
Desigualdades, del tipo $ax+b \geq cx+d$

Resolver las siguientes desigualdades

1. $3x + 2 < 5x - 1$

2. $3 - 2x \geq 5x - 3$

3. $3x - 1 \leq 9 + 2x$

4. $-x + 1 \geq 3x + 1$

5. $\frac{3}{2}x - 1 \geq 4x - \frac{5}{2}$

6. $\frac{2}{3}x + \frac{2}{3} \leq -\frac{2}{3}x + 9$

7. $\frac{4}{9}x - 5 \geq \frac{6}{5} + 5x$

8. $-\frac{x}{2} + 1 \leq -3 - \frac{9x}{5}$

9. $-3 - \frac{3}{5}x > \frac{5}{3}x + 2$

10. $\frac{-x + \frac{4}{3}}{2} \leq 6x - 6$

11. $\frac{3x}{2} \geq 3\frac{(x-2)}{4}$

12. $4\left(\frac{x-5}{3}\right) > \frac{2(-3+x)}{5}$

13. $\frac{3}{2}(-2+x) \leq -\frac{5}{2} + x$

14. $-1(-3x+2) \geq 3(-2x-1)$

$$15. \left(x - \frac{1}{2}\right)^2 \geq \frac{5}{2}x$$

$$16. \left(-5 + \frac{x}{9}\right)^2 > 3 - 2x$$

$$17. \frac{2}{3} \cdot \frac{x-1}{5} \leq 3(3x+1)$$

$$18. -\frac{4}{9} \left(\frac{x+5}{2}\right) > -1 \left(\frac{1}{3}x + \frac{1}{2}\right)$$

$$19. -\frac{(x+2)}{3} \left(-\frac{1}{2}\right) < \left(-\frac{2}{3}\right) \left(\frac{x}{5} - 1\right)$$

$$20. \left(\frac{4}{3}\right) \left(-x - \frac{1}{5}\right) \geq \left(-\frac{1}{9}\right) \left(\frac{x}{3} - 9\right)$$

Respuestas

1. $3x + 2 < 5x - 1$

$$3x + 2 < 5x - 1 \Rightarrow 3x - 5 < -1 - 2 = -3 \Rightarrow -2x < -3 \Rightarrow x > \frac{-3}{-2} = \frac{3}{2} \Rightarrow$$

$$\Rightarrow CS = \left(\frac{3}{2}, +\infty\right)$$

2. $3 - 2x \geq 5x - 3$

$$3 - 2x \geq 5x - 3 \Rightarrow -2x - 5x \geq -3 - 3 \Rightarrow -7x \geq -6 \Rightarrow x \leq \frac{-6}{-7} \Rightarrow x \leq \frac{6}{7} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, \frac{6}{7}\right]$$

3. $3x - 1 \leq 9 + 2x$

$$3x - 1 \leq 9 + 2x \Rightarrow 3x - 2x \leq 9 + 1 \Rightarrow x \leq 10 \Rightarrow$$

$$\Rightarrow CS = (-\infty, 10]$$

4. $-x + 1 \geq 3x + 1$

$$-x + 1 \geq 3x + 1 \Rightarrow -x - 3x \geq 1 - 1 \Rightarrow -4x \geq 0 \Rightarrow x \leq \frac{0}{-4} \Rightarrow x \leq 0 \Rightarrow$$

$$\Rightarrow CS = (-\infty, 0]$$

5. $\frac{3}{2}x - 1 \geq 4x - \frac{5}{2}$

$$\frac{3}{2}x - 1 \geq 4x - \frac{5}{2} \Rightarrow \frac{3}{2}x - 4x \geq -\frac{5}{2} + 1 \Rightarrow \frac{3x - 8x}{2} \geq \frac{-5 + 2}{2} \Rightarrow -5x \geq -3 \Rightarrow$$

$$x \leq \frac{-3}{-5} \Rightarrow x \leq \frac{3}{5} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, \frac{3}{5}\right]$$

6. $\frac{2}{3}x + \frac{2}{3} \leq -\frac{2}{3}x + 9$

$$\frac{2}{3}x + \frac{2}{3} \leq -\frac{2}{3}x + 9 \Rightarrow \frac{2}{3}x + \frac{2}{3}x \leq 9 - \frac{2}{3} \Rightarrow \frac{4}{3}x \leq \frac{27 - 2}{3} \Rightarrow \frac{4}{3}x \leq \frac{25}{3} \Rightarrow 4x \leq$$

$$25 \Rightarrow x \leq \frac{25}{4} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, \frac{25}{4}\right]$$

$$7. \frac{4}{9}x - 5 \geq \frac{6}{5} + 5x$$

$$\frac{4}{9}x - 5 \geq \frac{6}{5} + 5x \Rightarrow \frac{4}{9}x - 5x \geq \frac{6}{5} + 5 \Rightarrow \frac{4x - 45x}{9} \geq \frac{6 + 25}{5} \Rightarrow \frac{-41x}{9} \geq \frac{31}{5} \Rightarrow$$

