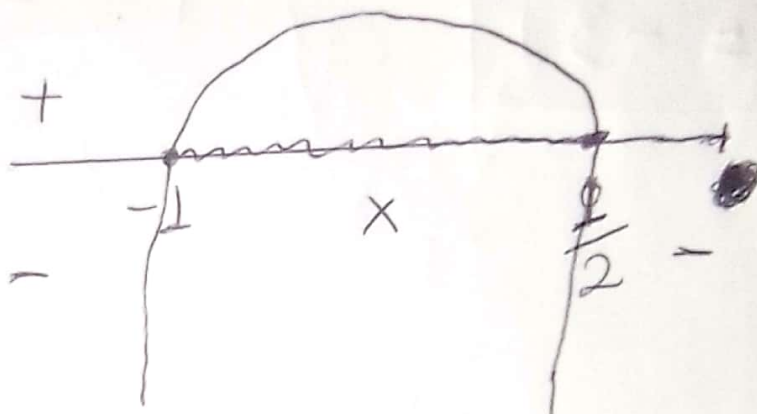
$$x^1 = -1$$

$$\frac{1-3}{-4} = \frac{-2}{-4} = -\frac{1}{2} \quad x_2$$

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

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

$$-1 \leq x \leq \frac{1}{2}$$



$$h) \frac{x+1}{2-x} < \frac{x}{3+x}$$

$$\frac{3x+3+x^2+1-2x+x^2}{\cancel{3x+3}(2-x)(3+x)} = 0$$

$$\frac{x+1}{2-x} - \frac{x}{3+x} < 0$$

$$\frac{2x^2+x+4}{(2-x)(3+x)} = 0$$

$$\frac{x+1}{2-x} - \frac{x}{3+x} = 0$$

$$\frac{(3+x)(x+1)-x(2-x)}{(2-x)(3+x)} = 0$$

$$2x^2 + x + 4 = 0$$

$$\Delta = b^2 - 4 \cdot a \cdot c$$

$$\Delta = 1^2 - 4 \cdot 2 \cdot 4$$

$$\Delta = 1 - 32$$

$$\Delta = -31$$

$$(2-x), (3+x) = 0$$

$$2-x=0$$

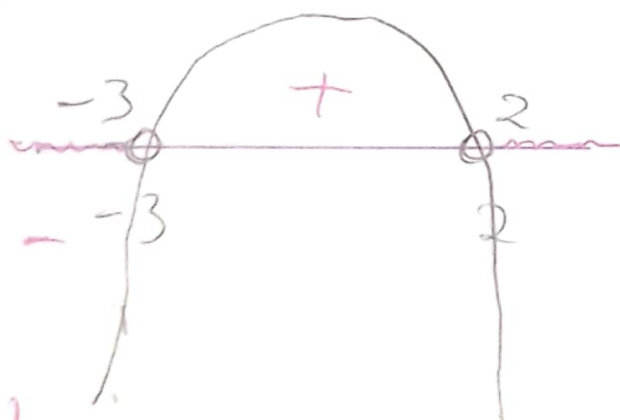
$$-x = -2 \quad (-1) \quad x' = -3$$

$$x = 2$$

$$x^2 = 2$$

$$3+x=0$$

$$x = -3$$



$$(-\infty, -3) \cup (2, +\infty)$$

$$-3 \quad 2$$

$$i) x^3 + 1 > x^2 + x$$

$$a^3 + b^3 = (a+b)(a^2 - ab + b^2)$$

$$x^3 + 1 - x^2 - x > 0$$

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

$$(x+1)(x^2 - x + 1) - x^2 - x > 0$$

$$(x+1) \cdot (x^2 - x + 1) - x(x+1)$$

$$(x+1) \cdot [(x^2 - x + 1) - x] > 0$$

$$(x+1) \cdot (x^2 - x + 1 - x) > 0$$

$$(x+1) \cdot (x^2 - 2x + 1) > 0$$

$$\underbrace{(x+1)}_{f(x)} \cdot \underbrace{(x^2 - 2x + 1)}_{g(x)} > 0$$

$$x+1=0$$

$$\boxed{x = -1}$$



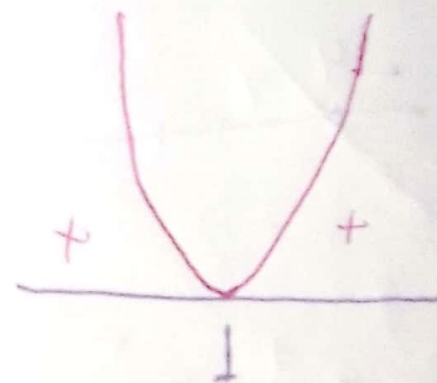
$$x^2 - 2x + 1$$

$$S = \frac{-b}{a}$$

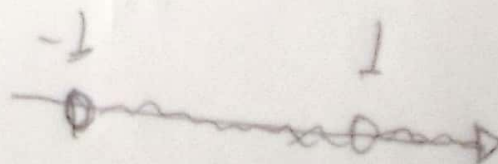
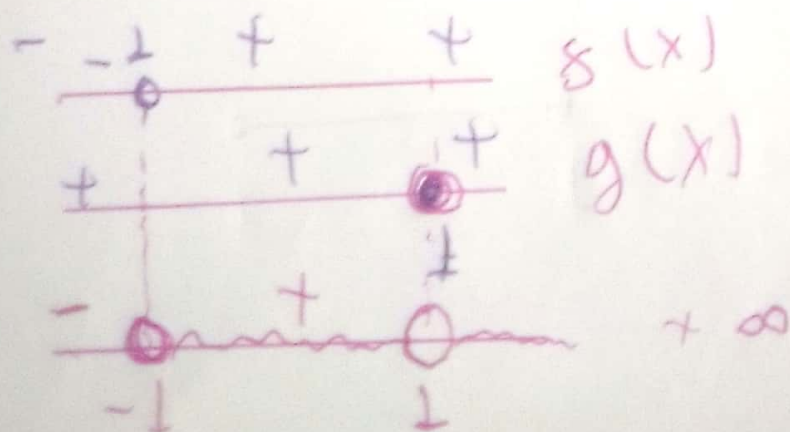
$$S = \frac{-(-2)}{1} = 2$$

