10-2 EQUITY AND DEPRECIATION FOR NEW AND USED CARS

Alex thought it would be fun to help his father pick out a used van for the family. His father took him to quite a few used-car lots, where they looked at a variety of vans before they finally made the deal for the van they bought. At first, Alex did not understand why his father inspected the vans so closely and insisted on driving them, sometimes even onto the freeway and back.

Alex's father told him about the first used car that he had bought. It was only two years old and showed 14,000 miles on the odometer. Alex's father took a short test drive and didn't even notice that the odometer was not working. In fact, he didn't notice a number of things about the car. It turned out that the car was a repainted taxi with 90,000 miles on it. During the first year the car needed a new radiator, an alternator, a fuel pump, and a rebuilt transmission. These repairs were very costly.

Alex now understands why the van that his father finally purchased was thoroughly checked by their mechanic before his father bought it. He also knows that there is a lot more to buying a used car than first meets the eye.

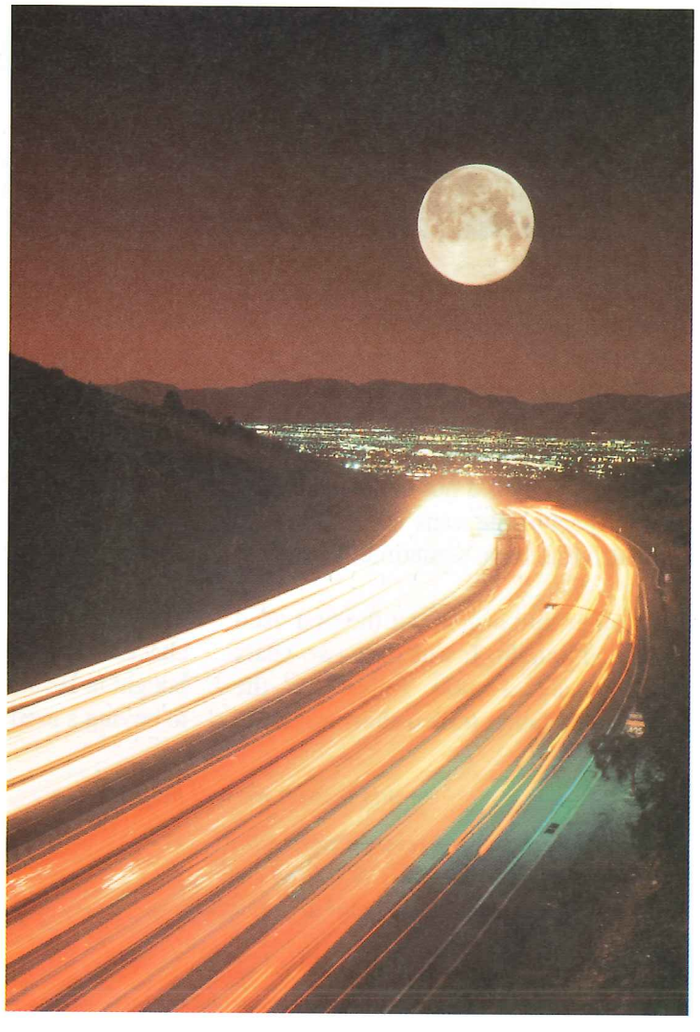
OBJECTIVES: *In this lesson, we will help Alex to:*

- *Learn how to select a used car.*
- *Estimate the value of a used car.*
- *Understand equity and depreciation.*

EQUITY AND DEPRECIATION

When you take out a loan to buy a car, the car dealer is being paid mostly by the bank. The bank really owns the car until you finish paying for it. If for some reason you cannot continue your car payments, you will have to sell the car to pay the remainder of loan, or the bank will repossess the car—that is, take it from you. As you pay off the loan, you increase your equity in the car. **Equity** is your part of the financial worth of the car. If your car could be resold for $8000 but you still owe $3000 on a loan, then your equity in the car is $5000.

But what is a car worth at any time? You know that a car loses value as it gets older. It can be sold for less and less, until it is worth nothing. This loss in the value of the car is called **depreciation.** For a new car this loss begins immediately after you purchase the car. For a used car, depreciation is more gradual.



