

Name ID

FN 211

Problem set 1: Time Value of Money

1. You deposit \$2,000 in a savings account that pays 10 percent interest, compounded annually. How much will your account be worth in 15 years?

	N	15.00
	I	10.0%
	PV	2,000.00
	PMT	0.00
Answer	FV	-8,354.50

2. You can earn 15 percent interest, compounded annually. How much must you deposit today to withdraw \$4,000 in 10 years?

	N	10.00
	I	15.0%
	PV	-988.74
	PMT	0.00
Answer	FV	4,000.00

3. Suppose you invested \$1,000 in stocks 10 years ago. If your account is now worth \$2,839.42, what rate of return did your stocks earn?

	N	10.00
	I	11.0%
	PV	1,000.00
	PMT	0.00
Answer	FV	-2,839.42

4. You are currently investing your money in a bank account which has a nominal annual rate of 8 percent, compounded annually. If you invest \$2,000 today, how many years will it take for your account to grow to \$10,000?

	N	20.91
	I	8.0%
	PV	2,000.00
	PMT	0.00
Answer	FV	-10,000.00 Answer = 21 years

5. What is the **future value** of a 5-year ordinary annuity with annual payments of \$200, evaluated at a 15 percent interest rate?

	N	5.00
	I	15.0%
	PV	0.00
	PMT	200.00
Answer	FV	-1,348.48

Name ID

6. What is the **present value** of a 5-year ordinary annuity with annual payments of \$200, evaluated at a 15 percent interest rate?

N	5.00
I	15.0%
PV	-670.43
PMT	200.00
FV	0.00

Answer

7. If a 5-year ordinary annuity has a present value of \$1,000, and if the interest rate is 10 percent, what is the amount of each annuity payment?

N	5.00
I	10.0%
PV	-1,000.00
PMT	263.80
FV	0.00

Answer

8. Your uncle has agreed to deposit \$3,000 in your brokerage account **at the beginning** of each of the next five years ($t = 0, t = 1, t = 2, t = 3$ and $t = 4$). You estimate that you can earn 9 percent a year on your investments. How much will you have in your account four years from now (at $t = 4$)? (Assume that no money is withdrawn from the account until $t = 4$.)

Answer \$17,954.13

One of the several ways of doing this is to treat this as a 4-year annuity due plus a payment in Year 4.

Numerical solution:

$$\begin{aligned} & \$3,000[(1.09^4 - 1) / .09] (FVIFA_{9\%,4}) (1.09) + \$3,000 \\ & \$3,000(4.5731)(1.09) + \$3,000 = \$17,954.04. \end{aligned}$$

Financial calculator solution:

BEGIN Mode

N = 4

I = 9

PV = 0

PMT = -3,000

FV = \$14,954.13.

Plus the \$3,000 at the end of Year 4 = \$14,954.13 + \$3,000 = \$17,954.13.

9. You are interested in saving money for your first house. Your plan is to make regular deposits into a brokerage account which will earn 14 percent. Your first deposit of \$5,000 will be made today. You also plan to make four additional deposits at the beginning of each of the next four years. Your plan is to increase your deposits by 10 percent a year. (That is, you plan to deposit \$5,500 at $t = 1$, and \$6,050 at $t = 2$, etc.) How much money will be in your account after five years?

Numerical solution:

$$\begin{aligned} & PMT_0 = \$5,000; PMT_1 = \$5,000 \times 1.10 = \$5,500; PMT_2 = \$5,000 \times (1.10)^2 = \\ & \$6,050; PMT_3 = \$5,000 \times (1.10)^3 = \$6,655; PMT_4 = \$5,000 \times (1.10)^4 = \\ & \$7,320.50. \\ & FV = \$5,000(1.14)^5 + \$5,500(1.14)^4 + \$6,050(1.14)^3 + \$6,655(1.14)^2 + \\ & \$7,320.50(1.14) = \$44,873.90. \end{aligned}$$

Financial calculator solution:

First, calculate the payment amounts:

Name ID

$PMT_0 = \$5,000$, $PMT_1 = \$5,500$, $PMT_2 = \$6,050$, $PMT_3 = \$6,655$, $PMT_4 = \$7,320.50$. Then, find the future value of each payment at $t = 5$: For PMT_0 , $N = 5$, $I = 14$, $PV = -5,000$, $PMT = 0$; thus, $FV = \$9,627.0729$. Similarly, for PMT_1 , $FV = \$9,289.2809$, for PMT_2 , $FV = \$8,963.3412$, for PMT_3 , $FV = \$8,648.8380$, and for PMT_4 , $FV = \$8,345.3700$. Finally, summing the future values of the respective payments will give the balance in the account at $t = 5$ or **\$44,873.90**.

10. Assume that you will receive \$2,000 a year in Years 1 through 5, \$3,000 a year in Years 6 through 8, and \$4,000 in Year 9, with all cash flows to be received at the end of the year. If you require a 14 percent rate of return, what is the present value of these cash flows?

Year	CF
1	2,000
2	2,000
3	2,000
4	2,000
5	2,000
6	3,000
7	3,000
8	3,000
9	4,000

Answer **NPV 11,714**