

1. Ecuaciones sencillas:

a)	b)	c)	d)
$x+4=5$	$x-3=6$	$7+x=10$	$7-x=5$
$x=5-4$	$x=6+3$	$x=10-7$	$-x=5-7$
$x=1$	$x=9$	$x=3$	$-x=-2$
			$x=2$

e)	f)	g)	h)
$11=x+5$	$2=x-9$	$5=2+x$	$9=15-x$
$x+5=11$	$x-9=2$	$x=5-2$	$x=15-9$
$x=11-5$	$x=2+9$	$x=3$	$x=6$
$x=6$	$x=11$		

i)

$$2-x=9$$
$$-x=9-2$$
$$-x=7$$
$$x=-7$$

2. Ecuaciones sencillas.

a)	b)	c)
$2x+x=5$	$7x-3x=10-7$	$x-9x=9-7$
$3x=5$	$4x=3$	$-8x=2$
$x=\frac{5}{3}$	$x=\frac{3}{4}$	$x=\frac{2}{-8}$
		$x=-\frac{1}{4}$

d)	e)	f)
$5x-x=3-5$	$6=12x-2x$	$2-8=x+2x$
$4x=-2$	$6=10x$	$-6=3x$
$x=\frac{-2}{4}$	$x=\frac{6}{10}$	$x=\frac{-6}{3}$
$x=-\frac{1}{2}$	$x=\frac{3}{5}$	$x=-2$

$$\begin{aligned} \text{g)} \\ 5x - 13x &= 6 - 10 \\ -8x &= -4 \\ x &= \frac{-4}{-8} \\ x &= \frac{1}{2} \end{aligned}$$

$$\begin{aligned} \text{h)} \\ 2x + 4 + 5x &= 18 \\ 7x &= 18 - 4 \\ 7x &= 14 \\ x &= \frac{14}{7} \\ x &= 2 \end{aligned}$$

$$\begin{aligned} \text{i)} \\ 11x + 17 - 6x &= 2 \\ 5x &= -15 \\ x &= \frac{-15}{5} \\ x &= -3 \end{aligned}$$

$$\begin{aligned} \text{j)} \\ 9 &= 12x - 6 - 7x \\ 9 &= 5x - 6 \\ 5x &= 9 + 6 \\ x &= \frac{15}{5} \\ x &= 3 \end{aligned}$$

$$\begin{aligned} \text{k)} \\ 2x - 5 + 3x + 1 &= 3x - 2 \\ 5x - 3x &= -2 + 5 - 1 \\ 2x &= 2 \\ x &= \frac{2}{2} \\ x &= 1 \end{aligned}$$

$$\begin{aligned} \text{l)} \\ x + 7 &= 12x - 3 - 8x + 1 \\ x - 12x + 8x &= -2 - 7 \\ -3x &= -9 \\ x &= \frac{-9}{-3} \\ x &= 3 \end{aligned}$$

$$\begin{aligned} \text{m)} \\ 6x - 1 + x &= 4 - 5x + 3 \\ 7x + 5x &= 7 + 1 \\ 12x &= 8 \\ x &= \frac{8}{12} \\ x &= \frac{2}{3} \end{aligned}$$

$$\begin{aligned} \text{n)} \\ x + 2x + 3x - 5 &= 4x - 9 \\ 6x - 4x &= -9 + 5 \\ 2x &= -4 \\ x &= \frac{-4}{2} \\ x &= -2 \end{aligned}$$

$$\begin{aligned} \text{ñ)} \\ 5x + 4 - 6x &= 7 - x - 3 \\ -x + x &= 4 - 4 \\ 0 &= 0 \\ \text{Identidad} \end{aligned}$$

$$\begin{aligned} \text{o)} \\ 4x + 2 + 7x &= 10x + 3 + x \\ 11x - 10x - x &= 3 - 2 \\ 0 &= 1 \text{ !} \\ \text{No tiene solución} \end{aligned}$$

**Nota 1:** Cuando una expresión algebraica como la del apartado ñ, nos da una expresión como  $0=0$ , ó  $5=5$  ó cualquier otra igualdad sin término literal, significa que dicha expresión no es una ecuación sino una **identidad**. Esto significa que en dicha expresión algebraica no existe un resultado para la  $x$ , sino infinitos resultados.

