Solving Exponential Equations

① $3^x = 3^5$

$\boxed{x = 5}$

② $6^{3-2x} = 6^{-x}$

$3 - 2x = -x$

$3 = x$

$\boxed{x = 3}$

$2^3 = 8$

③ $8^{x-1} = 2^{x+2}$ (multiply)

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

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

$3x - 3 = x + 2$

$2x = 5$

$\boxed{x = \frac{5}{2}}$

④ $144^{2x+1} = 12^{5x-1}$

$(12^2)^{(2x+1)} = 12^{5x-1}$

$12^{4x+2} = 12^{5x-1}$

$4x + 2 = 5x - 1$

$3 = x$

$\boxed{x = 3}$

$4^2 = 16$

$4^3 = 64$

$4^4 = 256$

⑤ $4^{m+1} = 32^{m+7}$

$(2^2)^{(m+1)} = (2^5)^{(m+7)}$

$2^{2m+2} = 2^{5m+35}$

$2m + 2 = 5m + 35$

$-33 = 3m$

$\boxed{m = -11}$

$2^3 = 8$

$2^4 = 16$

$2^5 = 32$

$2^6 = 64$

⑥ $5 \cdot 5^{-x+1} = 5^{18}$ (add)

$5^{3x+1} = 5^{18}$

$3x + 1 = 18$

$3x = 17$

$\boxed{x = \frac{17}{3}}$

$3^3 = 27$
$3^4 = 81$
$3^5 = 243$

$x^5 \cdot x^2 = x^7$

(7) $243 \cdot 3^{2x+5} = 1$

$3^{(5)} \cdot 3^{(2x+5)} = 3^0$ (add)

$3^{2x+10} = 3^0$

$2x + 10 = 0$

$2x = -10$

$\boxed{x = -5}$

(8) $\frac{4}{256^{3x}} = 16^{2x}$

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

$\frac{4^1}{4^{12x}} = 4^{4x}$ (subtract)

$4^{1-12x} = 4^{4x}$

$1 - 12x = 4x$

$1 = 16x$

$\boxed{x = \frac{1}{16}}$

$6^2 = 36$
$6^3 = 216$

(9) $\frac{1}{216} = 6^{5x} \cdot 6^{2x+1}$ (add)

$\frac{6^0}{6^3} = 6^{7x+1}$

$6^{-3} = 6^{7x+1}$

$-3 = 7x + 1$

$-4 = 7x$

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

Exponential Equations Not Requiring Logarithms

Date_____ Period____

Solve each equation.

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

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

3) $3^{1-2x} = 243$

4) $3^{2a} = 3^{-a}$

5) $4^{3x-2} = 1$

6) $4^{2p} = 4^{-2p-1}$

7) $6^{-2a} = 6^{2-3a}$

8) $2^{2x+2} = 2^{3x}$

9) $6^{3m} \cdot 6^{-m} = 6^{-2m}$

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

11) $10^{-3x} \cdot 10^{x} = \frac{1}{10}$

12) $3^{-2x+1} \cdot 3^{-2x-3} = 3^{-x}$

13) $4^{-2x} \cdot 4^{x} = 64$

14) $6^{-2x} \cdot 6^{-x} = \dfrac{1}{216}$

15) $2^{x} \cdot \dfrac{1}{32} = 32$

16) $2^{-3p} \cdot 2^{2p} = 2^{2p}$

17) $64 \cdot 16^{-3x} = 16^{3x-2}$

18) $\dfrac{81^{3n+2}}{243^{-n}} = 3^{4}$

19) $81 \cdot 9^{-2b-2} = 27$

20) $9^{-3x} \cdot 9^{x} = 27$

21) $\left(\dfrac{1}{6}\right)^{3x+2} \cdot 216^{3x} = \dfrac{1}{216}$

22) $243^{k+2} \cdot 9^{2k-1} = 9$

23) $16^{r} \cdot 64^{3-3r} = 64$

24) $16^{2p-3} \cdot 4^{-2p} = 2^{4}$