



ECUACIONES

ECUACIONES DE PRIMER GRADO

1. $2x - 34 = 120$
2. $10x + 5 = 3x + 12$
3. $2(3x - 2) = 8$
4. $\frac{x+2}{3} = 5x - 46$
5. $\frac{x}{3} - x = -12 - \frac{2x}{9}$

ECUACIONES DE SEGUNDO GRADO

1. $x^2 - 7x + 12$
2. $x^2 - 6x + 9 = 0$
3. $x^2 + x + 1 = 0$
4. $x^2 + x = 0$
5. $x^2 - 3 = 0$
6. $4x^2 - 25 = 0$
7. $(x + 6)(x - 6) - 8 = 1 - 4x$
8. $(x + 2)(x - 3) - x(2x + 1) + 6x = 0$
9. $x + \frac{1}{x} = \frac{10}{3}$
10. $x(x - 1)(x + 1) = 8[(x - 1) + x + (x + 1)]$

ECUACIONES BICUADRADAS

1. $x^4 - 13x^2 + 36 = 0$
2. $x^4 - 7x^2 + 12 = 0$
3. $x^4 + x^2 - 20 = 0$
4. $x^4 - x^2 - 12 = 0$
5. $x^4 + 10x^2 + 9 = 0$

ECUACIONES DE GRADO MAYOR QUE DOS

1. $x^3 - x^2 - 4 = 0$
2. $x^3 + 2x^2 - 5x - 6 = 0$
3. $x^4 - x^3 - 16x^2 - 20x = 0$
4. $6x^4 - 17x^3 + 7x^2 + 8x - 4 = 0$



ECUACIONES RACIONALES

1. $\frac{30}{x+5} + \frac{5+4x}{x+5} = 5$
2. $\frac{2}{x+1} = \frac{x}{x-1} - 1$
3. $\frac{x+8}{x-1} - \frac{x+4}{x+1} = \frac{12x}{x^2-1}$
4. $\frac{1}{(x-1)^2} - \frac{2}{2x-2} = -\frac{3}{2x+2}$
5. $\frac{4x+5}{15x^2+7x-2} - \frac{2x+3}{12x^2-7x-10} - \frac{2x-5}{20x^2-29x+5} = 0$
6. $\frac{6}{x-1} - \frac{10}{x+2} = \frac{4}{x+1}$
7. $\frac{2}{x + \frac{1}{1 + \frac{x+1}{x-2}}} = \frac{6}{3x-1}$

ECUACIONES IRRACIONALES

1. $\sqrt{x+1} = 2$
2. $\sqrt{2x+1} = x-1$
3. $2 - \sqrt{2x+3} = 2x-1$
4. $x+2 = \sqrt{x^2+1}$
5. $\sqrt{2x^2-1} = \sqrt{x}$
6. $\sqrt{x} + x = \sqrt{3x+x^2}$
7. $\sqrt{x+5} + \sqrt{2x+8} = 7$
8. $\sqrt{x^2+6x} = x + \sqrt{2x}$
9. $\sqrt{x} + \sqrt{x+7} = 7$
10. $\sqrt{x-1} + \sqrt{x-7} = 2\sqrt{x-3}$
11. $\frac{1}{\sqrt{1-x}} = \frac{1}{2}$

ECUACIONES EXPONENCIALES

1. $3^x = 27$
2. $2^{x+2} = 16$
3. $(2^{x+1})^2 = 64$
4. $2^{x+1} + 2^{x-1} = 20$
5. $3^{2x-2} + 3^{x-1} = 12$
6. $2^{2x} + 4^{x-1} + 44 = 2^{2x+2}$
7. $10^{3-x} = 1$
8. $5^x + 5^{2x-2} - 25^{x-1} = 5^{2x-3}$
9. $2^{3x-1} + 4^{2x-2} = 8^x$



ECUACIONES LOGARITMICAS

1. $\log_3(x + 5) = 2$
2. $\ln(x + 10) = 2$
3. $2 \log x - \log(x - 16) = 2$
4. $2 \log x^3 = \log 8 + 3 \log x$
5. $\frac{\log(16-x^2)}{\log(3x-4)} = 2$
6. $\ln x = 2 \ln 10$
7. $\ln(x^2 - 1) = 1$
8. $5 \log_2(x + 3) = \log_2 32$
9. $2 \log x + \log(x + 1) = \log(x^2 + 4x)$
10. $\log x = \log 9 + \log 2$



