2005 annual report, Amazon.com notes that "we currently lease office and fulfillment center facilities and fixed assets under non-cancelable operating and capital leases."

STOP • REVIEW • APPLY

3-1. What is a contingent liability, and how does it differ from a commitment?

3-2. What are two examples of contingent liabilities? Why is each a contingent liability?

3-3. What is an example of a commitment?

The Time Value of Money

LO4 Define the *time value of money,* and apply it to future and present values.

"Time is money" is a common expression. It derives from the concept of the **time value of money**, which refers to the costs or benefits derived from holding or not holding money over time. **Interest** is the cost of using money for a specific period.

The interest associated with the time value of money is an important consideration in any kind of business decision. For example, if you sell a bicycle for $100 and hold that amount for one year without putting it in a savings account, you have forgone the interest that the money would have earned. However, if you accept a note payable instead of cash and add the interest to the price of the bicycle, you will not forgo the interest that the cash could have earned.

Study Note

In business, compound interest is the most useful concept of interest because it helps decision makers choose among alternative courses of action.

Simple interest is the interest cost for one or more periods when the principal sum—the amount on which interest is computed—stays the same from period to period. **Compound interest** is the interest cost for two or more periods when after each period, the interest earned in that period is added to the amount on which interest is computed in future periods. In other words, the principal sum is increased at the end of each period by the interest earned in that period. The following two examples illustrate these concepts:

Example of Simple Interest Joe Sanchez accepts an 8 percent, $30,000 note due in 90 days. How much will he receive at that time? The interest is calculated as follows:

$$\begin{aligned}\text{Interest} &= \text{Principal} \times \text{Rate} \times \text{Time}\\ &= \$30{,}000.00 \times 8/100 \times 90/365\\ &= \$591.78\end{aligned}$$

Therefore, the total that Sanchez will receive is $30,591.78, calculated as follows:

$$\begin{aligned}\text{Total} &= \text{Principal} + \text{Interest}\\ &= \$30{,}000.00 + \$591.78\\ &= \$30{,}591.78\end{aligned}$$

Example of Compound Interest Anna Wang deposits $5,000 in an account that pays 6 percent interest. She expects to leave the principal and accumulated interest in the account for three years. How much will the account total at the end of three years? Assume that the interest is paid at the end of the year and is added to the principal at that time, and that this total in turn earns interest. The amount at the end of three years is computed as follows:

(1) Year	(2) *Principal Amount at Beginning of Year*	(3) *Annual Amount of Interest (Col. 2 × 6%)*	(4) *Accumulated Amount at End of Year (Col. 2 + Col. 3)*
1	$5,000.00	$300.00	$5,300.00
2	5,300.00	318.00	5,618.00
3	5,618.00	337.08	5,955.08

At the end of three years, Wang will have $5,955.08 in her account. Note that the amount of interest increases each year by the interest rate times the interest of the previous year. For example, between year 1 and year 2, the interest increased by $18, which equals 6 percent times $300.

Future Value

Another way to ask the question we posed in our example of compound interest is, What is the future value of a single sum ($5,000) at compound interest (6 percent) for three years? **Future value** is the amount an investment will be worth at a future date if invested at compound interest. Managers often want to know future value, but the method of computing future value that we just illustrated is too time-consuming in practice. Imagine how tedious the calculation would be if the example were ten years instead of three. Fortunately, there are tables that simplify solving problems involving compound interest. Table 1, which shows the future value of $1 after a given number of periods, is an example. This table and the others in this chapter are excerpts from larger tables in the appendix on future value and present value tables.