**Nota 2:** Cuando una expresión algebraica como la del apartado o, nos da una expresión incongruente como  $0=1$  ó cualquier otra incongruencia, significa que la ecuación **no tiene solución**, es decir, no existe ningún valor para  $x$  que confirme la ecuación.

3. Ecuaciones con paréntesis.

a)

$$6(x+1)-4x=5x-9$$

$$6x+6-4x=5x-9$$

$$2x-5x=-9-6$$

$$-3x=-15$$

$$x = \frac{-15}{-3}$$

$$x = 5$$

b)

$$18x-13=8-4(3x-1)$$

$$18x-13=8-12x+4$$

$$18x+12x=12+13$$

$$30x=25$$

$$x = \frac{25}{30}$$

$$x = \frac{5}{6}$$

c)

$$3x+5(2x-1)=8-3(4-5x)$$

$$3x+10x-5=8-12+15x$$

$$13x-15x=-4+5$$

$$-2x=1$$

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

d)

$$5-(4x+6)=3x+(7-4x)$$

$$5-4x-6=3x+7-4x$$

$$-4x-3x+4x=7-5+6$$

$$-3x=8$$

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

e)

$$x-7(2x+1)=2(6-5x)-13$$

$$x-14x-7=12-10x-13$$

$$-13x+10x=-1+7$$

$$-3x=6$$

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

$$x = -2$$

f)

$$11-5(3x+2)+7x=1-8x$$

$$11-15x-10+7x=1-8x$$

$$-8x+8x=1-11+10$$

$$0=0$$

Identidad

g)

$$13x-5(x+2)=4(2x-1)+7$$

$$13x-5x-10=8x-4+7$$

$$8x-8x=3+10$$

$$0=13!$$

No tiene solución

4. Ecuaciones con denominadores.

a)

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

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

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

$$3x+1=x$$

$$3x-x=-1$$

$$2x=-1$$

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

b)

$$\frac{5x}{3} + 1 = \frac{5}{6} + x$$

$$\frac{10x}{6} + \frac{6}{6} = \frac{5}{6} + \frac{6x}{6}$$

$$\frac{10x+6}{6} = \frac{5+6x}{6}$$

$$10x+6=5+6x$$

$$10x-6x=5-6$$

$$4x=-1$$

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

c)

$$\frac{3x}{5} - \frac{1}{4} = x - \frac{7x}{10} - \frac{1}{5}$$

$$\frac{12x}{20} - \frac{5}{20} = \frac{20x}{20} - \frac{14x}{20} - \frac{4}{20}$$

$$\frac{12x-5}{20} = \frac{20x-14x-4}{20}$$

$$12x-5=20x-14x-4$$

$$12x-20x+14x=-4+5$$

$$6x=1$$

$$x=\frac{1}{6}$$

d)

$$\frac{x}{3} + \frac{4}{15} - x = \frac{1}{6} - \frac{7x}{10}$$

$$\frac{10x}{30} + \frac{8}{30} - \frac{30x}{30} = \frac{5}{30} - \frac{21x}{30}$$

$$\frac{10x+8-30x}{30} = \frac{5-21x}{30}$$

$$10x+8-30x=5-21x$$

$$-20x+21x=5-8$$

$$x=-3$$

e)

$$\frac{7x}{4} - 1 - \frac{x}{8} = x + \frac{5x}{8} + 1$$

$$\frac{14x}{8} - \frac{8}{8} - \frac{x}{8} = \frac{8x}{8} + \frac{5x}{8} + \frac{8}{8}$$

$$\frac{14x-8-x}{8} = \frac{8x+5x+8}{8}$$

$$14x-8-x=8x+5x+8$$

$$13x-8x-5x=8-8$$

$$0=0$$

Identidad

f)

$$\frac{x}{2} + \frac{1}{6} - \frac{x}{3} = \frac{x}{6} - \frac{2}{3} + \frac{5}{6}$$

$$\frac{3x}{6} + \frac{1}{6} - \frac{2x}{6} = \frac{x}{6} - \frac{4}{6} + \frac{5}{6}$$

$$\frac{3x+1-2x}{6} = \frac{x-4+5}{6}$$

$$3x+1-2x=x-4+5$$

$$x-x=1-6$$

$$0=-5!$$

No tiene solución

5. Ecuaciones con denominadores y paréntesis.

a)

