

1. Find the correct numerical value for the following factors from the interest tables.
 1. $(F/P, 8\%, 25)$
 2. $(P/A, 3\%, 8)$
 3. $(P/G, 9\%, 20)$
 4. $(F/A, 15\%, 18)$
 5. $(A/P, 30\%, 15)$

2. The U.S. Border Patrol is considering the purchase of a new helicopter for aerial surveillance of the New Mexico–Texas border with Mexico. A similar helicopter was purchased 4 years ago at a cost of \$140,000. At an interest rate of 7% per year, what would be the equivalent value today of that \$140,000 expenditure?

3. Pressure Systems, Inc., manufactures high-accuracy liquid-level transducers. It is investigating whether it should update certain equipment now or wait to do it later. If the cost now is \$200,000, what will the equivalent amount be 3 years from now at an interest rate of 10% per year?

4. Petroleum Products, Inc., is a pipeline company that provides petroleum products to wholesalers in the northern United States and Canada. The company is considering purchasing insertion turbine flow meters to allow for better monitoring of pipeline integrity. If these meters would prevent one major disruption (through early detection of product loss) valued at \$600,000 four years from now, how much could the company afford to spend now at an interest rate of 12% per year?

5. Sensotech Inc., a maker of microelectromechanical systems, believes it can reduce product recalls by 10% if it purchases new software for detecting faulty parts. The cost of the new software is \$225,000. (a) How much would the company have to save each year for 4 years to recover its investment if it uses a minimum attractive rate of return of 15% per year? (b) What was the cost of recalls per year before the software was purchased if the company did exactly recover its investment in 4 years from the 10% reduction?

6. Thompson Mechanical Products is planning to set aside \$150,000 now for possibly replacing its large synchronous refiner motors whenever it becomes necessary. If the replacement isn't needed for 7 years, how much will the company have in its investment set-aside account if it achieves a rate of return of 18% per year?

7. French car maker Renault signed a \$75 million contract with ABB of Zurich, Switzerland, for automated underbody assembly lines, body assembly workshops, and line control systems. If ABB will be paid in 2 years (when the systems are ready), what is the present worth of the contract at 18% per year interest?

8. Atlas Long-Haul Transportation is considering installing Valutemp temperature loggers in all of its refrigerated trucks for monitoring temperatures during transit. If the systems will reduce insurance claims by \$100,000 two years from now, how much should the company be willing to spend now if it uses an interest rate of 12% per year?

9. GE Marine Systems is planning to supply a Japanese shipbuilder with aero-derivative gas turbines to power 11 DD-class destroyers for the Japanese Self-Defence Force. The buyer can pay the total contract price of \$1,700,000 now or an equivalent amount 1 year from now (when the turbines will be needed). At an interest rate of 18% per year, what is the equivalent future amount?
10. What is the present worth of a future cost of \$162,000 to Corning, Inc., 6 years from now at an interest rate of 12% per year?
11. How much could Cryogenics Inc., a maker of superconducting magnetic energy storage systems, afford to spend now on new equipment in lieu of spending \$125,000 five years from now if the company's rate of return is 14% per year?
12. V-Tek Systems is a manufacturer of vertical compactors, and it is examining its cash flow requirements for the next 5 years. The company expects to replace office machines and computer equipment at various times over the 5-year planning period. Specifically, the company expects to spend \$9000 two years from now, \$8000 three years from now, and \$5000 five years from now. What is the present worth of the planned expenditures at an interest rate of 10% per year?
13. A proximity sensor attached to the tip of an endoscope could reduce risks during eye surgery by alerting surgeons to the location of critical retinal tissue. If a certain eye surgeon expects that by using this technology, he will avoid lawsuits of \$1.25 and \$0.5 million 2 and 5 years from now, respectively, how much could he afford to spend now if his out-of-pocket costs for the lawsuits would be only 10% of the total amount of each suit? Use an interest rate of 8% per year.

14. The current cost of liability insurance for a certain consulting firm is \$65,000. If the insurance cost is expected to increase by 4% each year, what will be the cost 5 years from now?
15. American Gas Products manufactures a device called a Can-Emiter that empties the contents of old aerosol cans in 2 to 3 seconds. This eliminates having to dispose of the cans as hazardous wastes. If a certain paint company can save \$75,000 per year in waste disposal costs, how much could the company afford to spend now on the Can-Emiter if it wants to recover its investment in 3 years at an interest rate of 20% per year?
16. Atlantic Metals and Plastic uses austenitic nickel-chromium alloys to manufacture resistance heating wire. The company is considering a new annealing-drawing process to reduce costs. If the new process will cost \$1.8 million now, how much must be saved each year to recover the investment in 6 years at an interest rate of 12% per year?
17. A green algae, *Chlamydomonas reinhardtii*, can produce hydrogen when temporarily deprived of sulphur for up to 2 days at a time. A small company needs to purchase equipment costing \$3.4 million to commercialize the process. If the company wants to earn a rate of return of 20% per year and recover its investments in 8 years, what must be the net value of the hydrogen produced each year?
18. How much money could RTT Environmental Services borrow to finance a site reclamation project if it expects revenues of \$280,000 per year over a 5-year cleanup period? Expenses associated with the project are expected to be \$90,000 per year. Assume the interest rate is 10% per year.

