Name _____

Applying Exponent Rules to Solve Equations

Solve for any variables.

1. $3^{3x} = 3^{x+1} \cdot 3^{x+2}$

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

$3x = 2x + 3$

$-2x \quad -2x$

$\boxed{x = 3}$

2. $\frac{4^{5h}}{4^{2h+2}} = 4^2$

$5h - (2h+2) = 2$

$4^{3h-2} = 4^2$

$3h - 2 = 2$

$+2 \quad +2$

$3h = 4$

$\boxed{h = \frac{4}{3}}$

3. $5^{2w} \cdot 5^5 = (5^w)^3$

$5^{2w+5} = 5^{3w}$

$2w + 5 = 3w$

$-2w \quad -2w$

$\boxed{5 = w}$

4. $7^{5x-8} \cdot 7^{x+8} = (7^{x-10})^2$

$7^{6x+0} = 7^{2x-20}$

$6x = 2x - 20$

$-2x \quad -2x$

$4x = -20$

$\boxed{x = -5}$

5. $10^{10g-12} \cdot 10^{10-6g} = \frac{10^{8g+12}}{10^{5g}}$

$10^{4g-2} = 10^{3g+12}$

$4g - 2 = 3g + 12$

$-3g \quad -3g$

$g - 2 = 12$

$+2 \quad +2$

$\boxed{g = 14}$

6. $2^{7n+6} \cdot 2^{-4n-7} = (2^{-3})^n$

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

$3n - 1 = -3n$

$-3n \quad -3n$

$\frac{-1}{-6} = \frac{-6n}{-6}$

$\boxed{\frac{1}{6} = n}$

7. $\left(\frac{13^{10m-5}}{13^{2m+3}}\right)^2 = 13^{3m+2} \cdot 13^{11m+5}$

$(13^{8m-2})^2 = 13^{14m+7}$

$13^{16m-4} = 13^{14m+7}$

$16m - 4 = 14m + 7$

$-14m \quad -14m$

$2m - 4 = 7$

$+4 \quad +4$

$2m = 11$

$\boxed{m = \frac{11}{2}}$

8. $\frac{6^{7p}}{6^{32}} = 6^{10}$

$6^{7p-32} = 6^{10}$

$7p - 32 = 10$

$+32 \quad +32$

$\frac{7p}{7} = \frac{42}{7}$

$\boxed{p = 6}$

9. $(8^{4+2k})^2 \cdot 8^{10} = 8^k$

$8^{8+4k} \cdot 8^{10} = 8^k$

$8^{18+4k} = 8^k$

$18+4k = k$

$-4k \quad -4k$

$\frac{18}{-3} = \frac{-3k}{-3}$

$\boxed{-6 = k}$

10. $\frac{9^{2m}}{9^{16}} = (9^{m+1} \cdot 9^{m+3})^3$

$9^{2m-16} = (9^{2m+4})^3$

$9^{2m-16} = 9^{6m+12}$

$2m-16 = 6m+12$

$-2m \quad -2m$

$-16 = 4m+12$

$-12 \quad -12$

$\frac{-28}{4} = \frac{4m}{4}$

$\boxed{m = -7}$

11. $\left(\frac{14^{6b+5}}{14^{2b+4}}\right)^9 = (14^{8b+1} \cdot 14^{b+2})^2$

$(14^{4b+1})^9 = (14^{9b+3})^2$

$14^{36b+9} = 14^{18b+6}$

$36b+9 = 18b+6$

$-18b \quad -18b$

$18b+9 = 6$

$-9 \quad -9$

$\frac{18b}{18} = \frac{-3}{18}$

$\boxed{b = \frac{-1}{6}}$

12. $20^{2y-41} \cdot 20^{1} = \frac{20^{45}}{20^{3y}}$

$20^{2y-40} = 20^{45-3y}$

$2y-40 = 45-3y$

$+3y \quad +3y$

$5y-40 = 45$

$+40 \quad +40$

$\frac{5y}{5} = \frac{85}{5}$

$\boxed{y = 17}$

13. $(15^f \cdot 15^2)^5 = 15^{4f+1} \cdot 15^{5-6f}$

$(15^{f+2})^5 = 15^{-2f+6}$

$15^{5f+10} = 15^{-2f+6}$

$5f+10 = -2f+6$

$+2f \quad +2f$

$7f+10 = 6$

$-10 \quad -10$

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

$\boxed{f = \frac{-4}{7}}$

14. $2^{3k+2} \cdot 2^{2k-10} = \frac{2^{2k+12}}{2^{+k}}$

$2^{5k-8} = 2^{3k+12}$

$5k-8 = 3k+12$

$-3k \quad -3k$

$2k-8 = 12$

$+8 \quad +8$

$2k = 20$

$\boxed{k = 10}$

$2k+12-(-k)$