$$2x - \frac{5}{2} = \frac{1}{2}(x - 3)$$

$$2x - \frac{5}{2} = \frac{x}{2} - \frac{3}{2}$$

$$\frac{4x}{2} - \frac{5}{2} = \frac{x}{2} - \frac{3}{2}$$

$$\frac{4x - 5}{2} = \frac{x - 3}{2}$$

$$4x - 5 = x - 3$$

$$4x - x = -3 + 5$$

$$3x = 2$$

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

b)

$$\frac{5}{6}(2x - 1) - x = \frac{x}{6}$$

$$\frac{10x}{6} - \frac{5}{6} - x = \frac{x}{6}$$

$$\frac{10x}{6} - \frac{5}{6} - \frac{6x}{6} = \frac{x}{6}$$

$$\frac{10x - 5 - 6x}{6} = \frac{x}{6}$$

$$10x - 5 - 6x = x$$

$$4x - x = 5$$

$$3x = 5$$

$$x = \frac{5}{3}$$

c)

$$\frac{x}{5} - 1 = 2\left(x - \frac{4}{5}\right)$$

$$\frac{x}{5} - 1 = 2x - \frac{8}{5}$$

$$\frac{x}{5} - \frac{5}{5} = \frac{10x}{5} - \frac{8}{5}$$

$$\frac{x - 5}{5} = \frac{10x - 8}{5}$$

$$x - 5 = 10x - 8$$

$$x - 10x = -8 + 5$$

$$-9x = -3$$

$$x = \frac{-3}{-9}$$

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

d)

$$x - \frac{1}{3} = \frac{1}{6}(2x - 5)$$

$$x - \frac{1}{3} = \frac{2x}{6} - \frac{5}{6}$$

$$\frac{6x}{6} - \frac{2}{6} = \frac{2x}{6} - \frac{5}{6}$$

$$\frac{6x - 2}{6} = \frac{2x - 5}{6}$$

$$6x - 2 = 2x - 5$$

$$6x - 2x = -5 + 2$$

$$4x = -3$$

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

6. Ecuaciones con denominadores y paréntesis.

a)

$$\frac{1}{5}(2+5x) = \frac{1}{2}\left(x - \frac{1}{5}\right)$$

$$\frac{2}{5} + \frac{5x}{5} = \frac{x}{2} - \frac{1}{10}$$

$$\frac{4}{10} + \frac{10x}{10} = \frac{5x}{10} - \frac{1}{10}$$

$$\frac{4+10x}{10} = \frac{5x-1}{10}$$

$$4+10x = 5x-1$$

$$10x-5x = -1-4$$

$$5x = -5$$

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

$$x = -1$$

b)

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

$$2x-6 - \frac{1}{3} = x - \frac{x}{3} + \frac{1}{3}$$

$$\frac{6x}{3} - \frac{18}{3} - \frac{1}{3} = \frac{3x}{3} - \frac{x}{3} + \frac{1}{3}$$

$$\frac{6x-18-1}{3} = \frac{3x-x+1}{3}$$

$$6x-18-1 = 3x-x+1$$

$$6x-3x+x = 1+1+18$$

$$4x = 20$$

$$x = \frac{20}{4}$$

$$x = 5$$

c)

$$1 - \frac{3x}{8} = \frac{3}{4} - \frac{1}{2}(x-2)$$

$$1 - \frac{3x}{8} = \frac{3}{4} - \frac{x}{2} + \frac{2}{2}$$

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

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

$$8-3x = 6-4x+8$$

$$-3x+4x = 14-8$$

$$x = 6$$

d)

$$x - \frac{3x}{4} = \frac{1}{3}(2x-1) + \frac{x}{6}$$

$$x - \frac{3x}{4} = \frac{2x}{3} - \frac{1}{3} + \frac{x}{6}$$

$$\frac{12x}{12} - \frac{9x}{12} = \frac{8x}{12} - \frac{4}{12} + \frac{2x}{12}$$

$$\frac{12x-9x}{12} = \frac{8x-4+2x}{12}$$

$$12x-9x = 8x-4+2x$$

$$3x-8x-2x = -4$$

$$-7x = -4$$

$$x = \frac{4}{7}$$

e)