19. Western Playland and Aquatics Park spends \$75,000 each year in consulting services for ride inspection. New actuator element technology enables engineers to simulate complex computer-controlled movements in any direction. How much could the amusement park afford to spend now on the new technology if the annual consulting services will no longer be needed? Assume the park uses an interest rate of 15% per year and it wants to recover its investment in 5 years.
20. Under an agreement with the Internet Service Providers (ISPs) Association, SBC Communications reduced the price it charges ISPs to resell its high-speed digital subscriber line (DSL) service from \$458 to \$360 per year per customer line. A particular ISP, which has 20,000 customers, plans to pass 90% of the savings along to its customers. What is the total future worth of these savings over a 5-year horizon at an interest rate of 8% per year?
21. To improve crack detection in aircraft, the U.S. Air Force combined ultrasonic inspection procedures with laser heating to identify fatigue cracks. Early detection of cracks may reduce repair costs by as much as \$200,000 per year. What is the present worth of these savings over a 5-year period at an interest rate of 10% per year?
22. A recent engineering graduate passed the FE exam and was given a raise (beginning in year 1) of \$2000. At an interest rate of 8% per year, what is the present value of the \$2000 per year over her expected 35-year career?
23. Southwestern Moving and Storage wants to have enough money to purchase a new tractor-trailer in 3 years. If the unit will cost \$250,000, how much should the company set aside each year if the account earns 9% per year?

24. Vision Technologies, Inc., is a small company that uses ultra-wideband technology to develop devices that can detect objects (including people) inside buildings, behind walls, or below ground. The company expects to spend \$100,000 per year for labour and \$125,000 per year for supplies before a product can be marketed. At an interest rate of 15% per year, what is the total equivalent future amount of the company's expenses at the end of 3 years?
25. Find the numerical value of the following factors by (a) interpolation and (b) using the appropriate formula.
1. $(P/F, 18\%, 33)$
 2. $(A/G, 12\%, 54)$
26. Find the numerical value of the following factors by (a) interpolation and (b) using the appropriate formula.
1. $(F/A, 19\%, 20)$
 2. $(P/A, 26\%, 15)$
27. A cash flow sequence starts in year 1 at \$3000 and decreases by \$200 each year through year 10. (a) Determine the value of the gradient G ; (b) determine the amount of cash flow in year 8; and (c) determine the value of n for the gradient.
28. Cisco Systems expects sales to be described by the cash flow sequence $(6000 + 5k)$, where k is in years and cash flow is in millions. Determine (a) the value of the gradient G ; (b) the amount of cash flow in year 6; and (c) the value of n for the gradient if the cash flow ends in year 12.

29. For the cash flow sequence that starts in year 1 and is described by $900 - 100k$, where k represents years 1 through 5, (a) determine the value of the gradient G and (b) determine the cash flow in year 5.
30. Omega Instruments has budgeted \$300,000 per year to pay for certain ceramic parts over the next 5 years. If the company expects the cost of the parts to increase uniformly according to an arithmetic gradient of \$10,000 per year, what is it expecting the cost to be in year 1, if the interest rate is 10% per year?
31. Chevron-Texaco expects receipts from a group of stripper wells (wells that produce less than 10 barrels per day) to decline according to an arithmetic gradient of \$50,000 per year. This year's receipts are expected to be \$280,000 (i.e., end of year 1), and the company expects the useful life of the wells to be 5 years. (a) What is the amount of the cash flow in year 3, and (b) what is the equivalent uniform annual worth in years 1 through 5 of the income from the wells at an interest rate of 12% per year?
32. Income from cardboard recycling at Fort Bliss has been increasing at a constant rate of \$1000 in each of the last 3 years. If this year's income (i.e., end of year 1) is expected to be \$4000 and the increased income trend continues through year 5, (a) what will the income be 3 years from now (i.e., end of year 3) and (b) what is the present worth of the income over that 5-year period at an interest rate of 10% per year?
33. Amazon is considering purchasing a sophisticated computer system to "cube" a book's dimensions—measure its height, length, and width so that the proper box size will be used for shipment. This will save packing material, cardboard, and labour. If the savings will be \$150,000 the first year, \$160,000 the second year, and amounts increasing by \$10,000 each year for 8 years, what is the present worth of the system at an interest rate of 15% per year?

