

Case	Interest rate, r	Number of periods, n
A	12%	2
B	6	3
C	9	2
D	3	4

LG 1

P5-3 Future value You have \$100 to invest. If you can earn 12% interest, about how long does it take for your \$100 investment to grow to \$200? Suppose that the interest rate is just half that, at 6%. At half the interest rate, does it take twice as long to double your money? Why or why not? How long does it take?

LG 2

P5-4 Future values For each of the cases shown in the following table, calculate the future value of the single cash flow deposited today at the end of the deposit period if the interest is compounded annually at the rate specified.

Case	Single cash flow	Interest rate	Deposit period (years)
A	\$ 200	5%	20
B	4,500	8	7
C	10,000	9	10
D	25,000	10	12
E	37,000	11	5
F	40,000	12	9

Personal Finance Problem

LG 2

P5-5 Time value You have \$1,500 to invest today at 7% interest compounded annually.

- Find how much you will have accumulated in the account at the end of (1) 3 years, (2) 6 years, and (3) 9 years.
- Use your findings in part a to calculate the amount of interest earned in (1) the first 3 years (years 1 to 3), (2) the second 3 years (years 4 to 6), and (3) the third 3 years (years 7 to 9).
- Compare and contrast your findings in part b. Explain why the amount of interest earned increases in each succeeding 3-year period.

Personal Finance Problem

LG 2

P5-6 Time value As part of your financial planning, you wish to purchase a new car exactly 5 years from today. The car you wish to purchase costs \$14,000 today, and your research indicates that its price will increase by 2% to 4% per year over the next 5 years.

- Estimate the price of the car at the end of 5 years if inflation is (1) 2% per year and (2) 4% per year.
- How much more expensive will the car be if the rate of inflation is 4% rather than 2%?
- Estimate the price of the car if inflation is 2% for the next 2 years and 4% for 3 years after that.

LG 2

P5-7

Personal Finance Problem

Time value You can deposit \$10,000 into an account paying 9% annual interest either today or exactly 10 years from today. How much better off will you be at the end of 40 years if you decide to make the initial deposit today rather than 10 years from today?

LG 2

LG 5

P5-8

Personal Finance Problem

Time value Peter just got his driver's license, and he wants to buy a new sports car for \$70,000. He has \$3,000 to invest as a lump sum today. Peter is a conservative investor and he only invests in safe products. After approaching different banks, he is offered the following investment opportunities:

- (1) River Bank's savings account with an interest rate of 10.8% compounded monthly.
 - (2) First State Bank's savings account with an interest rate of 11.5% compounded annually.
 - (3) Union Bank's saving account with an interest rate of 9.3% compounded weekly.
- How long will it take for Peter to accumulate enough money to buy the car in each of the above three cases?

LG 2

P5-9

Personal Finance Problem

Single-payment loan repayment A person borrows \$200 to be repaid in 8 years with 14% annually compounded interest. The loan may be repaid at the end of any earlier year with no prepayment penalty.

- a. What amount will be due if the loan is repaid at the end of year 1?
- b. What is the repayment at the end of year 4?
- c. What amount is due at the end of the eighth year?

LG 2

P5-10

Present value calculation *Without referring to the preprogrammed function on your financial calculator,* use the basic formula for present value, along with the given opportunity cost, r , and the number of periods, n , to calculate the present value of \$1 in each of the cases shown in the following table.

Case	Opportunity cost, r	Number of periods, n
A	2%	4
B	10	2
C	5	3
D	13	2

LG 2

P5-11

Present values For each of the cases shown in the following table, calculate the present value of the cash flow, discounting at the rate given and assuming that the cash flow is received at the end of the period noted.

Case	Single cash flow	Discount rate	End of period (years)
A	\$ 7,000	12%	4
B	28,000	8	20
C	10,000	14	12
D	150,000	11	6
E	45,000	20	8

- LG 2 P5-12 Present value concept** Answer each of the following questions.
- What single investment made today, earning 12% annual interest, will be worth \$6,000 at the end of 6 years?
 - What is the present value of \$6,000 to be received at the end of 6 years if the discount rate is 12%?
 - What is the most you would pay today for a promise to repay you \$6,000 at the end of 6 years if your opportunity cost is 12%?
 - Compare, contrast, and discuss your findings in parts a through c.