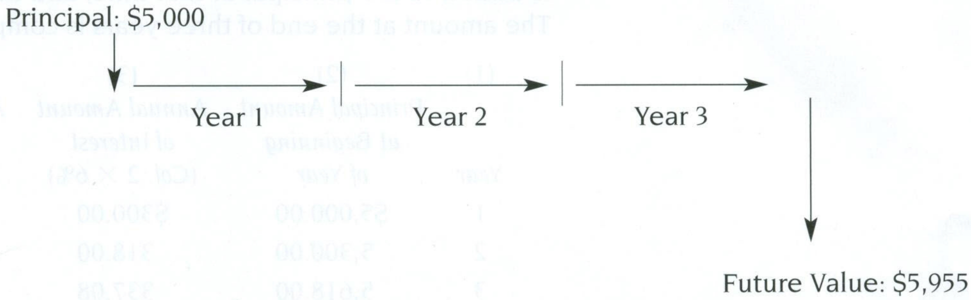
Future Value of a Single Sum Invested at Compound Interest

Using Table 1 to compute the future value of Anna Wang's savings account, we simply look down the 6 percent column until we reach the line for three periods and find the factor 1.191. This factor, when multiplied by $1, gives the

TABLE 1. Future Value of $1 After a Given Number of Periods

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%
1	1.010	1.020	1.030	1.040	1.050	1.060	1.070	1.080	1.090	1.100	1.120	1.140	1.150
2	1.020	1.040	1.061	1.082	1.103	1.124	1.145	1.166	1.188	1.210	1.254	1.300	1.323
3	1.030	1.061	1.093	1.125	1.158	1.191	1.225	1.260	1.295	1.331	1.405	1.482	1.521
4	1.041	1.082	1.126	1.170	1.216	1.262	1.311	1.360	1.412	1.464	1.574	1.689	1.749
5	1.051	1.104	1.159	1.217	1.276	1.338	1.403	1.469	1.539	1.611	1.762	1.925	2.011
6	1.062	1.126	1.194	1.265	1.340	1.419	1.501	1.587	1.677	1.772	1.974	2.195	2.313
7	1.072	1.149	1.230	1.316	1.407	1.504	1.606	1.714	1.828	1.949	2.211	2.502	2.660
8	1.083	1.172	1.267	1.369	1.477	1.594	1.718	1.851	1.993	2.144	2.476	2.853	3.059
9	1.094	1.195	1.305	1.423	1.551	1.689	1.838	1.999	2.172	2.358	2.773	3.252	3.518
10	1.105	1.219	1.344	1.480	1.629	1.791	1.967	2.159	2.367	2.594	3.106	3.707	4.046

future value of that $1 at compound interest of 6 percent for three periods (years in this case). Thus, we solve the problem as follows:



Principal	×	Factor	=	Future Value
$5,000	×	1.191	=	$5,955

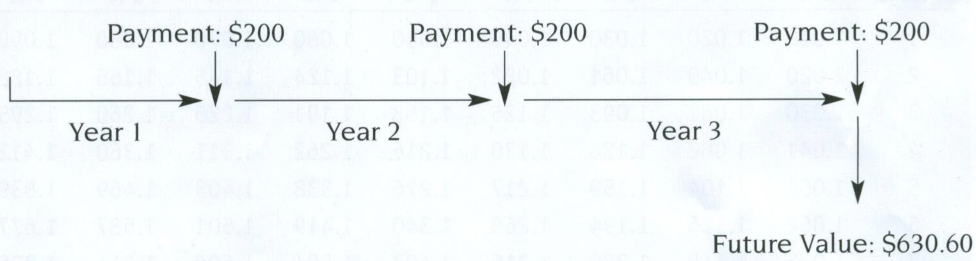
Except for a rounding difference of $.08, the answer is the same as our earlier one.

Future Value of an Ordinary Annuity Another common problem involves an **ordinary annuity**, which is a series of equal payments made at the end of equal intervals of time, with compound interest on these payments. For example, suppose that at the end of each of the next three years, Ben Katz puts $200 into a savings account that pays 5 percent interest. How much money will he have in his account at the end of the three years? The following is one way of computing the amount:

(1) Year	(2) *Beginning Balance*	(3) *Interest Earned (5% × Col. 2)*	(4) *Periodic Payment*	(5) *Accumulated at End of Period (Col. 2 + Col. 3 + Col. 4)*
1	—	—	$200	$200.00
2	$200.00	$10.00	200	410.00
3	410.00	20.50	200	630.50

Katz would have $630.50 in his account at the end of three years, consisting of $600.00 in periodic payments and $30.50 in interest.

