CHAPTER 8: EXPONENTS & EXPONENTIAL FUNCTIONS

Section 8 Part 1 -Exponential Growth

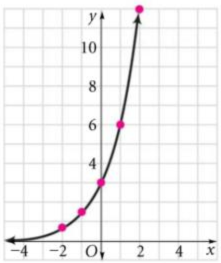
OBJECTIVES

- I can model exponential growth

VOCABULARY

Exponential Function	Exponential Growth
A function in the form $y = a \cdot b^x$ a = y-intercept b = growth factor	An exponential function where the growth factor is greater than 1
EXAMPLE	EXAMPLE
In $y = 3 \cdot 2^x$ what is the growth factor? Where does it cross the y-axis?	Graph $y = 3 \cdot 2^x$.

x	$3 \cdot 2^x$	(x, y)
−2	$3 \cdot 2^{-2} = \frac{3}{2^2} = \frac{3}{4}$	$\left(-2, \frac{3}{4}\right)$
−1	$3 \cdot 2^{-1} = \frac{3}{2^1} = 1\frac{1}{2}$	$\left(-1, 1\frac{1}{2}\right)$
0	$3 \cdot 2^0 = 3 \cdot 1 = 3$	(0, 3)
1	$3 \cdot 2^1 = 3 \cdot 2 = 6$	(1, 6)
2	$3 \cdot 2^2 = 3 \cdot 4 = 12$	(2, 12)



NOTES
PART 1: EXPONENTIAL GROWTH

In parts of the United States, wolves are being reintroduced to wilderness areas where they had become extinct. Suppose 20 wolves are released in northern Michigan, and the yearly growth factor for this population is expected to be 1.2.

a. Make a table showing the projected number of wolves at the end of each of the first 6 years.

b. Write an equation that models the growth of the wolf population.

PART 1: EXPONENTIAL GROWTH

2. a. The table shows that the elk population in a state forest is growing exponentially. What is the growth factor? Explain.

Growth of Elk Population

Time (yr)	Population
0	30
1	57
2	108
3	206
4	391
5	743

b. Suppose this growth pattern continues. How many elk will there be after 10 years? How many elk will there be after 15 years?

c. Write an equation you could use to predict the elk population p for any year n after the elk were first counted.

PART 1: EXPONENTIAL GROWTH

9. Maya's grandfather opened a savings account for her when she was born. He opened the account with $100 and did not add or take out any money after that. The money in the account grows at a rate of 4% per year.

a. Make a table to show the amount in the account from the time Maya was born until she turned 10.

b. What is the growth factor for the account?

c. Write an equation for the value of the account after any number of years.

PART 2: COMPOUND INTEREST

When a bank pays interest on both the principal *and* the interest an account has already earned, the bank is paying **compound interest.** An **interest period** is the length of time over which interest is calculated.

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

Where,

- P = principal amount (initial investment)
- r = annual nominal interest rate (as a decimal)
- n = number of times the interest is compounded per year
- t = number of years

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PART 2: COMPOUND INTEREST

Annual Interest Rate of 8%

Compounded	Periods per Year	Interest Rate per Period
annually	1	8% every year
semi-annually	2	$\frac{8\%}{2}$ = 4% every 6 months
quarterly	4	$\frac{8\%}{4}$ = 2% every 3 months
monthly	12	$\frac{8\%}{12}$ = $0.\overline{6}$% every month

PART 2: COMPOUND INTEREST

Savings Suppose your parents deposited $1500 in an account paying 3.5% interest compounded annually (once a year) when you were born. Find the account balance after 18 years.

PART 2: COMPOUND INTEREST

Savings Suppose the account in Example 2 paid interest compounded quarterly instead of annually. Find the account balance after 18 years.

CAN YOU?? PROVE IT!!

- I can model exponential growth

5. Suppose the population of a city is 50,000 and is growing 3% each year.
  a. The initial amount a is ■.
  b. The growth factor b is 100% + 3%, which is 1 + ■ = ■.
  c. To find the population after one year, you multiply 50,000 · ■.
  d. Complete the equation y = ■ · ■$^{■}$ to find the population after x years.
  e. Use your equation to predict the population after 25 years.