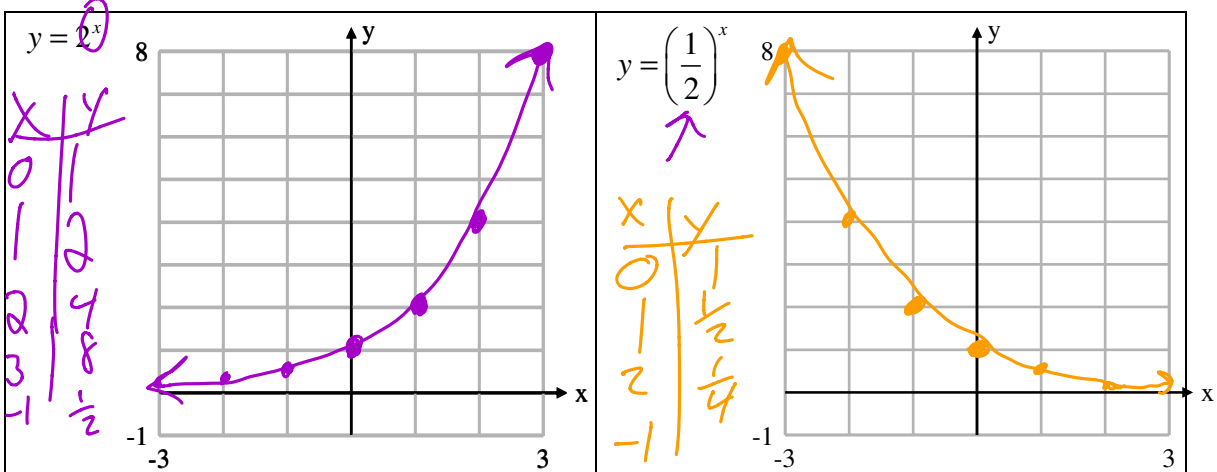# Chapter 3 Logarithmic and Exponential Functions

3.1 Introduction to Exponential Functions.

An exponential function is a function of the form $f(x) = ab^x$, where a and b are constants $\neq 0$, and $b > 0$.

$y = 2^x$

X	Y
0	1
1	2
2	4
3	8
-1	½

$y = \left(\frac{1}{2}\right)^x$

X	Y
0	1
1	½
2	¼
-1	

If $b>1$ then we say the function is a <u>growth</u> function
If $b<1$ then we say the function is a <u>decay</u> function.

Compound Interest Formula

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

A – Amount

P – Principle

r – Rate

n – $\dfrac{\text{\# of times}}{\text{period}}$

t – time period

Annually	N = 1
Monthly	N = 12
Weekly	N = 52
Bi-weekly	N = 26
Semi-monthly	N = 24
Daily	N = 365

Ex. Steve invests $12 000 at 11.5%/a compounded monthly for 2 years, what is the accumulated amount?

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

$$= 12,000\left(1 + \frac{0.115}{12}\right)^{12(2)}$$

$$= \$15\ 086.67 \longrightarrow \text{to the penny!}$$

Ex. Jessie bought a house for $250 000, six years later she sold it for $600 000. What was the annual interest rate (assume compounded annually)?

$$600,000 = 250,000\left(1 + \frac{r}{1}\right)^{1(6)}$$

$$\sqrt[6]{\frac{12}{5}} = \sqrt[6]{(1+r)^6}$$

$$1.157 = 1 + r$$

$$r = .157$$
$$= 15.7\%$$

Ex. Mr. Epp currently has 3 million hairs on his head. The amount of hair on his head decreases by 3% per year. How long will it take for the number of hairs on his head drop to 1 million?
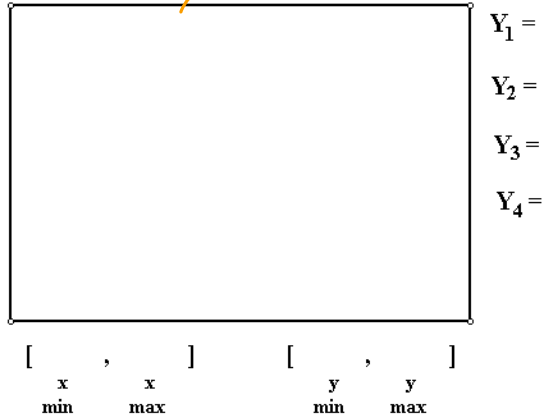
$$1 = 3\left(1 + \frac{-.03}{1}\right)^{(t)}$$

$$\ln\left(\frac{1}{3}\right) = \ln\left(97^t\right)$$

$$\ln\left(\frac{1}{3}\right) = t\ \ln(.97)$$

$$\frac{\ln\frac{1}{3}}{\ln .97} = t$$

$$t = 36$$

General Growth Formula: $A = P(X)^{\frac{t}{n}}$

A – Amount
P – Principle
X – rate of change
t – time
n – number/time

$Y_1 =$

$Y_2 =$

$Y_3 =$

$Y_4 =$

[,   ]   [,   ]

x min   x max   y min   y max

Ex. The Ebola virus doubles every 30 minutes. If there are currently 2000 Ebola viruses are present in a petrie dish, how many are present in 7 hours from now?

$$A = 2000(2)^{\frac{7}{\frac{1}{2}}}$$

$$\approx 22,627$$

Ex. Strontium-90 has a half life of 250 days. If there is a 50 gram sample present, how much Strontium-90 is left after 2000 days?

$$A = 50\left(\frac{1}{2}\right)^{\frac{2000}{250}}$$

$$= .195\ g$$