

ECUACIONES EXPONENCIALES

A.- Resolver las siguientes ecuaciones

- 1) $3^{x-8} = 81$
- 2) $2^{x+7} = 128$
- 3) $5^{9-x} = 25$
- 4) $3^{7-x} = 243$
- 5) $5^{x+2} = 125$
- 6) $7^{2x+4} = 49$
- 7) $10^{2-3x} = 100$
- 8) $5^{8-5x} = 1$
- 9) $10^{-4+9x} = 1000$
- 10) $5^{-7x+3} = 625$

B.- Resolver las siguientes ecuaciones

- 1) $2^{2x-1} = 0,5$
- 2) $2^{-4x+3} = 0,25$
- 3) $3^{4x-2} = \frac{1}{3}$
- 4) $3^{-5x+2} = \frac{1}{9}$
- 5) $5^{3x-1} = \frac{1}{25}$
- 6) $7^{-3x-2} = 1$
- 7) $4^{8+x} = 2^{15-3x}$
- 8) $10^{7+9x} = 0,01$
- 9) $10^{x^2-7} = 0,001$
- 10) $5^{-4-3x} = 0,2$

C.- Resolver las siguientes ecuaciones

- 1) $7^{5x+2} = \sqrt{7}$
- 2) $2^{-5x-3} = \sqrt[4]{8}$
- 3) $125^{x-2} = \sqrt[3]{25}$
- 4) $0,1^{x+4} = \sqrt[5]{1000}$
- 5) $9^{2x-1} = \sqrt[3]{3}$
- 6) $\sqrt{3^{5x-11}} = 9$
- 7) $2^{x^2-3x} = 16$
- 8) $5^{x^2+2x} = 125$
- 9) $10^{\frac{x^2+4}{3}x} = \sqrt[3]{0,1}$
- 10) $10^{4x} \cdot 10^{x-1} \cdot 10^{-2x+3} = 0,1 \cdot 0,001 \cdot 10^7$

D.- Resolver las siguientes ecuaciones

- 1) $2^x \cdot 8^{2x+1} \cdot 16^{-x} = 128^3$
- 2) $\frac{25^{3x} \cdot 5^{4x+2}}{0,2^x} = 3125^3$
- 3) $5^{2x-8} = 625$
- 4) $\frac{10^{2x} \cdot 1000^{-2x+3} \cdot 10^4}{0,01^{x-3} \cdot 10^3} = 1000^6$
- 5) $5^{3x-4} = 625$
- 6) $2^{7x+1} = 256$
- 7) $6^{3x+2} = 216$
- 8) $5^{2x-1} = \sqrt{5}$
- 9) $10^{5x-2} = 0,01$
- 10) $7^{2x+8} = 2401$

E.- Resolver las siguientes ecuaciones

- 1) $9^{x^2-1} = 1$
- 2) $3^{x-1} \cdot 3^x = 27$
- 3) $0,01^{x+3} = \sqrt{10}$
- 4) $16^{2x} \cdot 8^{x-1} \cdot 32^{-2x} = 64^5$
- 5) $\frac{0,1^{-2x} \cdot 100^{4x-1}}{10^{-3}} = 10^8$
- 6) $\frac{0,01^{3x} \cdot 100^{2x+3} \cdot 10^{5x}}{10^{-4} \cdot 10^{x+2}} = 100^6$
- 7) $\sqrt{a^x \sqrt{a^x \sqrt{a^x}}} = a^7$
- 8) $3^{\frac{2x+1}{3}} = 27$
- 9) $7^{x^2-3x+2} = 1$
- 10) $10^{\frac{3x-1}{2x+1}} = 100$
- 11) $2^{x+5} = 8^{x-1}$
- 12) $5^{x^2-5x+6} = 1$

F.- Resolver las siguientes ecuaciones

- 1) $2^{x+2} + 2^x = 80$
- 2) $2^{x+3} + 2^x = 72$
- 3) $3^{x+2} - 4 \cdot 3^{x+1} = -729$
- 4) $5^{x+3} - 5^{x+2} = 4$
- 5) $4^{x+5} + 4^{x+4} = 20$
- 6) $2^{x+1} + 2^x + 2^{x-1} = 28$
- 7) $2^{x+2} + 5 \cdot 2^{x-1} = \frac{13}{16}$
- 8) $3^x + 3^{x-2} + 3^{x-1} = 117$
- 9) $4^x + 4^{x-1} + 4^{x-2} = 336$
- 10) $3^{x+3} + 3^{x+4} = 12$
- 11) $10^{x+1} - 10^{x-2} = 999$
- 12) $6 \cdot 2^{x+5} - 9 \cdot 2^{x+4} = 384$
- 13) $7^{x+2} + 3 \cdot 7^{x+3} = 154$