Personal Finance Problem

- LG 2 P5-13 Time value** Jim Nance has been offered an investment that will pay him \$500 three years from today.
- If his opportunity cost is 7% compounded annually, what value should he place on this opportunity today?
 - What is the most he should pay to purchase this payment today?
 - If Jim can purchase this investment for less than the amount calculated in part a, what does that imply about the rate of return that he will earn on the investment?

- LG 2 P5-14 Time value** Suppose you want to save money to pay for a down payment on an apartment in 5 years' time. One year from now, you will invest your \$30,000 year-end bonus for the down payment. If you can invest at 15% per year, how much interest will you receive on your cash in 5 years? If you need \$210,000 for the down payment, and you would like to top-up the remaining amount by investing a lump sum today, what is the amount you should invest?

Personal Finance Problem

- LG 2 P5-15 Time value and discount rates** You just won a lottery that promises to pay you \$1,000,000 exactly 10 years from today. Because the \$1,000,000 payment is guaranteed by the state in which you live, opportunities exist to sell the claim today for an immediate single cash payment.
- What is the least you will sell your claim for if you can earn the following rates of return on similar-risk investments during the 10-year period?
 - 6%
 - 9%
 - 12%
 - Rework part a under the assumption that the \$1,000,000 payment will be received in 15 rather than 10 years.
 - On the basis of your findings in parts a and b, discuss the effect of both the size of the rate of return and the time until receipt of payment on the present value of a future sum.

Personal Finance Problem

- LG 2 P5-16 Time value comparisons of single amounts** In exchange for a \$20,000 payment today, a well-known company will allow you to choose *one* of the alternatives shown in the following table. Your opportunity cost is 11%.

Alternative	Single amount
A	\$28,500 at end of 3 years
B	\$54,000 at end of 9 years
C	\$160,000 at end of 20 years

- Find the value today of each alternative.
- Are all the alternatives acceptable? That is, are they worth \$20,000 today?
- Which alternative, if any, will you take?

Personal Finance Problem

LG 2

P5-17 Cash flow investment decision Tom Alexander has an opportunity to purchase any of the investments shown in the following table. The purchase price, the amount of the single cash inflow, and its year of receipt are given for each investment. Which purchase recommendations would you make, assuming that Tom can earn 10% on his investments?

Investment	Price	Single cash inflow	Year of receipt
A	\$18,000	\$30,000	5
B	600	3,000	20
C	3,500	10,000	10
D	1,000	15,000	40

LG 2

P5-18 Calculating deposit needed You put \$10,000 in an account earning 5%. After 3 years, you make another deposit into the same account. Four years later (that is, 7 years after your original \$10,000 deposit), the account balance is \$20,000. What was the amount of the deposit at the end of year 3?

LG 3

P5-19 Future value of an annuity For each case in the accompanying table, answer the questions that follow.

Case	Amount of annuity	Interest rate	Deposit period (years)
A	\$ 2,500	8%	10
B	500	12	6
C	30,000	20	5
D	11,500	9	8
E	6,000	14	30

- Calculate the future value of the annuity, assuming that it is
 - An ordinary annuity.
 - An annuity due.
- Compare your findings in parts a(1) and a(2). All else being identical, which type of annuity—ordinary or annuity due—is preferable? Explain why.

LG 3 P5-20 Present value of an annuity Consider the following cases.

Case	Amount of annuity	Interest rate	Period (years)
A	\$ 12,000	7%	3
B	55,000	12	15
C	700	20	9
D	140,000	5	7
E	22,500	10	5

- Calculate the present value of the annuity, assuming that it is
 - An ordinary annuity.
 - An annuity due.
- Compare your findings in parts a(1) and a(2). All else being identical, which type of annuity—ordinary or annuity due—is preferable? Explain why.

Personal Finance Problem

LG 3 P5-21 **Time value: Annuities** Marian Kirk wishes to select the better of two 10-year annuities, C and D. Annuity C is an *ordinary annuity* of \$2,500 per year for 10 years. Annuity D is an *annuity due* of \$2,200 per year for 10 years.

