

Chapter 8 - Homework Questions and Problems Answers

1. Calculating Payback. What is the payback period for the following set of cash flows?

Year	Cash Flow
0	-\$6,700
1	2,800
2	3,200
3	2,200
4	1,400

Answer: To calculate the payback period, we need to find the time it takes to recover the initial investment. After two years, the project has created:

$$\$2,800 + 3,200 = \$6,000$$

in cash flows. The project still needs to create another:

$$\$6,700 - 6,000 = \$700$$

in cash flows. During the third year, the cash flows from the project will be \$2,200. So, the payback period will be 2 years, plus what we still need to make divided by what we will make during the third year. The payback period is:

$$\text{Payback} = 2 + (\$700 / \$2,200)$$

$$\text{Payback} = 2.32 \text{ years}$$

5. Calculating IRR. A firm evaluates all of its projects by applying the IRR rule. If the required return is 11 percent, should the firm accept the following project?

Year	Cash Flow
0	-\$168,500
1	86,000
2	91,000
3	53,000

Answer: 5. The IRR is the interest rate that makes the NPV of the project equal to zero. So, the equation that defines the IRR for this project is:

$$0 = -\$168,500 + \$86,000 / (1+\text{IRR}) + \$91,000 / (1+\text{IRR})^2 + \$53,000 / (1+\text{IRR})^3$$

Using a spreadsheet, financial calculator, or trial and error to find the root of the equation, we find that:

IRR = 18.79% Since the cash flows are conventional and the IRR is greater than the required return, we would accept the project.

6. Calculating NPV. For the cash flows in the previous problem, suppose the firm uses the NPV decision rule. At a required return of 9 percent, should the firm accept this project? What if the required return was 21 percent?

Answer: The NPV of a project is the PV of the outflows minus by the PV of the inflows. The equation for the NPV of this project at a 9 percent required return is:

$$\begin{aligned} \text{NPV} &= -\$168,500 + \$86,000 / 1.09 + \$91,000 / 1.09^2 + \$53,000 / 1.09^3 \\ \text{NPV} &= \$27,917.69 \end{aligned}$$

At a 9 percent required return, the NPV is positive, so we would accept the project.

The equation for the NPV of the project at a 21 percent required return is:

$$\begin{aligned} \text{NPV} &= -\$168,500 + \$86,000 / 1.21 + \$91,000 / 1.21^2 + \$53,000 / 1.21^3 \\ \text{NPV} &= -\$5,354.28 \end{aligned}$$

At a 21 percent required return, the NPV is negative, so we would reject the project.

8. Calculating IRR. What is the IRR of the following set of cash flows?

Year	Cash Flow
0	-\$19,400
1	9,800
2	11,300
3	6,900

Answer: The IRR is the interest rate that makes the NPV of the project equal to zero. So, the equation that defines the IRR for this project is:

$$0 = -\$19,400 + \$9,800 / (1+\text{IRR}) + \$11,300 / (1+\text{IRR})^2 + \$6,900 / (1+\text{IRR})^3$$

Using a spreadsheet, financial calculator, or trial and error to find the root of the equation, we find that:

$$\text{IRR} = 22.09\%$$

13. Calculating Profitability Index. What is the profitability index for the following set of cash flows if the relevant discount rate is 10 percent? What if the discount rate is 15 percent? If it is 22 percent?

Year	Cash Flow
0	-\$27,500
1	15,800
2	13,600
3	8,300

Answer: 13. The profitability index is defined as the PV of the future cash flows divided by the initial investment. The equation for the profitability index at a required return of 10 percent is:

$$PI = (\$15,800 / 1.10 + \$13,600 / 1.10^2 + \$8,300 / 1.10^3) / \$27,500$$

$$PI = 1.158$$

The equation for the profitability index at a required return of 15 percent is:

$$PI = (\$15,800 / 1.15 + \$13,600 / 1.15^2 + \$8,300 / 1.15^3) / \$27,500$$

$$PI = 1.072$$

The equation for the profitability index at a required return of 22 percent is:

$$PI = (\$15,800 / 1.22 + \$13,600 / 1.22^2 + \$8,300 / 1.22^3) / \$27,500$$

$$PI = .969$$

We would accept the project if the required return were 10 percent or 15 percent since the PI is greater than one. We would reject the project if the required return were 22 percent since the PI is less than