Depreciation varies from one car to another. Some cars have a reputation for lasting and therefore hold their value better than others. Also, inflation means that the price of everything goes up a little bit each year. Inflation slightly reduces the effects of depreciation. Straight-line depreciation means that a car, or whatever is being discussed, depreciates an equal amount each year. For example, if a car costs $20,000 and depreciates over a straight line for 10 years, it loses 10% of its original cost or $2000 each year.

But cars, especially new cars, do not depreciate in a straight line. They tend to lose more of their resale value in the first years and less in the later years. A car might depreciate by 25–30% in the first year and 20–25% in the second year. To Alex, this does not seem "right." An "almost new car" should be worth almost as much as a new car. In fact, people now watch their finances more closely and are often interested in buying almost new cars. Consequently, newly purchased cars do not depreciate as rapidly as brand-new cars.

WHERE TO BUY

Alex has learned that while it is fairly easy to compare the prices of new cars at different dealers, it is difficult to compare the prices of used cars. This is because you can rarely find two used cars of the same year and model with the same number of miles and the same amount of wear and tear. Fortunately, there are lists that give the book value for used cars. **Book value** is a standard estimate of the resale value for an average used car of a particular year and model. Current used car prices are found in *Edmund's Used Car Prices* and in the *Official Used Car Guide* published monthly by the National Automobile Dealer's Association. The latter publication is also know as the *Blue Book.* The book value is sometimes used for tax purposes. In practice, you can expect to pay more or less than the book value depending on the condition of the car.

Dealers New car dealers generally keep the best used cars traded in, so you can expect to find good, but fairly expensive, used cars at new car dealers. There are many different kinds of salespeople at a used-car dealership. Some will help you find the best car to suit your needs; others just want to make a sale as quickly as possible. Until you get some experience, it is important to go slowly when looking at cars. Talk to your friends and relatives about different dealers. Ask a knowledgeable friend to go with you when you first visit car dealers. The Federal Trade Commission (FTC) has written consumer-protection regulations concerning the selling of used cars. The FTC encourages the buyer to have all verbal claims put in writing and to have a mechanic inspect the car before it is purchased.

Private Sales Cars for sale are listed in the newspaper. If a buyer knows what he or she wants, what questions to ask, and how to look at a car, then a private sale can be a good deal. It is always important to read the car's **title** carefully to be sure that there is no mistake about the car or owner. FTC regulations do not apply to used cars if they are purchased from an individual.

Car Rental Company Sales and Auctions Sometimes good used cars are available when rental agencies or other companies sell their cars. Rental cars are generally kept in excellent condition, but a buyer should always think twice about buying a car that has been driven by many people. Cars bought at auction or from a car-leasing agency require extra investigation because maintenance information may not be available.

Inspecting a Used Car It should be clear that staring at an engine, kicking the tires, or driving a car around the block will not tell you what you need to know about the condition of a used car. A smart buyer conducts three types of inspections: on the lot, on the road, and in the garage.

On the lot, you should ask questions about the history of the car including replacement of parts, accidents, and the number of previous owners. On the road, you should pay attention to how the car feels and sounds. Trust your experience, and ask more questions if anything does not seem right. Finally, pay a mechanic to examine the car. You will do this only with a car that you are almost ready to buy.

In addition, the name of the previous owner must be given to you with a proof of odometer reading. It is also a good idea to call the National Highway Traffic Safety Administration (1-800-424-9393) to see if there are any safety recalls on the car.

ALGEBRA *REVIEW*

Set up an appropriate coordinate system and plot the points.

1. (1, 1000), (2, 600), (3, 400)
2. (1, 10,000), (2, 8000), (3, 6000)
3. (1, 10.5), (2, 21), (3, 42)

Find the value of t. Round to the nearest hundredth.

4. $t = 1.05^{10}$
5. $t = (1000)(1.006)^{24}$
6. $t = (5000)(1.005)^{36}$

Evaluate each for $x = 3$.

7. $3.5x - 1$
8. $1.05x + 2.007$
9. $1.05x + 2.25$
10. $1.005x$

Ask Yourself

1. What is equity?
2. What is depreciation?
3. Which depreciates more rapidly in the early years, a new car or a used car?
4. What is book value?
5. Why do new car dealers tend to charge more for their used cars than other dealers?

SHARPEN YOUR SKILLS

SKILL 1

There are several different ways to calculate depreciation. The method depends on the rate at which a car, or something else of value, tends to lose its value.

