CHAPTER 1
Introduction to Corporate Finance

The values shown in the solutions may be rounded for display purposes. However, the answers were derived using a spreadsheet without any intermediate rounding.

Answers to Problem Sets

1. a. real

   b. executive airplanes

   c. brand names

   d. financial

   e. bonds

   *f. investment or capital budgeting

   *g. capital budgeting or investment

   h. financing

   *Note that f and g are interchangeable in the question.

Est time: 01-05

2. A trademark, a factory, undeveloped land, and your work force (c, d, e, and g) are all real assets. Real assets are identifiable as items with intrinsic value. The others in the list are financial assets, that is, these assets derive value because of a contractual claim.

Est time: 01-05

3. a. Financial assets, such as stocks or bank loans, are claims held by investors. Corporations sell financial assets to raise the cash to invest in real assets such as plant and equipment. Some real assets are intangible.

   b. Capital budgeting means investment in real assets. Financing means raising the cash for this investment.

   b. The shares of public corporations are traded on stock exchanges and can be purchased by a wide range of investors. The shares of closely held corporations are not publicly traded and are held by a small group of private investors.

   d. Unlimited liability: Investors are responsible for all the firm's debts. A sole proprietor has unlimited liability. Investors in corporations have limited liability. They can lose their investment, but no more.

Est time: 01 05

4. Items c and d apply to corporations. Because corporations have perpetual life, ownership can be transferred without affecting operations, and managers can be fired with no effect on ownership. Other forms of business may have unlimited liability and limited life.

Est time: 01-05

5. Separation of ownership facilitates the key attributes of a corporation, including limited liability for investors, transferability of ownership, a separate legal personality of the corporation, and delegated centralized management. These four attributes provide substantial benefit for investors, including the ability to diversify their investment among many uncorrelated returns—a very valuable tool explored in later chapters. Also, these attributes allow investors to quickly exit, enter, or short sell an investment, thereby generating an active liquid market for corporations.

   However, these positive aspects also introduce substantial negative externalities as well. The separation of ownership from management typically leads to agency problems, where managers prefer to consume private perks or make other decisions for their private benefit—rather than maximize shareholder wealth. Shareholders tend to exercise less oversight of each individual investment as their diversification increases. Finally, the corporation's separate legal personality makes it difficult to enforce accountability if they externalize costs onto society.

Est time: 01-05

6. Shareholders will only vote to maximize shareholder wealth. Shareholders can modify their pattern of consumption through borrowing and lending, match risk preferences, and hopefully balance their own checkbooks (or hire a qualified professional to help them with these tasks).

Est time: 01-05

7. If the investment increases the firm's wealth, it will increase the value of the firm's shares. Ms. Espinoza could then sell some or all of these more valuable shares in order to provide for her retirement income.

Est time: 01-05

8. a. Assuming that the encabulator market is risky, an 8% expected return on the F&H encabulator investments may be inferior to a 4% return on U.S. government securities, depending on the relative risk between the two assets.

   b. Unless their financial assets are as safe as U.S. government securities (i.e. risk-free), their cost of capital would be higher. The CFO could consider what the expected return is on assets with similar risk.

Est time: 06-10

9. As the Goldman Sachs example illustrates, the firm's value typically falls by significantly more than the amount of any fines and settlements. The firm's reputation suffers in a financial scandal, and this can have a much larger effect than the fines levied. Investors may also wonder whether all of the misdeeds have been contained.

Est time: 01-05

10. Answers will vary. The principles of good corporate governance discussed in the chapter should apply. In addition, the following mechanisms help to keep agency issues in check:
    - Laws and regulations that protect outside investors from self-dealing by insiders.

- Disclosure requirements and accounting standards that keep public firms reasonably transparent.
- Monitoring by banks and other financial intermediaries.
- Monitoring by boards of directors.
- The threat of takeover (although takeovers are very rare in some countries).
- Compensation tied to earnings and stock price.

