
CHAPTER 4

INTRODUCTION TO VALUATION: THE TIME VALUE OF MONEY

Answers to Concepts Review and Critical Thinking Questions

1. The four parts are the present value (PV), the future value (FV), the discount rate (r), and the life of the investment (t).
2. Compounding refers to the growth of a dollar amount through time via reinvestment of interest earned. It is also the process of determining the future value of an investment. Discounting is the process of determining the value today of an amount to be received in the future.
3. Future values grow (assuming a positive rate of return); present values shrink.
4. The future value rises (assuming a positive rate of return); the present value falls.
5. It would appear to be both deceptive and unethical to run such an ad without a disclaimer or explanation.
6. It's a reflection of the time value of money. GMAC gets to use the \$500 immediately. If GMAC uses it wisely, it will be worth more than \$10,000 in thirty years.
7. Oddly enough, it actually makes it more desirable since GMAC only has the right to pay the full \$10,000 before it is due. This is an example of a "call" feature. Such features are discussed in a later chapter.
8. The key considerations would be: (1) Is the rate of return implicit in the offer attractive relative to other, similar risk investments? and (2) How risky is the investment; i.e., how certain are we that we will actually get the \$10,000? Thus, our answer does depend on who is making the promise to repay.
9. The Treasury security would have a somewhat higher price because the Treasury is the strongest of all borrowers, therefore has a lower rate of return.
10. The price would be higher because, as time passes, the price of the security will tend to rise toward \$10,000. This rise is just a reflection of the time value of money. As time passes, the time until receipt of the \$10,000 grows shorter, and the present value rises. In 2006, the price will probably be higher for the same reason. We cannot be sure, however, because interest rates could be much higher, or GMAC's financial position could deteriorate. Either event would tend to depress the security's price.

Solutions to Questions and Problems

Basic

1. $\$5,000(1.05)^{10} = \$8,144.47$; $\$3,144.47 - 250(10) = \644.47
2. $FV = \$2,250(1.18)^4 = \$4,362.25$
 $FV = \$9,310(1.06)^9 = \$15,729.05$
 $FV = \$76,355(1.12)^{15} = \$417,934.11$
 $FV = \$183,796(1.08)^{21} = \$925,198.50$
3. $PV = \$15,451 / (1.04)^6 = \$12,211.15$
 $PV = \$51,557 / (1.12)^8 = \$20,823.01$
 $PV = \$886,073 / (1.22)^{16} = \$36,788.51$
 $PV = \$550,164 / (1.20)^{25} = \$5,767.15$
4. $FV = \$307 = \$221(1 + r)^3$; $r = (\$307 / \$221)^{1/3} - 1 = 11.58\%$
 $FV = \$761 = \$425(1 + r)^9$; $r = (\$761 / \$425)^{1/9} - 1 = 6.69\%$
 $FV = \$136,771 = \$25,000(1 + r)^{15}$; $r = (\$136,771 / \$25,000)^{1/15} - 1 = 12.00\%$
 $FV = \$255,810 = \$40,200(1 + r)^{30}$; $r = (\$255,810 / \$40,200)^{1/30} - 1 = 6.36\%$
5. $FV = \$1,284 = \$250(1.04)^t$; $t = \ln(\$1,284 / \$250) / \ln 1.04 = 41.72 \text{ yrs}$
 $FV = \$4,341 = \$1,941(1.09)^t$; $t = \ln(\$4,341 / \$1,941) / \ln 1.09 = 9.34 \text{ yrs}$
 $FV = \$402,662 = \$21,320(1.23)^t$; $t = \ln(\$402,662 / \$21,320) / \ln 1.23 = 14.19 \text{ yrs}$
 $FV = \$173,439 = \$32,500(1.34)^t$; $t = \ln(\$173,439 / \$32,500) / \ln 1.34 = 5.72 \text{ yrs}$
6. $FV = \$250,000 = \$25,000(1 + r)^{18}$; $r = (\$250,000 / \$25,000)^{1/18} - 1 = 13.65\%$
7. $FV = \$2 = \$1(1.10)^t$; $t = \ln 2 / \ln 1.10 = 7.27 \text{ yrs}$
 $FV = \$4 = \$1(1.10)^t$; $t = \ln 4 / \ln 1.10 = 14.55 \text{ yrs}$
8. $FV = \$50,000 = \$10,000(1 + r)^{15}$; $r = (\$50,000 / \$10,000)^{1/15} - 1 = 11.33\%$
9. $FV = \$120,000 = \$40,000(1.04)^t$; $t = \ln(\$120,000 / \$40,000) / \ln 1.04 = 35.35 \text{ yrs}$
10. $PV = \$825\text{M} / (1.08)^{20} = \$177,002,271$
11. $PV = \$2\text{M} / (1.14)^{80} = \56.06
12. $FV = \$50(1.035)^{98} = \$1,455.88$
13. $FV = \$45,000 = \$630(1 + r)^{47}$; $r = 9.51\%$
 $FV = \$20,000(1.0951)^{47} = \$1,428,571.43$
14. $PV = \$100 / (1.277)^{20} = \0.75
15. $FV = \$1.95\text{M} / (1 + r)^6 = \3.52M ; $r = -9.37\%$

Intermediate

16. a. $FV = \$10,000 / (1 + r)^{30} = \$500; r = 10.50\%$
b. $FV = \$4,490.22 / (1 + r)^{18} = \$500; r = 12.97\%$
c. $FV = \$10,000 / (1 + r)^{12} = \$4,490.22; r = 6.90\%$
17. $PV = \$120,000 / (1.105)^{10} = \$44,213.86$
18. $FV = \$2,000 (1.11)^{45} = \$219,060.48$
 $FV = \$2,000 (1.11)^{35} = \$77,149.70$
Better start early!
19. $FV = \$24,000 (1.06)^6 = \$34,044.46$
20. $FV = \$120,000 = \$60,000 (1.06)^t; t = \ln(\$120,000 / \$60,000) / \ln 1.07 = 10.24 \text{ yrs}$
From now, you'll wait $2 + 10.24 = 12.24 \text{ yrs}$
21. Roten Bank: $FV = \$10,000 (1.01)^{120} = \$33,003.87$
Brook Bank: $FV = \$10,000 (1.12)^{10} = \$31,058.48$
22. $FV = \$4 = \$1(1 + r)^5; r = 31.95\%$
23. $FV = \$2,500 = \$1,200 (1.004)^t; t = 183.86 \text{ months}$
24. $PV = \$60,000 / (1.0075)^{96} = \$29,283.70$
25. $PV = \$1M / (1.11)^{40} = \$15,384.41$
 $PV = \$1M / (1.07)^{40} = \$66,780.38$