EXAMPLE 1 A new car sells for $20,000 and depreciates in a straight line until, after ten years, it is worth nothing.

QUESTION How would you construct a table and draw a graph to show the straight-line depreciation?

SOLUTION

The amount of depreciation is the same for each year. Depreciation begins as soon as the car is purchased and continues at the rate of 10% per year. At the end of the first year the car has depreciated $2000.

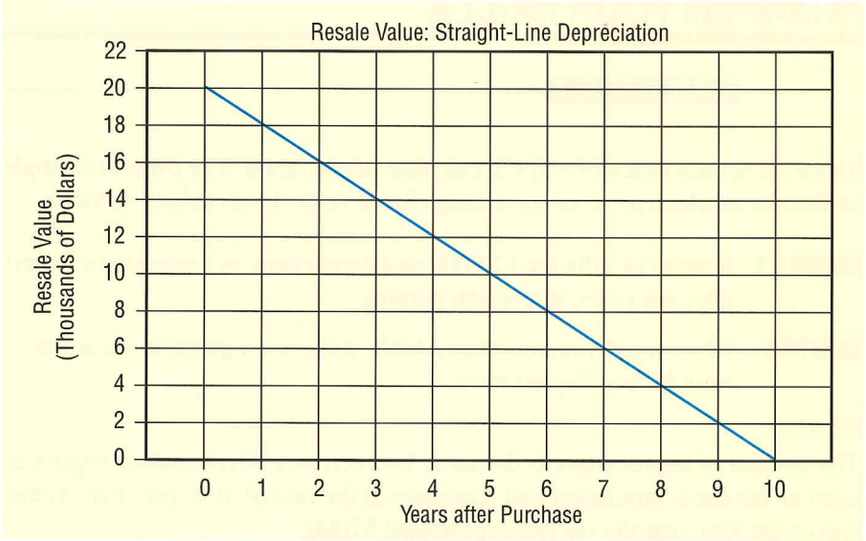
$$20{,}000 \cdot 0.10 = 2000$$

You can use a spreadsheet to calculate the depreciation and graph the results. Choose the number of years for x values and the resale values for y values. The graph shows the resale value as a function of time.

	A	B	C	D
1		Percent of	Amount of	Resale
2	Year	Depreciation	Depreciation	Value
3	0			20000
4	1	10%	2000	18000
5	2	10%	2000	16000
6	3	10%	2000	14000
7	4	10%	2000	12000
8	5	10%	2000	10000
9	6	10%	2000	8000
10	7	10%	2000	6000
11	8	10%	2000	4000
12	9	10%	2000	2000
13	10	10%	2000	0

+D3−C4

The graph of the resale value of the car is a straight line that slopes downward and to the right. This slope accounts for the name "straight-line" depreciation. The graph appears at the top of the next page.



EXAMPLE 2 Records for one standard model of car indicate that during 10 years it depreciates by the following percent of the original cost:

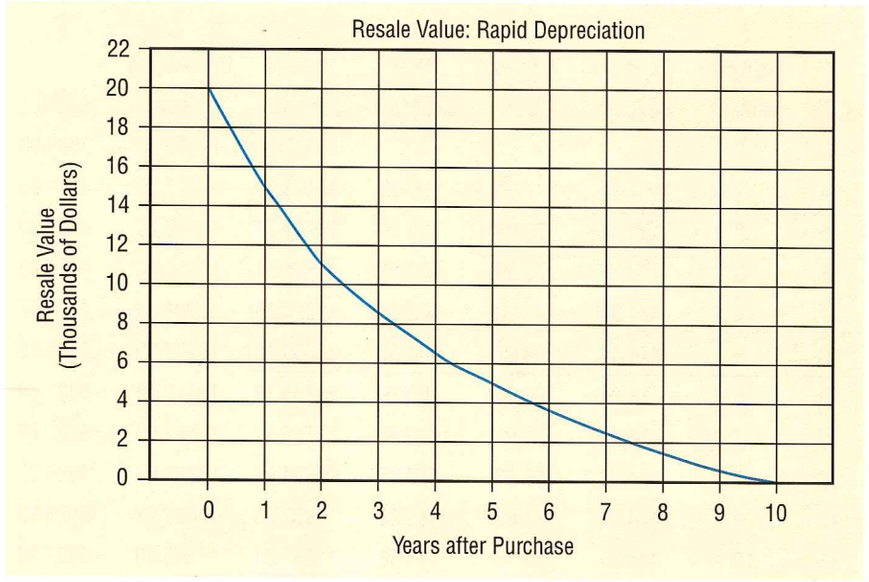
25, 20, 12, 10, 8, 7, 6, 5, 4, 3.