Est time: 06-10

11. Answers will vary depending on selection:
Example: Short selling→ Short selling can be an important component of efficient markets, by keeping prices in line with a corporation's intrinsic value. Because short-selling bears risk and short-sellers are required to post margin if prices move too far against them, the practice is rarely unethical. Perhaps this practice crosses the line if unscrupulous actors are able to defame or destroy a company's value, and use short selling to profit as a result.

Example: Corporate Raiders→ Corporate raiders or activist investors similarly serve a valuable role in the market for corporations. However, this practice can result in the destruction of value if performed carelessly. Often the target company is loaded with a heavy debt burden from the acquisition. The practice may cross into unethical territory if the raiders begin to make decisions that benefit their position, such as taking extreme risks in line with their upside exposure, at the expense of the limited partners in the venture and at the expense of the other key stakeholders of the operation (employees, customers, governments, etc).

Est time: 06-10

12. Managers would act in shareholders' interests because they have a legal duty to act in their interests. Managers may also receive compensation, either bonuses or stock and option payouts whose value is tied (roughly) to firm performance. Managers may fear personal reputational damage that would result from not acting in shareholders' interests. And managers can be fired by the board of directors, which in turn is elected by shareholders. If managers still fail to act in shareholders' interests, shareholders may sell their shares, lowering the stock price and potentially creating the possibility of a takeover, which can again lead to changes in the board of directors and senior management.

Est time: 01-05

13. Managers that are insulated from takeovers may be more prone to agency problems and therefore more likely to act in their own interests rather than in shareholders'. If a firm instituted a new takeover defense, we might expect to see the value of its shares decline as agency problems increase and less shareholder value maximization occurs. The counterargument is that defensive measures allow managers to negotiate for a higher purchase price in the face of a takeover bid—to the benefit of shareholder value.

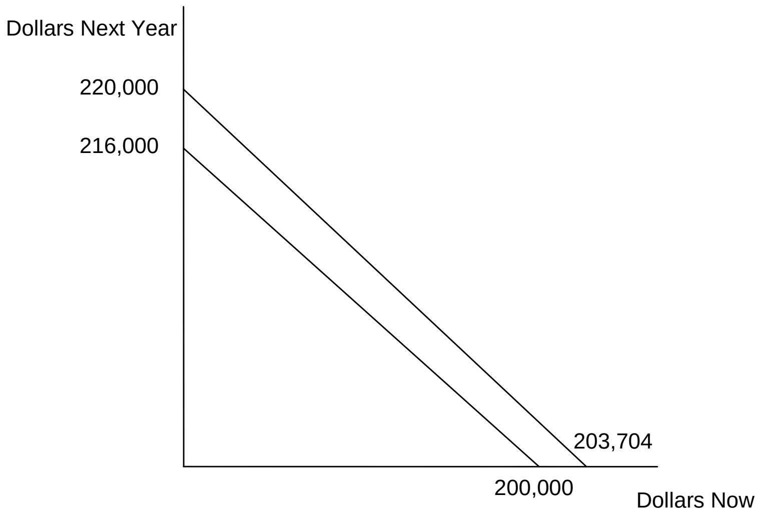
Est time: 01-05

Appendix Questions:

1. Both would still invest in their friend's business. A invests and receives $121,000 for his investment at the end of the year—which is greater than the $120,000 that would be received from lending at 20% ($100,000 × 1.20 = $120,000). G also invests, but borrows against the $121,000 payment, and thus receives $100,833 ($121,000 / 1.20) today.