We can simplify this calculation by using Table 2. Looking down the 5 percent column and across the row for the third period, we find the factor 3.153. This factor, when multiplied by $1, gives the future value of a series of three $1 payments at compound interest of 5 percent. Thus, we solve the problem as follows:



Periodic Payment	×	Factor	=	Future Value
$200.00	×	3.153	=	$630.60

Except for a rounding difference of $.10, the result is the same as our earlier one.

TABLE 2. Future Value of an Ordinary Annuity of $1 Paid in Each Period for a Given Number of Periods

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	12%	14%	15%
1	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000	1.000
2	2.010	2.020	2.030	2.040	2.050	2.060	2.070	2.080	2.090	2.100	2.120	2.140	2.150
3	3.030	3.060	3.091	3.122	3.153	3.184	3.215	3.246	3.278	3.310	3.374	3.440	3.473
4	4.060	4.122	4.184	4.246	4.310	4.375	4.440	4.506	4.573	4.641	4.779	4.921	4.993
5	5.101	5.204	5.309	5.416	5.526	5.637	5.751	5.867	5.985	6.105	6.353	6.610	6.742
6	6.152	6.308	6.468	6.633	6.802	6.975	7.153	7.336	7.523	7.716	8.115	8.536	8.754
7	7.214	7.434	7.662	7.898	8.142	8.394	8.654	8.923	9.200	9.487	10.090	10.730	11.070
8	8.286	8.538	8.892	9.214	9.549	9.897	10.260	10.640	11.030	11.440	12.300	13.230	13.730
9	9.369	9.755	10.160	10.580	11.030	11.490	11.980	12.490	13.020	13.580	14.780	16.090	16.790
10	10.460	10.950	11.460	12.010	12.580	13.180	13.820	14.490	15.190	15.940	17.550	19.340	20.300

Present Value

Study Note

Present value is a method of valuing future cash flows. Financial analysts commonly compute present value to determine the value of potential investments.

Suppose you had the choice of receiving $100 today or one year from today. No doubt, you would choose to receive it today. Why? If you have the money today, you can put it in a savings account to earn interest so you will have more than $100 a year from today. In other words, an amount to be received in the future (future value) is not worth as much today as an amount received today (present value). **Present value** is the amount that must be invested today at a given rate of interest to produce a given future value. Thus, present value and future value are closely related.

For example, suppose Sue Dapper needs $1,000 one year from now. How much does she have to invest today to achieve that goal if the interest rate is 5 percent? From earlier examples, we can establish the following equation:

Present Value	×	(1.0 + Interest Rate)	=	Future Value
Present Value	×	1.05	=	$1,000.00
Present Value			=	$1,000.00 ÷ 1.05
Present Value			=	$952.38

To achieve a future value of $1,000, Dapper must invest a present value of $952.38. Interest of 5 percent on $952.38 for one year equals $47.62, and these two amounts added together equal $1,000.

Present Value of a Single Sum Due in the Future

When more than one period is involved, the calculation of present value is more complicated. For example, suppose Don Riley wants to be sure of having $4,000 at the end of three years. How much must he invest today in a 5 percent savings account to achieve this goal? We can compute the present value of $4,000 at compound interest of 5 percent for three years by adapting the above equation:

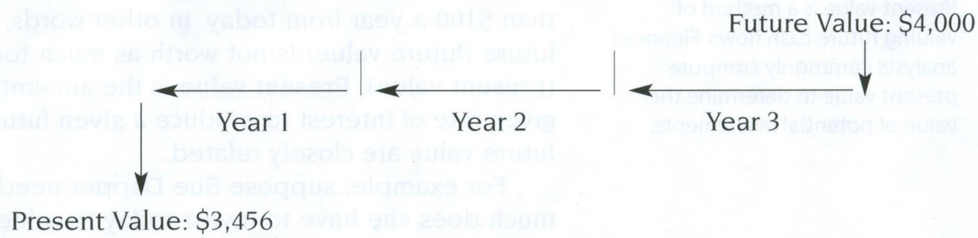
Year	*Amount at End of Year*		*Divide by*		*Present Value at Beginning of Year*
3	$4,000.00	÷	1.05	=	$3,809.52
2	3,809.52	÷	1.05	=	3,628.11
1	3,628.11	÷	1.05	=	3,455.34

Riley must invest $3,455.34 today to achieve a value of $4,000 in three years.

