Day 7: Compound Interest

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AW Math 11

DAY 7 *Compound Interest class notes*

To find the **total value using compound interest**:

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

A is the **final value of the investment (principal plus interest)**
Ex.

P is the **principal (amount invested)**
Ex.

r is the **annual interest rate (expressed as a decimal)**
Ex. 7% → 0.07

n is the **number of compounding periods in a year**
Ex. n = 12
n = 1

t is the **term of the investment (in years)**
Ex. 6 months → $\frac{6 \text{ months}}{12 \text{ months}} = 0.5$ years

EXAMPLE 1 Comparing Simple Interest and Compound Interest

a) Calculate the interest you would earn from $1000.00 deposited in an account that pays 4.00% interest per annum **compounded annually** if you left it for 20 years. ↳ n = 1

b) Compare this to what you would get with **simple interest at 4% per annum**, also invested for a 20 year term.

a) Compounded

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

$A = 1000\left(1 + \frac{0.04}{1}\right)^{(1 \times 20)}$

$A = 1000(1.04)^{20}$ → 1.04 x^y 20, 1.04 ^ 20, 1.04 y^x 20

$A = 1000(2.191)$

$A = \$2191.12$

$\$2191.12 - 1000 = \$1191.12$

b) Simple

$I = Prt$

$I = 1000(0.04)(20)$

$I = \$800$

EXAMPLE 2 Calculating Compound Interest

Calculate the final value of a deposit of $1000.00 invested at a rate of 2.80% per annum for 4 years, with the following compounding periods:

a. semi-annually

$n = 2$
$t = 4$

$A = 1000\left(1 + \frac{0.028}{2}\right)^{(2\times 4)}$
$A = 1000(1.014)^8 \rightarrow 1.014 \; x^y \; 8 = 1.117$
$A = \$1117.64$

b. monthly

$n = 12$
$t = 4$

$A = 1000\left(1 + \frac{0.028}{12}\right)^{(12\times 4)}$
$A = 1000(1.0023)^{48}$
$A = \$1116.58$

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DAY 7 *Compound Interest assignment*

1. Calculate the final value of a deposit of $5000.00 invested at 3.00% per annum, compounded annually, for 2 years.

2. Calculate the difference between the final values of the following two investments after 3 years:
   - $4000.00 invested at 3.50% per annum, compounded annually
   - $4000.00 invested at 3.50% simple interest

3. Calculate how much **interest** you would earn on a deposit of $8000.00 invested at 2.50%, compounded annually, for a term of 5 years.

4. Calculate the final value of an investment of $4000.00 that earns interest at a rate of 4.00% per annum for 8 years, with the following compounding periods:

   a. annually

   b. monthly

5. Calculate the final value of a deposit of $3500.00 invested at 1.75% per annum, compounded quarterly, for 4 years.

6. Calculate the final value of a deposit of $4500.00 invested at 2.5% per annum, compounded semi-annually, for 5 years.

7. Calculate the final value of a deposit of $2000.00 invested at 3.50% per annum, compounded daily, for 10 years.

8. **How much more interest** will you earn on an investment of $10 000 deposited at 3.75% per annum for one year, if it compounds **daily** versus **annually**?

9. Calculate the difference between the final values of the following two investments after 5 years:

   - $3000.00 invested at 2.75% per annum, simple interest
   - $3000.00 invested at 2.5% per annum, compounded semi-annually

10. An investment offers a rate of 2.80% per annum, compounded annually.

    a. Use the Rule of 72 to determine how long it will take for the value to double.

    b. Use the number of years found in (a). Plug into the compound interest formula using an investment of $1000. Compare results of (a) and (b).

11. Ryan has a $1000.00 investment that offers an interest rate of 2.50% per annum, compounded monthly.

    a. If he invests it for 5 years, how much will the investment be worth at the end of the term?

    b. Approximately how long will it take for his investment to double in value?