Est time: 01-05

2. a. He could consume up to $200,000 now (forgoing all future consumption) or up to $216,000 next year ($200,000 × 1.08, forgoing all consumption this year). He should invest all of his wealth to earn $216,000 next year. To choose the same consumption (*C*) in both years, *C* = ($200,000 – *C*) × 1.08 = $103,846.



b. He should invest all of his wealth to earn $220,000 ($200,000 × 1.10) next year. If he consumes all this year, he can now have a total of $203,703.70 ($200,000 × 1.10/1.08) this year or $220,000 next year. If he consumes *C* this year, the amount available for next year's consumption is ($203,703.70 – *C*) × 1.08. To get equal consumption in both years, set the amount consumed today equal to the amount next year:

C = ($203,703.70 – *C*) × 1.08
C = $105,769.20

Est time: 06-10

CHAPTER 2

How to Calculate Present Values

The values shown in the solutions may be rounded for display purposes. However, the answers were derived using a spreadsheet without any intermediate rounding.

Answers to Problem Sets

1. a. False. The opportunity cost of capital varies with the risks associated with each individual project or investment. The cost of borrowing is unrelated to these risks.

   b. True. The opportunity cost of capital depends on the risks associated with each project and its cash flows.

   c. True. The opportunity cost of capital is dependent on the rates of returns shareholders can earn on the own by investing in projects with similar risks

   d. False. Bank accounts, within FDIC limits, are considered to be risk-free. Unless an investment is also risk-free, its opportunity cost of capital must be adjusted upward to account for the associated risks.

Est time: 01-05

2. The opportunity cost of capital refers to the rate of return a firm's shareholders could earn on their own by investing at the same level of risk. Thus, when a firm considers a new project, it is the risk level of the project that determines opportunity cost of capital for that project.

Est time: 01-05

3. a. In the first year, you will earn $1,000 × 0.04 = $40.00

   b. In the second year, you will earn $1,040 × 0.04 = $41.60

   c. By the end of the ninth year, you will accrued a principle of $1,040 × ($1.04^9$) = $1,423.31. Therefore, in the Tenth year, you will earn $1,423.31 × 0.04 = $56.93

Est time: 01-05

4. The "Rule of 72" is a rule of thumb that says with discrete compounding the time it takes for an investment to double in value is roughly 72/interest rate (in percent). Therefore, without a calculator, the Rule of 72 estimate is:

   Time to double = 72 / r

   Time to double = 72 / 4

   Time to double = 18 years , so less than 25 years.

   If you did have a calculator handy, this estimate is verified as followed:

   $C_t = \text{PV} \times (1 + r)^t$
   $t = \ln 2 / \ln 1.04$
   t = 17.67 years

Est time: 01-05

5. a. Using the inflation adjusted 1958 price of $1,060, the real return per annum is:

$\$450{,}300{,}000 = \$1{,}060 \times (1 + r)^{(2017-1958)}$

$r = [\$450{,}300{,}000/\$1{,}060]^{(1/59)} - 1 = 0.2456$ or 24.56% per annum

b. Using the inflation adjusted 1519 price of $575,000, the real return per annum is:

$\$450{,}300{,}000 = \$575{,}000 \times (1 + r)^{(2017-1519)}$

$r = [\$450{,}300{,}000/\$575{,}000]^{(1/498)} - 1 = 0.0135$ or 1.35% per annum

Est time: 01-05

6. $C_t = PV \times (1 + r)^t$
$C_8 = \$100 \times 1.15^8$
$C_8 = \$305.90$

Est time: 01-05

7. a. $C_t = PV \times (1 + r)^t$
$C_{10} = \$100 \times 1.06^{10}$
$C_{10} = \$179.08$

b. $C_t = PV \times (1 + r)^t$
$C_{20} = \$100 \times 1.06^{20}$
$C_{20} = \$320.71$

c. $C_t = PV \times (1 + r)^t$
$C_{10} = \$100 \times 1.04^{10}$
$C_{10} = \$148.02$

d. $C_t = PV \times (1 + r)^t$
$C_{20} = \$100 \times 1.04^{20}$
$C_{20} = \$219.11$

Est time: 01-05

8. $C_t = PV \times (1 + r)^t$
$C_{2016} = \$100 \times 1.34^5$
$C_{2016} = \$432.04$

