$\boxed{\text{BE-Alg. 2}}$ THURSDAY 5-5-11

From memory:

① LIST THE 3 logarithm rules

② List e to 10 digits.

The exponential growth or decay function can be broken down into its more general parts.

$$y = a(1 \pm r)^x$$

number of changes

change amount (as a decimal)

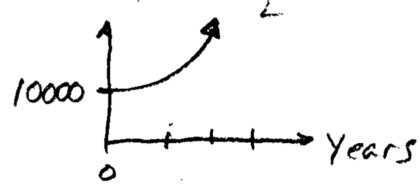
amount "starting value" ⇒ what you have when $x = 0$

Population increases 8% per year starting in 1985 when $P = 10000$

$$P = P_0 (1 + .08)^t \qquad t = 0 = 1985$$

the "sub zero" indicates starting value

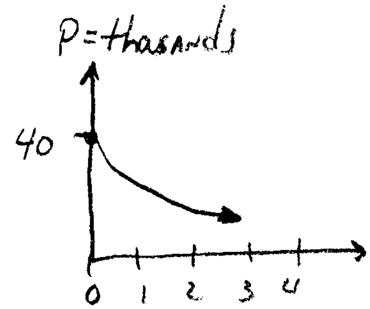
$$\boxed{P = 10000(1.08)^t}$$



Population decrease 5% per year starting in 2000 when $P = 40000$

$$P = 40000 (1 - .05)^t \qquad t = 0 = 2000$$

$$\boxed{P = 40000(.95)^t}$$



Ch. 10-6 Exponential Growth and Decay

(Ex) Swine flu cases, ↑ 10% per month, 12000 in Jan. 2008

$$F = F_0(1+.10)^m \qquad m = 0 = \text{Jan. } 2008$$

$$\boxed{F = 12000(1.10)^m}$$

(A) Find number of cases in Oct. 2009

$$m = 22 \quad \therefore \quad F = 12000(1.10)^{22}$$

$$\boxed{F = 97683}$$

(Ex) Car depreciates 15% per year. Bought new in 2002 for 18000. Present value?

$$C = C_0(1-.15)^t \qquad t = 0 = 2002$$

Model: $\boxed{C = 18000(.85)^t}$ $\qquad t = 8$ in 2010

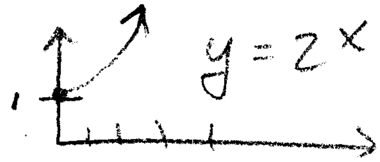
$$\therefore C = 18000(.85)^8$$

$$\boxed{C = \$4904.83}$$

(Ex) Something ↑ 100% per period X. Starting value = 1

$$Y = 1(1+1.00)^x$$

$$\boxed{Y = 2^x}$$



$y = 2^x$

Money has its own vocabulary and conventions: rate ⇒ is assumed to be per year.

P = Principal = starting amount

N = compounding period (how many times per year interest is paid)

(Ex) \$5000 invested at 6% compounded quarterly

\$5000 → principal; invested → growth; 6% → per year; quarterly → 4 times per yr

$$A = 5000\left(1 + \frac{.06}{4}\right)^{4 \cdot t}$$

$t = 0$ = now
t is in years

interest rate per quarter

Number of quarters

$$\boxed{A = 5000(1.015)^{4t}}$$

Find A in 10 years

$$A = 5000(1.015)^{4 \cdot 10}$$

$$\boxed{A = \$9070.09}$$

General: $\boxed{A = P\left(1 \pm \frac{r}{N}\right)^{Nt}}$ Compound Interest Formula

WHAT HAPPENS AS N GETS VERY BIG ?

LETS LOOK AT 8% (per year) for various compounding periods AND compare $(1+r)^t$ AND e^{rt}.

$\boxed{\text{Assume } P = 1 \text{ AND } t = 1}$

N = COMPOUNDING period

$\therefore\ A = 1\left(1+\frac{r}{N}\right)^{Nt}$ OR $A = 1e^{rt}$

N	$\left(1+\frac{r}{N}\right)^{N\cdot 1}$	$e^{r\cdot 1}$
1	1.08	1.083287
4	1.082432	1.083287
12	1.083	1.083287
365	1.083278	1.083287
730	1.083282	1.083287
1095	1.083284	1.083287
3650	1.083286	1.083287

AN N Approaches "CONTINUOUSLY" compounded, the result approaches base "e" $\Rightarrow$ Why ? Because:

$$\boxed{\lim_{N\to\infty}\left(1+\frac{1}{N}\right)^{N} = e}$$

e is the "NATURAL base" for CONTINUOUS changes

Two forms of Exponential Growth and Decay:

Non-Continuous Ex) Monthly, yearly, ...	Continuous
$\boxed{y = a(1 \pm r)^t}$	$\boxed{y = ae^{\pm rt} \text{ or } y = ae^{\pm kt}}$

Homework: • Read Ch. 10-6

• Pg 563 #10, 11.