34. West Coast Marine and RV is considering replacing its wired pendant controllers on its heavy-duty cranes with new portable infrared keypad controllers. The company expects to achieve cost savings of \$14,000 the first year and amounts increasing by \$1500 each year thereafter for the next 4 years. At an interest rate of 12% per year, what is the equivalent annual worth of the savings?
35. Ford Motor Company was able to reduce by 80% the cost required for installing data acquisition instrumentation on test vehicles by using MTS-developed spinning wheel force transducers. (a) If this year's cost (i.e., end of year 1) is expected to be \$2000, what was the cost the year before installation of the transducers? (b) If the costs are expected to increase by \$250 each year for the next 4 years (i.e., through year 5), what is the equivalent annual worth of the costs (years 1 through 5) at an interest rate of 18% per year?
36. For the cash flow shown below, determine the value of G that will make the future worth in year 4 equal to \$6000 at an interest rate of 15% per year.
- | Year | 0 | 1 | 2 | 3 | 4 |
|-----------|---|--------|------------|-------------|-------------|
| Cash Flow | 0 | \$2000 | $2000 - G$ | $2000 - 2G$ | $2000 - 3G$ |
37. A major drug company anticipates that in future years it could be involved in litigation regarding perceived side effects of one of its antidepressant drugs. To prepare a "war chest," the company wants to have money available 6 years from now that has a present worth today of \$50 million. The company expects to set aside \$6 million the first year and uniformly increasing amounts in each of the next 5 years. If the company can earn 12% per year on the money it sets aside, by how much must it increase the amount set aside each year to achieve its goal?

38. A start-up direct marketer of car parts expects to spend \$1 million the first year for advertising, with amounts decreasing by \$100,000 each year. Income is expected to be \$4 million the first year, increasing by \$500,000 each year. Determine the equivalent annual worth in years 1 through 5 of the company's *net cash flow* at an interest rate of 16% per year.
39. Assume you were told to prepare a table of factor values (like those in the back of this book) for calculating the present worth of a geometric gradient series. Determine the first three values (i.e., for $n = 1, 2,$ and 3) for an interest rate of 10% per year and a rate of change g of 4% per year.
40. A chemical engineer planning for her retirement will deposit 10% of her salary each year into a high-technology stock fund. If her salary this year is \$60,000 (i.e., end of year 1) and she expects her salary to increase by 4% each year, what will be the present worth of the fund after 15 years if it earns 4% per year?
41. The effort required to maintain a scanning electron microscope is known to increase by a fixed percentage each year. A high-tech equipment maintenance company has offered it services for a fee of \$25,000 for the first year (i.e., end of year 1) with increases of 6% per year thereafter. If a biotechnology company wants to pay for a 3-year contract up front to take advantage of a temporary tax loophole, how much should it be willing to pay if it uses an interest rate of 15% per year?

42. Hughes Cable Systems plans to offer its employees a salary enhancement package that has revenue sharing as its main component. Specifically, the company will set aside 1% of total sales for year-end bonuses for all its employees. The sales are expected to be \$5 million the first year, \$6 million the second year, and amounts increasing by 20% each year for the next 5 years. At an interest rate of 10% per year, what is the equivalent annual worth in years 1 through 5 of the bonus package?
43. Determine how much money would be in a savings account that started with a deposit of \$2000 in year 1 with each succeeding amount increasing by 10% per year. Use an interest rate of 15% per year and a 7-year period.
44. The future worth in year 10 of a geometric gradient series of cash flows was found to be \$80,000. If the interest rate was 15% per year and the annual rate of increase was 9% per year, what was the cash flow amount in year 1?
45. Thomasville Furniture Industries offers several types of high-performance fabrics that are capable of withstanding chemicals as harsh as chlorine. A certain midwestern manufacturing company that uses fabric in several products has a report showing that the present worth of fabric purchases over a certain 5-year period was \$900,000. If the costs were known to geometrically increase by 5% per year during that time and the company used an interest rate of 15% per year for investments, what was the cost of the fabric in year 2?
46. Find the present worth of a series of investments that starts at \$1000 in year 1 and increases by 10% per year for 20 years. Assume the interest rate is 10% per year.

47. A northern California consulting firm wants to start saving money for replacement of network servers. If the company invests \$3000 at the end of year 1 and increases the amount invested by 5% each year, how much will be in the account 4 years from now if it earns interest at a rate of 8% per year?
48. A company that manufactures purgable hydrogen sulphide monitors is planning to make deposits such that each one is 5% larger than the preceding one. How large must the first deposit be (at the end of year 1) if the deposits extend through year 10 and the fourth deposit is \$1250? Use an interest rate of 10% per year.
49. What compound interest rate per year is equivalent to a 12% per year simple interest rate over a 15-year period?
50. A publicly traded consulting engineering firm pays a bonus to each engineer at the end of the year based on the company's profit for that year. If the company's initial investment was \$1.2 million, what rate of return has it made on its investment if each engineer's bonus has been \$3000 per year for the past 10 years? Assume the company has six engineers and that the bonus money represents 5% of the company's profit.
51. Danson Iron Works, Inc., manufactures angular contact ball bearings for pumps that operate in harsh environments. If the company invested \$2.4 million in a process that resulted in profits of \$760,000 per year for 5 years, what rate of return did the company make on its investment?

