Apply the tax rate to calculate the tax.

$$Tax = (0.35)\,(\$11,667) = \$4083$$

Since tax is an acutal expense, subtract the tax from the net profit before tax to obtain the net profit after tax. This figure summarizes the annualized cash flows for years 1 through 12.

$$Net\,profit\,after\,tax = \$20,000 - \$4083 = \$15,917$$

Write an expression for the present value. The after-tax rate of return is the interest rate that makes the present value equal zero. Solve for cash flow factor $(P/A, i, 12)$.

$$PV = -\$100,000 + \$15,917\,(P/A, i, 12) = 0$$

$$(P/A, i, 12) = 6.2827$$

Review the Economic Factor Tables and note that the cash flow factor P/A with a duration of 12 years decreases as the interest rate increases, because future cash flows are discounted more as the interest rate increases. At an interest rate $i = 10$, $(P/A, 10, 12) = 6.8137$. At an interest rate $i = 12$, $(P/A, 12, 12) = 6.1944$. The interest rate must be within the range if $10 - 12\%$, which is sufficient information to select a final answer based on the choices. If time permits, make a table and interpolate to drill down on the answer.

$i[\%]$	$(P/A, i, 12)$
10	6.8137
i	6.2827
12	6.1944

$$\frac{i - 10}{12 - 10} = \frac{6.2827 - 6.8137}{6.1944 - 6.8137}$$

$$i - 10 = 1.71$$

$$i = 11.7\%$$

Answer C

45.21 A new piece of equipment costs \$100,000 and increases revenue by \$15,000 per year for the next 6 years, and by \$20,000 per year (from the original baseline) for the following 6 years. Assuming no maintenance costs and no salvage value, what is the present value of investing in this equipment if the effective annual interest rate is 6%?

A. \$43,000

B. \$56,000

C. \$145,000

D. \$195,000

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

In year zero, there is an initial cost of \$100,000 (negative).

In years 1 through 6, there is an annual revenue of \$15,000.

In years 7-12, there is an annual revenue of \$20,000.

Rather than handle the (6) additional \$5,000 cash flows in years 7-12 as individual future cash flows, it is faster to assume and annual revenue of \$20,000 for the entire 12 years, then compensate for overstating the revenue in years 1-6 by *subtracting* \$5,000 per year over 6 years from the outset. This can be handled as an annualized cash flow over 6 years.

The present value can be determined with the following expression.

$$PV = -\$100,000 + (\$20,000)(P/A, 6\%, 12) - (\$5,000)(P/A, 6\%, 6)$$

Use the 6% Factor Table to look up the cash flow factors needed to translate the cash flows into present value. Solve for the present value.

$$PV = -\$100,000 + (\$20,000)(8.3838) - (\$5,000)(4.9173) = \$43,090$$

Answer A

45.22 A piece of equipment is purchased for \$20K and will be sold 5 years later for \$5K. The first year maintenance costs \$2500, then increases by \$500 per year. The effective interest rate is 8%. What is the present worth?

A. $-\$30K$

B. $-\$23K$

C. $-\$10K$

D. $-\$3K$

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

In Year 0, there is an initial payment of \$20K (negative).

In Years 1-5, there is an annual maintenance cost of \$2500 (negative) which escalates by an additional \$500 per year. This can be treated as a uniform series of payments *plus* a uniform gradient.

In Year 5, there is a \$5K future cash payment (positive) for the salvage value.

Write an expression for the present value. Use the $i = 8\%$ Factor Table to retreive the cash flow factors.

$$PV = -\$20,000 - \$2500(P/A, 8\%, 5) - \$500(P/G, 8\%, 5) + \$5000(P/F, 8\%, 5)$$

$$PV = -\$20,000 - \$2500(3.9927) - \$500(7.3724) + \$5000(0.6806) = -\$30,264$$

Answer A