Est time: 01-05

9. a. $PV = C_t \times DF_t$
$DF_t = \$125 / \$139$
$DF_t = .8993$

b. $C_t = PV \times (1 + r)^t$
$\$139 = \$125 \times (1+r)^5$
$r = [\$139/\$125]^{(1/5)} - 1 = 0.0215$ or 2.15%

Est time: 01-05

10. $PV = C_t / (1 + r)^t$
$PV = \$374 / 1.09^9$
$PV = \$172.20$

Est time: 01-05

11. $PV = C_1 / (1 + r)^1 + C_2 / (1 + r)^2 + C_3 / (1 + r)^3$
$PV = \$432 / 1.15 + \$137 / 1.15^2 + \$797 / 1.15^3$
$PV = \$1,003.28$

NPV = PV – investment
NPV = $1,003.28 – 1,200
NPV = –$196.72

Est time: 01-05

12. The basic present value formula is: $PV = C / (1 + r)^t$

a. $PV = \$100 / 1.01^{10}$
$PV = \$90.53$

b. $PV = \$100 / 1.13^{10}$
$PV = \$29.46$

c. $PV = \$100 / 1.25^{15}$
$PV = \$3.52$

d. $PV = C_1 / (1 + r) + C_2 / (1 + r)^2 + C_3 / (1 + r)^3$
$PV = \$100 / 1.12 + \$100 / 1.12^2 + \$100 / 1.12^3$
$PV = \$240.18$

Est time: 01-05

13. $$NPV = \sum_{t=0}^{10} \frac{C_t}{(1.12)^t}$$

$NPV = -\$380,000 + \$50,000 / 1.12 + \$57,000 / 1.12^2 + \$75,000 / 1.12^3 + \$80,000 / 1.12^4 + \$85,000 / 1.12^5 + \$92,000 / 1.12^6 + \$92,000 / 1.12^7 + \$80,000 / 1.12^8 + \$68,000 / 1.12^9 + \$50,000 / 1.12^{10}$

NPV = $23,696.15

Est time: 01-05

14. a. $NPV = -\text{Investment} + C \times ((1 / r) - \{1 / [r(1 + r)^t]\})$
$NPV = -\$800,000 + \$170,000 \times ((1 / .14) - \{1 / [.14(1.14)^{10}]\})$
NPV = $86,739.66

b. After five years, the factory's value will be the present value of the five remaining year's of cash flows.

$PV = \$170{,}000 \times ((1 / .14) - \{1 / [.14(1.14)^{(10-5)}]\})$

$PV = \$583{,}623.76$

Est time: 01-05

15. Use the formula: $NPV = -C_0 + C_1 / (1 + r) + C_2 / (1 + r)^2$

$NPV_{5\%} = -\$700{,}000 + \$30{,}000 / 1.05 + \$870{,}000 / 1.05^2$

$NPV_{5\%} = \$117{,}687.07$

$NPV_{10\%} = -\$700{,}000 + \$30{,}000 / 1.10 + \$870{,}000 / 1.10^2$

$NPV_{10\%} = \$46{,}280.99$

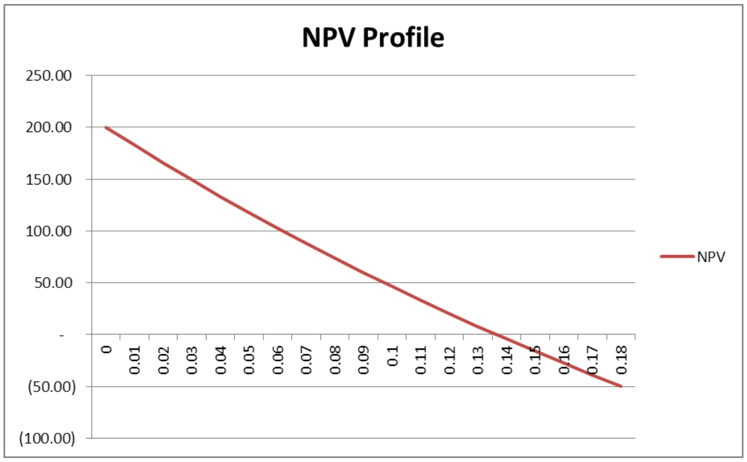
$NPV_{15\%} = -\$700{,}000 + \$30{,}000 / 1.15 + \$870{,}000 / 1.15^2$

$NPV_{15\%} = -\$16{,}068.05$

The figure below shows that the project has a zero NPV at about 13.65%.

