

Business Mathematics – 2017 Spring

1 Simple Interest

In all problems involving days, a 360-day year is assumed. When annual rates are requested as an answer, compute 100% to three decimal places.

- 1.1. If \$3,000 is loaned for 4 months at a 14% annual rate, how much interest is earned?
- 1.2. If \$5,000 is loaned for 10 months at a 10% annual rate, how much interest is earned?
- 1.3. How much interest will you have to pay for a one-month overdue credit card balance of \$554, if a 20% annual rate is charged?
- 1.4. A department store charges an 18% annual rate for overdue accounts. How much interest will be owed on a \$835 account 2 months overdue?
- 1.5. A loan of \$7,250 was repaid at the end of 8 months. What size repayment check (principal and interest) was written, if a 9% annual rate of interest was charged?
- 1.6. A loan of \$10,000 was repaid at the end of 14 months. What amount (principal and interest) was repaid if a 12% annual rate of interest was charged?
- 1.7. A loan of \$4,000 was repaid at the end of 8 months with check for \$4,270. What annual rate on interest was charged?
- 1.8. A check for \$3,262.5 was used to retire a \$3,000 15-month loan. What annual rate of interest was charge?
- 1.9. If you paid \$30 to a loan company for the use of \$1,000 for 60 days, what annual rate of interest did they charge?
- 1.10. If you paid \$120 to a loan company for the use of \$2,000 for 90 days, what annual rate of interest did they charge?
- 1.11. A radio commercial for a loan company states: “You only pay 50 cents a day for each \$500 borrowed.” If you borrow \$1,5000 for 120 days, what annual interest rate is the company actually charging?
- 1.12. George finds a company that charges \$70 per day for each \$1,000 borrowed. If he borrows \$3,000 for 60 days, what annual interest rate will he be paying the company?
- 1.13. You are interested in buying a 13-week T-bill (treasury bill) from the United States Treasury Department. If you buy a bill with a maturity value of \$10,000 for \$9,776.94, what annual interest rate will you earn?
- 1.14. If you buy a 26-week T-bill with a maturity value of \$10,000 for \$9,562.56 form the Treasury Department, what annual interest rate will you earn?

- 1.15. If an investor wants to earn an annual interest rate of 12.63% on a 13-week T-bill with a maturity value of \$10,000, how much should the investor pay for the bill?
- 1.16. If an investor wants to earn an annual interest rate of 10.58% on a 26-week T-bill with a maturity value of \$10,000, how much should the investor pay for the bill?
- 1.17. An attorney accepts a 90-day note for \$5,500 at 12% simple interest from a client for services rendered. (Both interest and principal will be repaid at the end of 90 days.) Wishing to have use of her money sooner, the attorney sells the note to a third party for \$5,500 after 30 days. What annual interest rate will the third party receive for the investment?
- 1.18. To complete the sale of a house, the seller accepts a 180-day note for \$10,000 at 10% simple interest. (Both interest and principal will be repaid at the end of 180 days.) Wishing to have use of her money sooner for the purchase of another house, she sells the note to a third party for \$10,100 after 60 days. What annual interest rate will the third party receive for the investment?
- 1.19. *Simple interest.* If P (the principal) is invested at an Interest rate of r , then the amount A that is due after t years is given by

$$A = Prt + P$$

If \$100 is invested at 6% ($r = 0.06$), then $A = 6t + 100$, $t \geq 0$.

- (A) What will \$100 amount to after 5 years? After 20 years?
- (B) Graph the equation for $0 \leq t \leq 20$.
- (C) What is the slope of the graph? (The slope indicates the increase in the amount A for each additional year of investment.)
- 1.20. You have \$12,000 to invest. If part is invested at 10% and the rest at 15%, how much should be invested at each rate to yield 12% on the total amount?
- 1.21. An investor has \$20,000 to invest. If part is invested at 8% and the rest at 12%, how much should be invested at each rate to yield 11% on the total amount?

