

Name:

Date:

Period:

5.2 Solving Exponential Equations (using common bases) Notes

Warm-up

$$2^x = 8$$

$$x = 3$$

Reason

$$2^x = 2^3$$

$$\frac{1}{5} = 5^x$$

$$x = -1$$

$$5^{-1} = 5^x$$

Does not work with ALL Exponential Equations!

How to Solve Exponential Equations (common base)

1. Simplify each side of the equation using properties of exponents to a single exponential expression on each side.
2. Rewrite so each side has the same base.
3. Set the exponents equal to each other.

SAME BASES: Solve. (Step 2) already Done

$$1. \underline{3}^x \cdot \underline{3}^{x+2} = 3^{5x-1}$$

$$\textcircled{1} \quad 3^{x+x+2} = 3^{5x-1}$$

$$3^{2x+2} = 3^{5x-1}$$

$\textcircled{2}$ have the same base "3"

$$\textcircled{3} \quad 2x+2 = 5x-1$$

$$2x = 5x-3$$

$$-3x = -3$$

$$x = 1$$

$$2. 10^{-4} \cdot 10^9 = 10^{x+4} \cdot 10^{2x-11}$$

$$\textcircled{1} \quad 10^{-4+9} = 10^{x+4+2x-11}$$

$$10^5 = 10^{3x-7}$$

$$\textcircled{3} \quad 5 = 3x-7$$

$$3x = 12$$

$$x = 4$$

UNLIKE BASES: Solve.

3. $6^{2x-10} = 36$

① not needed

② $6^{2x-10} = 6^2$

③ $2x-10 = 2$

$2x = 12$

$x = 6$

4. $7^{4x+11} = \frac{1}{7}$

① not needed

② $7^{4x+11} = 7^{-1}$

③ $4x+11 = -1$

$4x = -12$

$x = -3$

5. $27^{2x+6} = 3^{2x}$

② $(3^3)^{2x+6} = 3^{2x}$

power to a power property

③ $3(2x+6) = 2x$

$6x + 18 = 2x$

$4x = -18$

$x = \frac{-18}{4}$

$x = \frac{-9}{2}$

6. $4^{3x} = 8^{x-1}$

② $(2^2)^{3x} = (2^3)^{x-1}$

③ $2 \cdot 3x = 3(x-1)$

$6x = 3x - 3$

$3x = -3$

$x = -1$

7. $9^{2x+4} \cdot 9^{2x} = \frac{1}{81}$

$9^{2x+4+2x} = 9^{-2}$

$4x+4 = -2$

$4x = -6$

$x = \frac{-6}{4}$

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

8. $\frac{1}{7} = 49^{x-5} \cdot 7^{x-9}$

$7^{-1} = (7^2)^{x-5} \cdot 7^{x-9}$

$7^{-1} = 7^{2x-10} \cdot 7^{x-9}$

$7^{-1} = 7^{2x-10+x-9}$

$-1 = 3x - 19$

$18 = 3x$

$x = 6$