SOLUCIONES

ECUACIONES DE PRIMER GRADO

1. $2x - 34 = 120$

$$x = \frac{120 + 34}{2} \rightarrow$$

$$x = 77$$

2. $10x + 5 = 3x + 12$

$$10x - 3x = 12 - 5$$

$$7x = 7$$

$$x = 1$$

3. $2(3x - 2) = 8$

$$6x - 4 = 8$$

$$6x = 12$$

$$x = 2$$

4. $\frac{x+2}{3} = 5x - 46$

$$x + 2 = 15x - 138$$

$$-14x = -140$$

$$x = 10$$

5. $\frac{x}{3} - x = -12 - \frac{2x}{9}$

$$3x - 9x = -108 - 2x$$

$$-4x = -108$$

$$x = 27$$



ECUACIONES DE SEGUNDO GRADO

1. $x^2 - 7x + 12$

$$x = \frac{7 \pm \sqrt{49 - 4(1)(12)}}{2} \rightarrow x = \frac{7 \pm 1}{2} \rightarrow x = \begin{cases} 4 \\ 3 \end{cases}$$

2. $x^2 - 6x + 9 = 0$

$$x = \frac{6 \pm \sqrt{36 - 4(1)(9)}}{2} \rightarrow x = \frac{6}{2} \rightarrow x = \begin{cases} 3 \\ 3 \end{cases}$$

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

$$x = \frac{1 \pm \sqrt{1 - 4(1)(1)}}{2} \rightarrow \text{No tiene solución}$$

4. $x^2 + x = 0$

$$x(x + 1) = 0 \rightarrow \begin{cases} x = 0 \\ x + 1 = 0 \rightarrow x = -1 \end{cases}$$

5. $x^2 - 3 = 0$

$$x^2 = 3 \rightarrow x = \pm\sqrt{3}$$

6. $4x^2 - 25 = 0$

$$4x^2 = 25$$

$$x^2 = \frac{25}{4}$$

$$x = \sqrt{\frac{25}{4}} \rightarrow x = \pm \frac{5}{2}$$

7. $(x + 6)(x - 6) - 8 = 1 - 4x$

$$x^2 - 36 - 8 = 1 - 4x$$

$$x^2 + 4x - 45 = 0$$

$$x = \frac{-4 \pm \sqrt{16 - 4(1)(-45)}}{2} \rightarrow x = \frac{-4 \pm 14}{2} \rightarrow x = \begin{cases} 5 \\ -9 \end{cases}$$

8. $(x + 2)(x - 3) - x(2x + 1) + 6x = 0$

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

$$-x^2 + 4x - 6 = 0$$

$$x = \frac{-4 \pm \sqrt{16 - 4(-1)(-6)}}{2} \rightarrow \text{No tiene solución}$$



$$9. \quad x + \frac{1}{x} = \frac{10}{3}$$

$$m.c.m.(x; 3) = 3x$$

$$3x^2 + 3 = 10x$$

$$3x^2 - 10x + 3 = 0 \rightarrow x = \frac{10 \pm \sqrt{100 - 4(3)(3)}}{6} \rightarrow x = \frac{10 \pm 8}{6} \rightarrow x = \begin{cases} 3 \\ 2/3 \end{cases}$$

$$10. \quad x(x-1)(x+1) = 8[(x-1) + x + (x+1)]$$

$$x(x^2 - 1) = 8(3x)$$

$$x^3 - x = 24x$$

$$x^3 - 25x = 0$$

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

$$\begin{cases} x = 0 \\ x^2 - 25 = 0 \rightarrow x = \pm 5 \end{cases}$$



ECUACIONES BICUADRADAS

1. $x^4 - 13x^2 + 36 = 0$

$$x^2 = z$$

$$z^2 - 13z + 36 = 0$$

$$z = \frac{13 \pm \sqrt{169 - 4(1)(36)}}{2} \rightarrow z = \frac{13 \pm 5}{2} \rightarrow \begin{cases} z = 9 \\ z = 4 \end{cases}$$

Cuando $z = 9 \rightarrow x = \sqrt{9} \rightarrow x = \pm 3$

Cuando $z = 4 \rightarrow x = \sqrt{4} \rightarrow x = \pm 2$

2. $x^4 - 7x^2 + 12 = 0$

$$x^2 = z$$

$$z^2 - 7z + 12 = 0$$

$$z = \frac{7 \pm \sqrt{49 - 4(1)(12)}}{2} \rightarrow z = \frac{13 \pm 1}{2} \rightarrow \begin{cases} z = 7 \\ z = 6 \end{cases}$$