TABLE 3. Present Value of $1 to Be Received at the End of a Given Number of Periods

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	0.980	0.961	0.943	0.925	0.907	0.890	0.873	0.857	0.842	0.826
3	0.971	0.942	0.915	0.889	0.864	0.840	0.816	0.794	0.772	0.751
4	0.961	0.924	0.888	0.855	0.823	0.792	0.763	0.735	0.708	0.683
5	0.951	0.906	0.863	0.822	0.784	0.747	0.713	0.681	0.650	0.621
6	0.942	0.888	0.837	0.790	0.746	0.705	0.666	0.630	0.596	0.564
7	0.933	0.871	0.813	0.760	0.711	0.665	0.623	0.583	0.547	0.513
8	0.923	0.853	0.789	0.731	0.677	0.627	0.582	0.540	0.502	0.467
9	0.914	0.837	0.766	0.703	0.645	0.592	0.544	0.500	0.460	0.424
10	0.905	0.820	0.744	0.676	0.614	0.558	0.508	0.463	0.422	0.386

Again, we can simplify the calculation by using the appropriate table. In Table 3, the point at which the 5 percent column and the row for period 3 intersect shows a factor of .864. This factor, when multiplied by $1, gives the present value of $1 to be received three years from now at 5 percent interest. Thus, we solve the problem as follows:



Future Value	×	Factor	=	Present Value
$4,000	×	.864	=	$3,456

Except for a rounding difference of $.66, this result is the same as our earlier one.

Present Value of an Ordinary Annuity

It is often necessary to compute the present value of a series of receipts or payments equally spaced over time—in other words, the present value of an ordinary annuity. For example, suppose Kathy Casal has sold a piece of property and is to receive $15,000 in three equal annual payments of $5,000 beginning one year from today. What is the present value of this sale if the current interest rate is 5 percent?

Using Table 3, we can compute the present value by calculating a separate value for each of the three payments and summing the results, as follows:

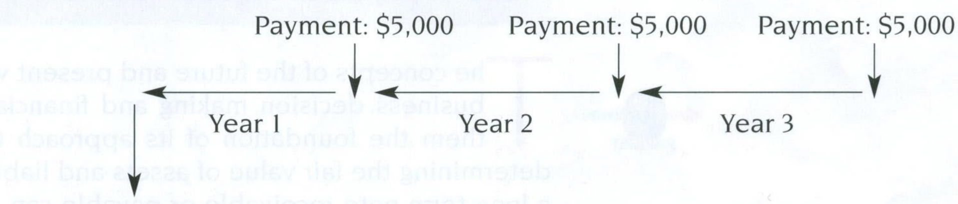
Future Receipts (Annuity)				*Present Value Factor at 5 Percent*		
Year 1	*Year 2*	*Year 3*		*(from Table 3)*		*Present Value*
$5,000			×	.952	=	$ 4,760
	$5,000		×	.907	=	4,535
		$5,000	×	.864	=	4,320
Total Present Value						$13,615

The present value of the sale is $13,615. Thus, there is an implied interest cost (given the 5 percent rate) of $1,385 associated with the payment plan that allows the purchaser to pay in three installments.

