Practice Quiz 1: Interest Rates (Solutions)

1. Nick borrows $5,000 with a loan charging 12% interest. At the end of 4 years, how much will he owe?

Ans. Using the interest compounding formula:

$$F = P(1+r)^T = \$5{,}000(1.12)^4 = \$7{,}867.60$$

2. For her 5th birthday, Anna's grandparents buy her a $100 savings bond earning an interest rate of 5%. When Anna cashes in the bond at age 20, how much will she receive?

Ans. The bond will accrue interest for 15 years. Using the interest compounding formula:

$$F = P(1+r)^T = \$100(1.05)^{15} = \$207.89$$

3. Bob invests $10,000 in stock today, and another $10,000 in five years. If the investment account earns an average of 8% per year for the first five years and an average of 10% per year for the following five years, how much will be in the account at the end of ten years?

Ans. At the end of the first five years, the original $10,000 contribution will grow to:

$$F = P(1+r)^T = \$10{,}000(1.08)^5 = \$14{,}693.28$$

Bob will then contribute an additional $10,000 for a balance of $24,693.28. This will then grow by 10% per year for another five years and become:

$$F = P(1+r)^T = \$24{,}693.28(1.10)^5 = \$39{,}768.77$$

4. Eva is saving for a down payment on a house. If the down payment will be $30,000 and she can earn 6% interest on her savings, how much must she set aside today to make the down payment in 8 years?

Ans. Solving the interest compounding formula for *P*:

$$F = P(1+r)^T \Rightarrow P = \frac{F}{(1+r)^T} = \frac{\$30{,}000}{(1.06)^8} = \$18{,}822.37$$

5. James borrows $2,000 today. In two years, he must repay the lender $2,400. What is the implied interest rate on this loan?

Ans. Solving the interest compounding formula for *r (F=$2,400, and P =$2,000, T= 2)*:

$$F = P(1+r)^T \Rightarrow r = \left(\frac{F}{P}\right)^{1/T} - 1 = 9.54\%$$

6. Kaiesha is saving for a $30,000 down payment on a house. She can earn 6% interest on her savings and sets aside $15,000 today. How long will it take for these savings to grow enough to make the down payment?

Ans. Solving the interest compounding formula for *t*:

$$F = P(1+r)^T \Rightarrow T = \frac{\ln(F/P)}{\ln(1+r)} = \frac{\ln(\$30{,}000/\$15{,}000)}{\ln(1.06)} = 11.90$$

7. Paul is saving for his daughter's college education. He can earn 8% interest in his investment account and will need $120,000 in 15 years. He plans to set aside the same amount today, in five years, and in ten years. What amount must he set aside each time to meet this commitment?

Ans. The first contribution of *P* will accrue interest for 15 years and grow to:

$$P(1.08)^{15}$$

The second will accrue interest for 10 years and grow to:

$$P(1.08)^{10}$$

And the third will accrue interest for 5 years and grow to:

$$P(1.08)^{5}$$

The sum of these three values will be the ending balance in the account and must satisfy the equation:

$$P(1.08)^{15} + P(1.08)^{10} + P(1.08)^{5} = F = \$120{,}000$$

Solving for *P* yields:

$$P = \frac{\$120{,}000}{(1.08)^{15} + (1.08)^{10} + (1.08)^{5}} = \$17{,}645.96$$

8. Victor borrows at a 12% interest rate. How long would it take such a debt to double?

Ans. Solving the interest compounding formula for *T*:

$$F = P(1+r)^{T} \Rightarrow T = \frac{\ln(F/P)}{\ln(1+r)}$$

If the debt doubles, *F* will be twice *P* and *F/P* = 2:

$$T = \frac{\ln(F/P)}{\ln(1+r)} = \frac{\ln(2)}{\ln(1.12)} = 6.12 \text{ years}$$