

ASSIGNMENT #1

The purpose of this assignment is to solidify your understanding on the applications of the time value of money. The scores of this assignment will help in assessing the following learning goal of the course: “students successfully completing this course will be able to apply principles of time value of money to personal and corporate financial decisions.”

Instructions:

You are required to use a financial calculator or spreadsheet (Excel) to solve 10 problems (provided on page 5) on the applications of the time value of money. You are required to show the following 4 steps for each problem (sample questions and solutions are provided for guidance):

- (i) Develop the timeline (linear representation of the timing of cash flows)
- (ii) Identify the time value of money variable (PV, FV, PMT, N or Rate) which needs to be calculated in the question.
- (iii) Identify the values of the remaining four variables (PV, FV, PMT, N or Rate) from the question. Be sure to input positive or negative signs.
- (iv) Calculate the correct value of the variable identified in step (ii).

Grading Rubric

Subcomponent	Not Submitted	Does Not Meet Expectations	Meets expectations	Exceeds Expectations
The student will make and evaluate important assumptions in identification of appropriate time value of money variables	No attempt made	Attempts to describe assumptions	Explicitly describes assumptions	Explicitly describes assumptions and provides rationale on why each assumption is appropriate (e.g., provides information on why each time value of money variable is FV, PV, N, I/Y or, PMT with inflows and outflows (+/- signs)
The student will convert relevant information into various mathematical forms (e.g., equations, graphs, diagrams, tables, words)	No attempt made	Completes conversion of information but resulting mathematical portrayal is inappropriate or inaccurate	Completes conversion of information into mathematical portrayal	Relevant information is expressed in an insightful mathematical portrayal in a way that contributes to a further or deeper understanding (e.g., correctly develops timeline of cash flows by labeling FV, PV, N, I/Y and PMT as time value of money variables)
The student will calculate the value of unknown time value of money variable	No attempt made	Calculations are attempted but are both unsuccessful and not comprehensive	Calculations are attempted to solve the problem but not comprehensive	Calculations attempted are essentially all successful and sufficiently comprehensive to solve the problem. Calculations are also presented elegantly (e.g., provides information on the interpretation of the calculated time value of money variable such as the calculated PMT means annuity)

The above rubric will be applied to grade each question and the average score will be calculated for each subcomponent.

Sample Questions and Solutions

Sample Question1:

Sara wants to have \$100,000 in her savings account after 6 years. How much must she put in the account now, if the account pays a fixed interest rate of 8%, to ensure that she has \$100,000 in 6 years?

Solution:

- (i) Develop the timeline:

Years	0	1	2	3	4	5	6
Cash Flows	?	0	0	0	0	0	\$100,000

- (ii) Time Value of Money Variable which needs to be calculated:

Present Value (PV)

Rationale: The question is how much she should put now. This unknown value is as of today (now) and therefore represented by the Present value.

- (iii) Values of the remaining four variables:

FV = \$100,000; N= 6 years; Rate = 8%; PMT = 0

Rationale: She wants \$100,000 after 6 years. This amount is expected to occur in the future and therefore is represented by the Future value. The investment duration is 6 years and therefore it the N. She expects to earn 8% therefore it is the Rate. There is no annuity amount and therefore PMT is zero.

- (iv) Calculation:

FV = \$100,000; N= 6 years; Rate = 8%; PMT = 0; **Calculate PV = \$63,016.96**

Amount she should put in the account today: \$63,016.96.

Sample Question2:

Anthony borrowed \$50,000 today that he must repay in 15 annual end-of-year installments of \$5,000. What annual interest rate is Anthony paying on his loan?

Solution:

- (i) Develop the timeline:

Years	0	1	2	3	4	5	6
Cash Flows	\$50,000	-\$5,000	-\$5,000	-\$5,000	-\$5,000	-\$5,000	-\$5,000

Years	7	8	9	10	11	12	13
Cash Flows	-\$5,000	-\$5,000	-\$5,000	-\$5,000	-\$5,000	-\$5,000	-\$5,000

Years	14	15
Cash Flows	-\$5,000	-\$5,000

- (ii) Time Value of Money Variable which needs to be calculated:

Rate (I/Y)

Rationale: The question is how much annual interest rate she is paying. This unknown variable is represented by Rate.

- (iii) Values of the remaining four variables:

PV = \$50,000; N= 15 years; PMT = -\$5,000 FV = 0

Rationale: She has borrowed \$50,000 as of today. Therefore, this is the present value.

The time duration of the loan is 15 years, and therefore it is N. The annual payment which is required to be paid is \$5,000. This is the annuity since same amount is paid every year and therefore represented by the PMT. The value is input as a negative since it is a cash outflow from Anthony's point of view. The value of the loan at the end of the loan period is expected to be zero. Therefore, the future value is zero.

- (iv) Calculation:

PV = -\$50,000; N= 15 years; PMT = \$5,000 FV = 0; **Calculate I/Y = 5.56%**

Interest rate she is paying: **5.56%**

Assignment Problems

1. On Naomi's sixth birthday, her parents put \$24,000 into an investment account that promises to pay a fixed interest rate of 8 percent per year. How much money will she have in this account when she turns 18? Round to two decimal places.
2. Joel has \$3,600,000 in a Roth IRA and is ready to retire. He plans to withdraw equal amounts at the end of each year for the next 20 years. If the funds remaining in the account continue to earn 8% annually, how much can he withdraw each year? Round to two decimal places.
3. Alice would like to raise \$420,000 in ten years for her son to go to college. She plans to deposit equal amounts into an account at the end of each year earning 13% annually. How much must she invest each year if the first deposit is made at the end of the first year? Round to two decimal places.
4. You deposited \$1,000 into your savings account twelve years ago. Today, the amount has doubled to \$2,000. What annual rate of interest did your account generate? Submit your answer as a percentage and round to two decimal places.
5. Abner Corporation takes out a \$200,000 loan for a piece of new machinery. The annual payments are \$21,878.23. If the loan accrues 7.5% interest per year, how many loan payments must the company make? Round to the nearest number of years.
6. Harley invested \$5,000 into various stocks and bonds exactly nine years ago. During that time, her account earned an average rate of return of 9.5% per year, compounded monthly. How much is her account worth today? Round to two decimal places.
7. Jamie plans to retire in 30 years. She decides to put \$200 into a Roth IRA at the end of every month starting at the end of this month. She expects the IRA to earn 12% per year compounded monthly. How much will she have accumulated in the account at the end of 30 years? Round to two decimal places.
8. Durran has recently acquired a rare art piece that he plans to put on display in his private collection. He estimates that revenues generated from donations and admissions tickets to see the new exhibit will be \$19,000 per year for the next six years. If he requires a rate of return of 4%, how much are the expected cash flows worth for him today? Round to two decimal places.
9. Luke wants to save up \$2,000 in two years for a new computer. He can invest in a fund earning a 16% rate of return, compounded monthly. How much must he deposit into the fund today to have the necessary funds in two years? Round to two decimal places.
10. Cillian takes out a payday loan for \$400. In one month, he must pay back the loan plus \$50 in interest. Assuming monthly compounding, what is the annual interest rate (APR) he is being charged? Submit your answer as a percentage and round to two decimal places.