TABLE 4. Present Value of an Ordinary $1 Annuity Received in Each Period for a Given Number of Periods

Period	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%
1	0.990	0.980	0.971	0.962	0.952	0.943	0.935	0.926	0.917	0.909
2	1.970	1.942	1.913	1.886	1.859	1.833	1.808	1.783	1.759	1.736
3	2.941	2.884	2.829	2.775	2.723	2.673	2.624	2.577	2.531	2.487
4	3.902	3.808	3.717	3.630	3.546	3.465	3.387	3.312	3.240	3.170
5	4.853	4.713	4.580	4.452	4.329	4.212	4.100	3.993	3.890	3.791
6	5.795	5.601	5.417	5.242	5.076	4.917	4.767	4.623	4.486	4.355
7	6.728	6.472	6.230	6.002	5.786	5.582	5.389	5.206	5.033	4.868
8	7.652	7.325	7.020	6.733	6.463	6.210	5.971	5.747	5.535	5.335
9	8.566	8.162	7.786	7.435	7.108	6.802	6.515	6.247	5.995	5.759
10	9.471	8.983	8.530	8.111	7.722	7.360	7.024	6.710	6.418	6.145

We can make this calculation more easily by using Table 4. The point at which the 5 percent column intersects the row for period 3 shows a factor of 2.723. When multiplied by $1, this factor gives the present value of a series of three $1 payments (spaced one year apart) at compound interest of 5 percent. Thus, we solve the problem as follows:



Present Value: $13,615

Periodic Payment	×	Factor	=	Present Value
$5,000	×	2.723	=	$13,615

This result is the same as the one we computed earlier.

Time Periods As in all our examples, the compounding period is in most cases one year, and the interest rate is stated on an annual basis. However, the left-hand column in Tables 1 to 4 refers not to years but to periods. This wording accommodates compounding periods of less than one year. Savings accounts that record interest quarterly and bonds that pay interest semiannually are cases in which the compounding period is less than one year. To use the tables in these cases, it is necessary to (1) divide the annual interest rate by the number of periods in the year, and (2) multiply the number of periods in one year by the number of years.

Study Note

The interest rate used when compounding interest for less than one year is the annual rate divided by the number of periods in a year.

For example, suppose we want to compute the future (maturity) value of a $6,000 note that is to be paid in two years and that carries an annual interest rate of 8 percent. The compounding period is semiannual. Before using Table 1 in this computation, we must compute the interest rate that applies to each compounding period and the total number of compounding periods. First, the interest rate to use is 4 percent (8% annual rate ÷ 2 periods per year). Second, the total number of compounding periods is 4 (2 periods per year × 2 years). From Table 1, therefore, the maturity value of the note is computed as follows:

Principal	×	Factor	=	Future Value
$6,000	×	1.170	=	$7,020

The note will be worth $7,020 in two years.

This method of determining the interest rate and the number of periods when the compounding period is less than one year can be used with all four tables.

STOP • REVIEW • APPLY

4-1. What is the time value of money?

4-2. What is the difference between simple and compound interest?

4-3. What is an ordinary annuity?

4-4. What is the key variable that relates present value to future value?

4-5. How does a compounding period of less than one year affect the computation of present value?

Applications of the Time Value of Money

LO5 Apply the time value of money to simple accounting situations.

The concepts of the future and present value of money are widely used in business decision making and financial reporting. The FASB has made them the foundation of its approach to using cash flow information in determining the fair value of assets and liabilities.[13] For example, the value of a long-term note receivable or payable can be determined by calculating the present value of the future interest payments.

As a rapidly growing company that makes many long-term investments in such things as distribution facilities, software, and the acquisition of other companies, **Amazon.com** finds many uses for the time value of money. For example, Amazon.com's management will compare the expected present value of the future cash flows of an investment with the current outlay that the investment requires, and it will use a target interest rate that it wants to earn on the investment. If the present value of the investment exceeds the current outlay, Amazon.com will earn at least its target interest rate if management's projections of cash are accurate.