2 Supply and demand, cost and demand equations

- 2.1. *Supply and demand.* The demand equation for a certain brand of popular records is $d = 3,000/p$. Notice that as the price (p) goes up, the number of records people are willing to buy (d) goes down, and vice versa. The supply equation is given by $s = 1,000p - 500$. Notice again, as the price (p) goes up, the number of records a supplier is willing to sell (s) goes up. At what price will supply equal demand; that is, at what price will $d = s$? In economic theory the price at which supply equals demand is called the equilibrium point – the point where the price ceases to change.
- 2.2. *Cost equation.* The management of a company manufacturing surfboards has fixed costs (zero output) of \$200 per day and total costs of \$1,400 per day at a daily output of twenty boards.

- (A) Assuming the total cost per day (C) is linearly related to the total output per day (x), write an equation relating these two quantities. [Hint: Find an equation of the line that passes through $(0, 200)$ and $(20, 1,400)$.]
- (B) What are the total costs for an output of twelve boards per day?
- (C) Graph the equation for $0 \leq x \leq 20$.

[Note: The slope of the line found in part A is the increase in total cost for each additional unit produced and is called the marginal cost. More will be said about the concept of marginal cost later.]

- 2.3. *Demand equation.* A manufacturing company is interested in introducing a new power mower. Its market research department gave the management the demand-price forecast listed in the table.

Price	Estimated Demand
\$ 70	7,800
\$120	4,800
\$160	2,400
\$200	0

- (A) Plot these points, letting d represent the number of mowers people are willing to buy (demand) at a price of $\$p$ each.
- (B) Note that the points in part A lie along a straight line. Find an equation of that line.

[Note: The slope of the line found in part B indicates the decrease in demand for each \$1 increase in price.]

- 2.4. *Cost function.* The fixed costs (tooling and overhead) for manufacturing a particular stereo system are \$96,000, and the variable cost per unit (labor, material, etc.) is \$80. If x units are manufactured, express the cost $C(x)$ as a function of x . Find the cost of producing 500 stereos.
- 2.5. *Cost function.* A company that specializes in manufacturing reproductions of classic automobiles has fixed costs of \$100,000 and variable costs of \$15,000 per automobile produced. If x cars are manufactured, express the cost $C(x)$ as a function of x . Find the cost of producing 48 automobiles.
- 2.6. *Revenue function.* After extensive surveys, the research department of a stereo manufacturing company produced the demand equation

$$x = 8,000 - 40p$$

where x is the number of units that retailers, are likely to purchase at a price of $\$p$ per unit. Express the revenue $R(x)$ in terms of the demand x . Find the domain of R .

- 2.7. *Revenue function.* Repeat the previous problem for the demand equation

$$x = 9,000 - 60p$$

- 2.8. *Service charges.* On weekends and holidays, an emergency plumbing repair service charges \$60 for the first 30 minute period (or fraction thereof) of a service call and \$20 for each additional 15 minute period (or fraction thereof). Let $C(x)$ be the cost of a service call that lasts x minutes. Graph $C(x)$ for $0 < x \leq 90$.
- 2.9. *Delivery charges.* A nationwide package delivery service charges \$20.00 for overnight delivery of packages weighing 1 pound or less. Each additional pound (or fraction thereof) costs an additional \$2.50. Let $D(x)$ be the charge for overnight delivery of a package weighing x pounds. Graph $D(x)$ for $0 < x \leq 10$.