Cuando $z = 7 \rightarrow x = \pm\sqrt{7}$

Cuando $z = 6 \rightarrow x = \pm\sqrt{6}$

3. $x^4 + x^2 - 20 = 0$

$$x^2 = z$$

$$z^2 + z - 20 = 0$$

$$z = \frac{-1 \pm \sqrt{1 - 4(1)(-20)}}{2} \rightarrow z = \frac{-1 \pm 9}{2} \rightarrow \begin{cases} z = -5 \\ z = 4 \end{cases}$$

Cuando $z = -5 \rightarrow x = \sqrt{-5} \rightarrow$ No tiene solución

Cuando $z = 4 \rightarrow x = \sqrt{4} \rightarrow x = \pm 2$

4. $x^4 - x^2 - 12 = 0$

$$x^2 = z$$

$$z^2 - z - 12 = 0$$

$$z = \frac{1 \pm \sqrt{1 - 4(1)(-12)}}{2} \rightarrow z = \frac{1 \pm 7}{2} \rightarrow \begin{cases} z = -3 \\ z = 4 \end{cases}$$

Cuando $z = -3 \rightarrow x = \sqrt{-3} \rightarrow$ No tiene solución

Cuando $z = 4 \rightarrow x = \sqrt{4} \rightarrow x = \pm 2$



$$5. \quad x^4 + 10x^2 + 9 = 0$$

$$x^2 = z$$

$$z^2 + 10z + 9 = 0$$

$$z = \frac{-10 \pm \sqrt{100 - 4(1)(9)}}{2} \rightarrow z = \frac{-10 \pm 8}{2} \rightarrow \begin{cases} z = -9 \\ z = -1 \end{cases}$$

$$\text{Cuando } z = -9 \rightarrow x = \sqrt{-9} \rightarrow \text{No tiene solución}$$

$$\text{Cuando } z = -1 \rightarrow x = \sqrt{-1} \rightarrow \text{No tiene solución}$$



ECUACIONES DE GRADO MAYOR QUE DOS

1. $x^3 - x^2 - 4 = 0$

$$\begin{array}{r|rrrr} & 1 & -1 & 0 & -4 \\ 2 & & 2 & 2 & 4 \\ \hline & 1 & 1 & 2 & 0 \end{array}$$

$$x^2 + x + 2 = 0 \rightarrow x = \frac{-1 \pm \sqrt{1 - 4(1)(2)}}{2} \rightarrow \text{No tiene solución}$$

La única solución de la ecuación inicial es $x = 2$

2. $x^3 + 2x^2 - 5x - 6 = 0$

$$\begin{array}{r|rrrr} & 1 & 2 & -5 & -6 \\ 2 & & 2 & 8 & 6 \\ \hline & 1 & 4 & 3 & 0 \end{array}$$

$$x^2 + 4x + 3 = 0 \rightarrow x = \frac{-4 \pm \sqrt{16 - 4(1)(3)}}{2} \rightarrow x = \begin{cases} -1 \\ -3 \end{cases}$$

Las soluciones para la ecuación inicial son $x = 2 ; x = -1 ; x = -3$

3. $x^4 - x^3 - 16x^2 - 20x = 0$

$$x(x^3 - x^2 - 16x - 20) = 0$$

$$\begin{array}{r|rrrr} & 1 & -1 & -16 & -20 \\ -2 & & -2 & 6 & 20 \\ \hline & 1 & -3 & -10 & 0 \end{array}$$

$$x^2 - 3x + 10 = 0 \rightarrow x = \frac{3 \pm \sqrt{9 - 4(1)(-10)}}{2} \rightarrow x = \begin{cases} 5 \\ -2 \end{cases}$$

Las soluciones de la ecuación inicial son: $x = 0 ; x = -2 ; x = 5 ; x = -2$



4. $6x^4 - 17x^3 + 7x^2 + 8x - 4 = 0$

1	6	- 17	7	8	- 4
		6	- 11	- 4	4
	6	- 11	- 4	4	0
2		+12	+ 2	- 4	
	6	+ 1	- 2	0	

$$6x^2 + x - 2 = 0 \rightarrow x = \frac{-1 \pm \sqrt{1 - 4(6)(-2)}}{12} \rightarrow x = \begin{cases} 1/2 \\ -2/3 \end{cases}$$