$$P = \frac{c}{a}$$

$$P = \frac{1}{1} = 1$$



$$(-1, 1) \cup (1, +\infty)$$



$$2) \underbrace{(x^2 - 1)}_{f(x)} \underbrace{(x + 4)}_{g(x)} \leq 0$$

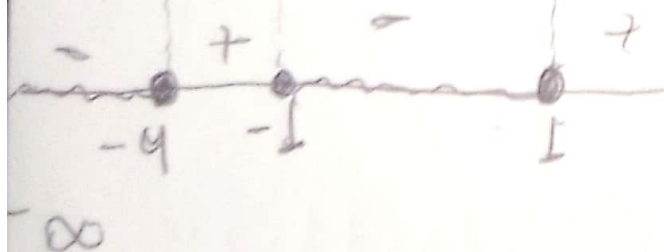
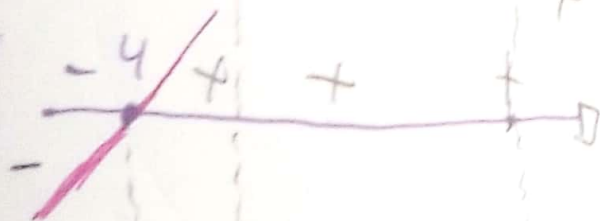
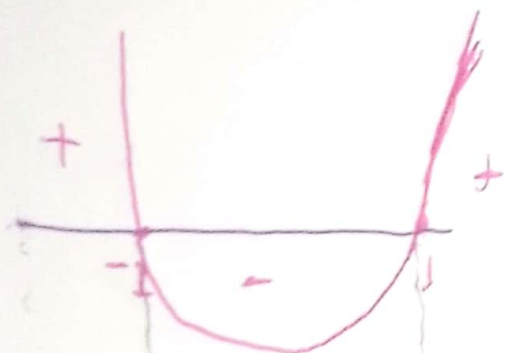
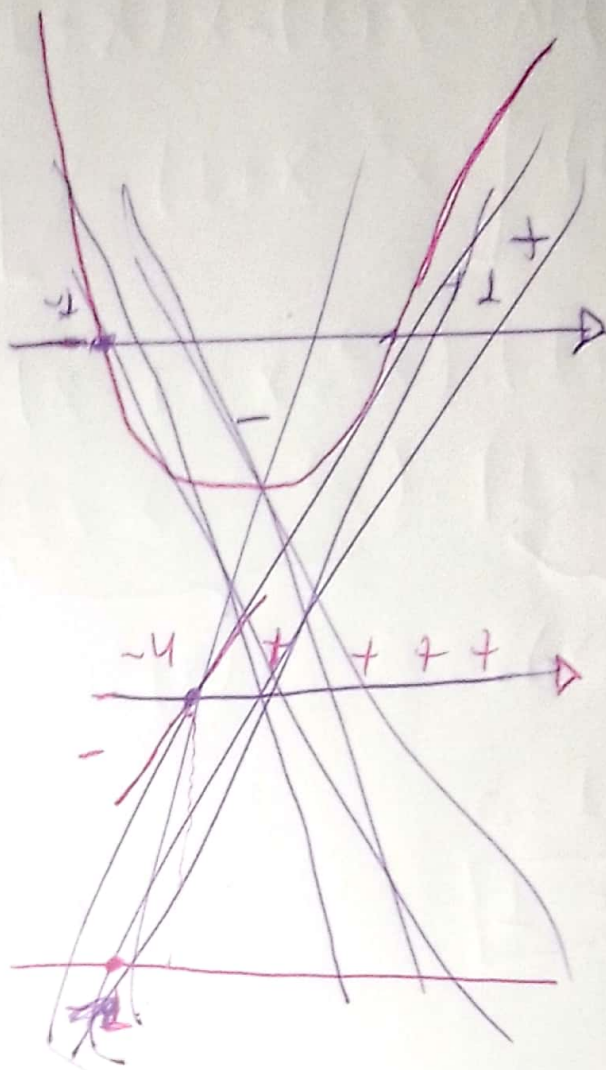
$$x^2 = 1$$

$$x = \pm 1$$

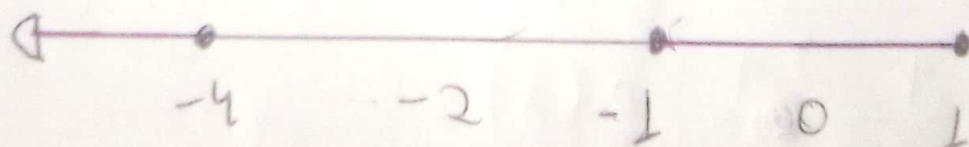
$$x = \pm 1$$

$$x + 4 = 0$$

$$x = -4$$



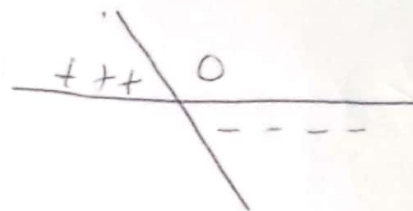
$$(-\infty, -4] \cup [-1, 1]$$



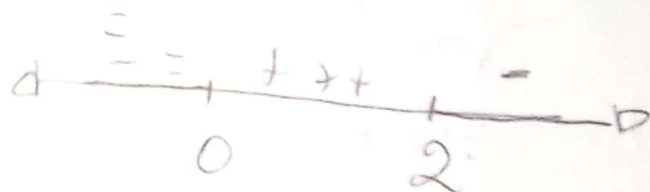
$$k) \frac{2}{x-2} \leq \frac{x+2}{x-2} \leq 1$$