QUESTION How can these percents be used to form a table and a graph to represent the depreciation?

SOLUTION

We start with the original price of $20,000 and subtract the depreciation amount for each year. Use a spreadsheet as in Example 1. Again, the graph shows the resale value of the car as a function of time. In the formula for cell C4, be sure to use an *absolute* address for cell D3 so the address stays the same when the formula is copied to another cell.

	A	B	C	D
1		Percent of	Amount of	Resale
2	Year	Depreciation	Depreciation	Value
3	0		+D3*B4	20000
4	1	25%	5000	+D3−C4 → 15000
5	2	20%	4000	11000
6	3	12%	2400	8600
7	4	10%	2000	6600
8	5	8%	1600	5000
9	6	7%	1400	3600
10	7	6%	1200	2400
11	8	5%	1000	1400
12	9	4%	800	600
13	10	3%	600	0



SKILL 2

Comparing depreciation with loan repayment can help you understand what your car is really worth and how to use your money.

EXAMPLE 3 Bryan decides to buy the Moonbeam car discussed in Lesson 10–1, Example 3, for $19,490. He makes a down payment of 20% and obtains a 3-year loan at an APR of 6%.

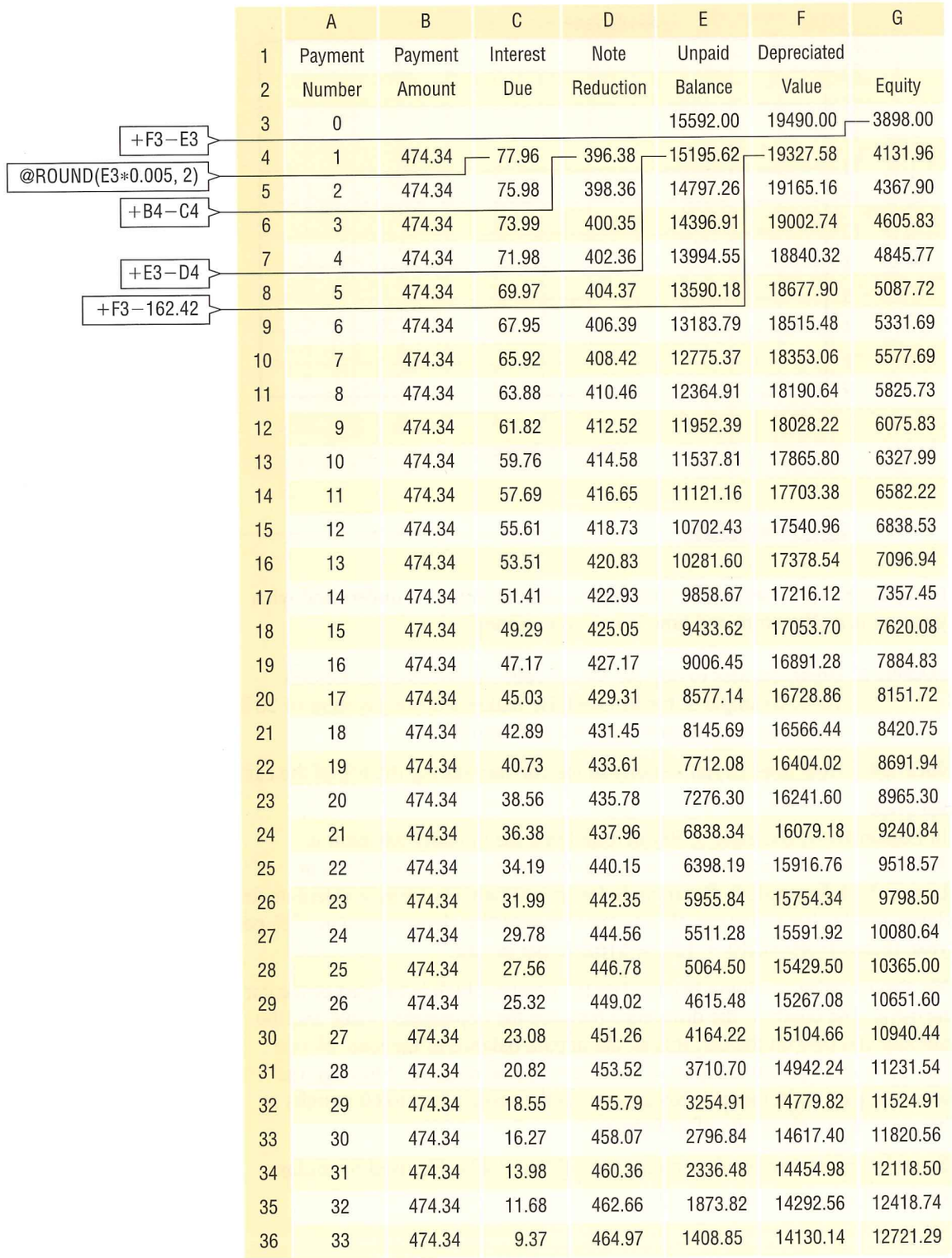
QUESTION How does Bryan's equity in the car vary during the life of the car?