Las soluciones de la ecuación inicial son: $x = 1$; $x = 2$; $x = \frac{1}{2}$; $x = \frac{-2}{3}$



ECUACIONES RACIONALES

$$1. \frac{30}{x+5} + \frac{5+4x}{x+5} = 5$$

$$m.c.m. [(x+5); (x+5)] = (x+5)$$

$$30 + 5 + 4x = 5(x+5)$$

$$30 + 5 + 4x = 5x + 25$$

$$4x - 5x = 25 - 5 - 30$$

$$-x = -10$$

$$x = 10$$

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

$$m.c.m. [(x+1); (x-1)] = (x-1)(x+1)$$

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

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

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

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

$$x = 4$$

$$3. \frac{x+8}{x-1} - \frac{x+4}{x+1} = \frac{12x}{x^2-1}$$

$$m.c.m. [(x-1); (x+1); (x^2-1)] = (x+1)(x-1)$$

$$(x+8)(x+1) - (x+4)(x-1) = 12x$$

$$x^2 + 9x + 8 - x^2 - 3x + 4 = 12x$$

$$6x - 12x = -12$$

$$-6x = -12 \rightarrow x = 2$$

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

$$m.c.m. [(x-1)^2; (2x-2); (2x+2)] = (x-1)^2(x+1) \cdot 2$$

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

$$2x + 2 - 2x^2 + 2 = -3(x^2 - 2x + 1)$$

$$x^2 - 4x + 7 = 0 \rightarrow x = \frac{4 \pm \sqrt{16 - 4(1)(7)}}{2} \rightarrow \text{No tiene solución}$$



$$5. \frac{4x+5}{15x^2+7x-2} - \frac{2x+3}{12x^2-7x-10} - \frac{2x-5}{20x^2-29x+5} = 0$$

$$m.c.m. [15x^2 - 7x - 2; 12x^2 - 7x - 10; 20x^2 - 29x + 5] =$$

Tenemos que sacar las raíces de cada polinomio para ver cual es el m.c.m.

$$15x^2 - 7x - 2 = 0 \rightarrow x = \frac{7 \pm \sqrt{49 - 4(15)(-2)}}{30} \rightarrow x = \begin{cases} -2/3 \\ 1/5 \end{cases}$$

$$15x^2 - 7x - 2 = (3x - 2)(5x + 1)$$

$$12x^2 - 7x - 10 = 0 \rightarrow x = \frac{7 \pm \sqrt{49 - 4(12)(-10)}}{24} \rightarrow x = \begin{cases} 5/4 \\ -2/3 \end{cases}$$

$$12x^2 - 7x - 10 = (4x - 5)(3x + 2)$$

$$20x^2 - 29x + 5 = 0 \rightarrow x = \frac{29 \pm \sqrt{841 - 4(20)(5)}}{40} \rightarrow x = \begin{cases} 5/4 \\ 1/5 \end{cases}$$

$$20x^2 - 29x + 5 = (4x - 5)(5x - 1)$$

$$m.c.m. \rightarrow (5x - 1)(3x + 2)(4x - 5)$$

$$(4x + 5)(4x - 5) - (2x + 3)(5x - 1) - (2x - 5)(3x + 2) = 0$$

$$16x^2 - 25 - 10x^2 + 2x - 15x + 3 - 6x^2 + 11x + 10 = 0$$

$$-2x - 12 = 0$$

$$-2x = 12$$

$$x = -6$$

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

$$m.c.m. [(x - 1); (x + 2); (x + 1)] = (x - 1)(x + 2)(x + 1)$$

$$6(x + 2)(x + 1) - 10(x - 1)(x + 1) = 4(x - 1)(x + 2)$$

$$6(x^2 + 3x + 2) - 10x^2 + 10 = 4(x^2 + x - 2)$$

$$6x^2 + 18x + 12 - 10x^2 + 10 - 4x^2 - 4x + 8 = 0$$

$$-8x^2 + 14x + 30 = 0 \rightarrow x = \frac{-14 \pm \sqrt{196 - 4(-8)(30)}}{-16} \rightarrow x = \begin{cases} -5/4 \\ 3 \end{cases}$$