- Find the *future value* of both annuities at the end of year 10 assuming that Marian can earn (1) 10% annual interest and (2) 20% annual interest.
- Use your findings in part a to indicate which annuity has the greater future value at the end of year 10 for both the (1) 10% and (2) 20% interest rates.
- Find the *present value* of both annuities, assuming that Marian can earn (1) 10% annual interest and (2) 20% annual interest.
- Use your findings in part c to indicate which annuity has the greater present value for both (1) 10% and (2) 20% interest rates.
- Briefly compare, contrast, and explain any differences between your findings using the 10% and 20% interest rates in parts b and d.

Personal Finance Problem

LG 3 P5-22 **Retirement planning** Hal Thomas, a 25-year-old college graduate, wishes to retire at age 65. To supplement other sources of retirement income, he can deposit \$2,000 each year into a tax-deferred individual retirement arrangement (IRA). The IRA will earn a 10% return over the next 40 years.

- If Hal makes annual end-of-year \$2,000 deposits into the IRA, how much will he have accumulated by the end of his sixty-fifth year?
- If Hal decides to wait until age 35 to begin making annual end-of-year \$2,000 deposits into the IRA, how much will he have accumulated by the end of his sixty-fifth year?
- Using your findings in parts a and b, discuss the impact of delaying making deposits into the IRA for 10 years (age 25 to age 35) on the amount accumulated by the end of Hal's sixty-fifth year.
- Rework parts a, b, and c, assuming that Hal makes all deposits at the beginning, rather than the end, of each year. Discuss the effect of beginning-of-year deposits on the future value accumulated by the end of Hal's sixty-fifth year.

LG 6

P5-23

Personal Finance Problem

Calculating the number of periods You want to borrow \$600,000 to buy an apartment, and you can only afford \$4,000 a month to repay the loan. Suppose the bank charges you a fixed interest rate of 4% with monthly compounding. How long will it take you to pay off the loan?

Personal Finance Problem

LG 2

LG 3

P5-24

Funding your retirement You plan to retire in exactly 20 years. Your goal is to create a fund that will allow you to receive \$20,000 at the end of each year for the 30 years between retirement and death (a psychic told you that you would die exactly 30 years after you retire). You know that you will be able to earn 11% per year during the 30-year retirement period.

- How large a fund will you need *when you retire* in 20 years to provide the 30-year, \$20,000 retirement annuity?
- How much will you need *today* as a single amount to provide the fund calculated in part a if you earn only 9% per year during the 20 years preceding retirement?
- What effect would an increase in the rate you can earn both during and prior to retirement have on the values found in parts a and b? Explain.
- Now assume that you will earn 10% from now through the end of your retirement. You want to make 20 end-of-year deposits into your retirement account that will fund the 30-year stream of \$20,000 annual annuity payments. How large do your annual deposits have to be?

Personal Finance Problem

LG 2

LG 3

P5-25

Value of an annuity versus a single amount Assume that you just won the state lottery. Your prize can be taken either in the form of \$40,000 at the end of each of the next 25 years (that is, \$1,000,000 over 25 years) or as a single amount of \$500,000 paid immediately.

- If you expect to be able to earn 5% annually on your investments over the next 25 years, ignoring taxes and other considerations, which alternative should you take? Why?
- Would your decision in part a change if you could earn 7% rather than 5% on your investments over the next 25 years? Why?
- On a strictly economic basis, at approximately what earnings rate would you be indifferent between the two plans?

LG 3

P5-26

Perpetuities Consider the data in the following table.

Perpetuity	Annual amount	Discount rate
A	\$ 20,000	8%
B	100,000	10
C	3,000	6
D	60,000	5

Determine the present value of each perpetuity.

Personal Finance Problem

LG 3

P5-27 Creating an endowment On completion of her introductory finance course, Marla Lee was so pleased with the amount of useful and interesting knowledge she gained that she convinced her parents, who were wealthy alumni of the university she was attending, to create an endowment. The endowment is to allow three needy students to take the introductory finance course each year in perpetuity. The guaranteed annual cost of tuition and books for the course is \$600 per student. The endowment will be created by making a single payment to the university. The university expects to earn exactly 6% per year on these funds.