SOLUTION

In Lesson 10–1, Example 3, Bryan found that the monthly payment is $474.34. He uses a spreadsheet to make an amortization schedule as in Lesson 5–4, Example 2. Bryan includes an additional column to calculate the depreciated value of the car. He assumes straight-line depreciation at 10% per year, that is 19,490(0.10 ÷ 12), or $162.42 per month.

He also includes a column to calculate the equity, which is the part of the car he owns. The equity is the difference between the depreciated value and the amount you owe on the car; that is, the unpaid balance of the loan. Notice that the final payment is adjusted for a zero unpaid balance. Although the loan is repaid in 36 months, Bryan extends the spreadsheet to 60 months so he can find out his equity after 5 years.

Bryan's spreadsheet is shown on pages 470 and 471. He used formulas as shown.



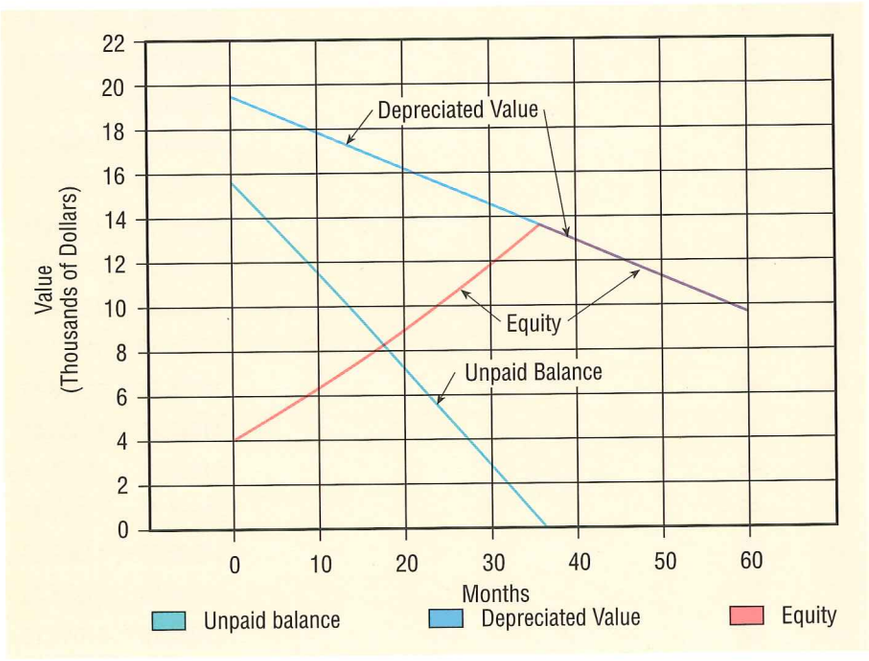
	A	B	C	D	E	F	G
1	Payment	Payment	Interest	Note	Unpaid	Depreciated	
2	Number	Amount	Due	Reduction	Balance	Value	Equity
3	0				15592.00	19490.00	3898.00
4	1	474.34	77.96	396.38	15195.62	19327.58	4131.96
5	2	474.34	75.98	398.36	14797.26	19165.16	4367.90
6	3	474.34	73.99	400.35	14396.91	19002.74	4605.83
7	4	474.34	71.98	402.36	13994.55	18840.32	4845.77
8	5	474.34	69.97	404.37	13590.18	18677.90	5087.72
9	6	474.34	67.95	406.39	13183.79	18515.48	5331.69
10	7	474.34	65.92	408.42	12775.37	18353.06	5577.69
11	8	474.34	63.88	410.46	12364.91	18190.64	5825.73
12	9	474.34	61.82	412.52	11952.39	18028.22	6075.83
13	10	474.34	59.76	414.58	11537.81	17865.80	6327.99
14	11	474.34	57.69	416.65	11121.16	17703.38	6582.22
15	12	474.34	55.61	418.73	10702.43	17540.96	6838.53
16	13	474.34	53.51	420.83	10281.60	17378.54	7096.94
17	14	474.34	51.41	422.93	9858.67	17216.12	7357.45
18	15	474.34	49.29	425.05	9433.62	17053.70	7620.08
19	16	474.34	47.17	427.17	9006.45	16891.28	7884.83
20	17	474.34	45.03	429.31	8577.14	16728.86	8151.72
21	18	474.34	42.89	431.45	8145.69	16566.44	8420.75
22	19	474.34	40.73	433.61	7712.08	16404.02	8691.94
23	20	474.34	38.56	435.78	7276.30	16241.60	8965.30
24	21	474.34	36.38	437.96	6838.34	16079.18	9240.84
25	22	474.34	34.19	440.15	6398.19	15916.76	9518.57
26	23	474.34	31.99	442.35	5955.84	15754.34	9798.50
27	24	474.34	29.78	444.56	5511.28	15591.92	10080.64
28	25	474.34	27.56	446.78	5064.50	15429.50	10365.00
29	26	474.34	25.32	449.02	4615.48	15267.08	10651.60
30	27	474.34	23.08	451.26	4164.22	15104.66	10940.44
31	28	474.34	20.82	453.52	3710.70	14942.24	11231.54
32	29	474.34	18.55	455.79	3254.91	14779.82	11524.91
33	30	474.34	16.27	458.07	2796.84	14617.40	11820.56
34	31	474.34	13.98	460.36	2336.48	14454.98	12118.50
35	32	474.34	11.68	462.66	1873.82	14292.56	12418.74
36	33	474.34	9.37	464.97	1408.85	14130.14	12721.29