$$-41x \geq \frac{31 \cdot 9}{5} \Rightarrow$$

$$\Rightarrow x \leq \frac{279}{5(-41)} \Rightarrow x \leq \frac{279}{-205} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, -\frac{279}{205}\right]$$

$$8. -\frac{x}{2} + 1 \leq -3 - \frac{9x}{5}$$

$$-\frac{x}{2} + 1 \leq -3 - \frac{9x}{5} \Rightarrow -\frac{x}{2} + \frac{9x}{5} \leq -3 - 1 \Rightarrow \frac{-5x + 18x}{10} \leq -4 \Rightarrow \frac{13x}{10} \leq -4 \Rightarrow$$

$$\Rightarrow x \leq \frac{(-4)10}{13} \Rightarrow x \leq \frac{-40}{13} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, -\frac{40}{13}\right]$$

$$9. -3 - \frac{3}{5}x > +\frac{5}{3}x + 2$$

$$-3 - \frac{3}{5}x > +\frac{5}{3}x + 2 \Rightarrow -\frac{3}{5}x - \frac{5}{3}x > 2 + 3 \Rightarrow \frac{-9x - 25x}{15} > 5 \Rightarrow -34x > 5 \cdot 15 \Rightarrow$$

$$x < \frac{75}{-34} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, -\frac{75}{34}\right)$$

$$10. \frac{-x + \frac{4}{3}}{2} \leq 6x - 6$$

$$\frac{-x + \frac{4}{3}}{2} \leq 6x - 6 \Rightarrow -x + \frac{4}{3} \leq 12x - 12 \Rightarrow -x - 12x \leq -12 - \frac{4}{3} \Rightarrow -13x \leq \frac{-36 - 4}{3} \Rightarrow$$

$$\Rightarrow x \geq \frac{-40}{3(-13)} \Rightarrow x \geq \frac{40}{39} \Rightarrow$$

$$\Rightarrow CS = \left(\frac{40}{39}, \infty\right)$$

$$11. \frac{3x}{2} \geq 3 \frac{(x-2)}{4}$$

$$\begin{aligned} \frac{3x}{2} \geq 3 \frac{(x-2)}{4} &\Rightarrow \frac{3x}{2 \cdot 3} \geq \frac{x \cdot 2}{4} \Rightarrow \frac{x}{2} - \frac{x}{4} \geq -\frac{2}{4} \Rightarrow \frac{2x-x}{4} \geq -\frac{1}{2} \Rightarrow \frac{x}{4} \geq -\frac{1}{2} \Rightarrow \\ &\Rightarrow x \geq -\frac{1 \cdot 4}{2} \Rightarrow x \geq -2 \Rightarrow \\ &\Rightarrow CS = [-2, +\infty) \end{aligned}$$

$$12. 4 \left(\frac{x-5}{3} \right) > \frac{2(-3+x)}{5}$$

$$\begin{aligned} 4 \left(\frac{x-5}{3} \right) > \frac{2(-3+x)}{5} &\Rightarrow \frac{x}{3} - \frac{5}{3} > \frac{2(-3+x)}{5 \cdot 4} \Rightarrow \frac{x}{3} > \frac{-3+x}{10} + \frac{5}{3} \Rightarrow \frac{x}{3} - \frac{x}{10} > \\ &\frac{-3}{10} + \frac{5}{3} \Rightarrow \\ &\Rightarrow \frac{10x-3x}{30} > \frac{-9+50}{30} \Rightarrow 7x > 41 \Rightarrow x > \frac{41}{7} \Rightarrow \\ &\Rightarrow CS = \left(\frac{41}{7}, \infty \right) \end{aligned}$$

$$13. \frac{3}{2}(-2+x) \leq -\frac{5}{2} + x$$

$$\begin{aligned} \frac{3}{2}(-2+x) \leq -\frac{5}{2} + x &\Rightarrow -2+x \leq \frac{2}{3} \left(-\frac{5}{2} + x \right) \Rightarrow x \leq -\frac{5}{3} + \frac{2x}{3} + 2 \Rightarrow x - \frac{2x}{3} \leq \\ &-\frac{5}{3} + 2 \Rightarrow \\ &\Rightarrow \frac{3x-2x}{3} \leq \frac{-5+6}{3} \Rightarrow \frac{x}{3} \leq \frac{1}{3} \Rightarrow x \leq 1 \Rightarrow \\ &\Rightarrow CS = (-\infty, 1] \end{aligned}$$

$$14. -1(-3x+2) \geq 3(-2x-1)$$

$$\begin{aligned} -1(-3x+2) \geq 3(-2x-1) &\Rightarrow 3x-2 \geq -6x-3 \Rightarrow 3x+6x \geq -3+2 \Rightarrow 9x \geq \\ &-1 \Rightarrow x \geq -\frac{1}{9} \Rightarrow \\ &\Rightarrow CS = \left(-\frac{1}{9}, +\infty \right) \end{aligned}$$