G.- Resolver las siguientes ecuaciones

- 1) $9^x - 7 \cdot 3^x - 18 = 0$
- 2) $9^x - 3^x - 6 = 0$
- 3) $4^x - 2^x - 2 = 0$
- 4) $4^x + 2^5 = 3 \cdot 2^{x+2}$
- 5) $3^{2(x+1)} - 18 \cdot 3^x + 9 = 0$
- 6) $2^x + 2^{1-x} = 3$
- 7) $2 - 3^{-x} + 3^{x+1} = 0$
- 8) $3^{1-x} - 3^x = 2$
- 9) $2^{2x} - 9 \cdot 2^{x+1} = -32$
- 10) $7^{2x} - 8 \cdot 7^{x+1} + 7^3 = 0$
- 11) $3^{2x+1} + 27 = 82 \cdot 3^x$
- 12) $3^{2x-2} + 81 = 10 \cdot 3^x$
- 13) $2^{2x-3} + 2^{x-1} = 12$
- 14) $5^{2x+2} - 3126 \cdot 5^{x-1} + 5 = 0$

H.- Resolver las siguientes ecuaciones

- 1) $2^{x+1} + 2^x + 2^{x-1} = 28$
- 2) $3^{x+2} + 3^{x+1} + 3^x + 3^{x-1} = 120$
- 3) $5^{x+1} + 5^{x-1} + 5^x = 775$
- 4) $2^{x-1} + 2^{x-2} + 2^{x-3} + 2^{x-4} = 960$
- 5) $2^{2x} + 2^{2x-1} + 2^{2(x-1)} + 2^{2x-3} + 2^{2(x-2)} = 1984$

I.- Resolver las siguientes ecuaciones

- 1) $3^{2x-1} - 8 \cdot 3^{x-1} = 3$
- 2) $2^{2x-1} - 6 \cdot 2^{x-1} + 4 = 0$
- 3) $4^{x+1} + 2^{x+3} = 320$
- 4) $7^{2x+1} - 2 \cdot 7^{x+1} + 7 = 0$
- 5) $5^{3x+2} + 3 \cdot 5^{6x+2} - 100 = 0$
- 6) $6^x - 9 \cdot 6^{-x} + 8 = 0$
- 7) $3^{2(x+1)} - 18 \cdot 3^x + 9 = 0$
- 8) $2^{2x-1} - 5 \cdot 2^{x-1} + 2 = 0$

J.- Resolver las siguientes ecuaciones

- 1) $3^{3x-2} = 81$
- 2) $4^{\frac{2x-3}{5}} = 64$
- 3) $7^{3x-2} = 2401$
- 4) $e^{x-1} = 3^{2(x+1)}$
- 5) $3^{2x-3} = 27^{\frac{x+1}{3}}$
- 6) $5^{\frac{x+3}{4}} = 25$
- 7) $4^{x^2-11x+30} = 16$
- 8) $6^{\frac{1-3x}{4}} = 1296$
- 9) $9^{x-2} = 3^{3x+1}$
- 10) $5^{3x+1} = 25^{x-5}$

A

$$\begin{aligned} 3^{x-8} &= 81 \\ 3^{x-8} &= 3^4 \\ x-8 &= 4 \\ \boxed{x=12} \end{aligned}$$

$$\begin{aligned} 2^{x+1} &= 128 \\ 2^{x+7} &= 2^7 \\ x+7 &= 7 \\ \boxed{x=0} \end{aligned}$$

$$\begin{aligned} 5^{9-x} &= 25 \\ 5^{9-x} &= 5^2 \\ 9-x &= 2 \\ -x &= -7 \\ \boxed{x=7} \end{aligned}$$

$$\begin{aligned} 3^{7-x} &= 243 \\ 3^{7-x} &= 3^5 \\ 7-x &= 5 \\ -x &= -2 \\ \boxed{x=2} \end{aligned}$$

$$\begin{aligned} 5^{x+2} &= 125 \\ x+2 &= 3 \\ \boxed{x=1} \end{aligned}$$

$$\begin{aligned} 7^{2x+4} &= 49 \\ 2x+4 &= 2 \\ 2x &= -2 \\ \boxed{x=-1} \end{aligned}$$

$$\begin{aligned} 10^{2-2x} &= 100 \\ 2-2x &= 2 \\ -2x &= 0 \\ \boxed{x=0} \end{aligned}$$

$$\begin{aligned} 5^{8-5x} &= 1 \\ 5^{8-5x} &= 5^0 \\ 8-5x &= 0 \\ -5x &= -8 \\ x &= 8/5 \end{aligned}$$

$$\begin{aligned} 10^{-4+9x} &= 1000 \\ -4+9x &= 3 \\ 9x &= 7 \\ x &= 7/9 \end{aligned}$$

$$\begin{aligned} 5^{-7x+3} &= 68 \\ -7x+3 &= 4 \\ -7x &= 1 \\ x &= -1/7 \end{aligned}$$