	A	B	C	D	E	F	G
1	Payment	Payment	Interest	Note	Unpaid	Depreciated	
2	Number	Amount	Due	Reduction	Balance	Value	Equity
37	34	474.34	7.04	467.30	941.55	13967.72	13026.17
38	35	474.34	4.71	469.63	471.92	13805.30	13333.38
39	36	474.28	2.36	471.92	0.00	13642.88	13642.88
40	37					13480.46	13480.46
41	38					13318.04	13318.04
42	39					13155.62	13155.62
43	40					12993.20	12993.20
44	41					12830.78	12830.78
45	42					12668.36	12668.36
46	43					12505.94	12505.94
47	44					12343.52	12343.52
48	45					12181.10	12181.10
49	46					12018.68	12018.68
50	47					11856.26	11856.26
51	48					11693.84	11693.84
52	49					11531.42	11531.42
53	50					11369.00	11369.00
54	51					11206.58	11206.58
55	52					11044.16	11044.16
56	53					10881.74	10881.74
57	54					10719.32	10719.32
58	55					10556.90	10556.90
59	56					10394.48	10394.48
60	57					10232.06	10232.06
61	58					10069.64	10069.64
62	59					9907.22	9907.22
63	60					9744.80	9744.80

Notice what happens in row 39 of the spreadsheet. Bryan's last payment amount was $474.28, which he inserts in cell B39. Now his unpaid balance is zero. Also, the depreciated value and the equity are equal.

Since his loan is paid off, he only needs to calculate the depreciated value and the equity in row 40. He adjusts row 40 to calculate only the depreciated value and the equity, and copies row 40 onto rows 41–63.

Bryan graphs the unpaid balance, the depreciated value, and the equity on the same graph. He notices that the graphs intersect and observes that after 36 months, the depreciated value is equal to his equity in the car. His equity in the car increases and then decreases when the depreciated value is less than the amount of money he has spent for the car. Although the graphs of the unpaid balance and the equity appear to be a straight lines, they are not. These graphs are slightly curved.



