What is the Time Value of Money?

Worksheet

TVM means money grows (or shrinks) over time due to interest. The future value (FV) of a present sum is FV = PV (1+r)^n, where r is the interest rate and n is the number of periods. Conversely, PV = FV / (1+r)^n.

FV = PV(1+r)^n

Questions

1. $1,000 invested at 5% annual rate for 2 years becomes

A) $1,050
B) $1,100
C) $1,102.50
D) $1,105

2. You want $10,000 in 5 years at 8% annual interest. Present value needed is

A) $6,806
B) $6,000
C) $8,000
D) $9,259

3. Doubling your money at 10% annual rate takes approximately how many years?

A) 5 years
B) 7.2 years
C) 10 years
D) 15 years

4. If inflation is 3% and your savings earn 2% interest, your real return is

A) 5%
B) 1%
C) 1%
D) 3%

5. If you invest $5,000 today at 6% annual interest, how much will it grow in 3 years?

6. You need $20,000 in 5 years. If the bank offers 4% annual interest, how much must you deposit today (present value)?

7. A retirement account grows from $50,000 to $100,000 over 10 years. What was the average annual return (interest rate)?

8. Define: What is the time value of money?

9. Define: What is the future value formula?

10. Define: What is compound interest?

Answer Key

1. C) $1,102.50 - FV = $1,000 (1.05)^2 = $1,000 1.1025 = $1,102.50 (compound interest).

2. A) $6,806 - PV = $10,000 / (1.08)^5 = $10,000 / 1.4693 $6,806.

3. B) 7.2 years - Rule of 72: n 72 / rate = 72 / 10 7.2 years. (More exactly: 2 = (1.10)^n n 7.27.)

4. B) 1% - Real return = nominal return inflation = 2% 3% = 1%. Your purchasing power actually declines.

5. FV = PV (1 + r)^n FV = $5,000 (1 + 0.06)^3 FV = $5,000 (1.06)^3 FV = $5,000 1.1910 FV = $5,955

6. PV = FV / (1 + r)^n PV = $20,000 / (1.04)^5 PV = $20,000 / 1.2167 PV = $16,438.54

7. $100,000 = $50,000 (1 + r)^10 2 = (1 + r)^10 r = 2^(1/10) 1 = 1.0718 1 = 0.0718 = 7.18% annual return

8. Money available now is worth more than the same amount in the future, because it can earn interest or be invested.

9. FV = PV (1+r)^n, where PV is present value, r is rate per period, n is number of periods.

10. Interest earned on both the principal and previously earned interest, amplifying growth over time.