B

$$\begin{aligned} 2^{2x-1} &= 0,5 \\ 2^{2x-1} &= \frac{1}{2} \\ 2^{2x-1} &= 2^{-1} \\ 2x-1 &= -1 \\ x &= 0 \end{aligned}$$

$$\begin{aligned} 2^{-4x+3} &= 0,25 \\ 2^{-4x+3} &= \frac{1}{4} \\ 2^{-4x+3} &= 2^{-2} \\ -4x+3 &= -2 \\ -4x &= -5 \\ x &= 5/4 \end{aligned}$$

$$\begin{aligned} 3^{4x-2} &= \frac{1}{3} \\ 3^{4x-2} &= 3^{-1} \\ 4x-2 &= -1 \\ 4x &= 1 \\ x &= 1/4 \end{aligned}$$

$$\begin{aligned} 3^{-5x+2} &= \frac{1}{9} \\ 3^{-5x+2} &= 3^{-2} \\ -5x+2 &= -2 \\ -5x &= -4 \\ x &= 4/5 \end{aligned}$$

$$\begin{aligned} 10^{x^2-7} &= 0,001 \\ 10^{x^2-7} &= 10^{-3} \\ x^2-7 &= -3 \\ x^2 &= 4 \\ \boxed{x=2} \quad \boxed{x=-2} \end{aligned}$$

$$\begin{aligned} 5^{3x-1} &= \frac{1}{25} \\ 3x-1 &= -2 \\ 3x &= -1 \\ x &= -1/3 \end{aligned}$$

$$\begin{aligned} 7^{-3x-2} &= 1 \\ -3x-2 &= 0 \\ -3x &= 2 \\ x &= -2/3 \end{aligned}$$

$$\begin{aligned} 4^{8+x} &= 2^{15-3x} \\ 16+2x &= 15-3x \\ 5x &= -1 \\ x &= -1/5 \end{aligned}$$

$$\begin{aligned} 10^{7+9x} &= 0,01 \\ 7+9x &= -2 \\ 9x &= -9 \\ x &= -1 \end{aligned}$$

$$\begin{aligned} 5^{-4-3x} &= 0,2 \\ 5^{-4-3x} &= \frac{1}{5} \\ -4-3x &= -1 \\ -3x &= 3 \\ x &= -1 \end{aligned}$$

$$\begin{aligned} 7^{5x+2} &= \sqrt{7} \\ 7^{5x+2} &= 7^{1/2} \\ 5x+2 &= \frac{1}{2} \\ 5x &= -3/2 \\ x &= -3/10 \end{aligned}$$

$$\begin{aligned} 2^{-5x-3} &= \sqrt[4]{8} \\ 2^{-5x-3} &= 2^{3/4} \\ -5x-3 &= \frac{3}{4} \\ -20x-12 &= 3 \\ -20x &= 15 \\ x &= -15/20 = -3/4 \end{aligned}$$

$$\begin{aligned} 125^{x-2} &= \sqrt[3]{25} \\ 5^{3x-6} &= 5^{2/3} \\ 3x-6 &= \frac{2}{3} \\ 9x-18 &= 2 \\ 9x &= 20 \\ x &= 20/9 \end{aligned}$$

$$\begin{aligned} 0,1^{x+4} &= \sqrt[5]{1000} \\ 10^{-x-4} &= 10^{3/5} \\ -x-4 &= \frac{3}{5} \\ -5x-20 &= 3 \\ -5x &= 23 \\ x &= -23/5 \end{aligned}$$

$$\begin{aligned} 9^{2x-1} &= \sqrt[3]{3} \\ 3^{4x-2} &= 3^{1/3} \\ 4x-2 &= \frac{1}{3} \\ 12x-6 &= 1 \\ 12x &= 7 \\ x &= 7/12 \end{aligned}$$

$$\begin{aligned} \sqrt[3]{3^{5x-11}} &= 9 \\ 3^{5x-11} &= 3^2 \\ 5x-11 &= 2 \\ 5x &= 13 \\ x &= 13/5 \end{aligned}$$

$$\begin{aligned} 2^{x^2-3x} &= 16 \\ x^2-3x &= 4 \\ x^2-3x-4 &= 0 \\ x &= 4; x = -1 \end{aligned}$$

$$\begin{aligned} 5^{x^2+2x} &= 125 \\ x^2+2x &= 3 \\ x^2+2x-3 &= 0 \\ x &= -3; x = 1 \end{aligned}$$

$$\begin{aligned} 10^{x^2+\frac{4}{3}x} &= \sqrt[3]{0,1} \\ x^2+\frac{4}{3}x &= -\frac{1}{3} \\ 3x^2+4x+1 &= 0 \\ x &= -1; x = -1/3 \end{aligned}$$

$$\begin{aligned} 10^{4x+x-1-2x+3} &= 10^3 \\ 3x+2 &= 3 \\ 3x &= 1 \\ x &= 1/3 \end{aligned}$$

D

① $2^x \cdot 8^{2x+1} \cdot 16^{-x} = 128$
 $2^x \cdot 2^{6x+3} \cdot 2^{-4x} = 2^{21}$
 $x+6x+3-4x=21$
 $3x=18$
 $\boxed{x=6}$

② $25^{3x} \cdot 5^{4x+2} = 3125^3$
 $5^{6x} \cdot 5^{4x+2} \cdot 5^x = 5^{15}$
 $9x+2=15$
 $11x=13$
 $x=13/11$