$NPV_{13.65\%} = -\$700{,}000 + \$30{,}000 / 1.1365 + \$870{,}000 / 1.1365^2$

$NPV_{13.65\%} = -\$36.83$



Est time: 06-10

16. a. $NPV = -\text{Investment} + PVA_{\text{operating cash flows}} - PV_{\text{refits}} + PV_{\text{scrap value}}$

$NPV = -\$8{,}000{,}000 + (\$5{,}000{,}000 - 4{,}000{,}000) \times ((1 / .08) - \{1 / [.08(1.08)^{15}]\}) -$
$(\$2{,}000{,}000 / 1.08^5 + \$2{,}000{,}000 / 1.08^{10}) + \$1{,}500{,}000 / 1.08^{15}$

$NPV = -\$8{,}000{,}000 + 8{,}559{,}479 - 2{,}287{,}553 + 472{,}863$

$NPV = -\$1{,}255{,}212$

b. The cost of borrowing does not affect the NPV because the opportunity cost of capital depends on the use of the funds, not the source.

Est time: 06-10

17. NPV = C / r – investment
NPV = \$138 / .09 − \$1,548
NPV = −\$14.67

Est time: 01-05

18. One way to approach this problem is to solve for the present value of:

(1) \$100 per year for 10 years, and
(2) \$100 per year in perpetuity, with the first cash flow at year 11.

If this is a fair deal, these present values must be equal, and thus we can solve for the interest rate (r).

The present value of \$100 per year for 10 years is:

$PV = C \times ((1 / r) - \{1 / [r(1 + r)^t]\})$

$PV = \$100 \times ((1 / r) - \{1 / [r(1 + r)^{10}]\})$

The present value, as of year 0, of \$100 per year forever, with the first payment in year 11, is:

$PV = (C / r) / (1 + r)^t$

$PV = (\$100 / r) / (1 + r)^{10}$

Equating these two present values, we have:

$\$100 \times ((1 / r) - \{1 / [r(1 + r)^{10}]\}) = (\$100 / r) / (1 + r)^{10}$

Using trial and error or algebraic solution, we find that r = 7.18%.

Est time: 06-10

19. PV = C / (r – g)
PV = \$4 / (.14 − .04)
PV = \$40

Est time: 01-05

20. a. PV = C / r
PV = \$1 / .10

$PV = \$10$

b. $PV_7 = (C_8 / r)$
$PV_{0\ approx} = (C_8 / r) / 2$
$PV_{0\ approx} = (\$1 / .10) / 2$
$PV_{0\ approx} = \$5$

c. A perpetuity paying $1 starting now would be worth $10 (part a), whereas a perpetuity starting in year 8 would be worth roughly $5 (part b). Thus, a payment of $1 for the next seven years would also be worth approximately $5 (= $10 – 5).

d. $PV = C / (r - g)$
$PV = \$10,000 / (.10 - .05)$
$PV = \$200,000$

Est time: 06-10

21. a. $DF_1 = 1 / (1 + r)$
$r = (1 – .905) / .905$
$r = .1050$, or 10.50%

b. $DF_2 = 1 / (1 + r)^2$
$DF_2 = 1 / 1.105^2$
$DF_2 = .8190$

c. $PVAF_2 = DF_1 + DF_2$
$PVAF_2 = .905 + .819$
$PVAF_2 = 1.7240$

d. $PVA = C \times PVAF_3$

$PVAF_3 = \$24.65 / \$10$

$PVAF_3 = 2.4650$

e. $PVAF_3 = PVAF_2 + DF_3$

$DF_3 = 2.465 – 1.7240$

$DF_3 = .7410$

Est time: 06-10

22. The fact that Kangaroo Autos is offering “free credit” tells us what the cash payments are; it does not change the fact that money has time value.

