Solving Exponential Expressions

1. Solve. Check your solutions by substituting into the left and right sides of the equation and evaluating.

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

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

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

$3x+1 = 2x-4$

$-2x \quad -2x$

$x+1 = -4$

$-1 \quad -1$

$\boxed{x=-5}$

b. $25^{2y-1} = 5^{3y+1}$

$(5^2)^{2y-1} = 5^{3y+1}$

$2(2y-1) = 3y+1$

$4y-2 = 3y+1$

$-3y \quad -3y$

$y-2 = 1$

$+2 \quad +2$

$\boxed{y=3}$

c. $4^{2(p-1)} = 64^{3p+4}$

$4^{2(p-1)} = (4^3)^{3p+4}$

$2(p-1) = 3(3p+4)$

$2p-2 = 9p+12$

$-9p \quad -9p$

$-7p-2 = 12$

$+2 \quad +2$

$-7p = 14$

$\frac{-7p}{-7} = \frac{14}{-7}$

$\boxed{p=-2}$

d. $1000^{2m-5} = 10^{3(m+3)}$

$(10^3)^{2m-5} = 10^{3(m+3)}$

$3(2m-5) = 3(m+3)$

$6m-15 = 3m+9$

$-3m \quad -3m$

$3m-15 = 9$

$+15 \quad +15$

$\frac{3m}{3} = \frac{24}{3}$

$\boxed{m=8}$

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

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

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

$2x-6 = 3x+3$

$-3x \quad -3x$

$-1x-6 = 3$

$+6 \quad +6$

$-1x = 9$

$\frac{-1x}{-1} = \frac{9}{-1}$

$\boxed{x=-9}$

f. $27^{w-3} = 9^{2(w+4)}$

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

$3(w-3) = 4(w+4)$

$3w-9 = 4w+16$

$-4w \quad -4w$

$-w-9 = 16$

$+9 \quad +9$

$-w = 25$

$\boxed{w=-25}$