③ $5^{2x-8} = 625$
 $2x-8=4$
 $2x=12$
 $\boxed{x=6}$

④ $10^{2x} \cdot 1000^{-2x+3} \cdot 10^4 = 1000^6$
 $10^{2x} \cdot 10^{-6x+9} \cdot 10^4 \cdot 10^0 = 10^6$
 $2x-6x+9+4+2x-6-9=18$
 $-2x=14$
 $\boxed{x=-7}$

⑤ $5^{3x-4} = 625$
 $3x-4=4$
 $x=8/3$

⑥ $2^{7x+1} = 256$
 $7x+1=8$
 $7x=7$
 $x=1$

⑦ $6^{3x+7} = 216$
 $3x+7=3$
 $3x=-4$
 $x=-4/3$

⑧ $5^{2x-1} = \sqrt{5}$
 $5^{2x-1} = 5^{1/2}$
 $2x-1 = \frac{1}{2}$
 $4x-2=1$
 $4x=3$
 $x=3/4$

⑨ $10^{5x-2} = 0,01$
 $10^{5x-2} = 10^{-2}$
 $5x-2=-2$
 $5x=0$
 $x=0$

⑩ $7^{2x+8} = 2401$
 $7^{2x+8} = 7^4$
 $2x+8=4$
 $2x=-4$
 $\boxed{x=-2}$

⑪ $0,01^{3x} \cdot 100^{2x+3} \cdot 10^{5x} = 100^6$
 $10^{-6x} \cdot 10^{4x+6} \cdot 10^{5x} = 10^{12}$
 $10^{-6x+4x+6+5x-x+2} = 10^{12}$
 $10^{2x+8} = 10^{12}$
 $2x+8=12$
 $2x=4$
 $\boxed{x=2}$

E

① $9^{x^2-1} = 1$
 $x^2-1=0$
 $\boxed{x=1}; \boxed{x=-1}$

② $3^{x-1} \cdot 3^x = 27$
 $3^{2x-1} = 3^3$
 $2x-1=3$
 $2x=4$
 $\boxed{x=2}$

③ $0,01^{x+3} = \sqrt{10}$
 $10^{-2x-6} = 10^{1/2}$
 $-2x-6 = \frac{1}{2}$
 $-2x = 6 + \frac{1}{2}$
 $-2x = \frac{13}{2}$
 $\boxed{x = -13/4}$

④ $16^{2x} \cdot 8^{x-1} \cdot 32^{-2x} = 64^5$
 $2^{8x} \cdot 2^{3x-3} \cdot 2^{-10x} = 2^{30}$
 $2^{x-3} = 2^{30}$
 $\boxed{x=33}$

⑤ $0,1^{-2x} \cdot 100^{4x-1} = 10^8$
 $10^{2x} \cdot 10^{8x-2} = 10^5$
 $10^{10x-2} = 10^5$
 $10x-2=5$
 $10x=7$
 $x=7/10$

⑦ $\sqrt{a^x} \sqrt{a^x} \sqrt{a^x} = a^7$
 $\sqrt{a^x} \sqrt{a^x} \cdot a^{3x/2} = a^7$
 $\sqrt{a^x} \cdot a^{3x/4} = a^7$
 $\sqrt{a^{7x/4}} = a^7$
 $a^{7x/8} = a^7$
 $7x/8=7$
 $7x=56$
 $\boxed{x=8}$

⑧ $3^{2x+1} = 27$
 $2x+1=3$
 $2x=2$
 $\boxed{x=1}$

⑨ $x^2-3x+2=1$
 $x^2-3x+2=0$
 $x = \frac{3 \pm \sqrt{9-8}}{2}$
 $x = \frac{3 \pm 1}{2}$
 $x = \frac{3+1}{2} = 2$
 $x = \frac{3-1}{2} = 1$

⑫ $5x^2-5x+6=1$
 $x^2-5x+6=1$
 $\boxed{x=2}; \boxed{x=3}$

F

$$\begin{aligned} 2^{x+2} + 2^x &= 80 \\ 4 \cdot 2^x + 2^x &= 80 \\ 2^x(4+1) &= 80 \\ 2^x &= \frac{80}{5} \\ 2^x &= 16; 2^x = 2^4 \\ \boxed{x=4} \end{aligned}$$

$$\begin{aligned} 4^{x+5} + 4^{x+4} &= 20 \\ 4^x(4^5 + 4^4) &= 20 \\ 4^x &= \frac{20}{2^{10} + 2^8} \\ 4^x &= \frac{20}{1280} \\ 4^x &= \frac{1}{64} \\ \boxed{x=-3} \end{aligned}$$

$$\begin{aligned} 4^x + 4^{x-1} + 4^{x-2} &= 336 \\ 4^x \left(1 + \frac{1}{4} + \frac{1}{16}\right) &= 336 \\ 4^x \cdot \frac{16+4+1}{16} &= 336 \\ 4^x &= 336 \cdot \frac{16}{21} \\ 4^x &= 4^4; \boxed{x=4} \end{aligned}$$