3 Market research, break-even analysis

- 3.1. *Break-even analysis.* For business to realize a profit, it is clear that revenue R must be greater than costs C ; that is, a profit will result only if $R > C$ (the company breaks even when $R = C$). A record manufacturer has a weekly cost equation $C = 300 + 1.5x$ and a revenue equation $R = 2x$, where x is the number of records produced and sold in a week. How many records must be sold for the company to make a profit?
- 3.2. *Break-even analysis.* A publisher is planning to produce a new textbook. The fixed costs (reviewing, editing, typesetting, etc.) are \$240,000, and the variable costs (printing, sales commissions, etc.) are \$20 per book. The wholesale price (the amount received by the publisher) will be \$35 per book. Let x be the number of books.
- (A) Express the cost C as a linear function of x .
- (B) Express the revenue R as a linear function of x .
- (C) Graph the cost and revenue functions found in parts A and B on the same set of axes.
- (D) Find the number of books the publisher has to sell in order to break even.
- 3.3. *Break-even analysis.* A computer software company is planning to market a new word processor for a microcomputer. The fixed costs (programming, debugging, etc.) are \$300,000, and the variable costs (disk duplication, manual production, etc.) are \$25 per unit. The wholesale price of the product will be \$100 per unit. Let x be the number of units.
- (A) Express the cost C as a linear function of x .
- (B) Express the revenue R as a linear function of x .
- (C) Graph the cost and revenue functions found in parts A and B on the same set of axes.
- (D) Find the number of units the company has to sell in order to break even.
- 3.4. *Market research.* Suppose that the demand equation is $x = 9,000 - 30p$ and the cost equation is $C = 90,000 + 30x$.
- (A) Express cost C as a linear function of price p .
- (B) Express revenue R as a quadratic function of price p .
- (C) Graph the cost and revenue functions found in parts (A) and (B) in the same coordinate system, and identify the regions of profit and loss on your graph.

- (D) Find the break-even points; that is, find the prices to the nearest dollar at which $R = C$.
(A calculator might prove useful here.)
- (E) Find the price that produces the maximum revenue.
- 3.5. *Market research.* Repeat the previous problem if the demand equation is changed to $x = 5,000 - 50p$ and the cost equation is changed to $C = 40,000 + 12x$.

4 Miscellaneous problems

- 4.1. *Wildlife management.* A naturalist for a fish and game department estimated the total number of rainbow trout in a certain lake using the popular capture-mark-recapture technique. He netted, marked, and released 200 rainbow trout. A week later, allowing for thorough mixing, he again netted 200 trout and found 8 marked ones among them. Assuming that the proportion of marked fish in the second sample was the same as the proportion of all marked fish in the total population, estimate the number of rainbow trout in the lake.
- 4.2. *Ecology.* If the temperature for a 24 hour period at an Antarctic station ranged between -49°F and 14°F (that is, $-49 \leq F \leq 14$), what was the range in degrees Celsius? [Note: $F = \frac{2}{3}C + 32$.]
- 4.3. *Psychology.* The IQ (intelligence quotient) is found by dividing the mental age (MA), as indicated on standard tests, by the chronological age (CA) and multiplying by 100. For example, if a child has a mental age of 12 and a chronological age of 8, the calculated IQ is 150. If a 9-year-old girl has an IQ of 140, compute her mental age.
- 4.4. *Ecology.* An important element in the erosive force of moving water is its velocity. To measure the velocity v (in feet per second) of a stream we have only to find a hollow L-shaped tube, place one end under the water pointing upstream and the other end pointing straight up a couple of feet out of the water. The water will then be pushed up the tube a certain distance h (in feet) above the surface of the stream. Physicists have shown that $v^2 = 64h$. Approximately how fast is a stream flowing if $h = 1$ foot? If $h = 0.5$ foot?
- 4.5. *Safety research.* It is of considerable importance to know the least number of feet d in which a car can be stopped, including reaction time of the driver, at various speeds v (in miles/hour). Safety research has produced the formula $d = 0.044v^2 + 1.1v$. If it took a car 550 feet to stop, estimate the car's speed at the moment the stopping process was started. You might find a calculator of help in this problem.
- 4.6. *Population growth.* If Kenya has a population of 23,000,000 people and a doubling time of 19 years, and if the growth continues at the same rate, find the population in:
(A) 10 years (B) 30 years
Compute answers to the nearest million.
- 4.7. *Bacterial growth.* If bacteria in a certain culture double every $\frac{1}{2}$ hour, write an equation that gives the number of bacteria N in the culture after t hours, assuming the culture has 100 bacteria at the start. Graph the equation for $0 \leq t \leq 5$.

