35.17 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