- How large an initial single payment must Marla's parents make to the university to fund the endowment?
- What amount would be needed to fund the endowment if the university could earn 9% rather than 6% per year on the funds?

LG 4

P5-28 Value of a mixed stream For each of the mixed streams of cash flows shown in the following table, determine the future value at the end of the final year if deposits are made into an account paying annual interest of 12%, assuming that no withdrawals are made during the period and that the deposits are made

- At the *end* of each year.
- At the *beginning* of each year.

Year	Cash flow stream		
	A	B	C
1	\$ 900	\$30,000	\$1,200
2	1,000	25,000	1,200
3	1,200	20,000	1,000
4		10,000	1,900
5		5,000	

Personal Finance Problem

LG 4

P5-29 Value of a single amount versus a mixed stream Gina Vitale has just contracted to sell a small parcel of land that she inherited a few years ago. The buyer is willing to pay \$24,000 at the closing of the transaction or will pay the amounts shown in the following table at the *beginning* of each of the next 5 years. Because Gina doesn't really need the money today, she plans to let it accumulate in an account that earns 7% annual interest. Given her desire to buy a house at the end of 5 years after closing on the sale of the lot, she decides to choose the payment alternative—\$24,000 single amount or the mixed stream of payments in the following table—that provides the higher future value at the end of 5 years. Which alternative will she choose?

Mixed stream	
Beginning of year	Cash flow
1	\$ 2,000
2	4,000
3	6,000
4	8,000
5	10,000

- LG 4 P5-30 Value of mixed streams** Find the present value of the streams of cash flows shown in the following table. Assume that the firm's opportunity cost is 12%.

A		B		C	
Year	Cash flow	Year	Cash flow	Year	Cash flow
1	-\$2,000	1	\$10,000	1-5	\$10,000/yr
2	3,000	2-5	5,000/yr	6-10	8,000/yr
3	4,000	6	7,000		
4	6,000				
5	8,000				

- LG 4 P5-31 Present value: Mixed streams** Consider the mixed streams of cash flows shown in the following table.

Year	Cash flow stream	
	A	B
1	\$ 50,000	\$ 10,000
2	40,000	20,000
3	30,000	30,000
4	20,000	40,000
5	10,000	50,000
Totals	<u>\$150,000</u>	<u>\$150,000</u>

- Find the present value of each stream using a 15% discount rate.
- Compare the calculated present values and discuss them in light of the undiscounted cash flows totaling \$150,000 in each case.

- LG 4 P5-32 Value of a mixed stream** In July 2012, Beijing had the heaviest rains in over six decades. More than 2 million people were affected by the rainfall, roads were flooded, and the whole transport system had to be suspended for days. The government now is offering a flood recovery project that requires the tender to draw the flood waters out within a week. CCTech is a large manufacturer of high-pressure industrial water pumps, and the firm decided to bid for the flood recovery project. The government will pay \$5 million this year and \$2 million for the following four years.
- Draw the time line for the stream of cash flows.
 - If the discount rate is 8% per year, what is the present value of the project?
 - Suppose the project is expected to cost \$10 million today. Should CCTech take the project if it is offered? Why or why not?

Personal Finance Problem

LG 4

P5-33 Funding budget shortfalls As part of your personal budgeting process, you have determined that in each of the next 5 years you will have budget shortfalls. In other words, you will need the amounts shown in the following table at the end of the given year to balance your budget, that is, to make inflows equal outflows. You expect to be able to earn 8% on your investments during the next 5 years and wish to fund the budget shortfalls over the next 5 years with a single amount.

End of year	Budget shortfall
1	\$ 5,000
2	4,000
3	6,000
4	10,000
5	3,000

- How large must the single deposit today into an account paying 8% annual interest be to provide for full coverage of the anticipated budget shortfalls?
- What effect would an increase in your earnings rate have on the amount calculated in part a? Explain.

LG 4

P5-34 Relationship between future value and present value: Mixed stream Using the information in the accompanying table, answer the questions that follow.