$$\frac{2}{x-2} - \left(\frac{x+2}{x-2} \right) \leq 0$$

$$\frac{2 - x - 2}{x-2} \leq 0$$

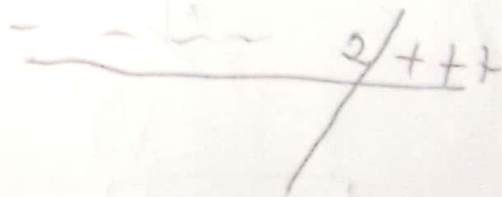


$$\frac{-x}{-x-2} \leq 0$$

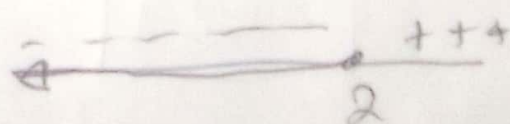


$$\frac{x+2}{x-2} - 1 \leq 0$$

$$\frac{\cancel{x+2} - \cancel{x+2}}{x-2} \leq 0$$



$$\frac{4}{x-2} \leq 0$$





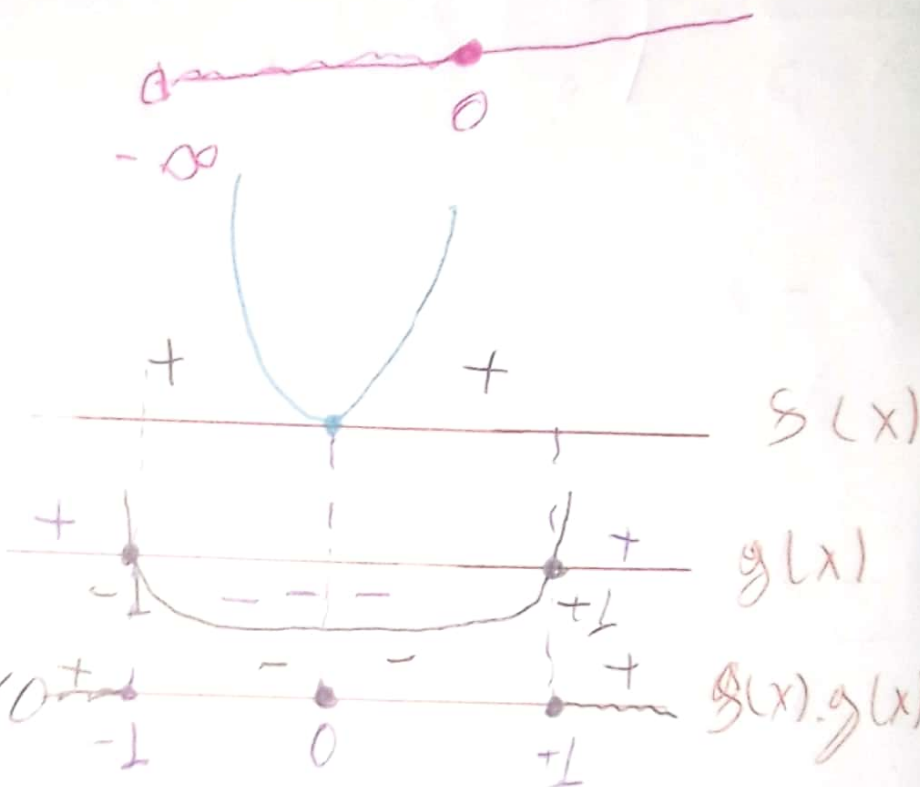
$$(-\infty, 0]$$



$$e) x^4 \geq x^2$$

$$x^4 - x^2 \geq 0$$

$$\underbrace{x^2}_{f(x)} \underbrace{(x^2 - 1)}_{g(x)} \geq 0$$



$$(-\infty, -1] \cup [1, +\infty) \cup \{0\}$$

$$\left. \begin{array}{l} x^2 = 0 \\ x^2 - 1 \end{array} \right\} \begin{array}{l} x = 0 \\ x^2 = 1 \end{array}$$

