Name: KEY

Topic: 8.1: Exponential Growth

Date: _____ Block: ____

Summary:

Exponential Growth Function

$y = ab^x$

$a >$ 0

$b >$ 1

Why do I need to learn this? When is it used?

1. Technology → Facebook started small
2. Financial Planning
3. Population Studies
4. Travel Times
5. Business / Customer Service (Good Service vs. Bad Service)

General equation

$y = a(1 + r)^t$

a	r	t
Initial amount * What did you start with?	Rate (%) of Increase * written as a decimal. Ex. 6% = 0.06	Time * number of years

8.1

$y = a(1+r)^t$ → time (years)

a: Initial, r: rate

Example 1:

In 1980 about 2,180,000 U.S. workers worked at home. During the next ten years, the number of workers working at home increased 5% per year. Write a model giving the number w (in millions) or workers working at home t years after 1980.

$a = 2,180,000$

$r = 5\% \rightarrow 0.05$

$t = ?$

$$y = 2,180,000(1+.05)^t$$

From this formula, estimate about how many workers worked from home in 1988.

$a = 2,180,000$

$r = 5\% = .05$

$t = 8$ years $(1988-1980)$

$y = 2,180,000(1+.05)^8$

$y = 2,180,000(1.05)^8$

$y = 3,220,852$ people

Example 2:

In 1990 the cost of tuition at a state university was $4,300. During the next 8 years, the tuition rose 4% each year. Write a model that gives the tuition y (in dollars) t years after 1990.

$a = 4300$

$r = 4\% = .04$

$t = ?$

$$y = 4300(1+.04)^t$$

From this formula, estimate what the tuition will be this year.

2010

$t = 2010 - 1990$

$t = 20$ years

$y = 4300(1+.04)^{20}$

$y = 4300(1.04)^{20}$

$y = \$9421.83$

Principle: initial amount (of money)

Compound Interest: Interest that is paid on the principle AND on interest (previously earned).

Simple Interest: Interest paid on principle ONLY.

Important note about the %:

- Usually shown as an annual percent
- Interest is usually compounded more than once per year.

CALCULATING INTEREST

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

Annual = 1
Semi-annual = 2
Quarterly = 4
Monthly = 12
Daily = 365

A = amount of money in account
P = principle (initial amount)
r = rate (as a decimal)
n = number of times compounded each year
t = time (years)

Example 3:

You deposit $1,500 to an account that pays 6% annual interest. Find the balance after 1 year if the interest is compounded

a) annually

P=1500
r=.06
t=1
n=1

$A = 1500\left(1 + \frac{.06}{1}\right)^{1\cdot 1}$
$A = 1500\,(1.06)^{1}$
A = $1590

b) semiannually

P=1500
r=.06
t=1
n=2

$A = 1500\left(1 + \frac{.06}{2}\right)^{2\cdot 1}$
$A = 1500\,(1.03)^{2}$
A = $1,591.35

c) monthly

P=1500
r=.06
t=1
n=12

$A = 1500\left(1 + \frac{.06}{12}\right)^{12\cdot 1}$
$A = 1500(\quad)^{12}$
A = $1,592.52

Example 4:

You deposit $2,000 to an account that pays 8% annual interest.

a) find the balance after 2 years if the interest is compounded annually.

$P=2000$
$r=.08$
$t=2$
$n=1$

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$
$$A = 2000\left(1+\frac{.08}{1}\right)^{1\cdot 2}$$
$$A = 2000\,(1.08)^2$$
$$\boxed{A = \$\,2332.80}$$

b) Find the balance after 2 years if the interest is compounded quarterly.

$P=2000$
$r=.08$
$t=2$
$n=4$

$$A = P\left(1+\frac{r}{n}\right)^{nt}$$
$$A = 2000\left(1+\frac{.08}{4}\right)^{4\cdot 2}$$
$$A = 2000\,(1+.02)^8$$
$$A = 2000\,(1.02)^8$$
$$\boxed{A = \$\,2343.32}$$