

**9.6 – Compound Interest**Name: key**Formula for Compound Interest:**

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

P = principal

A = final amount

r = rate (in decimal)

n = # times compounded in one year

t = time in years

**Example 1:** You decide to open four savings accounts, each holding \$1000 earning 1.5% annual interest. Consider the four scenarios below:

- **Your bank compounds interest annually.**

How many times per year do you collect interest? 1For any year t in this situation, the equation  $y = 1000 \left(1 + \frac{.015}{1}\right)^{1t}$  models the amount in your account.

How much money will be in your account after 2 years?

$$y = 1000 \left(1 + .015\right)^2 = \boxed{\$1030.23}$$

- **Your bank compounds interest quarterly.**

How many times per year do you collect interest? 4 Quarterly growth rate:  $\frac{.015}{4}$ For any year t in this situation, the equation  $y = 1000 \left(1 + \frac{.015}{4}\right)^{4t}$  models the amount in your account.

How much money will be in your account after 2 years?

$$y = 1000 \left(1 + \frac{.015}{4}\right)^{4(2)} = \boxed{\$1030.40}$$

- **Your bank compounds interest monthly.**

How many times per year do you collect interest? 12 Monthly growth rate:  $\frac{.015}{12}$ For any year t in this situation, the equation  $y = 1000 \left(1 + \frac{.015}{12}\right)^{12t}$  models the amount in your account.

How much money will be in your account after 2 years?

$$y = 1000 \left(1 + \frac{.015}{12}\right)^{12(2)} = \boxed{\$1030.44}$$

- Your bank compounds interest daily. (Use 365 days in a year)

How many times per year do you collect interest? 365 Daily growth rate:  $\frac{.015}{365}$

For any year  $t$  in this situation, the equation  $y = 1000 \left(1 + \frac{.015}{365}\right)^{365t}$  models the amount in your account.

How much money will be in your account after 2 years?  
 $y = 1000 \left(1 + \frac{.015}{365}\right)^{365(2)} = \boxed{\$1030.45}$

**Example 2:** Over your 4 years of high school, you earn \$8,000 from your after school job and keep the cash in a box in your closet. When leaving for college, you decide it is time to put the money in a bank account earning 3.5% annual interest compounded quarterly. After how many years will the account double?

$y = 8000 \left(1 + \frac{.035}{4}\right)^{4t}$        $\downarrow$  solve for  $t$        $\rightarrow$  \$16,000

$16000 = 8000 \left(1 + \frac{.035}{4}\right)^{4t}$   
 $2 = (1.00875)^{4t}$   
 $\log 2 = \log (1.00875)^{4t}$   
 $\log 2 = 4t \cdot \log (1.00875)$

$\frac{\log 2}{\log 1.00875} = 4t$

19.89 =  $t$   
 years