$$x^2 = 1$$

$$x = \pm \sqrt{1}$$

$$x = \pm 1$$



$$m) \frac{x}{x-3} < 4$$

$$\frac{x}{x-3} - 4 < 0$$

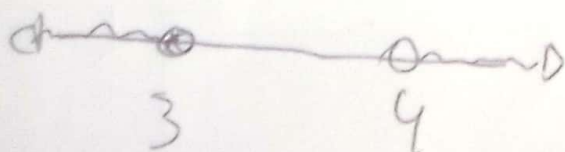
$$\frac{x - 4(x-3)}{(x-3)} < 0$$

$$\frac{x - 4x + 12}{(x-3)} < 0$$

$$\frac{-3x + 12}{(x-3)} < 0$$

$s(x)$
 $g(x)$

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



$$-3x + 12 = 0$$

$$-3x = -12 \quad (-1)$$

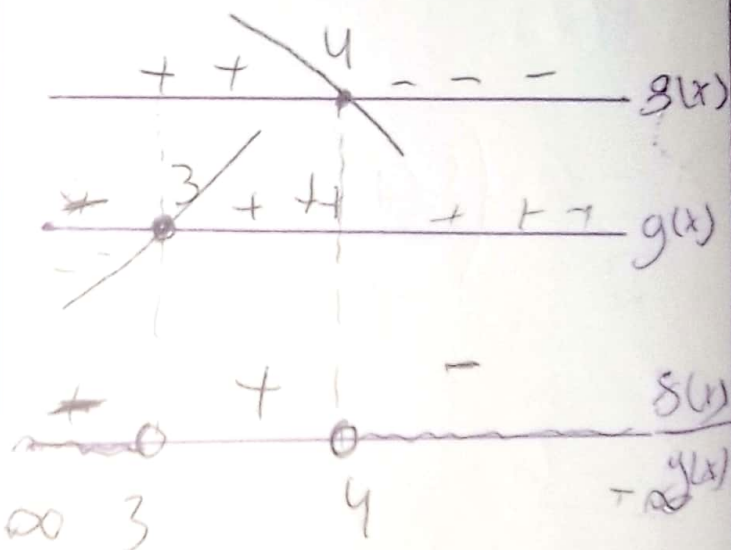
$$3x = 12$$

$$x = \frac{12}{3} \quad s(x)$$

$$x = 4$$

$$x - 3 = 0$$

$$x = 3 \quad g(x)$$



$$m) \frac{2x-3}{4+x} > 1$$

$$\frac{x}{2-3} > 1$$

$$\frac{x-6}{2} > 1$$

$$\frac{x-6}{2} \cdot \frac{1}{4+x} > 1$$

$$\frac{x-6}{2(4+x)} > 1$$

$$\frac{x-6}{8+2x} > 1$$

$$\frac{x-6}{8+2x} - 1 > 0$$

$$\frac{x-6-\cancel{1}(8+2x)}{(8+2x)} > 0$$

$$\frac{x-6-8-2x}{8+2x} > 0$$

$$\frac{-x-14}{8+2x} > 0$$

$$1^{\circ} -x-14=0$$

$$-x=14 \quad (-1)$$

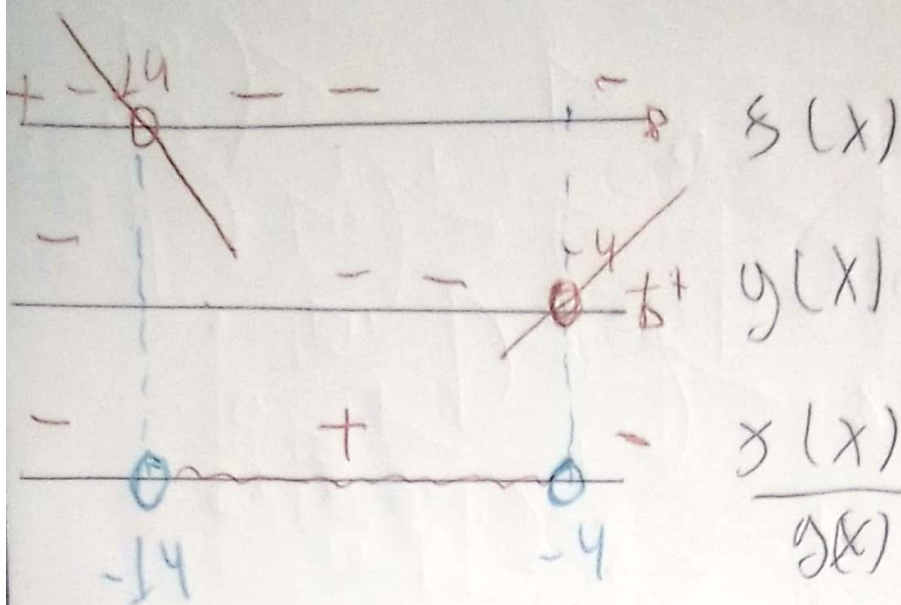
$$x=-14$$

$$2^{\circ} 8+2x=0$$

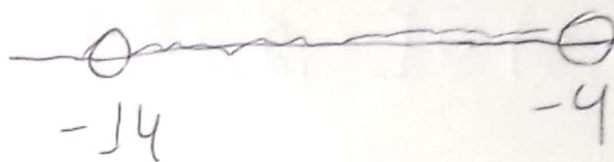
$$2x=-8$$

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

$$x=-4$$



$$(-14, -4)$$



$$e) \frac{3}{x-5} \leq 2$$

$$\frac{3}{x-5} - 2 \leq 0$$

$$\frac{3 - 2(x-5)}{(x-5)}$$

$$\frac{3 - 2x + 10}{x-5} \leq 0$$

$$\frac{-2x + 13}{x-5} \leq 0$$

$f(x)$
 $g(x)$

$$-2x + 13 = 0$$

$$-2x = -13$$

$$-x = -\frac{13}{2} \quad (-1)$$

$$x = \frac{13}{2}$$

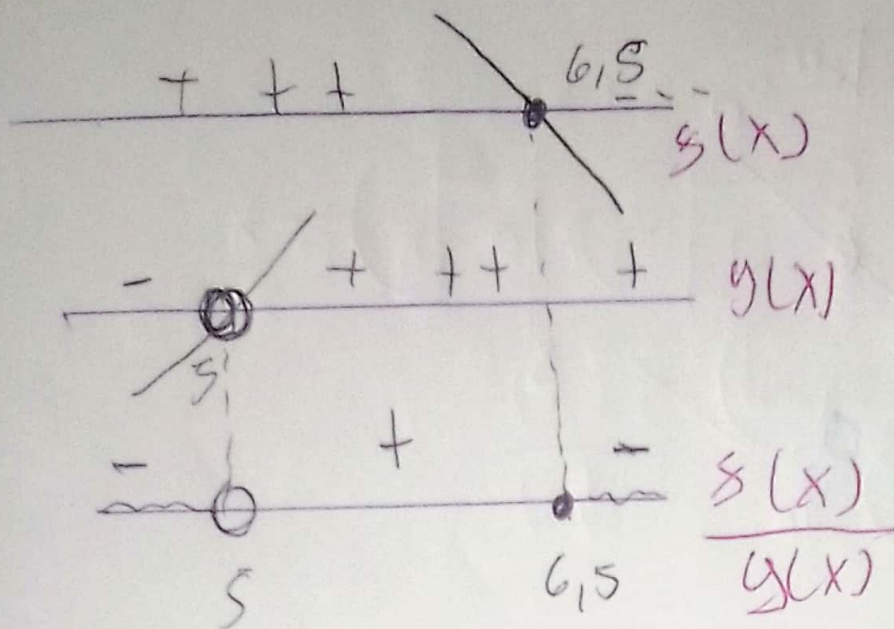
$$x = 6,5$$

$$x - 5 = 0$$

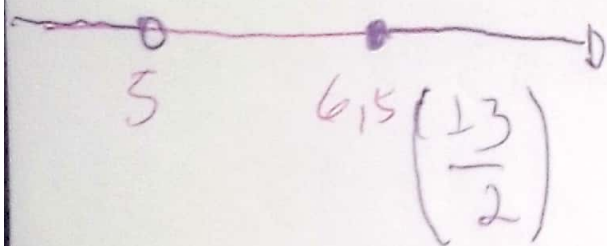
$$x = 5$$

$$x - 5 \neq 0$$

$$x \neq 5$$



$$(-\infty, 5) \cup [6,5, +\infty)$$



$$P) x^3 - x^2 - x - 2 > 0$$

$$x^3 - x^2 - x \leq -1 \quad | +1$$

$$x^3 - 1 - x^2 - x - 1 > 0$$

$$x^3 - 1^3 - x^2 - x - 1 > 0$$

$$(x-1) \cdot (x^2+x+1) - 1(x^2+x+1) > 0$$

$$(x^2+x+1)[(x-1)-1] > 0$$

$$(x^2+x+1) \cdot (x-2) > 0$$

$$(x^2+x+1)(x-2) > 0$$

$$x-2=0$$

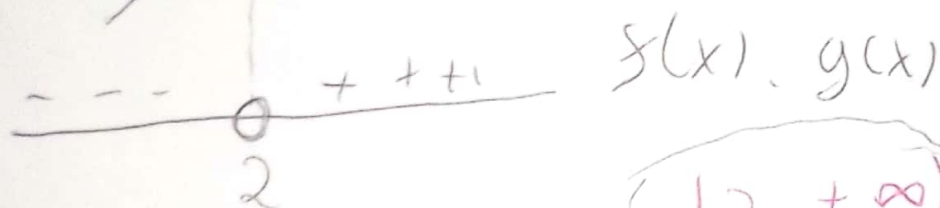
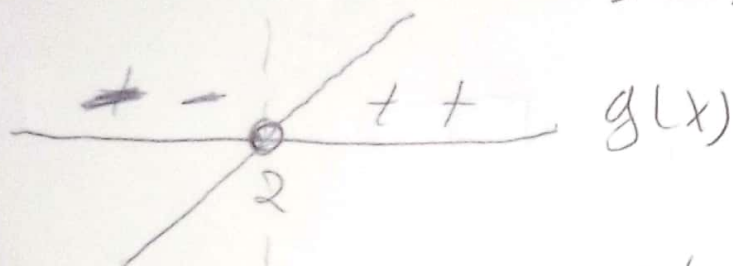
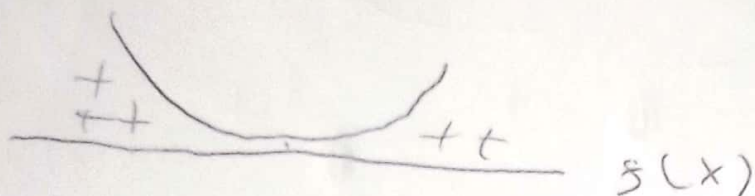
$$x=2$$

