

Therefore, $ROI < 18\%$
 Interpolate and solve for i .

i [%]	PV [\$]
12	11,635
i	0
18	-43,912

$$\frac{i - 12}{18 - 12} = \frac{0 - 11,635}{-43,912 - 11,635} = 0.2095$$

$$i - 12 = 1.257$$

$$i = 13.3\%$$

Answer A

45.17 A \$100,000 investment today pays back \$10,000 in years 1 through 9 and \$100,000 in year 10. What is the rate of return?

- A. 7.8%
- B. 8.6%
- C. 9.4%
- D. 10.3%

The rate of return is the interest rate that makes the present value zero. Draw a cash flow diagram or make a list of cash flows.

There is an initial outlay of \$100,000 in year zero (negative).

In years 1-9 there is a return of \$10,000 per year.

In year 10, there is a return of the original \$100,000 principle.

Write an expressions for the present value and set it equal to zero.

$$PV = -\$100,000 + \$10,000 (P/A, i, 9) + \$100,000 (P/F, i, 10) = 0$$

Direct solutions are challenging when the interest rate is unknown. The fastest approach is to guess values for i in close proximity to the answer choices. It is also possible to try the answer choices by trial and error; however, since only certain integer percentages can be found in the **Economic Factor Tables**, this would require using the **Economic Factor Conversions** to derive the cash flow factors. This solution will describe the process without testing answer choices.

Assume $i = 8\%$.

$$PV = -\$100,000 + \$10,000 (6.2469) + \$100,000 (0.4632) = \$8,789 > 0$$

Since the present value is *greater* than zero, the interest rate must be *higher*, thereby discounting the future (positive) cash flows *more* and *reducing* the present value.

Assume $i = 10\%$.

$$PV = -\$100,000 + \$10,000 (5.7590) + \$100,000 (0.3855) = -\$3,860 < 0$$

Since the present value is *less* than zero, the interest rate must be *lower*, thereby discounting the future (positive) cash flows *less* and *increasing* the present value.

Looking at the answer choices, it is possible at this stage to eliminate choices A and D as they are outside the range of 8-10% which is now known to contain the interest rate that drives the present to zero. Furthermore, it is possible to infer that the interest rate will be closer to 10% than 8% since the resulting present value obtained for $i = 10\%$ was closer to zero.

If time allows, interpolate and solve for i .

i [%]	PV [\$]
8	8,789
i	0
10	-3,860

$$\frac{i - 8}{10 - 8} = \frac{0 - 8,789}{-3,860 - 8,789} = 0.695$$

$$i - 8 = 1.39$$

$$i = 9.4\%$$

Answer C

45.18 A contractor leases a piece of equipment for \$50K down and \$30K per year for a project expected to take 3 years. After the third year, the equipment is still needed due to a schedule delay and the contractor must pay \$40K per year to continue to lease for the fourth and fifth years. After the fifth year, the project is completed and the equipment is returned. How much annual revenue is required to ensure the project has a 18% return on investment?

- A. \$33K
- B. \$44K
- C. \$49K
- D. \$56K

Draw a cash flow diagram or make a list of cash flows.

For year 0 there is a payment (negative cash flow) of -\$50K.

For years 1 through 3 there is a negative cash flow of -\$30K.

For years 4 and 5 there is a negative cash flow of -\$40K.

For years 1 through 5 there is a positive cash flow of R , the unknown revenue.

Write an expression for the present value. For convenience, overstate the costs in years 1 through 3 by showing a negative -\$40K cash flow for the entire 5 years, then offset with a *positive* cash flow