TRY YOUR SKILLS

A new car is purchased for $16,000, with a 20% down payment, and is financed for 3 years at a rate of 7.2% per year.

1. Find the amount of the monthly payment.
2. Find the amount of interest paid in the first payment.
3. Find the amount of principal paid in the first payment.
4. Find the amount of interest and principal paid in the second payment.
5. If the car depreciates 30% the first year and 20% the second year, what is its resale value at the beginning of the third year?
6. Since the car depreciates 30% during the first year, what is the percent of depreciation during the first month?
7. Find the owner's equity in the car at the end of 1 year.

EXERCISE YOUR SKILLS

1. Why do some buyers prefer "young" used cars to new cars?
2. How can a used-car buyer reduce the chances of making a mistake when purchasing a used car?

Alex's uncle purchased a new car for $24,000. Terms of financing were 15% down, 6% annual interest, and 36 months to pay. Annual depreciation on the car as a percent of the purchase price is likely to follow the pattern 30%, 20%, 15%, 10%, 8%, 7%, 5%, 3%, 2%.

3. Find the amount of the monthly payment.
4. Find the amount of interest paid in the first payment.
5. Find the amount of principal paid in the first payment.
6. What is the estimated resale value (depreciated value) of the car at the start of the fourth year after purchase?
7. Draw a graph showing the unpaid balance as a function of time. Example 3 will remind you of how this is done. (A straight line will approximate this graph.)
8. On the same axes as the graph for Exercise 7, graph the resale value of the car based on depreciation.
9. Draw a graph showing equity as a function of time.
10. At approximately what point in time does Alex's uncle have the least amount of equity in the car?
11. At approximately what point in time does Alex's uncle have the greatest amount of equity in the car?

Alex's father purchases a used van for $12,000. He pays $4000 down and finances the car for 3 years at an annual rate of 9%. He estimates that, because it is used, the van will depreciate in a straight line over 6 years.

12. Find the monthly payment for the van.
13. Find the amount of interest paid in the first payment.
14. Find the amount of principal paid in the first payment.
15. Graph the outstanding balance of the loan as a function of time.
16. On the same axes, graph the resale value as determined by depreciation.
17. What is the approximate equity in the car after 3 years?

KEY TERMS

book value
depreciation
equity
title

Bob and Dena are both planning to purchase used cars for $8000. Financing can be selected from the following terms: The amount of the down payment can be 10% at a 6.5% annual interest rate or 20% at a 5.5% annual interest rate; the time of the loan can be 3, 4, or 5 years. Bob has $3000 in the bank and a good job and would like to purchase a new car in 3 years. Dena has $500 saved and can borrow a few hundred dollars from her parents. She has a part-time job and hopes to keep the car for as long as possible.

18. Which financing terms would be best for Bob and why?
19. Which financing terms would be best for Dena and why?
20. According to the terms you selected, who pays the greater total amount for the car?
21. If the car depreciates in a straight line over 5 years, what amount is Bob likely to get when he sells it?

MIXED REVIEW

1. Jason works from 10:00 A.M. until 12:30 P.M., and then from 1:00 P.M. to 5:00 P.M. He earns $9.60 an hour. What is his daily pay?
2. Emily has $568.21 in her checking account. What is the balance in the account after she pays bills totalling $178.96?
3. Find the interest earned on $790.30 for one month at a monthly interest rate of 0.45%.
4. Use the Multiples of Salary Chart in the Reference Section to find the amount of life insurance a 25-year-old who has gross earnings of $23,500 would need in order to provide 60% income replacement.
5. If you buy 680 shares of stock at a price of $21\frac{1}{4}$ per share, what is the total cost of the stock? The commission rate is 1.5%.

What profit does an insurance company expect to make for each 1-year term insurance policy described in Exercises 6 and 7? Assume that the direct and indirect expenses for each policy are $20. Refer to the following table. Write and solve an equation.

EXPECTED DEATHS PER 100,000 ALIVE AT SPECIFIED AGE		
Age	**Expected Deaths Within 1 Year**	**Expected to be Alive in 1 Year**
45	315	99,685
46	341	99,659
47	371	99,629
48	405	99,595
49	443	99,557

6. Face value: $100,000; Age of insured: 47; annual premium: $500
7. Face value: $180,000; Age of insured: 45; annual premium: $860