$$x^2+x+1=0$$

$$\Delta=b^2-4ac$$

$$\Delta=1-4 \cdot 1 \cdot 1$$

$$\Delta=-3$$



$$(2, +\infty)$$



$$9) x^3 - 3x + 2 \leq 0$$

$$x^3 - 3x + 2 + 1 - 1 \leq 0$$

$$x^3 - 3x + 3 - 1 \leq 0$$

$$x^3 - 1 + 3 - 1 \leq 0$$

$$x^3 - 1^3 - 3x + 3 \leq 0$$

$$(x-1) \cdot (x^2+x+1) - 3(x-1) \leq 0$$

$$(x-1) [(x^2+x+1)-3] \leq 0$$

$$(x-1) \cdot (x^2+x+1-3) \leq 0$$

$$(x-1) \cdot (x^2+x-2)$$

$$s(x)$$

$$g(x)$$

$$x-1=0$$

$$\boxed{x=1}$$

$$x^2+x-2=0$$

$$\Delta = B^2 - 4ac$$

$$\Delta = (+1)^2 - 4 \cdot 1 \cdot -2$$

$$\Delta = 1 + 8$$

$$\Delta = 9$$

$$\frac{-B \pm \sqrt{\Delta}}{2a}$$

$$2 \cdot 1$$

$$\frac{-1 \pm \sqrt{9}}{2 \cdot 1}$$

$$2 \cdot 1$$

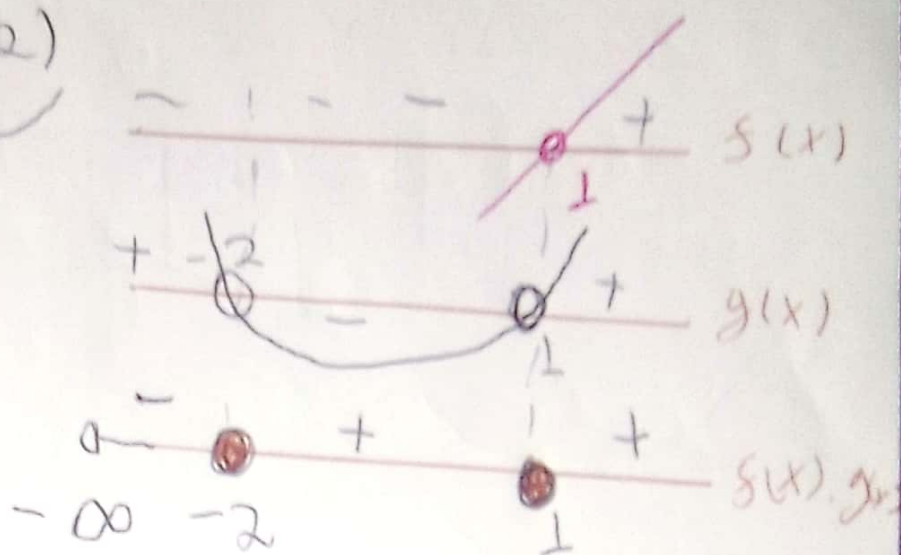
$$\frac{-1 \pm 3}{2}$$

$$= x' = \frac{-1+3}{2} = \frac{2}{2}$$

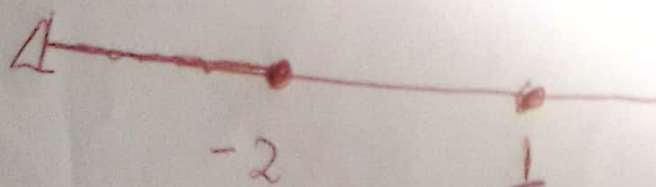
$$x' = \frac{2}{2} = 1$$

$$x^2 - 1 - 3 = \frac{-4}{2} = -2$$

$$x^2 = -2$$



$$(-\infty, -2] \cup \{1\}$$



$$n) \frac{1}{x+1} \geq \frac{3}{x-2}$$

$$\frac{1}{x+1} - \frac{3}{x-2} \geq 0$$

$$\frac{(x-2) - 3(x+1)}{(x+1)(x-2)} \geq 0$$

$$\frac{(\cancel{x}-2) - 3x - 3}{x^2 - 2x + x - 2} \geq 0$$

$$\frac{x - 2 - 3x - 3}{x^2 - x - 2} \geq 0$$

$$\frac{-2x - 5}{x^2 - x - 2} \geq 0$$

$$\frac{g(x)}{y(x)} \geq 0$$

$$-2x - 5 = 0$$

$$-2x = 5$$

$$-x = \frac{5}{2} \quad (-1)$$

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

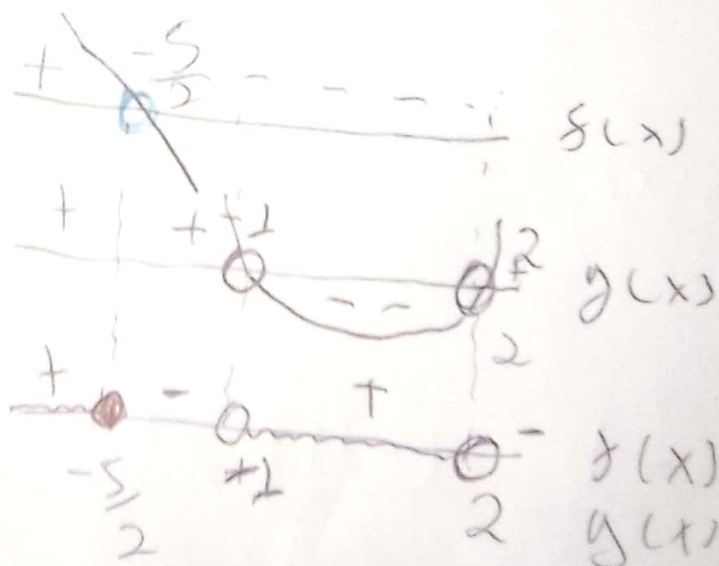
$$x^2 - x - 2 = 0$$

$$S = \frac{-B}{A} = \frac{-(-1)}{1} = 1$$

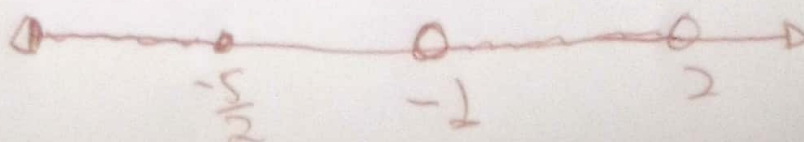
$$P = \frac{C}{A} = \frac{(-2)}{1} = -2$$

