Solutions to Engineering Economy Problems

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1 Problem-Solving

1. **Calculate the Net Present Value (NPV) of a project with an initial investment of $100,000 and expected annual cash inflows of $25,000 for 5 years. Assume a discount rate of 10%.**

   Solution: The NPV formula is:

   $$NPV = \sum_{t=1}^{n} \frac{R_t}{(1+i)^t} - C_0$$

   Plugging in the values:

   $$NPV = \sum_{t=1}^{5} \frac{\$25,000}{(1.10)^t} - \$100,000$$

   After calculation, the NPV is approximately **-$5,225.29**, indicating that the project is not financially viable.

   Video Explanation: Calculate Net Present Value To Decide Between Two Projects In Excel - NPV Function

2. **Determine the break-even point in units for a product with a fixed cost of $50,000, a variable cost of $20 per unit, and a selling price of $30 per unit.**

   Solution:

   $$BEP = \frac{\text{Fixed Costs}}{\text{Selling Price per Unit} - \text{Variable Cost per Unit}}$$

   $$BEP = \frac{\$50,000}{\$30 - \$20} = 5,000 \text{ units}$$

   Video Explanation: Break-Even Analysis Explained

3. **A project requires an initial investment of $150,000 and is expected to generate $40,000 annually for 5 years. Calculate the Internal Rate of Return (IRR).**

Solution: The IRR is the discount rate where NPV = 0:

$$0 = \sum_{t=1}^{5} \frac{\$40,000}{(1+IRR)^t} - 150,000$$

Using a financial calculator or Excel:

$$\text{IRR} \approx 14.87\%$$

Video Explanation: Calculate NPV, BCR and IRR for Cost/Benefit Analysis

4. **Compare two projects: Project A requires an initial investment of $200,000 and returns $60,000 annually for 4 years. Project B requires $150,000 and returns $50,000 annually for 4 years. Assume a discount rate of 8%.**

   Solution: Using the NPV formula:

$$NPV_A = \sum_{t=1}^{4} \frac{\$60,000}{(1.08)^t} - 200,000$$

$$NPV_B = \sum_{t=1}^{4} \frac{\$50,000}{(1.08)^t} - 150,000$$

   After calculations:

$$NPV_A \approx -\$1,279.17, \quad NPV_B \approx \$3,917.28$$

   Since **NPV_B ¿ NPV_A**, Project B is the better investment.

   Video Explanation: Calculate Net Present Value To Decide Between Two Projects In Excel - NPV Function

5. **A company wants to determine the total present worth of maintenance costs of $10,000 per year for 8 years at a discount rate of 6%.**

   Solution: Using the Present Worth of an Annuity formula:

$$PW = P \times \frac{1-(1+i)^{-n}}{i}$$

$$PW = 10,000 \times \frac{1-(1.06)^{-8}}{0.06}$$

$$PW \approx 58,378.52$$

   Video Explanation: Present Worth Calculation Example