52. An investment of \$600,000 increased to \$1,000,000 over a 5-year period. What was the rate of return on the investment?
53. A small company that specializes in powder coating expanded its building and purchased a new oven that is large enough to handle automobile frames. The building and oven cost \$125,000, but new business from hot-rodders has increased annual income by \$520,000. If operating expenses for gas, materials, labour, etc., amount to \$470,000 per year, what rate of return will be made on the investment if only the cash flows that occur over the next 4 years are included in the calculation?
54. The business plan for a start-up company that manufactures multigas portable detectors showed equivalent annual cash flows of \$400,000 for the first 5 years. If the cash flow in year 1 was \$320,000 and the increase thereafter was \$50,000 per year, what interest rate was used in the calculation?
55. A new company that makes medium-voltage soft starters spent \$85,000 to build a new website. Net income was \$60,000 the first year, increasing by \$15,000 each year. What rate of return did the company make in its first 5 years?
56. A company that manufactures plastic control valves has a fund for equipment replacement that contains \$500,000. If the company spends \$75,000 per year on new equipment, how many years will it take to reduce the fund to less than \$75,000 at an interest rate of 10% per year?

57. An A&E firm is considering purchasing the building it currently occupies under a long-term lease because the owner of the building suddenly put it up for sale. The building is being offered at a price of \$170,000. Since the lease is already paid for this year, the next annual lease payment of \$30,000 isn't due until the end of this year. Because the A&E firm has been a good tenant, the owner has offered to sell to them for \$160,000. If the firm purchases the building with no down payment, how long will it be before the company recovers its investment at an interest rate of 12% per year?
58. An engineer who invested very well plans to retire now because she has \$2,000,000 in her ORP account. How long will she be able to withdraw \$100,000 per year (beginning 1 year from now) if her account earns interest at a rate of 4% per year?
59. A company that manufactures ultrasonic wind sensors invested \$1.5 million 2 years ago to acquire part ownership in an innovative chip-making company. How long would it take (from the date of the initial investment) for its share of the chip company to be worth \$3 million if that company is growing at a rate of 20% per year?
60. A certain mechanical engineer plans to retire when he has \$1.6 million in his brokerage account. If he started with \$100,000 in the account, how long will it be (from the time he started) before he can retire if the account makes a rate of return of 18% per year?
61. How many years will it take for a uniform annual deposit of size A to accumulate to 10 times the size of a single deposit if the rate of return is 10% per year?

62. How many years would it take for an investment of \$10,000 in year 1 with increases of 10% per year to have a present worth of \$1,000,000 at an interest rate of 7% per year?
63. You were told that a certain cash flow sequence started at \$3000 in year 1 and increased by \$2000 each year. How many years were required for the equivalent annual worth of the sequence to be \$12,000 at an interest rate of 10% per year?
64. A construction company has an option to purchase a certain bulldozer for \$61,000 at any time between now and 4 years from now. If the company plans to purchase the dozer 4 years from now, the equivalent present amount that the company is paying for the dozer at 6% per year interest is closest to
- A. \$41,230
 - B. \$46,710
 - C. \$48,320
 - D. Over \$49,000
65. The cost of tuition at a certain public university was \$160 per credit-hour 5 years ago. The cost today (exactly 5 years later) is \$235. The annual rate of increase is closest to
- A. 4%
 - B. 6%
 - C. 8%
 - D. 10%
66. The present worth of an increasing geometric gradient is \$23,632. The interest rate is 6% per year, and the rate of change is 4% per year. If the cash flow amount in year 1 is \$3000, the year in which the gradient ends is year
- A. 7
 - B. 9
 - C. 11
 - D. 12
67. The winner of a multistate megamillions lottery jackpot worth \$175 million was given the option of taking payments of \$7 million per year for 25 years, beginning 1 year now, or taking \$109.355 million now. At what interest rate are the two options equivalent to each other?
- A. 4%
 - B. 5%
 - C. 6%
 - D. 7%

68. A manufacturer of toilet flush valves wants to have \$2,800,000 available 10 years from now so that a new product line can be initiated. If the company plans to deposit money each year, starting 1 year from now, how much will it have to deposit each year at 6% per year interest in order to have the \$2,800,000 available immediately after the last deposit is made?
- A. Less than \$182,000
 - B. \$182,500
 - C. \$191,300
 - D. Over \$210,000
69. Rubbermaid Plastics Corp. invested \$10,000,000 in manufacturing equipment for producing small wastebaskets. If the company uses an interest rate of 15% per year, how much money would it have to earn each year if it wanted to recover its investment in 7 years?
- A. \$2,403,600
 - B. \$3,530,800
 - C. \$3,941,800
 - D. Over \$4,000,000
70. An engineer deposits \$8000 in year 1, \$8500 in year 2, and amounts increasing by \$500 per year through year 10. At an interest rate of 10% per year, the present worth in year 0 is closest to
- A. \$60,600
 - B. \$98,300
 - C. \$157,200
 - D. \$173,400
71. The amount of money that could be spent 7 years from now in lieu of spending \$50,000 now at an interest rate 18% per year is closest to
- A. \$15,700
 - B. \$159,300
 - C. \$199,300
 - D. \$259,100
72. A deposit of \$10,000 twenty years from now at an interest rate of 10% per year will have a present value closest to
- A. \$1720
 - B. \$1680
 - C. \$1590
 - D. \$1490
73. Income from sales of an injector-cleaning gasoline additive has been averaging \$100,000 per year. At an interest rate of 18% per year, the future worth of the income in years 1 through 5 is closest to
- A. \$496,100
 - B. \$652,200
 - C. \$715,420
 - D. Over \$720,000
74. Chemical costs associated with a packed-bed flue gas incinerator (for odour control) have been decreasing uniformly for 5 years because of increases in efficiency. If the cost in year 1 was \$100,000 and it decreased by \$5000 per year through year 5, the present worth of the costs at 10% per year is closest to
- A. Less than \$350,000
 - B. \$402,200
 - C. \$515,400
 - D. Over \$520,000