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

$$x^2 = 2$$



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



$$D) 8x^3 - 4x^2 - 2x + 1 < 0$$

$$(2x)^3 - (2x)^2 - 2x + 1 < 0$$

$$(2x)^3 + 1^3 - (2x)^3 - 2x < 0$$

$$(2x+1) \cancel{((2x)^3 - 2x + 1)} - (2x) \cdot (2x+1)$$

$$(2x+1) [(2x)^2 - 2x + 1 - 2x] < 0$$

$$(2x+1) [(2x)^2 - 4x + 1] < 0$$

$$(2x+1) \cdot [4x^2 - 4x + 1] < 0$$

$$f(x)$$

$$g(x)$$

$$2x+1=0$$

$$2x = -1$$

$$f(x) \left(x = -\frac{1}{2} \right)$$

$$4x^2 - 4x + 1 = 0$$

$$\Delta = (-4)^2 - 4 \cdot 4 \cdot 1$$

$$\Delta = 16 - 16$$

$$\Delta = 0$$

$$\frac{-b}{2a} = \frac{-(-4)}{2 \cdot 4} = \frac{4}{8} = \frac{1}{2}$$

$$g(x) = \frac{1}{2}$$

$$- \frac{1}{2} + + + + \quad f(x)$$

$$+ + \quad \frac{1}{2} + + \quad g(x)$$

$$- \frac{1}{2} + + + \quad \frac{1}{2} + \quad f(x) \cdot g(x)$$

$$\left(-\infty, -\frac{1}{2}\right) \quad \frac{1}{2}$$

$$+1) 12x^3 - 20x^2 \geq -11x + 2$$

$$12x^3 - 20x^2 + 11x - 2 \geq 0$$

$$(2x)^3 + 4x^3 - 20x^2 + 11x - 2 \geq 0$$

$$(2x)^3 - 1 + 4x^3 - 20x^2 + 11x - 1 \geq 0$$

$$(2x - 1)(4x^2 + 2x + 1) + 4x^3 - 20x^2 + 11x - 1 \geq 0$$

$$\begin{array}{r} 4x^3 - 20x^2 + 11x - 1 \quad | \quad 2x - 1 \\ -4x^3 + 2x^2 \quad \quad \quad 2x^2 - 9x + 1 \end{array}$$

$$-18x^2 + 11x - 1$$

$$18x^2 - 9x$$

$$+2x - 1$$

$$(2x-1) \cdot (4x^2 + 2x + 1) + (2x-1) \cdot (2x^2 - 3x + 1)$$

$$(2x-1) \cdot (4x^2 + 2x + 1 + 2x^2 - 3x + 1)$$

$$(2x-1) \cdot (6x^2 - 7x + 2) \geq 0$$

$$s(x) \cdot g(x)$$

$$2x - 1 = 0$$

$$2x = 1$$

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

$$6x^2 - 7x + 2 = 0$$

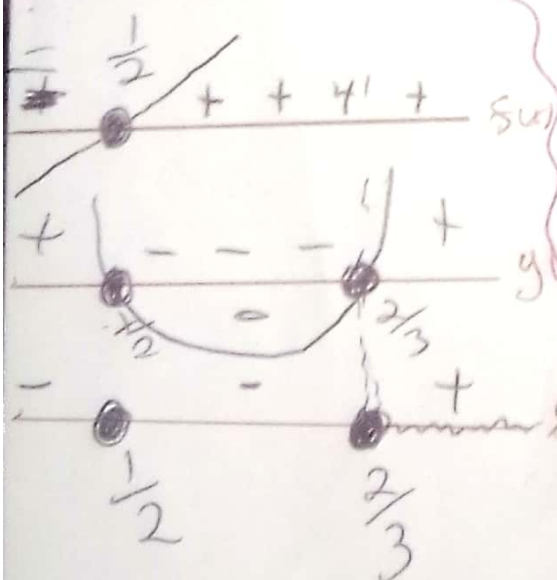
$$\Delta = b^2 - 4 \cdot a \cdot c$$

$$\Delta = (-7)^2 - 4 \cdot 6 \cdot 2$$

$$49 - 48$$

$$\Delta = 1$$

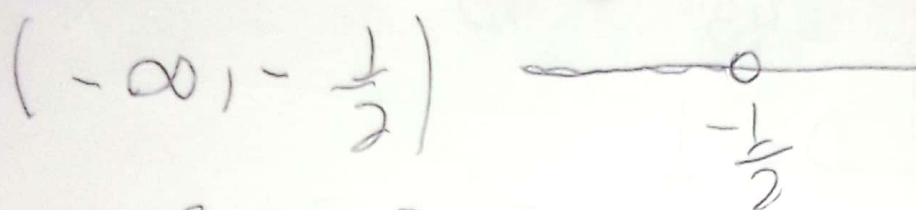
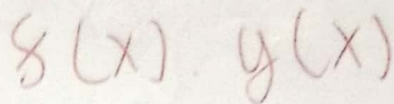
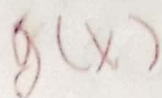
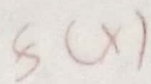
$$\frac{-b \pm \sqrt{\Delta}}{2 \cdot a} = \frac{-(-7) \pm \sqrt{1}}{2 \cdot 6} = \frac{+7 \pm 1}{12}$$



$$x' = \frac{8 + 1}{12} = \frac{8}{12} = \frac{2}{3}$$

$$x'' = \frac{7 - 1}{12} = \frac{6}{12} = \frac{1}{2}$$

$$\left[\frac{2}{3}, +\infty \right) \cup \left\{ \frac{1}{2} \right\}$$



+) $12x^3 - 20x^2 \geq -11x + 2$

$$12x^3 - 20x^2 + 11x - 2 \quad 7/0$$

$$(2x)^3 + 4x^3 - 20x^2 + 11x - 27/0$$

$$(2x)^3 - 1 + 4x^3 - 20x^2 + 11x - 27/0$$

$$(2x-1)(4x^2+2x+1) + 4x^3 - 20x^2 + 11x - 1 \geq 0$$

$$\begin{array}{r} 4x^3 - 20x^2 + 11x - 1 \mid 2x - 1 \\ -4x^3 + 2x^2 \\ \hline 2x^2 - 9x + 1 \end{array}$$

$$-18x^2 + 11x - 1$$

$$18x^2 - 9x$$

$$+2x - 1$$

$$2. a) |5x - 3| = 12$$

$$\left. \begin{array}{l} 5x - 3 = 12 \\ 5x = 12 + 3 \\ 5x = 15 \\ x = \frac{15}{5} \\ x = 3 \end{array} \right\} \begin{array}{l} 5x - 3 = -12 \\ 5x = -12 + 3 \\ 5x = -9 \\ x = \frac{-9}{5} \end{array}$$

Solução $\left\{ -\frac{9}{5}, 3 \right\}$

$$b) |1 - 4 + 12x| = 7$$

$$\left. \begin{array}{l} -4 + 12x = 7 \\ 12x = +4 + 7 \\ 12x = 11 \\ x = \frac{11}{12} \end{array} \right\} \begin{array}{l} -4 + 12x = -7 \\ 12x = -7 + 4 \\ 12x = -3 \\ x = -\frac{3}{12} = -\frac{1}{4} \end{array}$$

Solução $\left\{ -\frac{1}{4}, \frac{11}{12} \right\}$

$$c) |2x - 3| = |7x - 5|$$

$$\begin{array}{l} 2x - 3 = 7x - 5 \\ 2x - 7x = -5 + 3 \\ -5x = -2 \quad (-1) \\ x = \frac{2}{5} \end{array}$$