$$7. \frac{2}{x + \frac{1}{1 + \frac{x+1}{x-2}}} = \frac{6}{3x-1}$$

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

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

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

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

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

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

$$2(2x-1)(3x-1) = 6(2x^2-2)$$

$$(4x-2)(3x-1) = 12x^2-12$$

$$12x^2-10x+2 = 12x^2-12$$

$$-10x = -14$$

$$x = \frac{14}{10} \rightarrow x = \frac{7}{5}$$



ECUACIONES IRRACIONALES

1. $\sqrt{x+1} = 2$

$$(\sqrt{x+1})^2 = 4$$

$$x+1 = 4 \rightarrow x = 3$$

La comprobación

$$\sqrt{3+1} = 2 \rightarrow \text{Se cumple}$$

2. $\sqrt{2x+1} = x-1$

$$(\sqrt{2x+1})^2 = (x-1)^2$$

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

$$-x^2 + 4x = 0 \rightarrow \begin{cases} x = 0 \\ x = 4 \end{cases}$$

La comprobación:

$$\text{Cuando } x = 0 \rightarrow \sqrt{1} \neq 2 \rightarrow \text{No es solución}$$

$$\text{Cuando } x = 4 \rightarrow \sqrt{9} = 3 \rightarrow \text{SI es solución}$$

3. $2 - \sqrt{2x+3} = 2x-1$

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

$$(-\sqrt{2x+3})^2 = (2x-3)^2$$

$$2x+3 = 4x^2 - 12x + 9$$

$$-4x^2 + 14x - 6 = 0 \rightarrow x = \frac{-14 \pm \sqrt{14^2 - 4(-4)(-6)}}{-8} \rightarrow x = \begin{cases} \frac{1}{2} \\ 3 \end{cases}$$

4. $x+2 = \sqrt{x^2+1}$

$$(x+2)^2 = (\sqrt{x^2+1})^2$$

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

5. $\sqrt{2x^2-1} = \sqrt{x}$

$$(\sqrt{2x^2-1})^2 = (\sqrt{x})^2$$



$$2x^2 - 1 = x \rightarrow 2x^2 - x - 1 = 0 \rightarrow x = \begin{cases} 1 \\ -\frac{1}{2} \end{cases}$$

$$6. \sqrt{x} + x = \sqrt{3x + x^2}$$

$$(\sqrt{x} + x)^2 = 3x + x^2$$

$$x + 2x\sqrt{x} + x^2 = 3x + x^2$$

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

$$(2x\sqrt{x})^2 = 4x^2$$

$$4x^2 \cdot x = 4x^2$$

$$4x^3 - 4x^2 = 0 \rightarrow x = \begin{cases} 0 \\ 1 \end{cases}$$

$$7. \sqrt{x+5} + \sqrt{2x+8} = 7$$

$$\sqrt{x+5} = 7 - \sqrt{2x+8}$$

$$(\sqrt{x+5})^2 = (7 - \sqrt{2x+8})^2$$

$$x + 5 = 49 - 14\sqrt{2x+8} + (2x + 8)$$

$$x + 5 - 49 - 2x - 8 = -14\sqrt{2x+8}$$

$$-x - 52 = -14\sqrt{2x+8}$$

$$(-x - 52)^2 = (-14\sqrt{2x+8})^2$$

$$x^2 + 104x + 52^2 = 14^2(2x + 8)$$

$$x^2 + 104x + 2704 = 392x + 1568$$

$$x^2 - 288x + 1136 = 0$$

$$x = \frac{288 \pm \sqrt{288^2 - 4(1)(1136)}}{2} \rightarrow x = \frac{288 \pm 280}{2} \rightarrow x = \begin{cases} 4 \\ 284 \end{cases}$$