75. The future worth in year 10 of a present investment of \$20,000 at an interest rate of 12% per year is closest to
- A. \$62,120
 - B. \$67,560
 - C. \$71,900
 - D. \$81,030
76. A manufacturing company borrows \$100,000 with a promise to repay the loan with equal annual payments over a 5-year period. At an interest rate of 12% per year, the annual payment will be closest to
- A. \$23,620
 - B. \$27,740
 - C. \$29,700
 - D. \$31,800
77. Simpson Electronics wants to have \$100,000 available in 3 years to replace a production line. The amount of money that would have to be deposited each year at an interest rate of 12% per year would be closest to
- A. \$22,580
 - B. \$23,380
 - C. \$29,640
 - D. Over \$30,000
78. A civil engineer deposits \$10,000 per year into a retirement account that achieves a rate of return of 12% per year. The amount of money in the account at the end of 25 years is closest to
- A. \$670,500
 - B. \$902,800
 - C. \$1,180,900
 - D. \$1,333,300
79. The future worth (in year 8) of \$10,000 in year 3, \$10,000 in year 5, and \$10,000 in year 8 at an interest rate of 12% per year is closest to
- A. \$32,100
 - B. \$39,300
 - C. \$41,670
 - D. \$46,200
80. Maintenance costs for a regenerative thermal oxidizer have been increasing uniformly for 5 years. If the cost in year 1 was \$8000 and it increased by \$900 per year through year 5, the present worth of the costs at an interest rate of 10% per year is closest to
- A. \$31,670
 - B. \$33,520
 - C. \$34,140
 - D. Over \$36,000
81. An investment of \$100,000 resulted in income of \$20,000 per year for 10 years. The rate of return on the investment was closest to
- A. 15%
 - B. 18%
 - C. 21%
 - D. 25%
82. A construction company invested \$60,000 in a new bulldozer. If the income from temporary leasing of the bulldozer is expected to be \$15,000 per year, the length of time required to recover the investment at an interest rate of 18% per year is closest to
- A. 5 years
 - B. 8 years
 - C. 11 years
 - D. 13 years

83. What is the meaning of each of the following factors?
- (a) $(F/A, i, n)$
 - (b) $(P/G, i, n)$
 - (c) $(A/P, i, n)$
84. For a firm with limited liability, what are the theoretically possible minimum and maximum RORs?
85. A Canadian company decides to deposit X dollars in a bank account which pays compound interest at a rate of 6% per year. The interest from this account is to be used to pay for 20 scholarships per year for the next ten years. Each scholarship is \$5,000 in year 1 and will grow by 3% per year thereafter. What is X ?
86. Find the perpetuity equivalent to the annuity which pays 1200 in each of five consecutive years and the first payment occurs at the end of year 1. Assume the interest rate is 12% per year.
87. A firm is considering the purchase of machine today that will yield savings of 17,000 one year from today and then the saving will increase by 5,000 per year thereafter. The operating costs of the machine will be 9,000 in year 1 and then will increase by 5,000 per year thereafter.
- (a) Which pattern, if any, does the savings cash flow series exhibit?
 - (b) If the machine is purchased, what will be the savings of the firm in year 6?
 - (c) If the firm manages to recover its investment in 20 years and the price of the machine today is 160,000, what is the yearly rate of return the firm achieved? (Use linear interpolation.)
 - (d) If the interest rate at which the firm can borrow is 10%, what is the maximum amount the firm would be willing to pay for the machine?

88. What is the maximum present value of an annuity which pays A dollars per year starting at the end of year 1 given the interest rate per period is i ?

ch02 Key

4. $(F/A, 15\%, 18) = 75.8364$; 5. $(A/P, 30\%, 15) = 0.30598$

1. 1. $(F/P, 8\%, 25) = 6.8485$; 2. $(P/A, 3\%, 8) = 7.0197$; 3. $(P/G, 9\%, 20) = 61.7770$;