$$\begin{aligned} 7^{x+2} + 3 \cdot 7^{x+3} &= 154 \\ 7^x(7^2 + 3 \cdot 7^3) &= 154 \\ 7^x \cdot 1078 &= 154 \\ 7^x &= \frac{154}{1078} \\ 7^x &= \frac{1}{7}; \boxed{x=-1} \end{aligned}$$

$$\begin{aligned} e^{x-1} &= e^{2(x+1)} \\ x-1 &= 2x+2 \\ -x &= 3 \\ \boxed{x=-3} \end{aligned}$$

$$\begin{aligned} 3^{2x-3} &= 27^{\frac{x+1}{3}} \\ 3^{2x-3} &= 3^{x+1} \\ 2x-3 &= x+1 \\ \boxed{x=4} \end{aligned}$$

$$\begin{aligned} 5^{\frac{x+3}{4}} &= 25 \\ 5^{\frac{x+3}{4}} &= 5^2 \\ \frac{x+3}{4} &= 2 \\ x+3 &= 8 \\ \boxed{x=5} \end{aligned}$$

$$\begin{aligned} 4^{x^2-11x+30} &= 16 \\ 4^{x^2-11x+30} &= 4^2 \\ x^2-11x+30 &= 2 \\ x &= \frac{11 \pm \sqrt{121-112}}{2} \\ x &= \frac{11 \pm \sqrt{9}}{2} \\ x &= \frac{11+3}{2} = 7 \\ x &= \frac{11-3}{2} = 4 \end{aligned}$$

$$\begin{aligned} 6^{\frac{1-3x}{4}} &= 1296 \\ 6^{\frac{1-3x}{4}} &= 6^4 \\ \frac{1-3x}{4} &= 4 \\ 1-3x &= 16 \\ -3x &= 15 \\ 3x &= -15 \\ \boxed{x=-5} \end{aligned}$$

$$\begin{aligned} 2^{x+3} + 2^x &= 72 \\ 2^x + 2^x &= 72 \\ 2^x(8+1) &= 72 \\ 2^x &= \frac{72}{9} \\ 2^x &= 8; 2^x = 2^3 \\ \boxed{x=3} \end{aligned}$$

$$\begin{aligned} 3^{x+2} - 4 \cdot 3^{x+1} &= -729 \\ 9 \cdot 3^x - 12 \cdot 3^x &= -729 \\ 3^x(9-12) &= -729 \\ 3^x &= \frac{-729}{-3} \\ 3^x &= 243; 3^x = 3^5 \\ \boxed{x=5} \end{aligned}$$

$$\begin{aligned} 5^{x+3} - 5^{x+2} &= 4 \\ 125 \cdot 5^x - 25 \cdot 5^x &= 4 \\ 5^x(125-25) &= 4 \\ 5^x &= \frac{4}{100}; 5^x = \frac{1}{25} \\ 5^x &= 5^{-2}; \boxed{x=-2} \end{aligned}$$

$$\begin{aligned} 2^{x+1} + 2^x + 2^{x-1} &= 28 \\ 2^x \left(2 + 1 + \frac{1}{2}\right) &= 28 \\ 2^x \cdot \frac{7}{2} &= 28 \\ 2^x &= 28 \cdot \frac{2}{7} \\ 2^x &= 2^3 \\ \boxed{x=3} \end{aligned}$$

$$\begin{aligned} 2^{x+2} + 5 \cdot 2^{x-1} &= \frac{13}{6} \\ 2^x \left(2^2 + \frac{5}{2}\right) &= \frac{13}{6} \\ 2^x \cdot \frac{13}{2} &= \frac{13}{6} \\ 2^x &= \frac{13}{6} \cdot \frac{2}{13} \\ 2^x &= \frac{1}{3}; \boxed{x=-3} \end{aligned}$$

$$\begin{aligned} 3^x + 3^{x-2} + 3^{x-1} &= 117 \\ 3^x \left(1 + \frac{1}{9} + \frac{1}{3}\right) &= 117 \\ 3^x \cdot \frac{13}{9} &= 117 \\ 3^x &= 117 \cdot \frac{9}{13} \\ 3^x &= 3^4; \boxed{x=4} \end{aligned}$$

$$\begin{aligned} 3^{x+3} + 3^{x+4} &= 12 \\ 3^x(3^3 + 3^4) &= 12 \\ 3^x &= \frac{12}{108} \\ 3^x &= \frac{3 \cdot 4}{27 \cdot 4} \\ 3^x &= \frac{1}{9}; \boxed{x=-2} \end{aligned}$$

$$\begin{aligned} 10^{x+1} - 10^{x-2} &= 999 \\ 10^x \left(10 - \frac{1}{100}\right) &= 999 \\ 10^x &= 999 \cdot \frac{100}{999} \\ \boxed{x=2} \end{aligned}$$

$$\begin{aligned} 6 \cdot 2^{x+5} - 9 \cdot 2^{x+4} &= 384 \\ 2^x(6 \cdot 2^5 - 9 \cdot 2^4) &= 384 \\ 2^x \cdot 48 &= 384 \\ 2^x &= 8 \\ \boxed{x=3} \end{aligned}$$