$$8. \sqrt{x^2 + 6x} = x + \sqrt{2x}$$

$$(\sqrt{x^2 + 6x})^2 = (x + \sqrt{2x})^2$$

$$x^2 + 6x = x^2 + 2x\sqrt{2x} + 2x$$

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

$$(4x)^2 = (2x\sqrt{2x})^2$$

$$16x^2 = 4x^2 \cdot x$$

$$16x^2 - 4x^3 = 0 \rightarrow \begin{cases} x = 0 \\ x = 4 \end{cases}$$

$$9. \sqrt{x} + \sqrt{x+7} = 7$$

$$\sqrt{x} = 7 - \sqrt{x+7}$$

$$x = (7 - \sqrt{x+7})^2$$

$$x = 49 - 14\sqrt{x+7} + (x+7)$$

$$x - 49 - x - 7 = -14\sqrt{x+7}$$

$$-56 = -14\sqrt{x+7}$$

$$(-56)^2 = (-14\sqrt{x+7})^2$$

$$3136 = 196(x+7)$$

$$3136 = 196x + 1372$$

$$x = 9$$

$$10. \sqrt{x-1} + \sqrt{x-7} = 2\sqrt{x-3}$$

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

$$(x-1) + 2\sqrt{(x-1)(x-7)} + (x-7) = 4(x-3)$$

$$2\sqrt{(x-1)(x-7)} = 4x - 12 - x + 7 - x + 1$$

$$2\sqrt{(x-1)(x-7)} = 2x - 4$$

$$(2\sqrt{(x-1)(x-7)})^2 = (2x-4)^2$$



$$4(x - 1)(x - 7) = 4x^2 - 16x + 16$$

$$(4x - 4)(x - 7) = 4x^2 - 16x + 16$$

$$4x^2 - 28x - 4x + 28 = 4x^2 - 16x + 16$$

$$-28x - 4x + 16x = -28 + 16$$

$$-16x = -12$$

$$x = \frac{12}{16} \rightarrow x = \frac{3}{4}$$

$$11. \frac{1}{\sqrt{1-x}} = \frac{1}{2}$$

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

$$4 = 1 - x$$

$$x = -3$$



ECUACIONES EXPONENCIALES

1. $3^x = 27$

$$\cancel{3}^x = \cancel{3}^3 \rightarrow x = 3$$

2. $2^{x+2} = 16$

$$\cancel{2}^{x+2} = \cancel{2}^4 \rightarrow x + 2 = 4 \rightarrow x = 2$$

3. $(2^{x+1})^2 = 64$

$$\cancel{2}^{2x+2} = \cancel{2}^6 \rightarrow 2x + 2 = 6 \rightarrow x = 2$$

4. $2^{x+1} + 2^{x-1} = 20$

$$2^x(2^1 + 2^{-1}) = 20$$

$$2^x \left(2 + \frac{1}{2} \right) = 20$$

$$2^x \left(\frac{5}{2} \right) = 20 \rightarrow 2^x = \frac{20 \cdot 2}{5} \rightarrow 2^x = 8 \rightarrow \cancel{2}^x = \cancel{2}^3 \rightarrow x = 3$$

5. $3^{2x-2} + 3^{x-1} = 12$

$$3^{2x-2} + 3^{x-1} = 12 \rightarrow \frac{(3^x)^2}{3^2} + \frac{3^x}{3^1} - 12 = 0$$

$$3^x = t$$

$$\frac{t^2}{9} + \frac{t}{3} - 12 = 0$$

$$t^2 + 3t - 108 = 0$$

$$t = \frac{-3 \pm \sqrt{9 - 4(1)(-108)}}{2} \rightarrow t = \left\{ \begin{matrix} -12 \\ 9 \end{matrix} \right.$$

Cuando $t = -12 \rightarrow$ No tiene solución

Cuando $t = 9 \rightarrow 3^x = 9 \rightarrow x = 2$

6. $2^{2x} + 4^{x-1} + 44 = 2^{2x+2}$

$$2^{2x} + 2^{2x-2} + 44 = 2^{2x+2}$$

$$2^{2x} + 2^{2x-2} - 2^{2x+2} = -44$$

$$2^{2x}(1 + 2^{-2} - 2^2) = -44$$

$$2^{2x} \left(1 + \frac{1}{4} - 4 \right) = -44$$

$$2^{2x} \left(-\frac{11}{4} \right) = -44$$

$$2^{2x} = \frac{-44 \cdot 4}{-11} \rightarrow 2^{2x} = 16 \rightarrow 2^{2x} = 2^4 \rightarrow 2x = 4 \rightarrow x = 2$$



7. $10^{3-x} = 1$

$$10^{3-x} = 10^0$$

$$3 - x = 0 \rightarrow x = 3$$

8. $5^x + 5^{2x-2} - 25^{x-1} = 5^{2x-3}$

$$5^x + 5^{2x-2} - 5^{2x-2} - 5^{2x-3} = 0$$

$$5^x - 5^{2x-3} = 0$$

$$5^x = t$$

$$t - \frac{t^2}{5^3} = 0 \rightarrow 5^3 t - t^2 = 0 \rightarrow t(5^3 - t) = 0 \rightarrow t = \left\{ \begin{matrix} 0 \\ 5^3 \end{matrix} \right.$$