= \$183,512

= $140,000(1.3108)$

2. $P = 140,000(F/P, 7\%, 4)$

= \$266,200

= $200,000(1.3310)$

3. $F = 200,000(F/P, 10\%, 3)$

= \$381,300

= $600,000(0.6355)$

4. $P = 600,000(P/F, 12\%, 4)$

= \$788,110 per year

(b) Recall amount = $78,811/0.10$

= \$78,811

= $225,000(0.35027)$

5. (a) $A = 225,000(A/P, 15\%, 4)$

= \$477,825

= $150,000(3.1855)$

6. $F = 150,000(F/P, 18\%, 7)$

= \$53.865 million

= $75(0.7182)$

7. $P = 75(P/F, 18\%, 2)$

= \$79,720

= $100,000(0.7972)$

8. $P = 100,000((P/F, 12\%, 2)$

= \$2,006,000

= $1,700,000(1.18)$

9. $F = 1,700,000(F/P, 18\%, 1)$

= \$82,069

= $162,000(0.5066)$

10. $P = 162,000(P/F, 12\%, 6)$

$$= \$ 64,925$$

$$= 125,000(0.5149)$$

$$11. P = 125,000(P/F, 14\%, 5)$$

$$= \$16,553$$

$$= 9000(0.8264) + 8000(0.7513) + 5000(0.6209)$$

$$12. P = 9000(P/F, 10\%, 2) + 8000(P/F, 10\%, 3) + 5000(P/F, 10\%, 5)$$

$$= \$141,193$$

$$= 125,000(0.8573) + 50,000(0.6806)$$

$$13. P = 1,250,000(0.10)(P/F, 8\%, 2) + 500,000(0.10)(P/F, 8\%, 5)$$

$$= \$79,086$$

$$= 65,000(1.2167)$$

$$14. F = 65,000(F/P, 4\%, 5)$$

$$= \$157,988$$

$$= 75,000(2.1065)$$

$$15. P = 75,000(P/A, 20\%, 3)$$

$$= \$437,814$$

$$= 1.8(0.24323)$$

$$16. A = 1.8(A/P, 12\%, 6)$$

$$= \$886,074$$

$$= 3.4(0.26061)$$

$$17. A = 3.4(A/P, 20\%, 8)$$

$$= \$720,252$$

$$= 190,000(3.7908)$$

$$18. P = (280,000 - 90,000)(P/A, 10\%, 5)$$

$$= \$251,415$$

$$= 75,000(3.3522)$$

$$19. P = 75,000(P/A, 15\%, 5)$$

$$= \$10,348,682$$

$$= 1,764,000(5.8666)$$

$$20. F = (458 - 360)(20,000)(0.90)(F/A, 8\%, 5)$$

$$= \$758,160$$

$$= 200,000(3.7908)$$

$$21. P = 200,000((P/A, 10\%, 5)$$

$$= \$23,309$$

$$= 2000(11.6546)$$

$$22. P = 2000(P/A, 8\%, 35)$$

$$= \$76,263$$

$$= 250,000(0.30505)$$

$$23. A = 250,000(A/F, 9\%, 3)$$

$$= \$781,313$$

$$= 225,000(3.4725)$$

$$24. F = (100,000 + 125,000)(F/A, 15\%, 3)$$

$$= 8.2143$$

$$2. (A/G, 12\%, 54) = \{(1/0.12) - 54/[(1 + 0.12)^{54} - 1]\}$$

$$= 0.0042$$

$$(b) 1. (P/F, 18\%, 33) = 1/(1 + 0.18)^{33}$$

$$= 8.2120$$

$$(A/G, 12\%, 54) = 8.1597 + 0.05232$$

$$x = 0.05232$$

$$4/5 = x/0.0654$$

$$2. \text{Interpolate between } n = 50 \text{ and } n = 55:$$

$$= 0.0043$$

$$(P/F, 18\%, 33) = 0.0050 - 0.0007$$

$$x = 0.0007$$

$$1/2 = x/0.0014$$

$$25. (a) 1. \text{Interpolate between } n = 32 \text{ and } n = 34:$$

$$= 3.7261$$

$$2. (P/A, 26\%, 15) = [(1 + 0.26)^{15} - 1]/[0.26(1 + 0.26)^{15}]$$

$$= 169.6811$$

$$(b) 1. (F/A, 19\%, 20) = [(1 + 0.19)^{20} - 0.19]/0.19$$

$$= 3.7411$$

$$(P/A, 26\%, 15) = 3.8593 - 0.11822$$

$$x = 0.11822$$

$$1/5 = x/0.5911$$

$$2. \text{Interpolate between } i = 25\% \text{ and } i = 30\% \text{ at } n = 15:$$

$$= 166.658$$

$$(F/A, 19\%, 20) = 146.6280 + 20.03$$

$$x = 20.03$$

$$1/2 = x/40.06$$

$$26. (a) 1. \text{Interpolate between } i = 18\% \text{ and } i = 20\% \text{ at } n = 20:$$

$$27. (a) G = \$200 \text{ (b) } CF_8 = \$1600 \text{ (c) } n = 10$$

$$28. (a) G = \$5 \text{ million (b) } CF_6 = \$6030 \text{ million (c) } n = 12$$