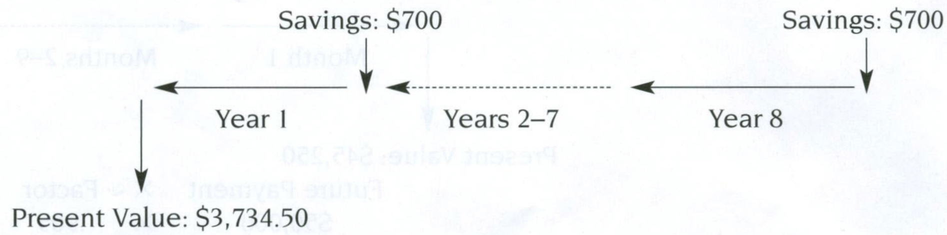
In the sections that follow, we illustrate some simple, useful applications of the time value of money.

Valuing an Asset

An asset is something that will provide future benefits to the company that owns it. Usually, the purchase price of an asset represents the present value of those future benefits. It is possible to evaluate a proposed purchase price by comparing it with the present value of the asset to the company.

For example, Sam Hurst is thinking of buying a new machine that will reduce his annual labor cost by $700 per year. The machine will last eight years. The interest rate that Hurst assumes for making managerial decisions is 10 percent. What is the maximum amount (present value) that Hurst should pay for the machine?

The present value of the machine to Hurst is equal to the present value of an ordinary annuity of $700 per year for eight years at compound interest of 10 percent. Using the factor from Table 4, we compute the value as follows:



Periodic Savings	×	Factor	=	Present Value
$700.00	×	5.335	=	$3,734.50

Hurst should not pay more than $3,734.50 for the machine because this amount equals the present value of the benefits he would receive from owning it.

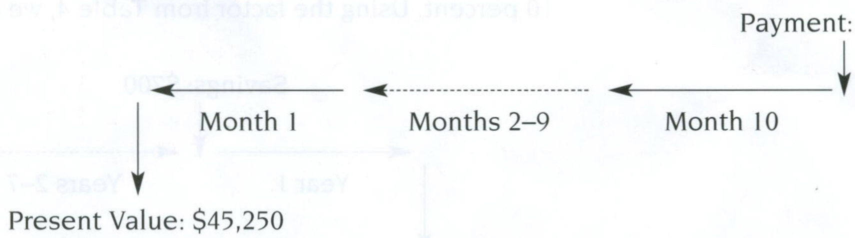
Deferred Payment

To encourage buyers to make a purchase, sellers sometimes agree to defer payment for a sale. This practice is common among companies that sell agricultural equipment; to accommodate farmers who often need new equipment in the spring but cannot pay for it until they sell their crops in the fall, these companies are willing to defer payment.

Suppose Plains Implement Corporation sells a tractor to Dana Washington for $50,000 on February 1 and agrees to take payment ten months later, on December 1. When such an agreement is made, the future payment includes not only the selling price, but also an implied (imputed) interest cost. If the prevailing annual interest rate for such transactions is 12 percent compounded monthly, the actual price of the tractor would be the present value of the future

Companies that sell agricultural equipment like these combine harvesters often agree to defer payment for a sale. This practice is common because farmers often need new equipment in the spring but cannot pay for it until they sell their crops in the fall. Deferred payment is a useful application of the time value of money.

payment, computed using the factor from Table 3 (10 periods, 1 percent [12 percent divided by 12 months]), as follows:



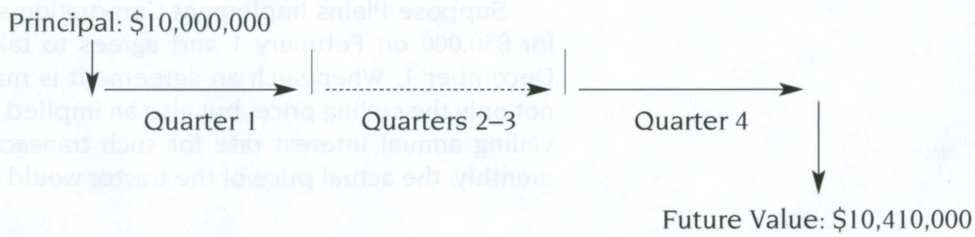
Future Payment	×	Factor	=	Present Value
$50,000	×	.905	=	$45,250

Washington records the present value, $45,250, in his purchase records, and Plains records it in its sales records. The balance consists of interest expense or interest income.

