

Unit 4 Bare Necessities - Exponents and Logarithms

Rewriting Exponents and Logarithms



logarithmic form: $\log_3 9 = 2$

exponential form: $3^2 = 9$

All Together!!

EX1. Rewrite $6^3 = 216$ in logarithmic form.

EX2. Rewrite $\log_2 16 = 4$ in exponential form.

You Try!!

Rewrite in logarithmic form.

1. $3^5 = 243$

2. $8^4 = 4096$

Rewrite in exponential form.

3. $\log_5 125 = 3$

4. $\log 100 = 2$

Solving Logarithmic Equations

1. apply a property if needed to write as one log
2. convert to exponential form
3. solve for x

Properties

* $\log_b M + \log_b N = \log_b M \cdot N$

* $\log_b M - \log_b N = \log_b \frac{M}{N}$

* If $\log_b M = \log_b N$, then $M = N$

All Together!!

EX3. $\log_5 (3x + 11) = 4$

EX4. $\log 6x - \log 3 = 2$

You Try!!

5. $\log_4 x = 3$

6. $\log_3 8 + \log_3 (x - 2) = 6$

$$7. \log_9(x + 20) = \log_9(3x - 4)$$

$$8. \log_7(3x + 6) = 4$$

Solving Exponential Equations

1. Take the natural log of both sides
2. bring exponent down in front of the log
3. solve for x

All Together!!

$$\text{EX5. } 5^x = 37$$

$$\text{EX6. } 9^{7x-2} = 3$$

You Try!!

$$9. e^{6x} = 2.9$$

$$10. 1.54^x = 28$$

$$11. 4^{x+3} = 22$$

$$12. 3.8^{2x-6} = 19.1$$

Exponential Growth and Decay

$$y = a(b)^t$$

y: final amount of whatever you are measuring

a: initial amount

b: growth or decay factor ($1 + r$ for growth; $1 - r$ for decay)

t: number of time periods that pass

All Together!!

EX7. Ryan's motorcycle is now worth \$2500. It has decreased in value 12% each year since it was purchased. If he bought it four years ago, what did it cost new?

You Try!!

13. According to a computer model, a population of salmon will decline each year by 6%. In 2015, there are currently 3000 salmon in the population. How many salmon are predicted to be in that population in 2025?

14. The half-life of a radioactive element is the time it takes for 50% of its atoms to decay. About how many grams of a radioactive element would remain from a sample of 20g after 3 half-lives?

15. Movie tickets now average \$9.75 a ticket, but are increasing 15% per year. How much will they cost 5 years from now?

Compound Interest

Compounded over time:

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

Compounded continuously:

$$A = P e^{rt}$$

A: final amount of money

P: initial amount of money

r: interest rate (as a decimal)

n: number of times compounded in a year

t: time (in years!)

All Together!!

EX8. What amount will an account have after 18 years if \$250 is invested at 5% interest compounded semiannually?

You Try!!

16. What amount invested at 9% interest compounded continuously for 4 years will yield \$590?

17. If \$800 is invested at 7% interest compounded continuously, how long will it take before the amount is \$1100?

18. Determine the amount that must be invested at 4.5% interest compounded quarterly, so that \$300,000 will be available for retirement in 15 years.

19. How long does it take \$800 to double if it is invested at 5% interest compounded monthly?