$$29. (a) G = \$100 \text{ (b) } CF_5 = 900 - 100(5) = \$400$$

$$A = \$281,899$$

$$300,000 = A + 10,000(1.8101)$$

$$30. 300,000 = A + 10,000(A/G, 10\%, 5)$$

$$= \$191,270$$

$$= 280,000 - 50,000(1.7746)$$

$$(b) A = 280,000 - 50,000(A/G, 12\%, 5)$$

$$= \$180,000$$

$$31. (a) CF_3 = 280,000 - 2(50,000)$$

$$= \$22,025$$

$$= 4000(3.7908) + 1000(6.8618)$$

$$(b) P = 4000(P/A, 10\%, 5) + 1000(P/G, 10\%, 5)$$

$$= \$6000$$

$$32. (a) CF_3 = 4000 + 2(1000)$$

$$= \$797,902$$

$$= 150,000(4.4873) + 10,000(12.4807)$$

$$33. P = 150,000(P/A, 15\%, 8) + 10,000(P/G, 15\%, 8)$$

$$= \$16,038$$

$$= 14,000 + 1500(1.3589)$$

34. $A = 14,000 + 1500(A/G, 12\%, 4)$

$$= \$2418$$

$$= 2000 + 250(1.6728)$$

(b) $A = 2000 + 250(A/G, 18\%, 5)$

$$= \$10,000$$

35. (a) $\text{Cost} = 2000/0.2$

$$G = \$601.94$$

$$6000(0.5718) = 2000(2.8550) - G(3.7864)$$

$$6000(P/F, 15\%, 4) = 2000(P/A, 15\%, 4) - G(P/G, 15\%, 4)$$

36. Convert future to present and then solve for G using P/G factor:

$$G = \$2,836,622$$

$$50 = 6(4.1114) + G(8.9302)$$

37. $50 = 6(P/A, 12\%, 6) + G(P/G, 12\%, 6)$

$$= \$4,023,600$$

$$= [4 + 0.5(1.7060)] - [1 - 0.1(1.7060)]$$

38. $A = [4 + 0.5(A/G, 16\%, 5)] - [1 - 0.1(A/G, 16\%, 5)]$

For $n = 3$: $\{1 - [(1 + 0.04)^3 / (1 + 0.10)^3]\} / (0.10 - 0.04) = 2.5812$

For $n = 2$: $\{1 - [(1 + 0.04)^2 / (1 + 0.10)^2]\} / (0.10 - 0.04) = 1.7686$

39. For $n = 1$: $\{1 - [(1 + 0.04)^1 / (1 + 0.10)^1]\} / (0.10 - 0.04) = 0.9091$

$$= \$86,538$$

40. For $g = i$, $P = 60,000(0.1)[15/(1 + 0.04)]$

$$= \$60,247$$

41. $P = 25,000\{1 - [(1 + 0.06)^3 / (1 + 0.15)^3]\} / (0.15 - 0.06)$

$$= \$71,892$$

$$= 272,525(0.26380)$$

$$A = 272,525(A/P, 10\%, 5)$$

$$= \$272,525$$

$$= 50,000\{5.4505\}$$

$$P = 5,000,000(0.01)\{1 - [(1 + 0.20)^5 / (1 + 0.10)^5]\} / (0.10 - 0.20)$$

42. Find P and then convert to A.

= \$28,452
 = 10,696(2.6600)
 $F = 10,696(F/P, 15\%, 7)$
 = \$10,696
 = 2000(5.3481)
 $P = 2000\{1 - [(1 + 0.10)^7 / (1 + 0.15)^7]\} / (0.15 - 0.10)$
 43. Find P and then convert to F.

A = \$2,860
 $19,776 = A\{6.9137\}$
 $19,776 = A\{1 - [(1 + 0.09)^{10} / (1 + 0.15)^{10}]\} / (0.15 - 0.09)$
 = \$19,776
 = 80,000(0.2472)
 $P = 80,000(P/F, 15\%, 10)$
 44. First convert future worth to P, then use P_g equation to find A.

= \$258,576
 Cost in year 2 = 246,263(1.05)
 A = \$246,263 in year 1
 $900,000 = A\{3.6546\}$
 $900,000 = A\{1 - [(1 + 0.05)^5 / (1 + 0.15)^5]\} / (0.15 - 0.05)$
 45. Find A in year 1 and then find next value.

= \$18,182
 = 1000[18.1818]
 46. $g = i$: $P = 1000[20 / (1 + 0.10)]$

= \$14,498
 = 10,657(1.3605)
 $F = 10,657(F/P, 8\%, 4)$
 = \$10,657
 = 3000{3.5522}
 $P = 3000\{1 - [(1 + 0.05)^4 / (1 + 0.08)^4]\} / (0.08 - 0.05)$
 47. Find P and then convert to F.

= \$1079.80
 First deposit = 1250/(1 + 0.05)³
 48. Decrease deposit in year 4 by 5% per year for three years to get back to year 1.