Year (<i>t</i>)	Cash flow
1	\$ 800
2	900
3	1,000
4	1,500
5	2,000

- Determine the *present value* of the mixed stream of cash flows using a 5% discount rate.
- How much would you be willing to pay for an opportunity to buy this stream, assuming that you can at best earn 5% on your investments?
- What effect, if any, would a 7% rather than a 5% opportunity cost have on your analysis? (Explain verbally.)

LG 4

P5-35 Relationship between future value and present value: Mixed stream The table below shows a mixed cash flow stream except that the cash flow for year 3 is missing.

Year 1	\$10,000
Year 2	5,000
Year 3	
Year 4	20,000
Year 5	3,000

Suppose that somehow you know that the present value of the entire stream is \$32,911.03 and that the discount rate is 4%. What is the amount of the missing cash flow in year 3?

- LG 5 P5-36 Changing compounding frequency** Using annual, semiannual, and quarterly compounding periods for each of the following, (1) calculate the future value if \$5,000 is deposited initially, and (2) determine the *effective annual rate (EAR)*.
- At 12% annual interest for 5 years.
 - At 16% annual interest for 6 years.
 - At 20% annual interest for 10 years.

- LG 5 P5-37 Compounding frequency, time value, and effective annual rates** For each of the cases in the following table:
- Calculate the future value at the end of the specified deposit period.
 - Determine the *effective annual rate, EAR*.
 - Compare the nominal annual rate, r , to the effective annual rate, *EAR*. What relationship exists between compounding frequency and the nominal and effective annual rates?

Case	Amount of initial deposit	Nominal annual rate, r	Compounding frequency, m (times/year)	Deposit period (years)
A	\$ 2,500	6%	2	5
B	50,000	12	6	3
C	1,000	5	1	10
D	20,000	16	4	6

- LG 5 P5-38 Continuous compounding** For each of the cases in the following table, find the future value at the end of the deposit period, assuming that interest is compounded continuously at the given nominal annual rate.

Case	Amount of initial deposit	Nominal annual rate, r	Deposit period (years), n
A	\$1,000	9%	2
B	600	10	10
C	4,000	8	7
D	2,500	12	4

Personal Finance Problem

- LG 5 P5-39 Compounding frequency and time value** You plan to invest \$2,000 in an individual retirement arrangement (IRA) today at a *nominal annual rate* of 8%, which is expected to apply to all future years.

- How much will you have in the account at the end of 10 years if interest is compounded (1) annually, (2) semiannually, (3) daily (assume a 365-day year), and (4) continuously?
- What is the *effective annual rate (EAR)* for each compounding period in part a?
- How much greater will your IRA balance be at the end of 10 years if interest is compounded continuously rather than annually?
- How does the compounding frequency affect the future value and effective annual rate for a given deposit? Explain in terms of your findings in parts a through c.

Personal Finance Problem

LG 5

LG 6

P5-40

Accumulating a growing future sum You have \$30,000, and you are making the decision between consumption and investment. You are considering either using all of the money to buy a new car or investing the whole amount. You have two investment options: You can either put the money into a savings account with a nominal interest rate of 5% compounded monthly, or invest the money in stocks with an expected return of 6% compounded continuously.

- If you choose to invest, how much will you have 6 years later if you invested in (1) the savings account, or (2) stocks?
- If you invested in the savings account, how long will it take for you to double your money?
- Suppose the price of the car inflates by 2% per year. If you choose to invest your money in stocks, how long will it take for you to be able to afford 2 cars?

Personal Finance Problem

LG 3

LG 5

P5-41

Annuities and compounding Janet Boyle intends to deposit \$300 per year in a credit union for the next 10 years, and the credit union pays an annual interest rate of 8%.

- Determine the future value that Janet will have at the end of 10 years, given that end-of-period deposits are made and no interest is withdrawn, if
 - \$300 is deposited annually and the credit union pays interest annually.
 - \$150 is deposited semiannually and the credit union pays interest semiannually.
 - \$75 is deposited quarterly and the credit union pays interest quarterly.
- Use your findings in part a to discuss the effect of more frequent deposits and compounding of interest on the future value of an annuity.