4.8. *Radioactive traces.* The radioactive isotope technetium-99m ($^{99\text{m}}\text{Tc}$) is used in imaging the brain. This isotope has a half-life of 6 hours. If 12 milligrams are used, how much will be present after:

- (A) 3 hours (B) 24 hours

Compute answers to two decimal places.

4.9. *Advertising.* A company is trying to introduce a new product to as many people as possible through television advertising in a large metropolitan area with 2 million possible viewers. A model for the number of people N (in millions) who are aware of the product after t days of advertising was found to be

$$N = 2(1 - e^{-0.037t})$$

Graph this function for $0 \leq t \leq 50$. What value does N tend to as t increases without bound?

4.10. *Learning curve.* People assigned to assemble circuit boards for a computer manufacturing company undergo on-the-job training. From past experience it was found that the learning curve for the average employee is given by

$$N = 40(1 - e^{0.12t})$$

where N is the number of boards assembled per day after t days of training. Graph this function for $0 \leq t \leq 30$. What is the maximum number of boards an average employee can be expected to produce in 1 day?

5 Revision exercises

5.1. *Investment.* An investor has \$60,000 to invest. If part is invested at 8% and the rest at 14%, how much should be invested at each rate to yield 12% on the total amount?

5.2. *Inflation.* If the consumer price index (CPI) was 89 in 1960 and 247 in 1980, how much would a net salary of \$800 in 1960 have to be in 1980 in order to keep up with inflation? Set up an equation and solve.

5.3. *Finance.* If P dollars is invested at $100r\%$ compounded annually, at the end of 2 years it will grow to $A = P(1 + r)^2$. At what interest rate will \$1,000 grow to \$1,210 in 2 years;

5.4. *Linear depreciation.* A word-processing system was purchased by a company for \$12,000 and is assumed to have a salvage value of \$2,000 after 8 years (for tax purposes). If its value is depreciated linearly from \$12,000 to \$2,000:

(A) Find the linear equation that relates value V in dollars to time t in years.

(B) What would be the value of the system after 5 years?

5.5. *Pricing.* A sporting goods store sells a tennis racket that cost \$30 for \$48 and a pair of jogging shoes that cost \$20 for \$32.

(a) If the markup policy of the store for items that cost over \$10 is assumed to be linear and is reflected in the pricing of these two items, write an equation that relates retail price R to cost C .

- (b) What should be the retail price of a pair of skis that cost \$105?
- 5.6. *Market equilibrium.* After extensive research, a retail firm has determined that the supply and demand equations for a certain product are

$$s = 10,000p - 25,000 \quad \text{and} \quad d = \frac{90,000}{p}$$

where p is the price in dollars. Find the equilibrium point (the price where supply equals demand).

- 5.7. *Break-even analysis.* A video production company is planning to produce an instructional video tape. The producer estimates that it will cost \$84,000 to shoot the video and \$15 per unit to copy and distribute the tape. The wholesale price of the tape is \$50 per unit. How many tapes must be sold for the company to break even?
- 5.8. *Market research.* The market research department of an electronics company has determined that the demand and cost equations for the production of an AM/FM clock radio, are respectively,

$$x = 500 - 10p \quad \text{and} \quad C = 3,000 + 10x$$

- (a) Express the revenue as a function of the price p .
- (b) Express the cost as a functional of the price p .
- (c) Graph R and C on the same set of axes and identify the regions of profit and loss.
- (d) Find the break-even points.
- (e) Find the price that will produce a maximum profit.

6 Compound interest

- 6.1. If P dollars is invested at $100r$ percent compounded annually, at the end of 2 years it will grow to $A = p(1 + r)^2$. At what interest rate will \$100 grow to \$144 in 2 years? [Note: If $A = 144$ and $P = 100$, find r .]
- 6.2. *Money growth.* If you invest \$7,500 in a account paying 8.35% compounded continuously, how much money will be in the account at the end of:
 (A) 5.5 years (B) 12 years
- 6.3. *Money growth.* If you invest \$5,250 in a account paying 11.38% compounded continuously, how much money will be in the account at the end of:
 (A) 6.25 years (B) 17 years
- 6.4. *Money growth.* Barron's (a national business and financial weekly) published the following "Top Savings Deposit Yields" for 1 year certificate of deposit accounts:
 (A) Alamo Savings, 8.25% compounded quarterly
 (B) Lamer Savings, 8.05% compounded continuously

Compute the value of \$10,000 invested in each account at the end of 1 year.