$$i = 4.0\%$$

$$\text{Compound: } 1.8 = (1 + i)^{15}$$

$$49. \text{ Simple: Total interest} = (0.12)(15) = 180\%$$

$$i = 27.3\% \text{ (Excel)}$$

$$(P/A, i, 10) = 3.3333$$

$$1,200,000 = 360,000(P/A, i, 10)$$

$$50. \text{ Profit/year} = 6(3000)/0.05 = \$360,000$$

$$i = 17.6\% \text{ (Excel)}$$

$$(P/A, i, 5) = 3.15789$$

$$51. 2,400,000 = 760,000(P/A, i, 5)$$

$$i = 10.8\% \text{ (Excel)}$$

$$(F/P, i, 5) = 1.6667$$

$$52. 1,000,000 = 600,000(F/P, i, 5)$$

$$i = 21.9\% \text{ (Excel)}$$

$$(P/A, i, 4) = 2.5000$$

$$53. 125,000 = (520,000 - 470,000)(P/A, i, 4)$$

$$i = 22.6\%$$

Interpolate between $i = 22\%$ and $i = 24\%$

$$(A/G, i, 5) = 1.6000$$

$$54. 400,000 = 320,000 + 50,000(A/G, i, 5)$$

$$i = 38.9\% \text{ (Excel)}$$

Solve for i by trial and error or spreadsheet:

$$55. 85,000 = 30,000(P/A, i, 5) + 8,000(P/G, i, 5)$$

From 10% table, n is between 11 and 12 years; therefore, $n = 11$ years

$$(P/A, 10\%, n) = 6.6667$$

$$56. 500,000 = 75,000(P/A, 10\%, n)$$

From 12% table, n is between 9 and 10 years; therefore, $n = 10$ years

$$(P/A, 12\%, n) = 5.3333$$

$$57. 160,000 = 30,000(P/A, 12\%, n)$$

Therefore, $n = 41$ years

From 4% table, n is between 40 and 45 years; by spreadsheet, $42 > n > 41$

$$(P/A, 4\%, n) = 20.000$$

$$58. 2,000,000 = 100,000(P/A, 4\%, n)$$

From 20% table, n is between 3 and 4 years; therefore, n = 4 years
 $(P/F, 20\%, n) = 0.5000$
59. $1,500,000 = 3,000,000(P/F, 20\%, n)$

From 18% table, n is between 16 and 17 years; therefore, n = 17 years
 $(P/F, 18\%, n) = 0.0625$
60. $100,000 = 1,600,000(P/F, 18\%, n)$

From 10% table, n is between 7 and 8 years; therefore, n = 8 years
 $(F/A, 10\%, n) = 10.000$
61. $10A = A(F/A, 10\%, n)$

By trial and error, n = is between 50 and 51; therefore, n = 51 years
62. $1,000,000 = 10,000\{1 - [(1 + 0.10)^n / (1 + 0.07)^n]\} / (0.07 - 0.10)$

From 10% table, n is between 12 and 13 years; therefore, n = 13 years
 $(A/G, 10\%, n) = 4.5000$
63. $12,000 = 3000 + 2000(A/G, 10\%, n)$

64. C

65. C

66. B

67. A

68. D

69. A

70. A

71. B

72. D

73. C

74. A

75. A

76. B

77. C

78. D

79. C

80. D

81. A

82. B

- (c) The per-period amount in a uniform series of n consecutive payments such that the present value of the series is 1 dollar given the per-period interest is i .
- (b) The present value of an arithmetic gradient series of n payments with base amount equal to zero, a gradient of 1 dollar given the period interest rate is i .
83. (a) The future value (at the end of period n) of a uniform series where each of n equal consecutive payments is 1 dollar and the per-period interest rate is i .

84. The minimum ROR is -100% or simply -1, indicating that all the invested money is lost. The maximum ROR can be any positive number.

$$X = P_s + X/(1.06)^{10} \Rightarrow X = 7,548,219.90$$

The present value of the amount deposited is simply X and it must be equal to the sum of the present value of the scholarship series and the present value of the X dollars that will still be in the account after 10 years. Thus we have

$$P_s = 100,000 [1 - (1.03/1.06)^{10}] / (.06 - .03) = 3,333,333.33$$

85. The scholarship cash flows form a geometric series with base amount $A = (5000)(20) = 100,000$ and with $g = .03$. Thus the present value of the scholarship series is

$$86. A/.12 = 1200(P/A, 12\%, 5) \Rightarrow A = (.12)(1200)(3.60478) \Rightarrow A = 519.088$$

$$(d) P = 8,000(P/A, 10\%, 20) = (8000)(8.5136) = 68,108.80$$

Using linear interpolation and the table values $(P/A, 10\%, 20) = 8.51356$ and $(P/A, 11\%, 20) = 7.96333$, we find $i = 10.93\%$.

(c) Since the gradients of savings and costs cancel each other out, the yearly amount of net savings is $17,000 - 9,000 = 8,000$. Thus we have to solve the following equation for the interest rate i : $64,000 = 8,000 (P/A, i, 20) \Rightarrow (P/A, i, 20) = 8$

$$(b) \text{ Savings in year 6} = 17,000 + (6 - 1)(5000) = 42,000.$$

87. (a) This is an arithmetic gradient series with base amount $A = 17,000$ and gradient $G = 5,000$.

88. The present value of the annuity is given by $P = (A/i)[1 - 1/(1 + i)^n]$. We can make the annuity more valuable by increasing n , the number of payments. As n becomes very large, i.e., as n goes to infinity, the term $1/(1 + i)^n$ tends to zero. Thus the maximum present value of the annuity is equal to the present value of a perpetuity, namely, A/i .

ch02 Summary

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