LG 6

P5-42

Deposits to accumulate future sums For each of the cases shown in the following table, determine the amount of the equal, annual, end-of-year deposits necessary to accumulate the given sum at the end of the specified period, assuming the stated annual interest rate.

Case	Sum to be accumulated	Accumulation period (years)	Interest rate
A	\$ 5,000	3	12%
B	100,000	20	7
C	30,000	8	10
D	15,000	12	8

Personal Finance Problem

LG 6

P5-43

Creating a retirement fund To supplement your planned retirement in exactly 42 years, you estimate that you need to accumulate \$220,000 by the end of 42 years from today. You plan to make equal, annual, end-of-year deposits into an account paying 8% annual interest.

- How large must the annual deposits be to create the \$220,000 fund by the end of 42 years?
- If you can afford to deposit only \$600 per year into the account, how much will you have accumulated by the end of the forty-second year?

Personal Finance Problem

LG 6

P5-44

Finding interest rates You want to borrow \$24,000 for a tax payment. Your friend offers you a loan, and he claims that he will only charge you 10% interest. He calculates that the total interest of the loan will be $\$24,000 \times 10\% = \$2,400$, so he deducts this amount from the loan, gives you \$21,600, and tells you to repay \$24,000 in one year. Has your friend charged you 10% interest? What is the real interest rate charged on the loan?

Personal Finance Problem

LG 3

LG 6

P5-45

Deposits to create a perpetuity You have decided to endow your favorite university with a scholarship. It is expected to cost \$6,000 per year to attend the university into perpetuity. You expect to give the university the endowment in 10 years and will accumulate it by making equal annual (end-of-year) deposits into an account. The rate of interest is expected to be 10% for all future time periods.

- How large must the endowment be?
- How much must you deposit at the end of each of the next 10 years to accumulate the required amount?

Personal Finance Problem

LG 2

LG 3

P5-46

Inflation, time value, and annual deposits While vacationing in Florida, John Kelley saw the vacation home of his dreams. It was listed with a sale price of \$200,000. The only catch is that John is 40 years old and plans to continue working until he is 65. Still, he believes that prices generally increase at the overall rate of inflation. John believes that he can earn 9% annually after taxes on his investments. He is willing to invest a fixed amount at the end of each of the next 25 years to fund the cash purchase of such a house (one that can be purchased today for \$200,000) when he retires.

LG 6

- Inflation is expected to average 5% per year for the next 25 years. What will John's dream house cost when he retires?
- How much must John invest at the *end* of each of the next 25 years to have the cash purchase price of the house when he retires?
- If John invests at the *beginning* instead of at the end of each of the next 25 years, how much must he invest each year?

LG 6

P5-47

Loan payment Determine the equal, annual, end-of-year payment required each year over the life of the loans shown in the following table to repay them fully during the stated term of the loan.

Loan	Principal	Interest rate	Term of loan (years)
A	\$12,000	8%	3
B	60,000	12	10
C	75,000	10	30
D	4,000	15	5

Personal Finance Problem

- LG 6 P5-48** **Loan amortization schedule** Joan Messineo borrowed \$15,000 at a 14% annual rate of interest to be repaid over 3 years. The loan is amortized into three equal, annual, end-of-year payments.
- Calculate the annual, end-of-year loan payment.
 - Prepare a loan amortization schedule showing the interest and principal breakdown of each of the three loan payments.
 - Explain why the interest portion of each payment declines with the passage of time.

- LG 6 P5-49** **Loan interest deductions** Liz Rogers just closed a \$10,000 business loan that is to be repaid in three equal, annual, end-of-year payments. The interest rate on the loan is 13%. As part of her firm's detailed financial planning, Liz wishes to determine the annual interest deduction attributable to the loan. (Because it is a business loan, the interest portion of each loan payment is tax-deductible to the business.)
- Determine the firm's annual loan payment.
 - Prepare an amortization schedule for the loan.
 - How much interest expense will Liz's firm have in *each* of the next 3 years as a result of this loan?