Cuando $t = 0 \rightarrow 5^x = 0 \rightarrow$ No tiene solución

Cuando $t = 5^3 \rightarrow 5^x = 5^3 \rightarrow x = 3$

9. $2^{3x-1} + 4^{2x-2} = 8^x$

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

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

$$2^x = t$$

$$\frac{(t)^3}{2^1} + \frac{(t)^4}{2^4} = (t)^3$$

$$8t^3 + t^4 - t^3 = 0 \rightarrow 7t^3 + t^4 = 0 \rightarrow t^3(7 + t) = 0 \rightarrow t = \left\{ \begin{matrix} 0 \\ -7 \end{matrix} \right.$$

Cuando $t = 0 \rightarrow 2^x = 0 \rightarrow$ No tiene solución

Cuando $t = -7 \rightarrow 2^x = -7 \rightarrow$ no tiene solución



ECUACIONES LOGARITMICAS

1. $\log_3(x + 5) = 2$

$$\cancel{\log_3}(x + 5) = \cancel{\log_3} 3^2$$

$$(x + 5) = 3^2$$

$$x = 4$$

2. $\ln(x + 10) = 2$

$$\cancel{\ln}(x + 10) = \cancel{\ln} e^2$$

$$(x + 10) = e^2$$

$$x = e^2 - 10$$

3. $2 \log x - \log(x - 16) = 2$

$$\log x^2 - \log(x - 16) = \log 10^2$$

$$\cancel{\log} \frac{x^2}{(x - 16)} = \cancel{\log} 10^2$$

$$\frac{x^2}{x - 16} = 10^2$$

$$x^2 = 100(x - 16)$$

$$x^2 - 100x + 1600 = 0 \rightarrow x = \begin{cases} 20 \\ 80 \end{cases}$$

4. $2 \log x^3 = \log 8 + 3 \log x$

$$\log(x^3)^2 = \log 8 + \log x^3$$

$$\cancel{\log} x^6 = \cancel{\log} 8x^3$$

$$x^6 = 8x^3$$

$$x^6 - 8x^3 = 0$$

$$x^3(x^3 - 8) = 0 \rightarrow x = \begin{cases} 0 \\ 2 \end{cases}$$

5. $\frac{\log(16-x^2)}{\log(3x-4)} = 2$

$$\log(16 - x^2) = 2 \log(3x - 4)$$

$$\cancel{\log}(16 - x^2) = \cancel{\log}(3x - 4)^2$$

$$(16 - x^2) = (3x - 4)^2$$

$$16 - x^2 = 9x^2 - 24x + 16$$

$$-10x^2 + 24x = 0 \rightarrow x(-10x + 24) = 0 \rightarrow x = \begin{cases} 0 \\ \frac{24}{10} \end{cases} \rightarrow x = \begin{cases} x = 0 \\ x = \frac{12}{5} \end{cases}$$



6. $\ln x = 2 \ln 10$

$$\cancel{\ln x} = \cancel{\ln 10^2}$$

$$x = 100$$

7. $\ln(x^2 - 1) = 1$

$$\cancel{\ln(x^2 - 1)} = \cancel{\ln e^1}$$

$$x^2 - 1 = e$$

$$x = \sqrt{e + 1}$$

8. $5 \log_2(x + 3) = \log_2 32$

$$\cancel{\log_2(x + 3)^5} = \cancel{\log_2 32}$$

$$(x + 3)^5 = 32$$

$$x + 3 = \sqrt[5]{32}$$

$$x + 3 = 2 \rightarrow x = -1$$

9. $2 \log x + \log(x + 1) = \log(x^2 + 4x)$

$$\log x^2 + \log(x + 1) = \log(x^2 + 4x)$$

$$\cancel{\log \frac{x^2}{x + 1}} = \cancel{\log(x^2 + 4x)}$$

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

$$x^3 + x^2 = (x^2 + 4x)$$

$$x^3 = 4x$$

$$x^3 - 4x = 0 \rightarrow x(x^2 - 4) = 0 \rightarrow \begin{cases} x = 0 \\ x^2 - 4 = 0 \rightarrow x = \pm 2 \end{cases}$$

10. $\log x = \log 9 + \log 2$

$$\cancel{\log x} = \cancel{\log 18}$$

$$x = 18$$