$$15. \left(x - \frac{1}{2} \right) 2 \geq \frac{5}{2}x$$

$$\begin{aligned} \left(x - \frac{1}{2} \right) 2 \geq \frac{5}{2}x &\Rightarrow x - \frac{1}{2} \geq \frac{5}{4}x \Rightarrow x - \frac{5}{4}x \geq \frac{1}{2} \Rightarrow \frac{4x-5x}{4} \geq \frac{1}{2} \Rightarrow -x \geq \frac{4}{2} \Rightarrow \\ &x \leq -2 \Rightarrow \end{aligned}$$

$$\Rightarrow CS = (-\infty, -2]$$

$$16. \left(-5 + \frac{x}{9}\right) 2 > 3 - 2x$$

$$\left(-5 + \frac{x}{9}\right) 2 > 3 - 2x \Rightarrow -10 + \frac{2x}{9} > 3 - 2x \Rightarrow \frac{2x}{9} + 2x > 3 + 10 \Rightarrow$$

$$\Rightarrow \frac{2x + 18x}{9} > 13 \Rightarrow 20x > 117 \Rightarrow x > \frac{117}{20} \Rightarrow$$

$$\Rightarrow CS = \left(\frac{117}{20}, +\infty\right)$$

$$17. \frac{2}{3} \cdot \frac{x-1}{5} \leq 3(3x+1)$$

$$\frac{2}{3} \cdot \frac{x-1}{5} \leq 3(3x+1) \Rightarrow \frac{2x}{15} - \frac{2}{15} \leq 9x + 3 \Rightarrow \frac{2x}{15} - 9x \leq 3 + \frac{2}{15} \Rightarrow$$

$$\Rightarrow \frac{2x - 135x}{15} \leq \frac{45 + 2}{15} \Rightarrow -133x \leq 47 \Rightarrow x \geq -\frac{47}{133} \Rightarrow$$

$$\Rightarrow CS = \left(-\frac{47}{133}, +\infty\right)$$

$$18. -\frac{4}{9} \left(\frac{x+5}{2}\right) > -1 \left(\frac{1}{3}x + \frac{1}{2}\right)$$

$$-\frac{4}{9} \left(\frac{x+5}{2}\right) > -1 \left(\frac{1}{3}x + \frac{1}{2}\right) \Rightarrow \frac{-2x}{9} - \frac{10}{9} > -\frac{1}{3}x - \frac{1}{2} \Rightarrow$$

$$\Rightarrow \frac{-2x}{9} + \frac{x}{3} > -\frac{1}{2} + \frac{10}{9} \Rightarrow \frac{-2x + 3x}{9} > \frac{-9 + 20}{18} \Rightarrow \frac{x}{9} > \frac{11}{18} \Rightarrow x > \frac{11}{2} \Rightarrow$$

$$\Rightarrow CS = \left(\frac{11}{2}, +\infty\right)$$

$$19. -\frac{(x+2)}{3} \left(-\frac{1}{2}\right) < \left(-\frac{2}{3}\right) \left(\frac{x}{5} - 1\right)$$

$$-\frac{(x+2)}{3} \left(-\frac{1}{2}\right) < \left(-\frac{2}{3}\right) \left(\frac{x}{5} - 1\right) \Rightarrow \frac{x}{6} + \frac{1}{3} < -\frac{2x}{15} + \frac{2}{3} \Rightarrow$$

$$\Rightarrow \frac{x}{6} + \frac{2x}{15} < \frac{2}{3} - \frac{1}{3} \Rightarrow \frac{5x + 4x}{30} < \frac{1}{3} \Rightarrow 9x < 10 \Rightarrow x < \frac{10}{9} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, \frac{10}{9}\right)$$

20. $\left(\frac{4}{3}\right)\left(-x - \frac{1}{5}\right) \geq \left(-\frac{1}{9}\right)\left(\frac{x}{3} - 9\right)$

$$\left(\frac{4}{3}\right)\left(-x - \frac{1}{5}\right) \geq \left(-\frac{1}{9}\right)\left(\frac{x}{3} - 9\right) \Rightarrow -\frac{4x}{3} - \frac{4}{15} \geq -\frac{-x}{27} + 1 \Rightarrow$$

$$\Rightarrow \frac{-4x}{3} + \frac{x}{27} \geq 1 + \frac{4}{15}$$

$$\Rightarrow \frac{-36x + x}{27} \geq \frac{15 + 4}{15} \Rightarrow \frac{-35x}{27} \geq \frac{19}{15} \Rightarrow -35x \geq \frac{19(27)}{15} \Rightarrow x \leq -\frac{513}{15 \cdot 35} \Rightarrow$$

$$\Rightarrow CS = \left(-\infty, -\frac{513}{525}\right) = \left(-\infty, -\frac{171}{175}\right)$$