

Properties of Exponents Notes

| | |
|---|---|
| Expand: $x^5 =$ | Compress: $x \cdot x \cdot x \cdot x \cdot x =$ |
| Product of Power: $x^a \cdot x^b = x^{a+b}$ Ex.1 $x^2 \cdot x^3 =$ Ex.2 $(4^3 ab^7)(4^2 a^3 b) =$ | Power of a Power: $(x^a)^b = x^{a \cdot b}$ Ex.3 $(x^2)^3 =$ |
| Power of a Product: $(xy)^a = x^a \cdot y^a$ Ex.4 $(xy)^3 =$ Ex.5 $(4x^3)^2 =$ | Quotient of a Power $\frac{x^a}{x^b} = x^{a-b}$ Ex.6 $\frac{5^6}{5^3} =$ |
| Power if a Quotient: $\left(\frac{x}{y}\right)^m = \frac{x^m}{y^m}$ Ex.7 $\left(\frac{x}{4}\right)^3 =$ | Zero Exponent: $x^0 = 1$ Ex.8 $x^0 =$ Ex.9 $(15abc)^0 =$ |
| Negative Exponents: $x^{-m} = \frac{1}{x^m}$ Ex.10 $x^{-3} =$ Ex.11 $\left(\frac{x}{2}\right)^{-2} =$ Ex.12 $\frac{x^2 y^{-3} z^{-2}}{m^{-2} z^2 y^3} =$ | Simplify. ***Combine terms and only have positive exponents. Ex.13 $\frac{r^2}{2r^3}$ Ex.14 $\frac{3m^{-3}}{3^4}$ Ex.15 $\frac{4x^0 y^{-2} z^3}{4x}$ |

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Exponential Growth and Decay

Exponential Growth

$$y = a(1 + r)^x \rightarrow \text{Same as } y = ab^x$$

This function is used when the initial amount **INCREASES** by a fixed percent or factor each time period

a is the: _____

r is the: _____ in decimal form

x is the: _____

if $b > 1$, then the function is exponential _____ (because the base of the exponent is greater than 1).

Ex.1 $f(x) = 4(1.5)^x \rightarrow \text{Same as } \underline{\hspace{2cm}}$

$a = \underline{\hspace{1cm}}, b = \underline{\hspace{1cm}}$

What is the initial amount? _____

What is the rate of growth? _____

Exponential Decay

$$y = a(1 - r)^x \rightarrow \text{Same as } y = ab^x$$

This function is used when the initial amount DECREASES by a fixed percent or factor each time period.

a is the: _____

r is the: _____ in decimal form

x is the: _____

if $0 < b < 1$, then the function is exponential _____ (because the base of the exponent is less than 1).

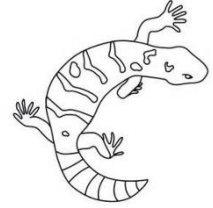
Ex.2 $f(x) = 4(0.25)^x \rightarrow \text{same as } \underline{\hspace{2cm}}$

$a = \underline{\hspace{1cm}}, b = \underline{\hspace{1cm}}$

What is the initial amount? _____

What is the rate of decay? _____

Ex.3 A Gila Monster is about 16 cm long at birth. During the beginning of its life, the Gila Monster's length increases by about 15% each week.



- a. Write a function that models the length of the Gila Monster at the beginning of the Gila Monster's life. Use x for the number of weeks and y for the length of the Gila Monster.

Define variables:

$x =$

$y =$

$a =$

$b =$

Write the function: _____

- b. Find the length of the Gila Monster at the end of the 3 weeks.

Ex.4 A 500 mL puddle of water is evaporating at a rate of 4.5% per hour.

- a. Write a function that represents the amount of water in the puddle at a given time. Use x for hours and y for the amount of water left in the puddle.

Define variables:

$x =$

$y =$

$a =$

$b =$

Write the function: _____

- b. Determine when the puddle will be reduced to half its original volume.

Compound interest

Compound interest is the interest earned or paid on both the principal and previously earned interest.

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

A represents the balance after t years.

P represents the principal, or the original amount.

r represents the annual interest rate expressed as a decimal.

n represents the number of times interest is compounded per year.

t represents time in years.

Annually means “once per year” (n=1)

Quarterly means “4 times per year” (n=4)

Monthly means “12 times per year” (n=12)

Daily usually means “365 times per year” (n=365)

Write a compound interest function to model the situation. Then find the balance after the given number of years.

| | |
|--|---|
| Ex.1 \$1200 invested at a rate of 2% compounded quarterly for 3 years. | Ex.2 \$15,000 invested at a rate of 4.8% compounded monthly for 2 years. |
| Ex.3 \$1200 invested at a rate of 3.5% compounded quarterly for 4 years. | Ex.4 \$4000 invested at a rate of 3% compounded monthly for 8 years. |
| Ex.5 \$4000 invested at a rate of 3% compounded monthly for 8 years. | Ex.6 Compare example 4 and 5. Would you want your investment compounded more or less? |