

Solving for an Unknown Interest Rate or Unknown Interest Periods

3.66 At what rate of interest compounded annually will an investment double in five years?

3.67 Determine the interest rate (i) that makes the pairs of cash flows shown economically equivalent.

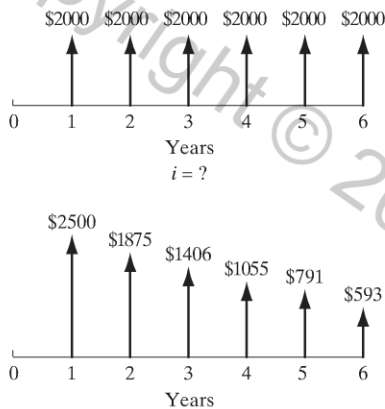


Figure P3.67

***3.68** You have \$10,000 available for investment in stock. You are looking for a growth stock whose value can grow to \$35,000 over five years. What kind of growth rate are you looking for?

3.69 How long will it take to save \$1 million if you invest \$2,000 each year at 6%?

3.70 You may have already won \$2 million! Just peel the game piece off the Instant Winner Sweepstakes ticket, and mail it to us along with your order for subscriptions to your two favorite magazines. As a grand prize winner, you may choose between a \$1 million cash prize paid immediately or \$100,000 per year for 20 years—that's \$2 million!

Suppose that, instead of receiving one lump sum of \$1 million, you decide to accept the 20 annual installments of \$100,000. If you are like most jackpot winners, you will be tempted to spend your winnings to improve your lifestyle during the first several years. Only after you get this type of spending “out of your system” will you save later sums for investment purposes. Suppose that you are considering the following two options.

Option 1: You save your winnings for the first 7 years and then spend every cent of the winnings in the remaining 13 years.

Option 2: You do the reverse, spending for 7 years and then saving for 13 years.

If you can save winnings at 7% interest, how much would you have at the end of 20 years, and what interest rate on your savings will make these two options equivalent?

3.71 Read the following letter from a magazine publisher.

Dear Parent:

Currently your *Growing Child/Growing Parent* subscription will expire with your 24-month issue. To renew on an annual basis until your child reaches 72 months would cost you a total of \$63.84 (\$15.96 per year). We feel it is so important for you to continue receiving this material until the 72nd month that we offer you an opportunity to renew now for \$57.12. Not only is this a savings of 10% off the regular rate, but it is an excellent inflation hedge for you against increasing rates in the future. Please act now by sending \$57.12.

- If your money is worth 6% per year, determine whether this offer can be of any value.
- What rate of interest would make you indifferent between the two renewal options?

Short Case Studies

ST3.1 A judge denied a 94-year-old woman's attempt to force the Massachusetts Lottery Commission to pay her entire \$5.6 million winnings up front on the grounds that she otherwise won't live

long enough to collect it all. The ruling means that the commission can pay Louise Outing, a retired waitress, in installments over 20 years. After an initial gross payment of \$283,770, Outing would be

paid 19 annual gross checks of \$280,000. That's about \$197,000 after taxes. Lottery Executive Director Joseph Sullivan said all players are held to the same rules, which are printed on the back of Megabucks tickets. Lottery winners are allowed to "assign" their winnings to a state-approved financial company that makes the full payment—but only in return for a percentage of the total winnings. Outing, who won a Megabucks drawing in September, has seven grandchildren, nine great-grandchildren, and six great-great-grandchildren. "I'd like to get it and do what I want with it," she said. "I'm not going to live 20 years. I'll be 95 in March."

- (a) Suppose that she were able to find an investor who was willing to buy her lottery ticket for \$2 million. Recall that after an initial gross payment of \$283,770, Outing would be paid 19 annual gross checks of \$280,000. If she could invest her money at 8% interest, what would be the fair amount to trade her 19 future lottery receipts? (Note that she already cashed in \$283,770 after winning the lottery, so she is giving up 19 future lottery checks in the amount of \$280,000.)
- (b) What is the rate of return for this investor who is willing to buy Ms. Outing's lottery ticket?

ST3.2 It always makes the papers when a well-known sports star signs a multi-million dollar contract, (such as the payment schedule for a football

player who has signed a 10-year, \$130 million contract extension that guarantees him an NFL-record \$37 million in bonuses.) The contract also comes with two categories of signing bonuses.

The initial signing bonus (\$30 million) can be pro-rated only over the first six years of the contract. Then the second roster bonus of \$7,002,000 can be pro-rated over the final nine seasons of the contract. With the salary and signing bonus paid at the beginning of each season, the net annual payment schedule looks like Table ST3.2.

- (a) How much is the player's contract actually worth at the time of signing, at an interest rate of 6%?
- (b) For the initial signing bonus and the second roster bonus, suppose that the ball club allows the player to take either the pro-rated payment option as just described (\$30 million over five years) or a lump-sum payment option in the amount of \$23 million at the time he signs the contract. Should the player take the lump-sum option instead of the pro-rated one?