$$5\left(\frac{x}{4} - \frac{1}{10}\right) = \frac{1}{2}\left(3x - \frac{1}{2}\right)$$

$$\frac{5x}{4} - \frac{5}{10} = \frac{3x}{2} - \frac{1}{4}$$

$$\frac{25x}{20} - \frac{10}{20} = \frac{30x}{20} - \frac{5}{20}$$

$$\frac{25x-10}{20} = \frac{30x-5}{20}$$

$$25x-10 = 30x-5$$

$$25x-30x = -5+10$$

$$-5x = 5$$

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

$$x = -1$$

f)

$$1 - \frac{3}{7}(x+1) = \frac{2x}{3} - \frac{1}{7}$$

$$1 - \frac{3x}{7} - \frac{3}{7} = \frac{2x}{3} - \frac{1}{7}$$

$$\frac{21}{21} - \frac{9x}{21} - \frac{9}{21} = \frac{14x}{21} - \frac{3}{21}$$

$$\frac{21-9x-9}{21} = \frac{14x-3}{21}$$

$$21-9x-9 = 14x-3$$

$$-9x-14x = -3-21+9$$

$$-23x = -15$$

$$x = \frac{15}{23}$$

## 7. Ecuaciones con numeradores compuestos.

a)

$$x - \frac{x-3}{5} = 1$$

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

$$\frac{5x-x+3}{5} = \frac{5}{5}$$

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

$$4x = 5-3$$

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

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

b)

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

$$\frac{3}{3} - \frac{x+1}{3} = \frac{6x}{3} - \frac{1}{3}$$

$$\frac{3-x-1}{3} = \frac{6x-1}{3}$$

$$3-x-1 = 6x-1$$

$$-x-6x = -1+1-3$$

$$-7x = -3$$

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

c)

$$1 - \frac{1-x}{3} = x + \frac{1}{2}$$
$$\frac{6}{6} - \frac{2-2x}{6} = \frac{6x}{6} + \frac{3}{6}$$
$$\frac{6-2+2x}{6} = \frac{6x+3}{6}$$
$$6-2+2x = 6x+3$$
$$2x-6x = 3-6+2$$
$$-4x = -1$$
$$x = \frac{1}{4}$$

e)

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

g)

$$2x + \frac{x-3}{2} = \frac{x-3}{4}$$
$$\frac{8x}{4} + \frac{2x-6}{4} = \frac{x-3}{4}$$
$$\frac{8x+2x-6}{4} = \frac{x-3}{4}$$
$$8x+2x-6 = x-3$$
$$10x-x = -3+6$$
$$9x = 3$$
$$x = \frac{3}{9}$$
$$x = \frac{1}{3}$$

d)

$$\frac{3x}{2} - 1 = \frac{3x+2}{4}$$
$$\frac{6x}{4} - \frac{4}{4} = \frac{3x+2}{4}$$
$$\frac{6x-4}{4} = \frac{3x+2}{4}$$
$$6x-4 = 3x+2$$
$$6x-3x = 2+4$$
$$3x = 6$$
$$x = \frac{6}{3}$$
$$x = 2$$

f)

$$x + \frac{2-3x}{5} = \frac{x}{2} + 1$$
$$\frac{10x}{10} + \frac{4-6x}{10} = \frac{5x}{10} + \frac{10}{10}$$
$$\frac{10x+4-6x}{10} = \frac{5x+10}{10}$$
$$10x+4-6x = 5x+10$$
$$4x-5x = 10-4$$
$$-x = 6$$
$$x = -6$$

h)

$$\frac{3x}{5} - 1 = x - \frac{x+1}{2}$$
$$\frac{6x}{10} - \frac{10}{10} = \frac{10x}{10} - \frac{5x+5}{10}$$
$$\frac{6x-10}{10} = \frac{10x-5x-5}{10}$$
$$6x-10 = 10x-5x-5$$
$$6x-10x+5x = -5+10$$
$$x = 5$$



i)

$$\begin{aligned}\frac{x}{5} - \frac{x+2}{15} &= \frac{x}{3} \\ \frac{3x}{15} - \frac{x+2}{15} &= \frac{5x}{15} \\ \frac{3x-x-2}{15} &= \frac{5x}{15} \\ 3x-x-2 &= 5x \\ 2x-5x &= 2 \\ -3x &= 2 \\ x &= -\frac{2}{3}\end{aligned}$$