J

$$\begin{aligned} 3^{3x-2} &= 81 \\ 3^{3x-2} &= 3^4 \\ 3x-2 &= 4 \\ 3x &= 6 \\ \boxed{x=2} \end{aligned}$$

$$\begin{aligned} 4^{\frac{2x-3}{5}} &= 64 \\ 4^{\frac{2x-3}{5}} &= 4^3 \\ \frac{2x-3}{5} &= 3 \\ 2x-3 &= 15 \\ 2x &= 18 \\ \boxed{x=9} \end{aligned}$$

$$\begin{aligned} 7^{3x-2} &= 2401 \\ 7^{3x-2} &= 7^4 \\ 3x-2 &= 4 \\ 3x &= 6 \\ \boxed{x=2} \end{aligned}$$

6/ ① $9^x - 7 \cdot 3^x - 18 = 0$
 $3^{2x} - 7 \cdot 3^x - 18 = 0$
 Cambio: $3^x = t$
 $t^2 - 7t - 18 = 0$
 $t = \frac{7 \pm \sqrt{49 + 72}}{2}$
 $t = \frac{7 \pm \sqrt{121}}{2} = \begin{cases} \frac{7+11}{2} = 9 \\ \frac{7-11}{2} = -2 \end{cases}$
 $3^x = 9 \quad \left\{ \begin{array}{l} 3^x = -2 \\ \text{NO es posible.} \end{array} \right.$
 $\boxed{x=2}$

② $9^x - 3^x - 6 = 0$
 $3^{2x} - 3^x - 6 = 0$
 Cambio: $3^x = t$
 $t^2 - t - 6 = 0$
 $t = \frac{1 \pm \sqrt{1+24}}{2}$
 $t = \frac{1 \pm \sqrt{25}}{2} = \begin{cases} \frac{1+5}{2} = 3 \\ \frac{1-5}{2} = -2 \end{cases}$
 $3^x = 3 \quad \left\{ \begin{array}{l} 3^x = -2 \\ \text{NO} \end{array} \right.$
 $\boxed{x=1}$

③ $4^x - 2^x - 2 = 0$
 $2^{2x} - 2^x - 2 = 0$
 Cambio: $2^x = t$
 $t^2 - t - 2 = 0$
 $t = \frac{1 \pm \sqrt{1+8}}{2}$
 $t = \frac{1 \pm \sqrt{9}}{2} = \begin{cases} \frac{1+3}{2} = 2 \\ \frac{1-3}{2} = -1 \end{cases}$
 $2^x = 2 \quad \left\{ \begin{array}{l} 2^x = -1 \\ \text{NO} \end{array} \right.$
 $\boxed{x=1}$

④ $4^x + 2^5 = 3 \cdot 2^{x+2}$
 $2^{2x} + 32 = 12 \cdot 2^x$
 $2^x = t$ Cambio
 $t^2 - 12t + 32 = 0$
 $t = \frac{12 \pm \sqrt{144 - 128}}{2}$
 $t = \frac{12 \pm \sqrt{16}}{2} = \begin{cases} \frac{12+4}{2} = 8 \\ \frac{12-4}{2} = 4 \end{cases}$
 $2^x = 8 \quad \left\{ \begin{array}{l} 2^x = 4 \\ \text{NO} \end{array} \right.$
 $\boxed{x=3}$

⑤ $3^{2(x+1)} - 18 \cdot 3^x + 9 = 0$
 $3^{2x} \cdot 3^2 - 18 \cdot 3^x + 9 = 0$
 $3^x = t$
 $9t^2 - 18t + 9 = 0$
 $t^2 - 2t + 1 = 0$
 $t = \frac{2 \pm \sqrt{4-4}}{2} = 1$
 $3^x = 1$
 $\boxed{x=0}$

⑦ $2 - 3^{-x} + 3^{x+1} = 0$
 $2 - \frac{1}{3^x} + 3^x \cdot 3 = 0$
 $3^x = t$
 $2 - \frac{1}{t} + 3t = 0$
 $2t - 1 + 3t^2 = 0$
 $3t^2 + 2t - 1 = 0$
 $t = \frac{-2 \pm \sqrt{4+12}}{6}$
 $t = \frac{-2 \pm \sqrt{16}}{6} = \begin{cases} \frac{-2+4}{6} = \frac{1}{3} \\ \frac{-2-4}{6} = -1 \end{cases}$
 $3^x = \frac{1}{3} \quad \left\{ \begin{array}{l} 3^x = -1 \\ \text{NO es posible.} \end{array} \right.$
 $\boxed{x=-1}$

⑥ $2^x + 2^{1-x} = 3$
 $2^x + \frac{2}{2^x} = 3$
 $2^x = t$
 $t + \frac{2}{t} = 3$
 $t^2 - 3t + 2 = 0$
 $t = \frac{3 \pm \sqrt{9-8}}{2}$
 $t = \frac{3 \pm \sqrt{1}}{2} = \begin{cases} \frac{3+1}{2} = 2 \\ \frac{3-1}{2} = 1 \end{cases}$
 $2^x = 2 \quad \left\{ \begin{array}{l} 2^x = 1 \\ \text{NO} \end{array} \right.$
 $\boxed{x=1}$