6.5. *Money growth.* Refer to Problem 25. In another issue of Barron's, $2\frac{1}{2}$ year certificate of deposit accounts included the following:

- (a) Gill Saving, 8.30% compounded continuously
- (b) Richardson Savings and Loan, 8.40% compounded quarterly
- (c) USA Savings, 8.25% compounded daily

Compute the value of \$1,000 invested in each account at the end of $2\frac{1}{2}$ years.

6.6. *Finance.* Suppose \$2,500 is invested at 7% compounded quarterly. How much money will be in the account in:

- (A) $\frac{3}{4}$ year?
- (B) 15 years?

Compute answers to the nearest cent.

6.7. *Finance.* Suppose \$4,000 is invested at 11% compounded weakly. How much money will be in the account in:

- (A) $\frac{1}{2}$ year?
- (B) 10 years?

Compute answers to the nearest cent.

6.8. *Finance.* A person wishes to have \$15,000 cash for a new car 5 years from now. How much should be placed in an account now, if the account pays 9.75% compounded weekly? Compute the answer the nearest dollar.

6.9. *Finance.* A couple just had a new child. How much should they invest now at 8.25% compounded daily in order to have \$40,000 for the child's education 17 years from now? Compute the answer to the nearest dollar.

6.10. A newborn child receives a \$5,000 gift towards a college education from her grandparents. How much will the \$5,000 be worth in 17 years if it is invested at 9% compounded quarterly?

6.11. A person with \$8,000 is trying to decide whether to purchase a car now or to invest the money at 12% compounded semiannually, and then buy a more expensive car. How much will be available for the purchase of a car at the end of 3 years?

6.12. What will a \$110,000 house cost 10 years from now if the inflation rate over that period averages 6% compounded annually?

6.13. If the inflation rate averages 8% per year compounded annually for the next 5 years, what will a car costing \$10,000 now cost 5 years from now?

6.14. Rental costs for office space has been going up at 7% per year compounded annually for the past 5 years. If office space rent is now \$20 per square foot per month, what were the rental rates 5 years ago?

6.15. In a suburb of a city, housing costs have been increasing at 8% per year compounded annually for the past 8 years. A house with a \$160,000 value now would have had what value 8 years ago?

- 6.16. If the population in a particular third world country is growing at 4% compounded annually, how long will it take the population to double? (Round up to the next higher year if not exact.)
- 6.17. If the world population is now about 5 billion people and is growing at 2% compounded annually, how long will take the population to grow to 8 billion people? (Round up to the next higher year if not exact.)
- 6.18. Which is the better investment and why: 9% compounded monthly or 9.3% compounded annually?
- 6.19. Which is the better investment and why: 8% compounded quarterly or 8.3% compounded annually?
- 6.20. You have saved \$7,000 towards the purchase of a car costing \$9,000. How long will the \$7,000 have to be invested at 9% compounded monthly to grow to \$9,000? (Round up to the next higher month if not exact.)
- 6.21. A newly married couple has \$15,000 towards the purchase of a house. For the type of house they are interested in buying, they estimate that a \$20,000 down payment will be necessary. How long will the money have to be invested at 10% compounded quarterly to grow to \$20,000? (Round up to the next higher quarter if not exact.)
- 6.22. An Individual Retirement Account (IRA) has \$20,000 in it and the owner decides not to add any more money to the account other than interest earned at 8% compounded daily. How much will be in the account 35 years from now when the owner reaches retirement age?
- 6.23. If one dollar had been placed in a bank account at the birth of Christ and forgotten until now, how much would be in the account at the end of 1990 if money earned 2% interest compounded annually? 2% simple interest? (Now you can see the power of compounding and see why inactive accounts are closed after a relatively short period of time.)
- 6.24. How long will it take money to double if it is invested at 14% compounded daily? 15% compounded annually? (Compute answers in years to three decimal places.)

