

### 3.5 Compound Interest Formula

Compound Interest - imagine calculating an investment for one year compounded daily. 365 Calculations!

#### Compound Interest Formula

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

B = Ending Balance

P = Principal

r = interest rate (as a decimal)

n = # times compounded per year

t = # of years

\* derivation of the formula on pg 144

1. Jeff deposits \$2300 at 3.13% interest compounded weekly. What will be his ending balance after one year?

$$B = 2300 \left( 1 + \frac{.0313}{52} \right)^{52 \cdot 1} = \$2,373.11$$

2. Nancy has \$4111 in an account that pays 3.07% interest compounded monthly. What is her ending balance after two years?

$$B = 4111 \left( 1 + \frac{.0307}{12} \right)^{12 \cdot 2} = \$4,370.98$$

3. Mr. Weinstein has a savings account with a balance of \$19,211.34. It pays 4% interest compounded daily. What is his ending balance after three years, if no other deposits or withdrawals are made? How much interest does he make over the three years?

$$B = 19211.34 \left( 1 + \frac{.04}{365} \right)^{3 \cdot 365} = \$21,660.58$$

$$- 19211.34$$

$$\$2,449.24 \text{ interest}$$

simple

$$I = 19211.34 (.04)(3) = 2305.36$$

4. Danielle has a CD at Crossland Bank. She invests \$22,350 for four years at 4.55% interest, compounded monthly. What is her ending balance? How much interest did she make?

$$B = 26802.15$$

$$I = \$4452.15$$

5. Imagine that you invest \$100,000 in an account that pays 9.5% annual interest compounded monthly. What will your balance be at the end of 18 years?

$$B = 549185.87$$

6. Stephanie has created a study tool to help her study compound interest. She writes the compound interest formula with letters different than the traditional representations.

$$X = M (1 + Q/K)^{KB}$$

a.) If Q is increased, does the new balance increase or decrease?

inc

b.) If K is decreased, does the new balance increase or decrease?

dec

c.) If B is increased, does the new balance increase or decrease?

inc

d.) Is it possible that  $M > X$ ?

No

e.) Using Stephanie's variable representation, express the amount of interest earned on the account.

$$X - M$$

$$\uparrow$$

$$\left( m \left( 1 + \frac{Q}{K} \right)^{KB} \right)$$

Annual Interest Rate (APR) - Interest rate expressed as a simple yearly interest

Annual Percentage Yield (APY)

- \* higher than APR when compounded more than once per year.
- \* it is an annual rate of interest that takes into account the effect of compounding.
- \* APY is the simple interest rate that would be required to give the same amount of interest that the compounding gave.

Annual Percentage Yield Formula

$$APY = \left( 1 + \frac{r}{n} \right)^n - 1$$

$r$  = APR - interest rate as a decimal  
 $n$  = # of compoundings per year

ex //  $r = .03$   $n = 12$

$$APY = \left( 1 + \frac{.03}{12} \right)^{12} - 1$$

$$= .0304 = 3.04\% APY$$

7. Ms. Santoro is opening a one-year CD for \$16,000. The interest is compounded daily. She is told by the bank representative that the annual percentage rate (APR) is 4.8%. What is the annual percentage yield (APY) for this account?

8. Kings Park Bank is advertising a special 5.08% APR for CDs. Kevin takes out a one-year CD for \$24,000. The interest is compounded daily. Find the APY for Kevin's account.

9. Britney invested \$4,000 in a CD at TTYL Bank that pays 3.4% interest compounded monthly.

a.) How much will Britney have in her account at the end of one year?

b.) What is the APY for this account?

10. How much more would \$5000 earn in ten years, compounded daily at 6%, when compared to the interest on \$5000 over ten years, at 6% compounded semiannually?

HW 3.5 pg 148-149 #2 - 8, 10, 14