Personal Finance Problem

- LG 6 P5-50** **Loan rates of interest** You want to buy a new car that costs \$48,000. Dealer A offers to lend you the entire \$48,000 for a zero-interest 2-year loan with monthly payments that start the next month. Dealer B requires you to pay \$10,000 now, followed by installments of \$1,500 for the next 24 months. You observe that the market interest rate is 6%.
- What is the net cost today of the two options? Which option offers you the cheapest financing?
 - Use a financial calculator or spreadsheet to help you calculate what the interest rate would be if the financing cost from Dealer A was equal to that of Dealer B.

- LG 6 P5-51** **Growth rates** You are given the series of cash flows shown in the following table.

Year	Cash flows		
	A	B	C
1	\$500	\$1,500	\$2,500
2	560	1,550	2,600
3	640	1,610	2,650
4	720	1,680	2,650
5	800	1,760	2,800
6		1,850	2,850
7		1,950	2,900
8		2,060	
9		2,170	
10		2,280	

- Calculate the compound annual growth rate between the first and last payment in each stream.

- b. If year-1 values represent initial deposits in a savings account paying annual interest, what is the annual rate of interest earned on each account?
- c. Compare and discuss the growth rate and interest rate found in parts a and b, respectively.

Personal Finance Problem**LG 6**

- P5-52 Rate of return** Rishi Singh has \$1,500 to invest. His investment counselor suggests an investment that pays no stated interest but will return \$2,000 at the end of 3 years.
- a. What annual rate of return will Rishi earn with this investment?
 - b. Rishi is considering another investment, of equal risk, that earns an annual return of 8%. Which investment should he make, and why?

Personal Finance Problem**LG 6**

- P5-53 Rate of return and investment choice** Clare Jaccard has \$5,000 to invest. Because she is only 25 years old, she is not concerned about the length of the investment's life. What she is sensitive to is the rate of return she will earn on the investment. With the help of her financial advisor, Clare has isolated four equally risky investments, each providing a single amount at the end of its life, as shown in the following table. All the investments require an initial \$5,000 payment.

Investment	Single amount	Investment life (years)
A	\$ 8,400	6
B	15,900	15
C	7,600	4
D	13,000	10

- a. Calculate, to the nearest 1%, the rate of return on each of the four investments available to Clare.
- b. Which investment would you recommend to Clare, given her goal of maximizing the rate of return?

LG 6

- P5-54 Rate of return: Annuity** What is the rate of return on an investment of \$10,606 if the company will receive \$2,000 each year for the next 10 years?

Personal Finance Problem**LG 6**

- P5-55 Monthly loan payments** Ricky is considering purchasing an apartment costing \$700,000. He will pay a 30% down payment and take out a mortgage for the remainder. Since he just got married and wants to save some money for future use, he will choose the plan with the lowest monthly payment. After visiting several banks, he received the following mortgage offers:

Bank	Interest rate	Term (years)
A	3.5%	15
B	3	20
C	4	25
D	4.5	18

- What are the monthly payments for plans offered by the four banks?
- Which plan should Ricky choose?

Personal Finance Problem

LG 6

- P5-56 Interest rate for an annuity** Anna Waldheim was seriously injured in an industrial accident. She sued the responsible parties and was awarded a judgment of \$2,000,000. Today, she and her attorney are attending a settlement conference with the defendants. The defendants have made an initial offer of \$156,000 per year for 25 years. Anna plans to counteroffer at \$255,000 per year for 25 years. Both the offer and the counteroffer have a present value of \$2,000,000, the amount of the judgment. Both assume payments at the end of each year.
- What interest rate assumption have the defendants used in their offer (rounded to the nearest whole percent)?
 - What interest rate assumption have Anna and her lawyer used in their counteroffer (rounded to the nearest whole percent)?
 - Anna is willing to settle for an annuity that carries an interest rate assumption of 9%. What annual payment would be acceptable to her?

Personal Finance Problem

LG 6

- P5-57 Loan rates of interest** You have credit card debt amounting to \$50,000. The card charges you a 32% interest rate with monthly compounding. You believe that the interest rate of the existing debt is too high, so you decide to switch cards and move the outstanding balance on the old card to the new card. After doing some research, you find Cards A, B, and C as alternatives. If you move the existing debt to Card B or Card C, there will be extra charges (handling fees). Card B will charge \$500, and Card C will charge \$1,000 handling fees.