7 Future value

- 7.1. What is the value of an ordinary annuity at the end of 10 years if \$500 per quarter is deposited into an account earning 8% compounded quarterly, How much of this value is interest?
- 7.2. What is the value of an ordinary annuity at the end of 20 years if \$1,000 per year is deposited into an account earning 7% compounded annually? How much of this value is interest?
- 7.3. In order to accumulate enough money for a down payment on a house, a couple deposits \$300 per month into an account paying 6% compounded monthly. If payments are made at the end of each period, how much money will be in the account in 5 years?
- 7.4. A self-employed person has a Keogh retirement plan. (This type of plan is free of taxes until money is withdrawn.) If deposits of \$7,500 are made each year into an account after 20 years?

- 7.5. In 5 years a couple would like to have \$25,000 for a down payment on a house. What fixed amount should be deposited each month into an account paying 9% compounded monthly?
- 7.6. A person wishes to have \$200,000 in an account for retirement 15 years from now. How much should be deposited quarterly in an account paying 8% compounded quarterly?
- 7.7. A company estimates it will need \$100,000 in 8 years to replace a computer. If it establishes a sinking fund by making fixed monthly payments into an account paying 12% compounded monthly, how much should each payment be?
- 7.8. Presets have set up a sinking fund in order to have \$30,000 in 15 years for their children's college education. How much should be paid semiannually into an account paying 10% compounded semiannually?
- 7.9. Beginning in January, a person plans to deposit \$100 at the end of each month into an account earning 9% compounded monthly. Each year taxes must be paid on the interest earned during each year for the first 3 years.
- 7.10. If 500 is deposited each quarter into an account paying 12% compounded quarterly for 3 years, find the interest earned during each of the 3 years.
- 7.11. Why does it make sense to open an Individual Retirement Account (IRA) early in one's life? (Money deposited into an IRA and earnings from an IRA are tax deferred until withdrawal.) Compare the following:
- Jane deposits \$2,000 a year into an IRA account earning 9% compounded annually. She makes her first deposit on her 24th birthday and her last deposit on her 31st birthday (8 deposits in all). Making no additional deposits, she leaves the accumulated amount from the 8 deposits in the account, earning interest at 9% compounded annually, until her 65th birthday. How much (to the nearest dollar) will be in her account on her 65th birthday?
 - John, procrastinating, doesn't make his first \$2,000 deposit into an IRA account until he is 32, but then he continues to deposit \$2,000 on every birthday until he is 65 (34 deposits in all). If his account also earns 9% compounded annually, how much (to the nearest dollar) will he have in his account when he makes his last deposit on his 65th birthday?
- 7.12. Starting on his 24th birthday, and continuing on every birthday up to and including his 65th, a person deposits \$2,000 a year into an IRA. How much (to the nearest dollar) will be in the account on the 65th birthday, if the account earns:
- 6% compounded annually?
 - 8% compounded annually?
 - 10% compounded annually?
 - 12% compounded annually?
- 7.13. You wish to have \$10,000 in 4 years to buy a car. How much should you deposit each month into an account paying 8% compounded monthly? How much interest will the account earn in the 4 years?

- 7.14. A company establishes a sinking fund to upgrade a plant in 5 years at an estimated cost of \$1,500,000. How much should be invested each quarter into an account paying 9.15% compounded quarterly? How much interest will the account earn in the 5 years?
- 7.15. You can afford monthly deposit of only \$150 into an account that pays 8.5% compounded monthly. How long will it be until you have \$7,000 to buy a boat? (Round to the next higher month if not exact.)
- 7.16. A company establishes a sinking fund for upgrading office equipment with monthly payments of \$1,000 into an account paying 10% compounded monthly. How long will it be an account has \$100,000? (Round up to the next higher month if not exact.)

