

6.5 Notetaking with Vocabulary

Write the meaning of each vocabulary term.

exponential equation - An equation in which the variable expression is an exponent.
 - problem: have to get x out of exponent to solve

Core Concepts

Property of Equality for Exponential Equations

iff

Words Two powers with the same positive base b, where $b \neq 1$, are equal if and only if their exponents are equal.

Numbers If $2^x = 2^5$, then $x = 5$. If $x = 5$, then $2^x = 2^5$.

Algebra If $b > 0$ and $b \neq 1$, then $b^x = b^y$ if and only if $x = y$.

Practice

In Exercises 1-3, practice solving the equations with the same base. Check your solution.

1. $3^{4x} = 3^{12}$

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

$$x = 3$$

2. $6^{4x-5} = 6^{2x}$

$$4x - 5 = 2x$$

$$-4x \quad -4x$$

$$-5 = -2x$$

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

$$\frac{5}{2} = 2.5 = x$$

3. $5^{6x-3} = 5^{-3+4x}$

$$6^{4(2.5)-5} = 6^{(2)(2.5)}$$

$$6^{10-5} = 6^5$$

$$6^5 = 6^5 \checkmark$$

In Exercises 4 - 12, practice solving the equations with different bases. Check your solution.

4. $4^{2x+11} = 1024$

$$4^{2x+11} = 4^5$$

$$2x+11 = 5$$

$$-11 \quad -11$$

$$\frac{2x}{2} = \frac{-6}{2}$$

$$x = -3$$

Check:

$$4^{2(-3)+11} = 1024$$

$$4^5 = 1024$$

$$1024 = 1024 \checkmark$$

5. $8^{3-2x} = 512$

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

$$3-2x = 3$$

$$-3 \quad -3$$

$$\frac{-2x}{-2} = \frac{0}{-2}$$

$$x = 0$$

Check:

$$8^{3-2(0)} = 512$$

$$8^3 = 512$$

$$512 = 512 \checkmark$$

$$6^2 = 36$$

$$7. 36^{6x-1} = 6^{5x}$$

$$(6^2)^{6x-1} = 6^{5x}$$

$$6^{12x-2} = 6^{5x}$$

$$12x-2 = 5x$$

$$\frac{-2}{-7} = \frac{-7x}{-7}$$

$$\frac{2}{7} = x$$

check...

$$81 = 9^2$$

$$8. 9^{x-4} = 81^{3x}$$

$$9^{x-4} = (9^2)^{3x}$$

$$9^{x-4} = 9^{6x}$$

$$x-4 = 6x$$

$$-x \quad -x$$

$$-4 = 5x$$

$$\frac{-4}{5} = x$$

Check...

$$9. 6^{2x} = 36^{2x+1}$$

$$6^{2x} = (6^2)^{2x+1}$$

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

$$2x = 4x+2$$

$$2x = 2$$

$$x = 1$$

$$5^2 = 25$$

$$5^3 = 625$$

$$10. \left(\frac{1}{7}\right)^x = 2401$$

$$(7^{-1})^x = 7^4$$

$$7^{-x} = 7^4$$

$$\frac{-x}{-1} = \frac{4}{-1}$$

$$x = -4$$

$$11. \frac{1}{512} = 2^{3x-1}$$

$$12. 25^{2-2x} = \left(\frac{1}{625}\right)^{x+1}$$

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

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

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

$$4-4x = -4x-4$$

$$4 = -4 \text{ False}$$

No solutions

$$\frac{1}{7} = 7^{-1}$$

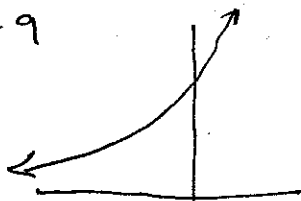
$$2401 = 7^4$$

In Exercises 14–16, use a graphing calculator to solve the equation.

$$14. 3^{x+3} = -9$$

$$y = 3^{x+3} \text{ exp. growth}$$

$$y = -9$$



No solution

$$y = -9$$

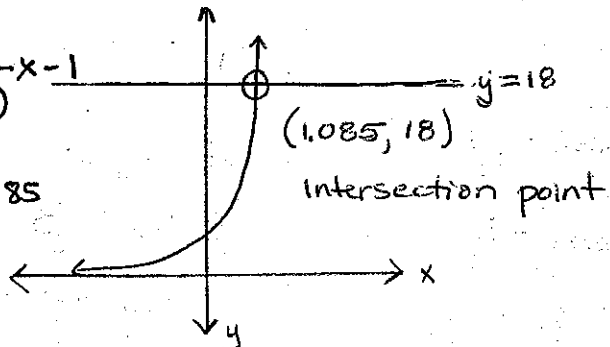
$$15. \left(\frac{1}{4}\right)^{-x-1} = 18$$

$$y = 18$$

$$y = \left(\frac{1}{4}\right)^{-x-1}$$

$$x \approx 1.085$$

$$16. 3^x = -2^{-x+1}$$



$$(1.085, 18)$$

Intersection point

17. You deposit \$1000 in a savings account that earns 5% annual interest compounded yearly.

a. Write an exponential equation to determine when the balance of the account will be \$1500.

$P = 1000$
 $r = .05$
 $n = 1$

$y = 1000 \left(1 + \frac{.05}{1}\right)^{1 \cdot t}$
 $y = 1000 (1.05)^t$

$y = P \left(1 + \frac{r}{n}\right)^{nt}$

b. Solve the equation.

$1500 = 1000 (1.05)^t$

$Y = 1500$
 $Y = 1000 (1.05)^x$

graph on graphing calculator and find intersection point
~~The x-coordinate~~
 The x-coordinate is the solution.