⑧ $3^{1-x} - 3^x = 2$
 $\frac{3}{3^x} - 3^x = 2$
 $3^x = t$
 $\frac{3}{t} - t - 2 = 0$
 $-t^2 - 2t + 3 = 0$
 $t^2 + 2t - 3 = 0$
 $t = \frac{-2 \pm \sqrt{4+12}}{2}$
 $t = \frac{-2 \pm \sqrt{16}}{2} = \begin{cases} \frac{-2+4}{2} = 1 \\ \frac{-2-4}{2} = -3 \end{cases}$
 $3^x = 1 \quad \left\{ \begin{array}{l} 3^x = -3 \\ \text{NO} \end{array} \right.$
 $\boxed{x=0}$

⑨ $2^{2x} - 9 \cdot 2^{x+1} = -32$
 $2^{2x} - 18 \cdot 2^x + 32 = 0$
 $2^x = t$
 $t^2 - 18t + 32 = 0$
 $t = \frac{18 \pm \sqrt{324 - 128}}{2}$
 $t = \frac{18 \pm \sqrt{196}}{2} = \begin{cases} \frac{18+14}{2} = 16 \\ \frac{18-14}{2} = 2 \end{cases}$
 $2^x = 16 \quad \left\{ \begin{array}{l} 2^x = 2 \\ \text{NO} \end{array} \right.$
 $\boxed{x=4}$

H/

$$\textcircled{1} 2^{x+1} + 2^x + 2^{x-1} = 28$$

$$2 \cdot 2^x + 2^x + \frac{1}{2} \cdot 2^x = 28$$

$$2^x \left(2 + 1 + \frac{1}{2} \right) = 28$$

$$2^x \cdot \frac{7}{2} = 28$$

$$2^x = 28 \cdot \frac{2}{7}$$

$$2^x = 2^3$$

$$\boxed{x=3}$$

$$\textcircled{3} 5^{x+1} + 5^{x-1} + 5^x = 775$$

$$5^x \left(5 + \frac{1}{5} + 1 \right) = 775$$

$$5^x \cdot \frac{31}{5} = 775$$

$$5^x = 775 \cdot \frac{5}{31}$$

$$5^x = 25 \cdot 5$$

$$\boxed{x=3}$$

$$\textcircled{4} 2^{x-1} + 2^{x-2} + 2^{x-3} + 2^{x-4} = 960$$

$$\frac{2^x}{2} + \frac{2^x}{4} + \frac{2^x}{8} + \frac{2^x}{16} = 960$$

$$2^x \left(\frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} \right) = 960$$

$$2^x \cdot \frac{8+4+2+1}{16} = 960$$

$$2^x \cdot \frac{15}{16} = 960; 2^x = 960 \cdot \frac{16}{15}$$

$$2^x = 2^{10}; \boxed{x=10}$$

$$\textcircled{2} 3^{x+2} + 3^{x+1} + 3^x + 3^{x-1} = 120$$

$$9 \cdot 3^x + 3 \cdot 3^x + 3^x + \frac{1}{3} \cdot 3^x = 120$$

$$3^x \left(9 + 3 + 1 + \frac{1}{3} \right) = 120$$

$$3^x \cdot \frac{40}{3} = 120$$

$$3^x = 120 \cdot \frac{3}{40}$$

$$3^x = 3^2$$

$$\boxed{x=2}$$

$$\textcircled{5} 2^{2x} + 2^{2x-1} + 2^{2(x-1)} + 2^{2x-3} + 2^{2(x-2)} = 1984$$

$$2^{2x} + \frac{2^{2x}}{2} + \frac{2^{2x}}{4} + \frac{2^{2x}}{8} + \frac{2^{2x}}{16} = 1984$$

$$2^{2x} \left(1 + \frac{1}{2} + \frac{1}{4} + \frac{1}{8} + \frac{1}{16} \right) = 1984$$

$$2^{2x} \cdot \frac{16+8+4+2+1}{16} = 1984$$

$$2^{2x} \cdot \frac{31}{16} = 1984; 2^{2x} = 1984 \cdot \frac{16}{31}$$

$$2^{2x} = \frac{31 \cdot 64 \cdot 16}{31} \Rightarrow 2^{2x} = 2^{10}$$

$$\boxed{x=5}$$

J/

$$\textcircled{9} 9^{x-2} = 3^{3x+1}$$

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

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

$$-x = 5$$

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

$$\textcircled{10} 5^{3x+1} = 25^{x-5}$$

$$5^{3x+1} = 5^{2x-10}$$

$$3x+1 = 2x-10$$

$$\boxed{x=-11}$$

I/

① $3^{2x-1} - 8 \cdot 3^{x-1} = 3$

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

Cambio: $3^x = t$

$\frac{t^2}{3} - \frac{8}{3}t - 3 = 0$

$t^2 - 8t - 9 = 0$

$t = \frac{8 \pm \sqrt{64 + 36}}{2}$

$t = \frac{8 \pm \sqrt{100}}{2} = \begin{cases} \frac{8+10}{2} = 9 \\ \frac{8-10}{2} = -1 \end{cases}$