Present value of payments to Kangaroo Auto:

$PV = \text{Down payment} + C \times ((1 / r) – \{1 / [r(1 + r)^t]\})$
$PV = \$1,000 + \$300 \times ((1 + .0083) – \{1 / [.0083(1 + .0083)^{30}]\})$

$PV = \$8,938.02$

Present value of car at Turtle Motors:

$PV = \text{price of car} – \text{discount}$
$PV = \$10,000 – 1,000$

PV = $9,000

Kangaroo Autos offers the best deal because it has the lower present value of costs.

Est time: 01-05

23. $PV = C_t / (1 + r)^t$

$PV = \$20,000 / 1.10^5$

PV = $12,418.43

$C = PVA / ((1 / r) – \{1 / [r(1 + r)^t]\})$

$C = \$12,418.43 / ((1 / .10) – \{1 / [.10 (1 + .10)^5]\})$

C = $3,275.95

Est time: 06-10

24. $C = PVA / ((1 / r) – \{1 / [r(1 + r)^t]\})$

$C = \$20,000 / ((1 / .08) – \{1 / [.08(1 + .08)^{12}]\})$

C = $2,653.90

Est time: 01-05

25. a. $PV = C \times ((1 / r) – \{1 / [r(1 + r)^t]\})$

$PV = (\$9,420,713 / 19) \times ((1 / .08) – \{1 / [.08(1 + .08)^{19}]\})$

PV = $4,761,724

b. $PV = C \times ((1 / r) – \{1 / [r(1 + r)^t]\})$

$\$4,200,000 = (\$9,420,713 / 19) \times ((1 / r) – \{1 / [r(1 + r)^t]\})$

Using Excel or a financial calculator, we find that *r* = 9.81%.

Est time: 06-10

26. a. $PV = C \times ((1 / r) – \{1 / [r(1 + r)^t]\})$
$PV = \$50,000 \times ((1 / .055) – \{1 / [.055(1 + .055)^{12}]\})$
PV = $430,925.89

b. Since the payments now arrive six months earlier than previously:

$PV = \$430,925.89 \times \{1 + [(1 + .055)^{.5} – 1]\}$
PV = $442,617.74

Est time: 06-10

27. $C_t = PV \times (1 + r)^t$

$C_t = \$1,000,000 \times (1.035)^3$

$C_t = \$1,108,718$

Annual retirement shortfall = 12 × (monthly aftertax pension + monthly aftertax Social Security – monthly living expenses)
Annual retirement shortfall = 12 × ($7,500 + 1,500 – 15,000)
Annual retirement shortfall = –$72,000

The withdrawals are an annuity due, so:

$PV = C \times ((1 / r) - \{1 / [r(1 + r)^t]\}) \times (1 + r)$

$\$1,108,718 = \$72,000 \times ((1 / .035) - \{1 / [.035(1 + .035)^t]\}) \times (1 + .035)$

$14.878127 = (1 / .035) - \{1 / [.035(1 + .035)^t]\}$

$13.693302 = 1 / [.035(1 + .035)^t]$

$.073028 / .035 = 1.035t$

$t = \ln 2.086514 / \ln 1.035$

$t = 21.38$ years

Est time: 06-10

28. a. $PV = C / r$
$PV = \$1 \text{ billion} / .08$
$PV = \$12.5$ billion

b. $PV = C / (r - g)$
$PV = \$1 \text{ billion} / (.08 - .04)$
$PV = \$25.0$ billion

c. $PV = C \times ((1 / r) - \{1 / [r (1 + r)^t]\})$
$PV = \$1 \text{ billion} \times ((1 / .08) - \{1 / [.08(1 + .08)^{20}]\})$
$PV = \$9.818$ billion

d. The continuously compounded equivalent to an annually compounded rate of 8% is approximately 7.7%, which is computed as:

