Another very important mathematical application of exponential functions is in finances.

When you deposit money in a bank you can earn interest on that money. Interest that is applied to the original amount, and any previously earned interest is called **compound interest.**

$100 10%

$110

$121

Equation for Compound Interest

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

A is the Final amount **P** is the principle amount (initial amount)

r is the annual interest rate (as a **DECIMAL**) **t** is the time in years

n is the number of times interest is compounded each year

REMEMBER: To change a **rate** or percent to a **decimal** I move the decimal point over 2 places to the left.

0 0.5%

.005

Example 1: Identify the principal amount, annual interest rate, and the number of times the interest is compounded each year.

$$A = 2000\left(1+\frac{.032}{12}\right)^{12t} \qquad A = 1500\left(1+\frac{.001}{6}\right)^{6t}$$

P = 2000
R: .032 → 3.2%
N = 12 monthly

P = 1500
R = .001 / 0.1
N = 6

Compounding...

Annually = 1 times per year Semi- annually = 2 times per year

Monthly = 12 times per year Quarterly = 4 times per year

Weekly = 52 times per year Daily = 365 times per year

Solving a compound interest problem –

1. Identify the principal amount invested (**P**)
2. Identify how often the interest is compounded (**n**) anually weekly
3. Identify the interest rate, then change to a decimal (**r**) %
4. Plug in the above values into $A = P\left(1+\frac{r}{n}\right)^{nt}$
5. Evaluate the expression. Don't forget the order of operations!! Parenthesis, exponents then multiplication!

Example 2: Maria's parents invested $14,000 at 6% per year compounded monthly. How much money will there be in the account after 10 years?

1. Principal amount invested = 14,000
2. how often interest is compounded = 12
3. interest rate = 6% .06 interest rate as a decimal = .06
4. A = $14{,}000\left(1+\frac{.06}{12}\right)^{12t}$
5.

$14{,}000\left(1+\frac{.06}{12}\right)^{12\cdot 10}$

14000(1+(.06/12))^(12·10)

$\boxed{\$25{,}471.55}$ $1471.55

Example 3: Determine the amount of an investment if $300 is invested at an interest rate of 3.5% compounded monthly for 22 years.

$A = P\left(1 + \frac{r}{n}\right)^{nt}$ .035%

$$A = 300\left(1 + \frac{0.035}{12}\right)^{12 \cdot 22}$$

$$= 300(1 + (.035/12))\wedge(12 \cdot 22)$$

$$\boxed{\$647.20}$$

Example 4: When Jing May was born, her grandparents invested $1000 in a fixed rate savings account at a rate of 7% compounded annually. Jing May will receive the money when she turns 18 to help with her college expenses. What amount of money will Jing May receive from the investment?

$$1000\left(1 + \frac{.07}{1}\right)^{(1 \cdot 18)}$$

$3,379.93