$\begin{cases} 3^x = 9 \\ 3^x = 3^2 \\ \boxed{x=2} \end{cases} \quad \begin{cases} 3^x = -1 \\ \text{No} \end{cases}$

② $2^{2x-1} - 6 \cdot 2^{x-1} + 4 = 0$

$\frac{1}{2} \cdot (2^x)^2 - 3 \cdot 2^x + 4 = 0$

Cambio: $2^x = t$

$\frac{t^2}{2} - 3t + 4 = 0$

$t^2 - 6t + 8 = 0$

$t = \frac{6 \pm \sqrt{36 - 32}}{2}$

$t = \frac{6 \pm \sqrt{4}}{2} = \begin{cases} \frac{6+2}{2} = 4 \\ \frac{6-2}{2} = 2 \end{cases}$

$\begin{cases} 2^x = 4 \\ 2^x = 2^2 \\ \boxed{x=2} \end{cases} \quad \begin{cases} 2^x = 2 \\ \boxed{x=1} \end{cases}$

③ $4^{x+1} + 2^{x+3} = 320$

$2^{2x+2} + 2^{x+3} = 320$

$4(2^x)^2 + 8 \cdot 2^x = 320$

Cambio: $2^x = t$

$4t^2 + 8t - 320 = 0$

$t^2 + 2t - 80 = 0$

$t = \frac{-2 \pm \sqrt{4 + 320}}{2}$

$t = \frac{-2 \pm \sqrt{324}}{2}$

$t = \begin{cases} \frac{-2+18}{2} = 8 \\ \frac{-2-18}{2} = -10 \end{cases}$

$\begin{cases} 2^x = 8 \\ 2^x = 2^3 \\ \boxed{x=3} \end{cases} \quad \begin{cases} 2^x = -10 \\ \text{No} \end{cases}$

④ $7^{2x+1} - 2 \cdot 7^{x+1} + 7 = 0$

$7 \cdot (7^x)^2 - 14 \cdot 7^x + 7 = 0$

Cambio: $7^x = t$

$7t^2 - 14t + 7 = 0$

$t^2 - 2t + 1 = 0$

$t = \frac{2 \pm \sqrt{4 - 4}}{2}$

$t = 1$

$7^x = 1; 7^x = 7^0$
 $\boxed{x=0}$

⑤ $5^{3x+2} + 3 \cdot 5^{6x+2} - 100 = 0$

$25(5^{3x}) + 125 \cdot (5^{3x})^2 - 100 = 0$

Cambio: $5^{3x} = t$

$25t + 125t^2 - 100 = 0$

$t + 5t^2 - 4 = 0$

$5t^2 + t - 4 = 0$

$t = \frac{-1 \pm \sqrt{1 + 48}}{5} = \frac{-1 \pm \sqrt{49}}{5}$

$t = \begin{cases} \frac{-1+7}{5} = 1 \\ \frac{-1-7}{5} = -\frac{8}{5} = -\frac{4}{3} \end{cases}$

$5^{3x} = 1; 5^{3x} = 5^0; x=0$

⑥ $6^x - 9 \cdot 6^{-x} + 8 = 0$

$6^x - \frac{9}{6^x} + 8 = 0$

Cambio: $6^x = t$

$t - \frac{9}{t} + 8 = 0$

$t^2 + 8t - 9 = 0$

$t = \frac{-8 \pm \sqrt{64 + 36}}{2}$

$t = \frac{-8 \pm \sqrt{100}}{2} = \begin{cases} \frac{-8+10}{2} = 1 \\ \frac{-8-10}{2} = -9 \end{cases}$

$6^x = 1; x=0$

$6^x = -9 \text{ No.}$

⑦ $3^{2(x+1)} - 18 \cdot 3^x + 9 = 0$

$3^{2x+2} - 18 \cdot 3^x + 9 = 0$

$9 \cdot (3^x)^2 - 18 \cdot 3^x + 9 = 0$

Cambio: $3^x = t$

$9t^2 - 18t + 9 = 0$

$t^2 - 2t + 1 = 0$

$t = \frac{2 \pm \sqrt{4 - 4}}{2} = \frac{2+0}{2} = 1$

$3^x = 1; x=0$

⑧ $2^{2x-1} - 5 \cdot 2^{x-1} + 2 = 0$

$\frac{(2^x)^2}{2} - \frac{5}{2} \cdot 2^x + 2 = 0$

$2^x = t$

$\frac{t^2}{2} - \frac{5t}{2} + 2 = 0$

$t^2 - 5t + 4 = 0$

$t = \frac{5 \pm \sqrt{25 - 16}}{2} = \begin{cases} \frac{5+3}{2} = 4 \\ \frac{5-3}{2} = 1 \end{cases}$

$t = \frac{5 \pm \sqrt{9}}{2} < \begin{cases} \frac{5+3}{2} = 4 \\ \frac{5-3}{2} = 1 \end{cases}$

$2^x = 4$

$\boxed{x=2}$

$2^x = 1$

$\boxed{x=0}$