$$
\begin{aligned}
PV &= (50{,}000 + 2000t)\left(-10e^{-0.10t}\right)\Big]_0^5 - \int_0^5 \left(-10e^{-0.10t}\right)(2000\,dt) \qquad \text{Using the parts formula, } uv - \int v\,du \\
&= (50{,}000 + 2000t)\left(-10e^{-0.10t}\right)\Big]_0^5 + 20{,}000\int_0^5 e^{-0.10t}\,dt \\
&= (50{,}000 + 2000t)\left(-10e^{-0.10t}\right)\Big]_0^5 + \left(-200{,}000e^{-0.10t}\right)\Big]_0^5 \\
&= 60{,}000\left(-10e^{-0.5}\right) + 500{,}000 - 200{,}000\left(e^{-0.5}\right) + 200{,}000 \\
&= 700{,}000 - 800{,}000e^{-0.5} \\
&\approx 700{,}000 - 800{,}000(0.6065307) \\
&\approx 700{,}000 - 485{,}225 = 214{,}775
\end{aligned}
$$

The present value of the new store's income stream is approximately $214,775.

7.2 EXERCISES

APPLICATIONS

1. **Annuity:** Estimate the amount of an annuity if $1000 is deposited annually for 10 years at a rate of 8 percent compounded continuously.

2. **Annuity:** An amount of $6000 is invested in an account each year for 8 years. Find the approximate balance at the end of the 8 years if the account pays interest at a rate of 7 percent compounded continuously.

3. **Annuity:** Christine has decided to invest $2000 each year into an IRA account that pays interest at the rate of 9 percent compounded continuously. Find the amount in the account at the end of 15 years.

4. **Annuity:** Bob and Ann plan to deposit $4000 per year into their retirement account. If the account pays interest at a rate of 8.4 percent compounded continuously, approximately how much will be in their account after 12 years?

5. **Annuity:** Bryan plans to deposit $1200 each year into an annuity. If the account pays interest at a rate of 7.5 percent compounded continuously, find the approximate balance of his account after 10 years.

6. **Annuity:** Seven thousand dollars is invested in an annuity account each year for 4 years. Find the approximate balance in the account after 4 years if the rate of interest is 6.8 percent compounded continuously.

7. **Income stream:** Find the value of an income stream after 7 years if the rate of flow is estimated to be $200,000 annually and the income is invested at a rate of 8 percent compounded continuously.

8. **Income stream:** The owner of a local convenience store estimates that the store will generate an annual income of $340,000 for the next 4 years. If the rate of interest is 9 percent compounded continuously, find the value of the income stream.

9. **Income stream:** What is the eventual sum accumulated by an income stream of $1200 per year for 15 years assuming continuous compounding at an annual rate of 5%?

10. **Income stream:** A hot dog stand profits by $90 per day (or $32,850 per year) over salaries and expenses. Assuming continuous compounding at an annual rate of 4%, what will be the accumulated profits in 6 years?

11. **Income stream:** A real estate investment is expected to generate an income flow of $12,000 annually for the next 6 years. Find the amount of the income stream if the interest rate is 7.8 percent compounded continuously.

12. **Income stream:** Find the value of an income stream after 5 years if $R(t) = 3600e^{0.02t}$ is the rate of flow of revenue and the income is deposited at a rate of 7 percent compounded continuously.

13. **Income stream:** A certain investment has a continuous flow of money at a rate of $R(t) = 7200e^{0.01t}$. Find the value of this flow after 4 years if the interest rate is 8.2 percent compounded continuously.

14. **Income stream:** The rate of income from a number of vending machines is estimated by $R(t) = 80e^{0.015t}$ thousand dollars per year. If the receipts are reinvested into an account paying 5.5 percent compounded continuously, find the amount of the income stream after 5 years.

15. **Income stream:** Find the value of an income stream in 6 years if the rate of flow of income at time t is estimated by the function $R(t) = 2000 + 800t$ dollars per year and the income is reinvested at 8 percent compounded continuously.

16. **Income stream:** Find the value of an income stream if $R(t) = 50 + 0.2t$ is the rate of flow of revenue reinvested at 6 percent compounded continuously for 8 years.

17. **Income stream:** Find the value of an income stream if $R(t) = 80 + 1.2t$ is the rate of flow of revenue reinvested at 6.4 percent compounded continuously over the next 6 years.

18. **Income stream:** The profit from a number of soft drink machines is estimated to be at the rate of $R(t) = 15 + 0.8t$ thousand dollars per year. If the profits are deposited into an account paying 6.5 percent compounded continuously, find the amount of the income stream after 7 years.

19. **Income stream:** It is estimated that a computer will save accounting fees at a small company at a rate of $R(t) = 4 + 0.6t$ thousand dollars per year. If the savings are reinvested at 5 percent compounded continuously, find the amount of the income stream after 4 years.

20. **Income stream:** Find the present value of an income stream with $R(t) = 60 - 0.4t$, $r = 8$ percent, and $T = 20$.

21. **Income stream:** Find the present value of an income stream with $R(t) = 150 - t$, $r = 12$ percent, and $T = 10$.

22. Income stream: The rate of flow of an income stream is estimated by $R(t) = 6000e^{0.015t}$ for the next 4 years. Find the present value of this flow if the interest rate is 6 percent compounded continuously.

23. Income stream: The rate of flow of an income stream for the next 6 years is estimated by $R(t) = 10{,}000e^{-0.01t}$. Find the present value of this flow if the interest rate is 8.5 percent compounded continuously.

24. Income stream: Sandy estimates that the profits from his ice cream store will be $R(t) = 24 + 3.6t$ thousand dollars per year for the next 5 years. Find the present value of the store if the current interest rate is 10 percent compounded continuously.

25. Income stream: An income stream is expected to generate revenues at a rate given by $R(t) = 18 + 2.4t$ thousand dollars per year for the next 6 years. Find the present value of the stream if the interest rate is 8.5 percent compounded continuously.

26. Income stream: Elco Grain Company expects their profits to be $R(t) = 30 + 12e^{0.02t}$ thousand dollars per year for the next 4 years. If the current interest rate is 8 percent compounded continuously, find the present value of the company.

WRITING & THINKING

27. In Figure 1, replace the column information with $100e^{0.01(5)}$, $100e^{0.01(4)}$, $100e^{0.01(3)}$, $100e^{0.01(2)}$, $100e^{0.01(1)}$, $100e^{0.01(0)}$. This suggests that the future value of an annuity could be given by $\int_0^N Pe^{rt}dt$. Does this give the same result as the formula for the future value of an annuity shown in the lesson? Explain why or why not.