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

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

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

$$-9x = -8 \quad (-1)$$

$$9x = 8$$

$$x = \frac{8}{9}$$

$$\text{Solução} \left\{ \frac{2}{5}, \frac{8}{9} \right\}$$

$$d) \left| \frac{x+2}{x-2} \right| = 5$$

$$\frac{x+2}{x-2} = 5 \quad , x \neq 2$$

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

$$x+2 = 5x-10$$

$$x-5x = -10-2$$

$$-4x = -12 \quad (-1)$$

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

$$x = 3$$

$$\frac{x+2}{x-2} = -5, \quad x \neq 2$$

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

$$x+2 = -5x+10$$

$$x+5x = +10-2$$

$$6x = 8$$

$$x = \frac{8}{6} = \frac{4}{3}$$

$$x = \frac{4}{3}$$

$$\text{Solução} = \left\{ \frac{4}{3}, 3 \right\}$$

$$e) \left| \frac{3x+8}{2x-3} \right| = 4$$

$$\frac{3x+8}{2x-3} = 4 \quad x \neq \frac{3}{2}$$

$$3x+8 = 4(2x-3)$$

$$3x+8 = 8x-12$$

$$3x-8x = -12-8$$

$$-5x = -20 \quad (-1)$$

$$5x = 20$$

$$x = \frac{20}{5}$$

$$x = 4$$

Solução $\left\{ \frac{4}{11}, 4 \right\}$

$$f) |3x+2| = 5-x$$

$$3x+2 = 5-x \quad \left\{ \begin{array}{l} 3x+2 = -(5-x) \end{array} \right.$$

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

$$4x = 3$$

$$x = \frac{3}{4}$$

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

$$3x-x = -5-2$$

$$2x = -7$$

$$x = \frac{-7}{2}$$

Solução $\left\{ -\frac{7}{2}, \frac{3}{4} \right\}$

$$\frac{3x+8}{2x-3} = -4 \quad x \neq \frac{3}{2}$$

$$3x+8 = -4(2x-3)$$

$$3x+8 = -8x+12$$

$$3x+8x = 12-8$$

$$11x = 4$$

$$x = \frac{4}{11}$$

$$g) |9x| - 11 = x$$

$$x > 0$$

$$9x - 11 = x$$

$$9x + x = +11$$

$$8x = 11$$

$$x = \frac{11}{8}$$

$$x < 0$$

$$-9x - 11 = x$$

$$-9x - x = 11$$

$$-10x = 11 \quad (-1)$$

$$x = -\frac{11}{10}$$

$$\text{Solução } \left\{ -\frac{11}{10}, \frac{11}{8} \right\}$$

$$h) 2x - 7 = |x| + 1$$

$$2x - 7 = x + 1$$

$$2x - x = +1 + 7$$

$$x = 8$$

$$(x > 0)$$

$$2x - 7 = -x + 1$$

$$2x + x = +1 + 7$$

$$3x = 8$$

$$x = \frac{8}{3}$$

$$(x < 0)$$

$$\text{Solução } \{8\}$$

$$3) a) |x + 12| < 7$$

$$-7 < x + 12 < 7$$

$$-7 + 12 < x < 7$$

$$-19 < x < 7 - 12$$

$$-19 < x < -5$$

$$x \in (-19, -5)$$

$$b) |3x - 4| \leq 2$$

$$-2 \leq 3x - 4 \leq 2$$

$$-2 + 4 \leq 3x + 4 + 4 \leq 2 + 4$$

$$+2 \leq 3x \leq 2 + 4$$

$$\frac{+2}{3} \leq \frac{3x}{3} \leq \frac{6}{3}$$

$$x \in \left[\frac{2}{3}, 2\right]$$

$$\frac{+2}{3} \leq x \leq 2$$

$$c) |5 - 6x| \geq 9$$

$$5 - 6x \geq 9$$

$$-6x \geq 9 - 5$$

$$-6x \geq 4$$

$$-x \geq \frac{4}{6} \quad (-1)$$

$$x \leq -\frac{4}{6} = -\frac{2}{3}$$

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

$$5 - 6x \leq -9$$

$$-6x \leq -9 - 5$$

$$-6x \leq -14$$

$$-x \leq -\frac{14}{6} \quad (-1)$$

$$x \geq \frac{14}{6}$$

$$x \geq \frac{7}{3}$$

$$\left(-\infty, -\frac{2}{3}\right] \cup \left[\frac{7}{3}, +\infty\right)$$

$$d) |2x - 5| > 3$$

$$\begin{array}{l} 2x - 5 > 3 \\ 2x > 3 + 5 \\ 2x > 8 \\ x > \frac{8}{2} \\ \boxed{x > 4} \end{array} \quad \left\{ \begin{array}{l} 2x - 5 < -3 \\ 2x < -3 + 5 \\ 2x < +2 \\ x < \frac{2}{2} \\ \boxed{x < 1} \end{array} \right.$$