Investment of Idle Cash

Suppose Childware Corporation, a toy manufacturer, needs funds for a future expansion. At present, it has $10,000,000 in cash that it does not expect to need for one year. It places the cash in an account that pays 4 percent annual interest. Interest is compounded and credited to the company's account quarterly. How much cash will Childware have at the end of the year?

The future value factor from Table 1 is based on four quarterly periods of 1 percent (4 percent divided by 4 quarters), and the future value is computed as follows:



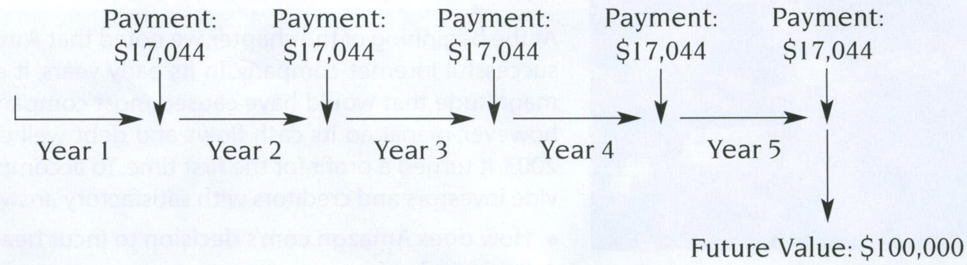
Investment	×	Factor	=	Future Value
$10,000,000	×	1.041	=	$10,410,000

The initial investment is recorded with a debit to Short-Term Investments. Each quarter, the company increases Short-Term Investments by the amount of the interest earned. Interest Income is credited. Similar entries would be made for four more months, at which time the balance of Short-Term Investments would be about $110,410,000. The actual amount accumulated might vary from this total because the interest rate paid may vary over time as a result of changes in market conditions.

Accumulation of a Fund for Loan Repayment

When a company owes a large fixed amount due in several years, management would be wise to accumulate a fund to pay off the debt at maturity. As part of a loan agreement, creditors sometimes require that such a fund be established. In establishing the fund, management must determine how much cash must be set aside each period to pay the debt. The amount will depend on the estimated rate of interest the fund will earn.

Suppose Aloha Corporation agrees with a creditor to set aside cash at the end of each year to accumulate enough to pay off a $100,000 note due in six years. It will make five annual contributions by the time the note is due. The fund is projected to earn 8 percent, compounded annually. We can calculate the amount of each annual payment by using Table 2 (5 periods, 8 percent):



Future Value of Fund	÷	Factor	=	Annual Investment
$100,000	÷	5.867	=	$17,044 (rounded)

Other Applications

There are many other applications of present value in accounting, including computing imputed interest on non-interest-bearing notes, accounting for installment notes, valuing a bond, and recording lease obligations. Present value is also applied in accounting for pension obligations; valuing debt; depreciating property, plant, and equipment; making capital expenditure decisions; and generally in accounting for any item in which time is a factor.

STOP • REVIEW • APPLY

5-1. Why is the time value of money important in making business decisions?

5-2. What are the applications of present value to financial reporting?

5-3. What are some of the ways in which businesses use present value?

Valuing an Asset When Making a Purchasing Decision Jerry owns a restaurant and has the opportunity to buy a high-quality espresso coffee machine for $5,000. After carefully studying projected costs and revenues, Jerry estimates that the machine will produce a net cash flow of $1,600 annually and will last for five years. He determines that an interest rate of 10 percent is an adequate return on investment for his business.

Calculate the present value of the machine to Jerry. Based on your calculation, do you think a decision to purchase the machine would be wise?

SOLUTION

Calculation of the present value:

Annual cash flow	$1,600.00
Factor from Table 4 (5 years at 10%)	× 3.791
Present value of net cash flows	$6,065.60
Less purchase price	− 5,000.00
Net present value	$1,065.60

The present value of the net cash flows from the machine exceeds the purchase price. Thus, the investment will return more than 10 percent to Jerry's business. A decision to purchase the machine would therefore be wise.