

Algebra 2

7.2

Solve exponential equations

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Solve exponential inequalities

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equation

$$\left( \quad \right) = \left( \quad \right)$$

inequality

exponential increase (rate of increase)

exponential decrease (rate of decrease)

interest (n)

compound interest

whiteboards

Are the answers equal?  
Are the bases the same?  
Then the exponents must be the same.

 **Key Concept** Property of Equality for Exponential Functions

**Words** Let  $b > 0$  and  $b \neq 1$ . Then  $b^x = b^y$  if and only if  $x = y$ .

**Example** If  $3^x = 3^5$ , then  $x = 5$ . If  $x = 5$ , then  $3^x = 3^5$ .

Express on same base: convert one or both

### Example 1 Solve Exponential Equations

Solve each equation.

a.  $2^x = 8^3$

$$2^x = (2^3)^3$$

$$2^x = 2^9$$

If the bases are the same...  
and the numbers are equal...  
the exponents must be the same!

$$9^{-24} = 3^6$$

b.  $9^{2x-1} = 3^{6x}$  0.00137

$$(3^2)^{2x-1} = 3^{6x}$$

$$3^{4x-2} = 3^{6x}$$

$$4x-2 = 6x$$
$$-4x \quad -4x$$

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$$-2 = 2x$$
$$-1 = x$$

► **Guided**Practice

1A.  $4^{2n-1} = 64$

$$4^{2n-1} = 4^3$$

1B.  $5^{5x} = 125^{x+2}$

dist. prop  
↓  
 $5^{5x} = (5^3)^{x+2}$

$S^{5x} = (5^3)^{x+2}$

$(2005, 3.2)$        $(2010, 0.42)$

Guided Practice (Assume exponential change)

2. **RECYCLING** A manufacturer distributed 3.2 million aluminum cans in 2005.

A. In 2010, the manufacturer distributed 420,000 cans made from the recycled cans it had previously distributed. Assuming that the recycling rate continues, write an equation to model the distribution each year of cans that are made from recycled aluminum.

B. How many cans made from recycled aluminum can be expected in the year

$y = ( )$

$0.42 = 3.2 ( ? )$

final      init

$0.42 = \frac{3.2 b^5}{3.2}$

$(0.13125)^{\frac{1}{5}} = b$

$b = 0.67$

$y = 3.2 \left(\frac{2}{3}\right)^{25}$

- 2030?
- 2040?
- 2050?

Domain???

$0.000126727$

$\approx 127$

Monthly 12  
Daily 365  
Quarterly 4  
Weekly 52  
etc....  
Semiannually 2

Exponential functions are used in situations involving compound interest.

**Compound interest** is interest paid on the principal of an investment and any previously earned interest.

### KeyConcept Compound Interest

You can calculate compound interest using the following formula.

$$A = P\left(1 + \frac{r}{n}\right)^{nt}, \quad t = \text{years}$$

where  $A$  is the amount in the account after  $t$  years,  $P$  is the principal amount invested,  $r$  is the annual interest rate, and  $n$  is the number of compounding periods each year.

$n$  = number of compounding periods

quarterly

monthly

weekly

daily

semiannually

etc.

(will write this on the board when needed)

Example 3 Compound Interest

An investment account pays 4.2% annual interest compounded monthly. If \$2500 is invested in this account, what will be the balance after 15 years?

0.042

$h = 12$



4.2%

monthly

\$2500

15 years

P

t

$$\begin{aligned} A &= 2500 \left( 1 + \frac{0.042}{12} \right)^{12 \cdot 15} \\ &= 2500 \left( 1.0035 \right)^{180} \\ &= 2500 \left( 2.0915 \right) \end{aligned}$$

46888666166

\$4688.87  
\$5128.71

### Guided Practice

3. Find the account balance after 20 years if \$100 is placed in an account that pays 1.2% interest compounded twice a month.
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9% daily

invest?