ST3.3 A local newspaper carried the following story: Texas Cowboys wide receiver John Young will earn either \$11,406,000 over 12 years or \$8,600,000 over 6 years. Young must declare which plan he prefers. The \$11 million package is deferred through the year 2017, while the nondeferred arrangement ends after the

TABLE ST3.2

Beginning of Season	Base Salary	Pro-rated Signing Bonus	Total Annual Payment
1	\$ 600,000	\$5,000,000	\$5,600,000
2	1,400,000	5,000,000 + 778,000	7,178,000
3	6,000,000	5,000,000 + 778,000	11,778,000
4	7,000,000	5,000,000 + 778,000	12,778,000
5	9,000,000	5,000,000 + 778,000	14,778,000
6	10,500,000	5,000,000 + 778,000	16,278,000
7	13,500,000	778,000	14,278,000
8	13,000,000	778,000	13,778,000
9	15,000,000	778,000	15,778,000
10	17,000,000	778,000	17,778,000

2011 season. Regardless of which plan is chosen, Young will be playing through the 2011 season. Details of the two plans are given in Table ST3.3.

- (a) As it happened, Young ended up with the non-deferred plan. In retrospect, if Young's interest rate was 6%, did he make a wise decision in 2006?
- (b) At what interest rate would the two plans be economically equivalent?

implements an acceptable CTS-prevention program that includes making the employees aware of CTS and how to reduce the chances of it developing. What would be the maximum amount that Fairmont should invest in the program to make it worthwhile? The firm's interest rate is 12% compounded annually.

ST3.5 Adidas will put on sale what it bills as the world's first computerized "smart shoe." But consumers will decide whether to accept the bionic running shoe's \$250 price tag—four times the average

TABLE ST3.3

Deferred Plan		Nondeferred Plan	
2006	\$2,000,000	2006	\$2,000,000
2007	566,000	2007	900,000
2008	920,000	2008	1,000,000
2009	930,000	2009	1,225,000
2010	740,000	2010	1,500,000
2011	740,000	2011	1,975,000
2012	740,000		
2013	790,000		
2014	540,000		
2015	1,040,000		
2016	1,140,000		
2017	1,260,000		
Total	\$11,406,000	Total	\$8,600,000

ST3.4 Fairmont Textile has a plant in which employees have been having trouble with carpal tunnel syndrome (CTS, an inflammation of the nerves that pass through the carpal tunnel, a tight space at the base of the palm), resulting from long-term repetitive activities, such as years of sewing. It seems as if 15 of the employees working in this facility developed signs of CTS over the last five years. DeepSouth, the company's insurance firm, has been increasing Fairmont's liability insurance steadily because of this problem. DeepSouth is willing to lower the insurance premiums to \$16,000 a year (from the current \$30,000 a year) for the next five years if Fairmont

shoe price at stores such as Foot Locker. Adidas uses a sensor, a microprocessor, and a motorized cable system to automatically adjust the shoe's cushioning. The sensor under the heel measures compression and decides whether the shoe is too soft or firm. That information is sent to the microprocessor, and while the shoe is in the air, the cable adjusts the heel cushion. The whole system weighs less than 40 grams. Adidas, computer-driven shoe—three years in the making—is the latest innovation in the \$16.4 billion U.S. sneaker industry. The top-end running shoe from New Balance lists for \$199.99. With runners typically replacing shoes every 500 miles, the

\$250 Adidas could push costs to 50 cents per mile. Adidas is spending an estimated \$20 million on the rollout.⁴

The investment required to develop a full-scale commercial rollout cost Adidas \$70 million (including the \$20 million ad campaign), which will be financed at an interest rate of 10%. With a price tag of \$250, Adidas will have about \$100 net cash profit from each sale. The product will have a five-year market life. Assuming that the annual demand for the product remains constant over the market life, how many units does Adidas have to sell each year to pay off the initial investment and interest?

ST3.6 Yuma, Arizona resident Rosalind Setchfield won \$1.3 million in an Arizona lottery drawing, to be

paid in 20 annual installments of \$65,277. However, her husband, a construction worker, suffered serious injuries when a crane dropped a heavy beam on him. The couple's medical expenses and debt mounted. Six years later, in early 1995, a prize broker from Singer Asset Finance Co. telephoned Mrs. Setchfield with a promising offer. Singer would immediately give her \$140,000 for one-half of each of her next nine prize checks ($\frac{1}{2} \times 9 \times \$65,277 = \$293,746$), an amount equal to 48% of the \$293,746 she had coming over that period. A big lump sum had obvious appeal to Mrs. Setchfield at that time, and she ended up signing a contract with Singer. Did she make the right decision? Table ST3.6 gives the details of the two options:

TABLE ST3.6

Year	Installment	Year	Installment	Reduced Payment
1988	\$65,277	1995	\$65,277	\$32,639
1989	65,277	1996	65,277	32,639
1990	65,277	1997	65,277	32,639
1991	65,277	1998	65,277	32,639
1992	65,277	1999	65,277	32,639
1993	65,277	2000	65,277	32,639
1994	65,277	2001	65,277	32,639
		2002	65,277	32,639
		2003	65,277	32,639
		2004	65,277	
		2005	65,277	
		2006	65,277	
		2007	65,277	

⁴Source: "Adidas puts computer on new footing," by Michael McCarthy, *USA Today*, Thursday, March 3, 2005, Section 5B.