$\ln(1.08) = .077$, or 7.7%

$PV = C \times \{(1 / r) - [1 / (r \times e^{rt})]\}$

PV = \$1 billion × {(1 / .077) – [1 / (.077 – $e^{.077 \times 20}$)]}

PV = \$10.206 billion

This result is greater than the answer in Part (c) because the endowment is now earning interest during the entire year.

Est time: 06-10

29. a. PV = *C* × ((1 / *r*) – {1 / [*r*(1 + *r*)^{t}]})
PV = \$2.0 million × ((1 / *.08*) – {1 / [*.08*(1.08)^{20}]})
PV = \$19.64 million

b. If each cashflow arrives one year earlier, then you can simply compound the PV calculated in part a by (1+r)→ \$19.64 million × (1.08) = \$21.21 million

Est time: 06-10

30. a. Start by calculating the present value of an annuity due assuming a price of \$1:
PV = 0.25 + 0.25 × ((1 / *.05*) – {1 / [*.05*(1.05)^{3}]})
PV = 0.93, therefore it is better to pay instantly at a lower cost of 0.90 [1 × 0.9]

b. Recalculate, except this time using an ordinary annuity:
PV = 0.25 × ((1 / *.05*) – {1 / [*.05*(1.05)^{4}]})
PV = 0.89, therefore it is better to take the financing deal as it costs less than 0.90.

Est time: 06-10

31. a. Using the annuity formula:
PV = \$70,000 × ((1 / *.08*) – {1 / [*.08*(1 + .08)^{8}]})
PV = \$402,264.73

b. The amortization table follows:

Year	Beg Bal.	Payment	Interest (8%)	Loan Red.	Ending Bal.
1	\$ 402,265	\$ (70,000)	\$ (32,181)	\$ (37,819)	\$ 364,446
2	364,446	(70,000)	(29,156)	(40,844)	323,602
3	323,602	(70,000)	(25,888)	(44,112)	279,490
4	279,490	(70,000)	(22,359)	(47,641)	231,849
5	231,849	(70,000)	(18,548)	(51,452)	180,397
6	180,397	(70,000)	(14,432)	(55,568)	124,829
7	124,829	(70,000)	(9,986)	(60,014)	64,815
8	64,815	(70,000)	(5,185)	(64,815)	-

Est time: 06-10

32. a. PV = *C* × ((1 / *r*) – {1 / [*r*(1 + *r*)^{t}]})
C = PV / ((1 / *r*) – {1 / [*r* (1 + *r*)^{t}]})
C = \$200,000 / ((1 / .06) – {1 / [.06(1 + .06)^{20}]})
C = \$17,436.91

b.

