

2.15

1) $5^x = 25$

$5^x = 5^2$

$x = 2$

$S = \{2\}$

2) $3^x = \frac{1}{9}$

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

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

$x = -2$

$S = \{-2\}$

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

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

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

$x = -3$

$S = \{-3\}$

4) $4^x = 64$

$4^x = 4^3$

$x = 3$

$S = \{3\}$

5) $4^x = 8$

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

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

$2x = 3$

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

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

6) $25^x = 125$

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

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

$2x = 3$

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

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

7) $16^x = 64$

$(2^4)^x = 2^6$

$2^{4x} = 2^6$

$4x = 6$

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

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

$$\begin{aligned}
8) \quad & 3^x = 9^{2x+3} \\
& 3^x = (3^2)^{2x+3} \\
& 3^x = 3^{2(2x+3)} \\
& 3^x = 3^{4x+6} \\
& x = 4x + 6 \\
& 0 = 3x + 6 \\
& x = -2 \\
& S = \{-2\}
\end{aligned}$$

$$\begin{aligned}
9) \quad & 3^{3x+2} = 9^x \\
& 3^{3x+2} = (3^2)^x \\
& 3^{3x+2} = 3^{2x} \\
& 3x + 2 = 2x \\
& x + 2 = 0 \\
& x = -2 \\
& S = \{-2\}
\end{aligned}$$

$$\begin{aligned}
10) \quad & 9^{2x+1} = 1 \\
& 9^{2x+1} = 9^0 \\
& 2x + 1 = 0 \\
& x = -\frac{1}{2} \\
& S = \{-\frac{1}{2}\}
\end{aligned}$$

$$\begin{aligned}
11) \quad & 2^x - 16 \cdot 2^{3x+2} = 0 \\
& 2^x = 16 \cdot 2^{3x+2} \\
& 2^x = 2^4 \cdot 2^{3x+2} \\
& 2^x = 2^{4+3x+2} \\
& x = 4 + 3x + 2 \\
& -2x = 6 \\
& x = -3 \\
& S = \{-3\}
\end{aligned}$$

$$\begin{aligned}
12) \quad & 16 \cdot 2^x = 4^{3x+5} \\
& 2^4 \cdot 2^x = (2^2)^{3x+5} \\
& 2^{4+x} = 2^{2(3x+5)} \\
& 4 + x = 2(3x + 5) = 6x + 10 \\
& -5x = 6 \\
& x = -\frac{6}{5} \\
& S = \{-\frac{6}{5}\}
\end{aligned}$$

$$\begin{aligned}
13) \quad & 5^{3x+2} - \frac{1}{25} = 0 \\
& 5^{3x+2} = \frac{1}{25}
\end{aligned}$$

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

$$3x + 2 = -2$$

$$3x = -4$$

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

$$S = \left\{-\frac{4}{3}\right\}$$

$$14) \quad 2^{x+7} = 4^{5x+2}$$

$$2^{x+7} = (2^2)^{5x+2}$$

$$2^{x+7} = 2^{2(5x+2)}$$

$$x + 7 = 2(5x + 2) = 10x + 4$$

$$-9x = -3$$

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

$$S = \left\{\frac{1}{3}\right\}$$

$$15) \quad 7^{8x^2+4} = 7^{(2-3x)^2}$$

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

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

$$0 = x^2 - 12x = x(x - 12)$$

$$x = 0 \quad \text{ou} \quad x = 12$$

$$S = \{0; 12\}$$

$$16) \quad 11^{x^2+3} = 11^{2x^2-6}$$

$$x^2 + 3 = 2x^2 - 6$$

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

$$x = -3 \quad \text{ou} \quad x = 3$$

$$S = \{-3; 3\}$$

$$17) \quad 3^{2x} (3^x - 3)^2 = 0$$

$$3^{2x} = 0 \quad \text{ou} \quad 3^x - 3 = 0$$

(a) $3^{2x} = 0$ n'admet aucune solution, car $3^y > 0$ pour tout $y \in \mathbb{R}$.

(b) $3^x - 3 = 0$

$$3^x = 3 = 3^1$$

$$x = 1$$

$$S = \{1\}$$

$$18) \quad 2^{x^2} = 4 \cdot 2^x$$

$$2^{x^2} = 2^2 \cdot 2^x$$

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

$$x^2 = 2 + x$$

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

$$x = -1 \quad \text{ou} \quad x = 2$$

$$S = \{-1; 2\}$$

$$\begin{aligned}
19) \quad & 2^{x^2} \cdot 4^x = 8 \\
& 2^{x^2} \cdot (2^2)^x = 2^3 \\
& 2^{x^2} \cdot 2^{2x} = 2^3 \\
& 2^{x^2+2x} = 2^3 \\
& x^2 + 2x = 3 \\
& x^2 + 2x - 3 = (x+3)(x-1) = 0 \\
& x = -3 \quad \text{ou} \quad x = 1 \\
& S = \{-3; 1\}
\end{aligned}$$

$$\begin{aligned}
20) \quad & 10^x = 1000^{2x-2} \\
& 10^x = (10^3)^{2x-2} \\
& 10^x = 10^{3(2x-2)} \\
& x = 3(2x-2) = 6x-6 \\
& 0 = 5x-6 \\
& x = \frac{6}{5} \\
& S = \{\frac{6}{5}\}
\end{aligned}$$