k)

$$\begin{aligned}\frac{x+3}{5} - \frac{x-6}{7} &= 1 \\ \frac{7x+21}{35} - \frac{5x-30}{35} &= \frac{35}{35} \\ \frac{7x+21-5x+30}{35} &= \frac{35}{35} \\ 7x+21-5x+30 &= 35 \\ 2x &= 35-21-30 \\ 2x &= -16 \\ x &= \frac{-16}{2} \\ x &= -8\end{aligned}$$

j)

$$\begin{aligned}\frac{x-5}{3} + \frac{x-2}{5} &= x-2 \\ \frac{5x-25}{15} + \frac{3x-6}{15} &= \frac{15x}{15} - \frac{30}{15} \\ \frac{5x-25+3x-6}{15} &= \frac{15x-30}{15} \\ 5x-25+3x-6 &= 15x-30 \\ 8x-15x &= -30+25+6 \\ -7x &= 1 \\ x &= -\frac{1}{7}\end{aligned}$$

l)

$$\begin{aligned}\frac{1-x}{3} - \frac{x-1}{12} &= \frac{3x-1}{4} \\ \frac{4-4x}{12} - \frac{x-1}{12} &= \frac{9x-3}{12} \\ \frac{4-4x-x+1}{12} &= \frac{9x-3}{12} \\ 4-4x-x+1 &= 9x-3 \\ -5x-9x &= -3-4-1 \\ -14x &= -8 \\ x &= \frac{-8}{-14} \\ x &= \frac{4}{7}\end{aligned}$$

## 8. Ecuaciones con fracciones con numerador compuesto y con paréntesis.

a)

$$\begin{aligned}\frac{3x-1}{4} - \frac{2x+1}{5} &= \frac{7x-13}{20} \\ \frac{15x-5}{20} - \frac{8x+4}{20} &= \frac{7x-13}{20} \\ \frac{15x-5-8x-4}{20} &= \frac{7x-13}{20} \\ 15x-5-8x-4 &= 7x-13 \\ 7x-7x &= -13+5+4 \\ 0 &= -4 ! \\ \text{No tiene solución}\end{aligned}$$

b)

$$\begin{aligned}2 + \frac{2}{5}(x+1) &= x - \frac{2x+3}{5} \\ 2 + \frac{2x}{5} + \frac{2}{5} &= x - \frac{2x+3}{5} \\ \frac{10}{5} + \frac{2x}{5} + \frac{2}{5} &= \frac{5x}{5} - \frac{2x+3}{5} \\ \frac{10+2x+2}{5} &= \frac{5x-2x-3}{5} \\ 10+2x+2 &= 5x-2x-3 \\ 2x-5x+2x &= -3-10-2 \\ -x &= -15 \\ x &= 15\end{aligned}$$

d)

$$\frac{2}{3}(1-3x) + \frac{3(x-1)}{4} = \frac{5}{12}(1-x)$$

$$\frac{2}{3} - \frac{6x}{3} + \frac{3x-3}{4} = \frac{5}{12} - \frac{5x}{12}$$

$$\frac{8}{12} - \frac{24x}{12} + \frac{9x-9}{12} = \frac{5}{12} - \frac{5x}{12}$$

$$\frac{8-24x+9x-9}{12} = \frac{5-5x}{12}$$

$$8-24x+9x-9 = 5-5x$$

$$-15x+5x = 5-8+9$$

$$-10x = 6$$

$$x = \frac{6}{-10}$$

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

e)

$$\frac{3}{5}\left(\frac{x-1}{3}+1\right) + x = \frac{3}{4}\left(x-\frac{2}{3}\right)$$

$$\frac{3x-3}{15} + \frac{3}{5} + x = \frac{3x}{4} - \frac{6}{12}$$

$$\frac{12x-12}{60} + \frac{36}{60} + \frac{60x}{60} = \frac{45x}{60} - \frac{30}{60}$$

$$\frac{12x-12+36+60x}{60} = \frac{45x-30}{60}$$

$$12x-12+36+60x = 45x-30$$

$$72x-45x = -30+12-36$$

$$27x = -54$$

$$x = \frac{-54}{27}$$

$$x = -2$$