Year	Beg Bal.	Payment	Interest	Loan Red.	Ending Bal.
1	$ 200,000.00	$ (17,436.91)	$ (12,000.00)	$ (5,436.91)	$ 194,563.09
2	194,563.09	(17,436.91)	(11,673.79)	(5,763.13)	188,799.96
3	188,799.96	(17,436.91)	(11,328.00)	(6,108.91)	182,691.05
4	182,691.05	(17,436.91)	(10,961.46)	(6,475.45)	176,215.60
5	176,215.60	(17,436.91)	(10,572.94)	(6,863.98)	169,351.63
6	169,351.63	(17,436.91)	(10,161.10)	(7,275.81)	162,075.81
7	162,075.81	(17,436.91)	(9,724.55)	(7,712.36)	154,363.45
8	154,363.45	(17,436.91)	(9,261.81)	(8,175.10)	146,188.34
9	146,188.34	(17,436.91)	(8,771.30)	(8,665.61)	137,522.73
10	137,522.73	(17,436.91)	(8,251.36)	(9,185.55)	128,337.19
11	128,337.19	(17,436.91)	(7,700.23)	(9,736.68)	118,600.51
12	118,600.51	(17,436.91)	(7,116.03)	(10,320.88)	108,279.62
13	108,279.62	(17,436.91)	(6,496.78)	(10,940.13)	97,339.49
14	97,339.49	(17,436.91)	(5,840.37)	(11,596.54)	85,742.95
15	85,742.95	(17,436.91)	(5,144.58)	(12,292.33)	73,450.61
16	73,450.61	(17,436.91)	(4,407.04)	(13,029.87)	60,420.74
17	60,420.74	(17,436.91)	(3,625.24)	(13,811.67)	46,609.07
18	46,609.07	(17,436.91)	(2,796.54)	(14,640.37)	31,968.71
19	31,968.71	(17,436.91)	(1,918.12)	(15,518.79)	16,449.92
20	16,449.92	(17,436.91)	(986.99)	(16,449.92)	-

c. Interest percent of first payment = Interest_1 / Payment

Interest percent of first payment = (.06 × $200,000) / $17,436.91

Interest percent of first payment = .6882, or 68.82%

Interest percent of last payment = Interest_{20} / Payment

Interest percent of last payment = $986.99 / $17,436.91

Interest percent of last payment = .0566, or 5.66%

Without creating an amortization schedule, the interest percent of the last payment can be computed as:

Interest percent of last payment = 1 – {[Payment / (1 + *r*)] / Payment}

Interest percent of last payment = 1 – [($17,436.91 / 1.06) / $17,436.91]

Interest percent of last payment = .0566, or 5.66%

After 10 years, the balance is:

$PV_{10} = C \times ((1 + r) – \{1 / [r \times (1 + r)^t]\})$

$PV_{10} = \$17,436.91 \times \{1.06 – [1 / (.06 \times 1.06^{10})]\}$

$PV_{10} = \$128,337.19$

Fraction of loan paid off = (Loan amount – PV_{10}) / Loan amount

Fraction of loan paid off = ($200,000 – 128,337.19) / $200,000

Fraction of loan paid off = .3583, or 35.83%

Est time: 16-20

33. a. $PV = C_t / (1 + r)^t$
$PV = \$10,000 / 1.05^5$
$PV = \$7,835.26$

b. $PV = C((1 / r) – \{1 / [r(1 + r)^t]\})$
$PV = \$12,000((1 / .08) – \{1 / [.08(1.08)^6]\})$
$PV = \$55,474.56$

c. $C_t = PV \times (1 + r)^t$
$C_t = (\$60,476 − 55,474.56) \times 1.08^6$
$C_t = \$7,936.66$

Est time: 06-10

34. a. $PV = C \times ((1 / r) – \{1 / [r(1 + r)^t]\})$
$C = \$2,000,000 / ((1 / .08) – \{1 / [.08(1 + .08)^{15}]\})$
$C = \$233,659.09$

b. $r = (1 + R) / (1 + h) – 1$

$r = 1.08 / 1.04 – 1$

$r = .0385$, or 3.85%

$PV = C \times ((1 / r) – \{1 / [r(1 + r)^t]\})$
$C = \$2,000,000 / ((1 / .0385) – \{1 / [.0385(1 +.0385)^{15}]\})$
$C = \$177,952.49$

The retirement expenditure amount will increase by 4% annually.

Est time: 06-10

35. Calculate the present value of a growing annuity for option 1, then compare this amount with the option to pay instantly $12,750:

$PV = C \times ([1 / (r – g)] – \{(1 + g)^t / [(r – g) \times (1 + r)^t]\})$
$PV = \$5,000 \times ([1 / (.10 – .06)] – \{(1 + .06)^3 / [(.10 – .06) \times (1 + .10)^3]\})$
$PV = \$13,146.51$