8 Present value

- 8.1. A relative wills you an annuity paying \$4,000 per quarter for the next 10 years. If money is worth 8% compounded quarterly, what is the present value of this annuity?
- 8.2. How much should you deposit in an account paying 12% compounded monthly in order to receive \$1,000 per month for the next 2 years?
- 8.3. Parents of a college student wish to set up an annuity that will pay \$350 per month to the student for 4 years. How much should they deposit now at 9% interest compounded monthly to establish this annuity? How much will the student receive in the 4 years?
- 8.4. A person pays \$120 per month for 48 months for a car, making no down payment. If the loan costs 1.5% interest per month on the unpaid balance, what was the original cost of the car? How much total interest will be paid?
- 8.5. (A) If you buy a stereo set for \$600 and agree to pay for it in 18 equal installments at 1% interest per month on the unpaid balance, how much are your monthly payments? How much interest will you pay?
 (B) Repeat part A for 1.5% interest per month on the unpaid balance.
- 8.6. (A) A company buys a large copy machine for \$12,000 and finances it at 12% interest compounded monthly. If the loan is to be amortized in 6 years in equal monthly payments, how much is each payment? How much interest will be paid?
 (B) Repeat part A with 18% interest compounded monthly.
- 8.7. A sailboat costs \$16,000. You pay 25% down and amortize the rest with equal monthly payments over a 6 year period. If you must pay 1.5% interest per month on the unpaid balance (18% compounded monthly), what is your monthly payment? How much interest will you pay over the 6 years?
- 8.8. A law firm buys a computerized word-processing system costing \$10,000. If it pays 20% down and amortizes the rest with equal monthly payments over 5 years at 9% compounded monthly, what will be the monthly payment? How much interest will the firm pay?
- 8.9. Construct the amortization schedule for a \$5,000 debt that is to be amortized in 8 equal quarterly payments at 4.5% interest per quarter on the unpaid balance.

- 8.10. Construct the amortization schedule for a \$10,000 debt that is to be amortized in 6 equal quarterly payments at 3.5% interest per quarter on the unpaid balance.
- 8.11. A person borrows \$6,000 at 12% compounded monthly, which is to be amortized over 3 years in equal monthly payments. For tax purposes, he needs to know the amount of interest paid during each year of the loan. Find the interest paid during the first year, the second year, and the third year of the loan. [Hint: Find the unpaid balance after 12 payments and after 24 payments.]
- 8.12. A person establishes an annuity for retirement by depositing \$50,000 into an account that pays 9% compounded monthly. Equal monthly withdrawals will be made each month for 5 years, at which time the account will have a zero balance. Each year taxes must be paid on the interest earned by account during that year. How much interest was earned during the first year? [Hint: The amount in the account at the end of the first year is the present value of a 4 year annuity.]
- 8.13. *Present value.* A promissory note will pay \$50,000 at maturity $5\frac{1}{2}$ years from now. How much should you be willing to pay for the note now if money is worth 10% compounded continuously?
- 8.14. *Present value.* A promissory note will pay \$30,000 at maturity 10 years from now. How much should you be willing to pay for the note now if money is worth 9% compounded continuously?
- 8.15. Some friends tell you that they paid \$25,000 down on a new house and are to pay \$525 per month for 30 years. If interest is 9.8% compounded monthly, what was the selling price of the house? How much interest will they pay in 30 years?
- 8.16. A family is thinking about buying a new house costing \$120,000. They must pay 20% down, and the rest is to be amortized over 30 years in equal monthly payments. If money costs 9.6% compounded monthly, what will their monthly payment be? How much total interest will be paid over the 30 years?
- 8.17. A student receives a federally backed student loan of \$6,000 at 3.5% interest compounded monthly. After finishing college in 2 years, the student must amortize the loan in the next 4 years by making equal monthly payments. What will the payments be and what total interest will the student pay? [Hint: This is a two-part problem. First find the amount of the debt at the end of the first 2 years; then amortize this amount over the next 4 years.]