$$(-\infty, 1) \cup (4, +\infty)$$

$$e) |6 + 2x| < |4 - x|$$

$$|6 + 2x|^2 < |4 - x|^2$$

$$36 + 24x + 4x^2 < 16 - 8x + x^2$$

$$3x^2 + 32x + 20 < 0$$

$$(3x + 2)(x + 10) < 0$$

$$3\left(x + \frac{2}{3}\right)(x + 10) < 0$$

$$x \in \left(-10, -\frac{2}{3}\right)$$

$$8) |x + 4| \leq |2x - 6|$$

$$x^2 + 8x + 16 \leq 4x^2 - 24x + 36$$

$$-3x^2 + 32x - 20 \leq 0$$

$$3x^2 - 32x + 20 \geq 0$$

$$(x - 10)(3x - 2) \geq 0$$

$$3(x - 10)\left(x - \frac{2}{3}\right) \geq 0$$

$$\text{Solución } (-\infty, \frac{2}{3}] \cup [10, +\infty)$$

$$9) |3x| > |5 - 2x|$$

$$9x^2 > 25 - 4x^2 - 20x$$

$$5x^2 + 20x - 25 > 0$$

$$(x - 1)(x + 5) > 0$$

$$x \in (-\infty, -5) \cup (1, +\infty)$$

$$h) \left| \frac{7 - 2x}{5 + 3x} \right| \leq \frac{1}{2}$$

$$\frac{7 - 2x}{5 + 3x} \leq \frac{1}{2}$$

$$2|7 - 2x| \leq |5 + 3x|$$

$$196 - 112x + 46x^2 \leq 25 + 30x + 9x^2$$

$$7x^2 - 142x + 171 \leq 0$$

$$(x-19)(7x-9) \leq 0$$

$$7(x-19)\left(x-\frac{9}{7}\right) \leq 0$$

$$\text{Solucao } \left[\frac{9}{7}, 19\right]$$

$$\wedge |x-1| + |x+2| \geq 4$$

$$x \geq 1$$

$$x < -2$$

$$x-1+x+2 \geq 4$$

$$2x+1 \geq 4$$

$$2x \geq 3$$

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

$$-x+1-x-2 \geq 4$$

$$-2x-1 \geq 4$$

$$-2x \geq 5$$

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

$$-2 \leq x < 1$$

$$-x+1+x+2 \geq 4$$

$$3 \geq 4$$

Solucao

$$\left[\frac{3}{2}, +\infty\right) \cup \left(-\infty, -\frac{5}{2}\right]$$

$$2) 1 < |x+2| < 4$$

$$1^{\circ} \text{ caso } x+2 \geq 0 \quad x \geq -2$$

$$1 < x+2 < 4$$

$$-1 < x < +2$$

$$(-1, 2)$$

$$2^{\circ} \text{ caso } x+2 < 0 \quad x < -2$$

$$1 < -x-2 < 4$$

$$3 < -x < 6 \quad (-1)$$

$$-6 < x < 3$$

$$(-6, -3)$$

$$(-6, -3) \cup (-1, 2)$$

$$K. \left| \frac{2+x}{3-x} \right| > 4$$

$$\left| \frac{2+x}{3-x} \right| > 4, \quad x \neq 3$$

$$|2+x| > 4|3-x|$$

$$4+4x+x^2 > 16(9-6x+x^2)$$

$$4+4x+x^2 > 144-96x+16x^2$$

$$15x^2 - 100x - 140 > 0$$

$$(x-2)(3x-14) < 0$$

$$3(x-2)\left(x-\frac{14}{3}\right) < 0$$

$$\text{Solução } \left(2, \frac{14}{3}\right) - \{3\}$$

$$e \left| \frac{5}{2x-1} \right| \geq \left| \frac{1}{x-2} \right|$$

$$\frac{5}{|2x-1|} \geq \frac{1}{|x-2|}$$

$$5|x-2| \geq |2x-1|$$

$$25(x^2 - 4x + 4) \geq 4x^2 - 4x + 1$$

$$25x^2 - 100x + 100 \geq 4x^2 - 4x + 1$$

$$21x^2 - 96x + 99 \geq 0$$

$$(x-3)(7x-11) \geq 0$$

$$x=3$$

$$x = \frac{11}{7}$$

$$(-\infty, \frac{11}{7}] \cup [3, +\infty) - \left\{\frac{1}{2}\right\}$$

$$m) |x| + 1 \leq x$$

$$1^\circ \text{ caso } x \geq 0$$

$$x+1 \leq x$$

$$x-x \leq -1$$

$$0 \leq -1$$

Solução: 0

$$2^\circ \text{ caso } x < 0$$

$$-x+1 \leq x$$

$$-x-x \leq -1$$

$$-2x \leq -1$$

$$x \geq \frac{1}{2}$$

Solução
Batal

(-1)

$$x-1-x-3 < 4x$$

$$2x-4x-4 < 0$$

$$-2x < 4$$

$$x > -\frac{4}{2}$$

$$x > -2$$

$$x \geq 3 \text{ ou } [3, +\infty)$$

2º caso $1 \leq x < 3$

$$x+1-x-3 < 4x$$

$$2 < 4x$$

$$(x > \frac{1}{2})$$

$$[1, 3)$$

3º caso $0 \leq x < 1$

$$-x+1-x+3 < 4x$$

$$-2x+4 < 4x$$

$$4 < 6x$$

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

$$(\frac{2}{3}, 1)$$

4º caso $x < 0$

$$-x+1-x+3 < -4x$$

$$-2x+4 < -4x$$

$$2x < -4$$

$$x < -2$$

$$S = (-\infty, -2) \cup$$

$$7) |3x-1| + |x| < 1$$

1º caso

$$x > 1$$

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

$$3x - 3 + x < 1$$

$$4x < 1 + 3$$

$$4x < 4$$

$$x < \frac{4}{4} = 1$$

$$S = x < 1$$

Solução ①

2º caso

$$x-1 < 0 \quad 1 < x < 0, x < 1$$

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

$$-3x + 3 - x < 1$$

$$-4x < -2 \quad (-1)$$

$$x > \frac{1}{2}$$

$$x > \frac{1}{2}$$

Solução ②

$$\text{Final} = 0$$

$$8) |2x^2 + 3x + 3| \leq 3$$

1º caso

$$2x^2 + 3x + 3 \neq 0$$

$$x \in \mathbb{R}$$

Solução Final

$$\left[-\frac{3}{2}, 0\right]$$

2º caso

$$2x^2 + 3x + 3 \leq 3$$

$$2x^2 + 3x \leq 0$$

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

$$9) |x-1| + |x-3| < |4x|$$

1º caso $x > 3$

$$4) \frac{1}{|x+1||x-3|} \geq \frac{1}{5}$$

$$5 \geq |x+1||x-3|$$

$$1^{\circ} \text{ caso } x > 3$$

$$5 \geq (x+1)(x-3)$$

$$5 \geq x^2 - 3x + 3 + x$$

$$x^2 - 2x - 8 \leq 0$$

$$(x-4)(x+2) \leq 0$$

$$[-2, 4]$$

$$2^{\circ} \text{ caso } (-1, 3)$$

$$5 \geq (x+1)(x+3)$$

$$5 \geq -x^2 + 3x - x + 3$$

$$x^2 - 2x + 2 \geq 0$$

$$x \in \mathbb{R}$$

$$S = (-1, 3)$$

$$3^{\circ} \text{ caso } x < -1$$

$$5 \geq (-x-1)(-x+3)$$

$$5 \geq x^2 - 3x + 3 + x$$

$$x^2 - 2x - 8 \leq 0$$

$$[-2, 4]$$

$$S \in [-2, 4] - \left\{-\frac{1}{2}\right\}$$

$$R \left| \frac{x - \frac{1}{2}}{x + \frac{1}{2}} \right| < 1$$

$$\left| x - \frac{1}{2} \right| < \left| x + \frac{1}{2} \right| \quad x \neq -\frac{1}{2}$$

$$x^2 - x + \frac{1}{4} < x^2 + 1x + \frac{1}{4}$$

$$-2x < 0$$

$$2x > 0$$

$$x > 0$$

$$(0, +\infty)$$

$$S) \left| \frac{3-2x}{1+x} \right| \leq 4$$

$$|3-2x| \leq 4|1+x|, \quad x \neq -1$$

$$9 - 12x + 4x^2 \leq 16(1 + 2x + x^2)$$

$$9 - 12x + 4x^2 \leq 16 + 32x + 16x^2$$

$$-12x - 44x - 7 \leq 0$$

$$12x^2 - 44x - 7 \geq 0$$

$$(6x+1)(2x+7) \geq 0$$

$$\left(-\infty, -\frac{7}{2}\right] \cup \left[-\frac{1}{6}, +\infty\right)$$