Card	Interest rate	Outstanding amount
A	30%	\$50,000
B	29	50,500
C	28	51,000

- If you pay off the debt in one year with equal monthly amounts, how much in interest payments have you saved by using (1) Card A, (2) Card B, and (3) Card C rather than keeping your existing card?
- Which card should you choose?

LG 6

- P5-58 Number of years to equal future amount** For each of the following cases, determine the number of years it will take for the initial deposit to grow to equal the future amount at the given interest rate.

Case	Initial deposit	Future amount	Interest rate
A	\$ 300	\$ 1,000	7%
B	12,000	15,000	5
C	9,000	20,000	10
D	100	500	9
E	7,500	30,000	15

Personal Finance Problem

- LG 6 P5-59 Time to accumulate a given sum** Manuel Rios wishes to determine how long it will take an initial deposit of \$10,000 to double.
- If Manuel earns 10% annual interest on the deposit, how long will it take for him to double his money?
 - How long will it take if he earns only 7% annual interest?
 - How long will it take if he can earn 12% annual interest?
 - Reviewing your findings in parts **a**, **b**, and **c**, indicate what relationship exists between the interest rate and the amount of time it will take Manuel to double his money.
- LG 6 P5-60 Number of years to provide a given return** In each of the following cases, determine the number of years that the given annual *end-of-year* cash flow must continue to provide the given rate of return on the given initial amount.

Case	Initial amount	Annual cash flow	Rate of return
A	\$ 1,000	\$ 250	11%
B	150,000	30,000	15
C	80,000	10,000	10
D	600	275	9
E	17,000	3,500	6

Personal Finance Problem

- LG 6 P5-61 Time to repay installment loan** Mia Salto wishes to determine how long it will take to repay a loan with initial proceeds of \$14,000 where annual *end-of-year* installment payments of \$2,450 are required.
- If Mia can borrow at a 12% annual rate of interest, how long will it take for her to repay the loan fully?
 - How long will it take if she can borrow at a 9% annual rate?
 - How long will it take if she has to pay 15% annual interest?
 - Reviewing your answers in parts **a**, **b**, and **c**, describe the general relationship between the interest rate and the amount of time it will take Mia to repay the loan fully.
- LG 6 P5-62 ETHICS PROBLEM** A manager at a “Check Into Cash” business (see *Focus on Ethics* box on page 238) defends his business practice as simply “charging what the market will bear.” “After all,” says the manager, “we don’t force people to come in the door.” How would you respond to this ethical defense of the payday-advance business?

Spreadsheet Exercise



At the end of 2015, Uma Corporation is considering undertaking a major long-term project in an effort to remain competitive in its industry. The production and sales departments have determined the potential annual cash flow savings that could accrue to the firm if it acts soon. Specifically, they estimate that a mixed stream of future cash flow savings will occur at the end of the years 2016 through 2021. The years 2022 through 2026 will see consecutive and equal cash flow savings at the end of each year. The firm estimates that its discount rate over the first 6 years will be 7%. The expected discount rate over the years 2022 through 2026 will be 11%.

The project managers will find the project acceptable if it results in present cash flow savings of at least \$860,000. The following cash flow savings data are supplied to the finance department for analysis.

End of year	Cash flow savings
2016	\$110,000
2017	120,000
2018	130,000
2019	150,000
2020	160,000
2021	150,000
2022	90,000
2023	90,000
2024	90,000
2025	90,000
2026	90,000

TO DO

Create spreadsheets similar to Table 5.2, and then answer the following questions.

- Determine the value (at the beginning of 2016) of the future cash flow savings expected to be generated by this project.
- Based solely on the one criterion set by management, should the firm undertake this specific project? Explain.
- What is the “interest rate risk,” and how might it influence the recommendation made in part b? Explain.

MyFinanceLab Visit www.myfinancelab.com for **Chapter Case: Funding Jill Moran’s Retirement Annuity**, Group Exercises, and numerous online resources.