

Compound Interest Warm-Up (Not included on the handout)

- 1a) If you received something **semi-annually**, how often would you receive it? **2 times per year**
 1b) If you received something **quarterly**, how often would you receive it? **4 times per year**

2. Calculate:

a) one half of \$200

$$\frac{1}{2} \times \$200 = \$100$$

\$100

b) one quarter of \$100

$$\frac{1}{4} \times \$100 = \$25$$

\$25

c) one twelfth of \$900

$$\frac{1}{12} \times \$900 = \$75$$

\$75

3. Use your calculator to evaluate: $A = 575 \left(1 + \frac{0.03}{4} \right)^8$

You may need to input your calculator as follows:

$$575 \times (1 + 0.03 \div 4) ^{xy} 8 =$$

\$610.42

Before we begin, are there any questions from last day's work?

Today's Learning Goal(s):

By the end of the class, I will be able to:

- a) Understand the compound interest formula.
- b) Calculate the final amount of money for different compounding period
- c) Determine the total interest earned.

MBF3CI

Compound Interest

Date:

Dec. 9/16

Suppose you deposit \$1000 into an investment at a bank that pays you 7% **compound interest** per year. The original investment of \$1000 is known as the original **principal**.

Compound interest is calculated on the original principal **PLUS** any interest that has already been earned! This is a chart that shows how the money grows over the first few years:

Example:

^x Years	^y Principal @ start of year (\$)	Compound Interest (\$)	Balance @ end of year (\$)
0	\$ 1000	$1000(0.07) = \$ 70$	\$ 1070.00
1	\$ 1070	$1070(0.07) = \$ 74.90$	\$ 1144.90
2	\$ 1144.90	$1144.90(0.07) = \$ 80.14$	\$ 1225.04

Does the money grow **linearly**, **exponentially**, or as a **quadratic relation**? Explain!

👉 **Compound interest grows exponentially.**

The chart above shows how \$1000 grows when the interest is 7% per year, **compounded annually**, for several years.






"Compounded annually" means the interest is calculated on the outstanding principal.

What **formula** can be made to find the final balance at the end of 2 years?

$$\begin{array}{c} \text{1st year} \quad \text{2nd year} \\ \downarrow \quad \downarrow \\ \text{👉 } A = 1000(1.07)(1.07) \\ \text{👉 } A = 1000(1.07)^2 \end{array}$$





Compound interest can be calculated more than just once per year!

How many times per year is interest calculated, if money is compounded...?

	annually	semi-annually	quarterly	monthly	daily
Number of interest periods <u>per year</u>	 1	 2	 4	 12	 365

EX. 1:

If a bank states that an investment earns 7% per year, calculate the interest rate per compounding period:

	annually	semi-annually	quarterly	monthly	daily
	7% = 0.07	 $\frac{0.07}{2}$	 $\frac{0.07}{4}$	 $\frac{0.07}{12}$	 $\frac{0.07}{365}$

Rather than using a table or a graph to see how the value of an investment/loan grows , you can use a formula:

$$A = P(1 + i)^n \quad \text{(COMPOUND INTEREST FORMULA)}$$

A is the final amount

P is the principal (original amount)

n is the number compounding periods

i is the interest rate per compounding period

EX. 2: State the values that would be substituted into the above formula. **Do not evaluate.**

a) A loan of \$750 is taken out for 3 years at a rate of 7%/a, compounded quarterly

$$A = ?$$

$$P = 750 \quad i = \frac{0.07}{4}$$

$$n = 3 \times 4 = 12$$

b) \$600 is invested for 5 years at $3\frac{3}{4}\%$ per year, compounded semi-annually

$$A = ?$$

$$P = 600$$

$$n = 5 \times 2 = 10$$

$$\text{Note: } 3\frac{3}{4}\%$$

$$= 3.75\%$$

$$= 0.0375$$

$$i = \frac{0.0375}{2}$$

EX. 3: USING THE NEW FORMULA, now evaluate.

$$a) \quad A = 750 \left(1 + \frac{0.07}{4} \right)^{12}$$

$$\div 923.579$$

$$\div \$923.58$$

$$b) \quad A = 600 \left(1 + \frac{0.0375}{2} \right)^{10}$$

$$\div 722.482$$

$$\div \$722.48$$

(last) **Note: These values are NOT the interest earned!!!**
(How would you calculate the interest earned?)

Don't forget that $A = P + I$, and $I = A - P$

EX. 4: Determine the amount of, and total interest earned on a \$1400 investment at 5% per year, compounded monthly for 4 years.

$$A = ?$$

$$P = 1400$$

$$i = \frac{0.05}{12}$$

$$n = 4 \times 12 = 48$$

$$A = P(1 + i)^n$$

$$A = 1400 \left(1 + \frac{0.05}{12} \right)^{48}$$

$$\doteq 1709.253$$

$$\doteq \$1709.25$$

$$I = A - P$$

$$\doteq 1709.25 - 1400$$

$$\doteq \$309.25$$

If you can't get this on your calculator, ask for help now!

the amount of the investment is \$1709.25,
and total interest earned is \$309.25.

Entertainment: pp. 432-434 #2, 3, 6, 8, 12, 15

Quiz 8.1 on **Tuesday** on Simple and Compound Interest