ANSWERS → Exercise 5.

1. $2^{2x+5} = 2^{x-6}$

$2x+5 = x-6$

$x = -11$

Since the bases are the same, the exponents must be the same!

2. $2^{3x} = 8$

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

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

$x = 1$

3. $2^{2x-5} = (32)(2^{x+2})$

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

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

$2^{2x-5} = 2^{x+7}$

$2x-5 = x+7$

$x = 12$

4. $5^{-x-4} = 125^{2x}$

$5^{-x-4} = (5^3)^{2x}$

$5^{-x-4} = 5^{6x}$

$-x-4 = 6x$

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

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

5. $(16)(2^{x-4}) = (64)(2^{3x+4})$

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

$2^{4+x-4} = 2^{6+3x+4}$

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

$x = 3x+10$

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

$x = -5$

6. $27^{x-5} = 9^{2x+5}$

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

$3^{3x-15} = 3^{4x+10}$

$3x - 15 = 4x + 10$

$-25 = x$

7. $4^x = 1$

$4^x = 4^0$

$x = 0$

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

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

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

$2^{-2x-6} = 2^{-3x+5}$

$-2x-6 = -3x+5$ → $x = 11$

9. $\left(\frac{1}{125}\right)^{3x-9} = \left(\frac{1}{5}\right)^{5x-8}$

$\left(\frac{1}{5^3}\right)^{3x-9} = \left(\frac{1}{5}\right)^{5x-8}$

$(5^{-3})^{3x-9} = (5^{-1})^{5x-8}$

$5^{-9x+27} = 5^{-5x+8}$

$-9x+27 = -5x+8$

$\frac{19}{4} = \frac{4x}{4}$

$\frac{19}{4} = x$

10. $\frac{1}{32} \cdot \left(\frac{1}{16}\right)^{x+6} = 2^{-7} \cdot \left(\frac{1}{2}\right)^{5x+2}$

$\frac{1}{2^5} \cdot \left(\frac{1}{2^4}\right)^{x+6} = 2^{-7} \cdot (2^{-1})^{5x+2}$

$(2^{-5})(2^{-4})^{x+6} = (2^{-7})(2^{-5x-2})$

$(2^{-5})(2^{-4x-24}) = 2^{-7+(-5x-2)}$

$2^{-5+(-4x-24)} = 2^{-7-5x-2}$

$2^{-5-4x-24} = 2^{-9-5x}$

$2^{-29-4x} = 2^{-9-5x}$

$-29-4x = -9-5x$

$x = 20$

11. $7^x + 11 = 60$

$7^x = 49$

$7^x = 7^2$

$x = 2$

12. $15 \cdot 3^{2x-3} = 5$

$3^{2x-3} = \frac{5}{15}$

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

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

$2x - 3 = -1$

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

$x = 1$

13. $48 = 6(2)^{x-1}$

$\frac{48}{6} = (2)^{x-1}$

$8 = (2)^{x-1}$

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

$3 = x - 1$

$4 = x$

14. $8(2)^{x+3} = 128$

$(2)^{x+3} = \frac{128}{8}$

$(2)^{x+3} = 16$

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

$x+3 = 4$

$x = 1$

15. $\frac{27^{x}}{9^{2x-1}} = 3^{x+4}$

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

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

$3^{3x-(4x-2)} = 3^{x+4}$

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

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

$-x+2 = x+4 \rightarrow -1 = x$

$-2 = 2x$

16. $8^{1/4} \cdot \left(\frac{1}{4}\right)^{\frac{x}{2}} = 16^{3/4}$

$(2^3)^{1/4} \cdot \left(\frac{1}{2^2}\right)^{x/2} = (2^4)^{3/4}$

$2^{3/4} \cdot (2^{-2})^{x/2} = 2^{12/4}$

$2^{3/4} \cdot (2^{-2x/2}) = 2^3$

$(2^{3/4})(2^{-x}) = 2^3$

$2^{3/4-x} = 2^3$

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

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

$\frac{3}{4} - \frac{12}{4} = x$

$-9/4 = x$

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17. $\dfrac{(9^{2x-1})\cdot(3^{3x})^2}{(27^{x+2})^4} = 1$

$\dfrac{[(3^2)^{2x-1}](3^{6x})}{[(3^3)^{x+2}]^4} = 3^0$

$\dfrac{(3^{4x-2})(3^{6x})}{(3^{3x+6})^4} = 3^0$

$\dfrac{3^{4x-2+6x}}{3^{12x+24}} = 3^0$

$\dfrac{3^{10x-2}}{3^{12x+24}} = 3^0$

$3^{10x-2-(12x+24)} = 3^0$

$3^{10x-2-12x-24} = 3^0$

$3^{-2x-26} = 3^0$

$-2x-26 = 0$

$\dfrac{-2x}{-2} = \dfrac{26}{-2}$

$x = -13.$