**1.3 / 1.5 / 1.6 – Compound Interest**

 **Important Concepts:**

**1) Understanding the Vocabulary – *Compound interest***

The important difference between simple interest and compound interest is that **compound interest** is interest that is calculated on \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_+ \_\_\_\_\_\_\_\_\_\_\_\_\_.

Because you earn or pay interest on interest – the **amount** of interest per period \_\_\_\_\_\_\_\_\_\_\_\_. The interest earned is added to the principal. The \_\_\_\_\_\_\_ is the principal for the next period. If interest is compounding, it means that the principal amount invested or owed \_\_\_\_\_\_\_\_\_\_\_\_\_ at a faster rate than it would if it were earning/paying simple interest.

**2) Understanding Compounding Periods – *the # of times interest compounds per year***

Interest rates are usually expressed as a percentage over 1 year.

However, interest can be compounded in different ways.

The number of compounding periods depends on the type of investment/institution.

How many times **per year** is the interest compounded for each compounding period?

|  |  |
| --- | --- |
| **Compounding Period** | **# of time interest compounds per year** |
| Annually |  |
| Semi-annually |  |
| Quarterly |  |
| Monthly |  |
| Weekly  |  |
| Daily  |  |

**3) Understanding and using the Compound Interest Formula**

 **A =** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ ($$ accumulated after **t** years **including interest**)

 **P =** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (the **initial amount** you borrow or deposit)

 **r =** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ (must be written as a decimal – not a %)

 **t =** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_(length of the investment / loan expressed in **years**)

 **n =** \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**4) Using the Formula – *For any Compound Interest Problem, follow these 3 steps:***

1. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
3. \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 1:**

Sheryl manages a high-rise building in Vancouver. She invested $40 000 from this year’s condo fees for a reserve fund. She invested $20 000 in an account that pays 1.8%/year compounded semi-annually. She invested $20 000 in an account that pays 1.8%/year compounded daily. What will be the value of each $20 000 investment after 3 years?

**Formula:**

Investment #1 - Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Total for investment 1: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Investment #2 – Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 Total for investment 2: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Which account earned more interest? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

 By how much? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Example 2:**

Maddy invested $10 000 4 years ago. Her investment earned compound interest at 2.1%/yr compounded annually. She plans to spend the interest her investment has earned. How much interest does Maddy have to spend?

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Interest Earned:**  = \_\_\_\_\_\_\_\_\_\_\_\_\_\_ – \_\_\_\_\_\_\_\_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_

**Practice Questions:**

**1.** Tom is a plumber in Kamloops. He installed 17 toilets in a new townhouse complex. He charged $50 per toilet installed. He invested all his earnings in a savings account for 2 years. The account paid 1.3%/yr compounded annually. How much will Tom have after 2 years?

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_ x \_\_\_\_\_\_\_ = \_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ After 2 years Tom will have: \_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**2.** Daisy started saving to have a big party to celebrate the success of her business on its 5 year anniversary. The interest rate for Daisy’s investment was 3.2%/yr compounded annually. How much did Daisy invest 5 years ago if her investment is now worth $4000?

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Daisy invested: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**3.** If you know the interest rate and the compounding period for an investment, you can use the Rule of 72 to estimate how long it will take for the investment to double.

**The Rule of 72 formula is:**

 

Suppose Austin invests $3000 at 3.6%/yr compounded annually. About how long will it take Austin’s money to double?

 Years to double =  = \_\_\_\_\_\_ yrs

Check to see if your answer is reasonable.

Use the compound interest formula where t = 20 yrs Reasonable Y / N

**4)** Diana borrows $10 000 from a credit card company at a rate of 19% interest per year compounded quarterly. Given that she makes no payments, what is the total amount Diana will owe after 3 years? How much will she pay in interest?

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total owing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total interest accrued on Diana’s loan: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**5)** Would you prefer simple or compound interest in the following situations:

1. A loan / credit card payment? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_
2. An investment / savings account? \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Why: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**6)** In an attempt to impress the ladies, Connar Peers registers a loan with a Vancouver BMW dealership so he can buy a fancy new sports car. The interest rate on his $22 000 loan is 6.0%, compounded monthly. If Connar is unable to make any payments towards his loan while he is studying at SFU, how much cash will he owe the car dealership after 4 years? How much interest will have accumulated on his loan?

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Total owing: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Interest accumulated: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

**7)** On November 1, 2008 – Mr. Yamamura fell in love with a $5000 state-of-the-art home entertainment unit. He needed that new flat screen for his week-night gaming binges. Unfortunately, a Math teacher’s salary means that Yams didn’t have the cash on hand. He decided to borrow money from a bank. He signed a loan agreement for $5000 at an annual rate of 7.0% compounded monthly. Given that Mr. Yams made no payments, how much was his outstanding loan balance on November 1, 2013?

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_ Outstanding loan balance: \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Think you’re cool ‘cause you’re done early?

Impress me by figuring this out. I’ll probably give you a prize. And by probably I mean definitely.

**Bonus:**

At the age of 19 – Mat invests $2000 into a Tax Free Savings Account with RBC. The interest rate on his investment is 1.05% compounded annually. How old will Mat be when his TFSA balance reaches $4000

**Formula:**

Identify your variables:

A = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

P = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

r = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

t = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

n = \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

Terrifying Log formula to solve for (t):

(t) = \_\_\_\_\_\_\_\_\_\_\_\_ years

Mat will be \_\_\_\_\_\_ years old when his investment reaches $4000

Check the Rule of 72 to see if your number is close! Years to double =  = \_\_\_\_\_\_ yr