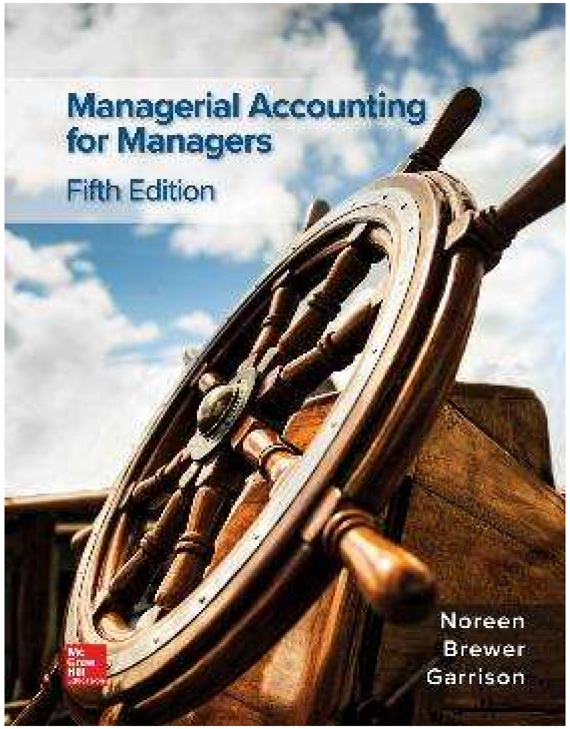
The Concept of Present Value

APPENDIX 7A



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Learning Objective 7

Understand present value concepts and the use of present value tables.

The Mathematics of Interest

A dollar received today is worth more than a dollar received a year from now because you can put it in the bank today and have more than a dollar a year from now.

The Mathematics of Interest – Example – Part 1

Assume a bank pays 8% interest on a $100 deposit made today. How much will the $100 be worth in one year?

$$F_n = P(1 + r)^n$$

F = the balance at the end of the period **n**.
P = the amount invested now.
r = the rate of interest per period.
n = the number of periods.

The Mathematics of Interest – Example – Part 2

Assume a bank pays 8% interest on a $100 deposit made today. How much will the $100 be worth in one year?

$$F_n = P(1 + r)^n$$

$$F_1 = \$100(1 + .08)^1$$

$$F_1 = \$108.00$$

Compound Interest – Example – Part 1

What if the $108 was left in the bank for a second year? How much would the original $100 be worth at the end of the second year?

$$F_n = P(1 + r)^n$$

F = the balance at the end of the period **n**.
P = the amount invested now.
r = the rate of interest per period.
n = the number of periods.

Compound Interest – Example –Part 2

$$F_2 = \$100(1 + .08)^2$$

$$F_2 = \$116.64$$

The interest that is paid in the second year on the interest earned in the first year is known as compound interest.

Computation of Present Value

An investment can be viewed in two ways: its future value or its present value.

Let's look at a situation where the future value is known and the present value is the unknown.

Present Value – Example – Part 1

If a bond will pay $100 in two years, what is the present value of the $100 if an investor can earn a return of 12% on investments?

$$P = \frac{F_n}{(1 + r)^n}$$

F = the balance at the end of the period **n**.
P = the amount invested now.
r = the rate of interest per period.
n = the number of periods.

Present Value – Example – Part 2

$$P = \frac{\$100}{(1 + .12)^2}$$

$$P = \$79.72$$

This process is called discounting. We have discounted the $100 to its present value of $79.72. The interest rate used to find the present value is called the discount rate.

Present Value – Example – Part 3

Let's verify that if we put $79.72 in the bank today at 12% interest that it would grow to $100 at the end of two years.

	Year 1	Year 2
Beginning balance	$ 79.72	$ 89.29
Interest @ 12%	9.57	10.71
Ending balance	$ 89.29	$ 100.00

If $79.72 is put in the bank today and earns 12%, it will be worth $100 in two years.

Present Value – Example – Part 4

$\$100 \times 0.797 = \$79.72$ present value

Periods	Rate 10%	Rate 12%	Rate 14%
1	0.909	0.893	0.877
2	0.826	0.797	0.769
3	0.751	0.712	0.675
4	0.683	0.636	0.592
5	0.621	0.567	0.519

Present value factor of $1 for 2 periods at 12%.

Quick Check 1

How much would you have to put in the bank today to have $100 at the end of five years if the interest rate is 10%?

a. $62.10

b. $56.70

c. $90.90

d. $51.90

Quick Check 1a

How much would you have to put in the bank today to have \$100 at the end of five years if the interest rate is 10%?

a. \$62.10

b. \$56.70

c. \$90.90

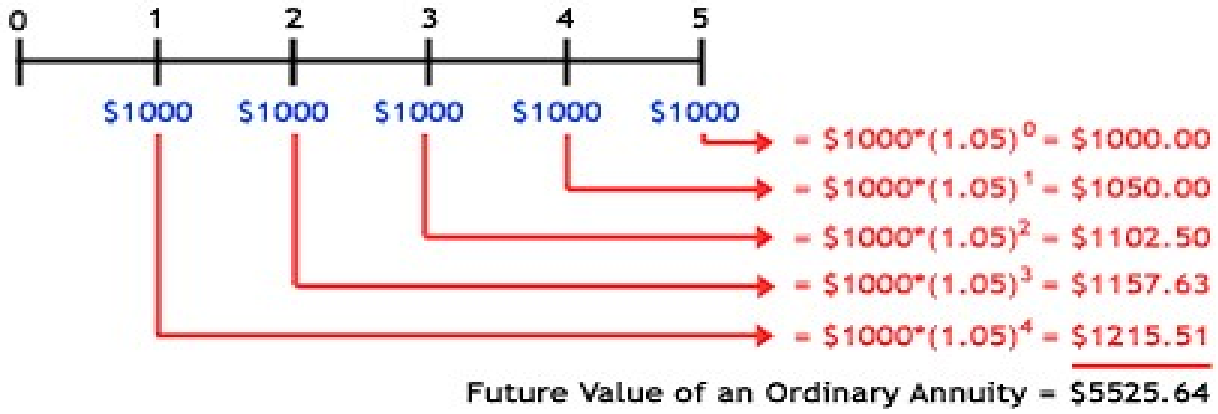
d. \$51.90

$$\$100 \times 0.621 = \$62.10$$

Present Value of a Series of Cash Flows

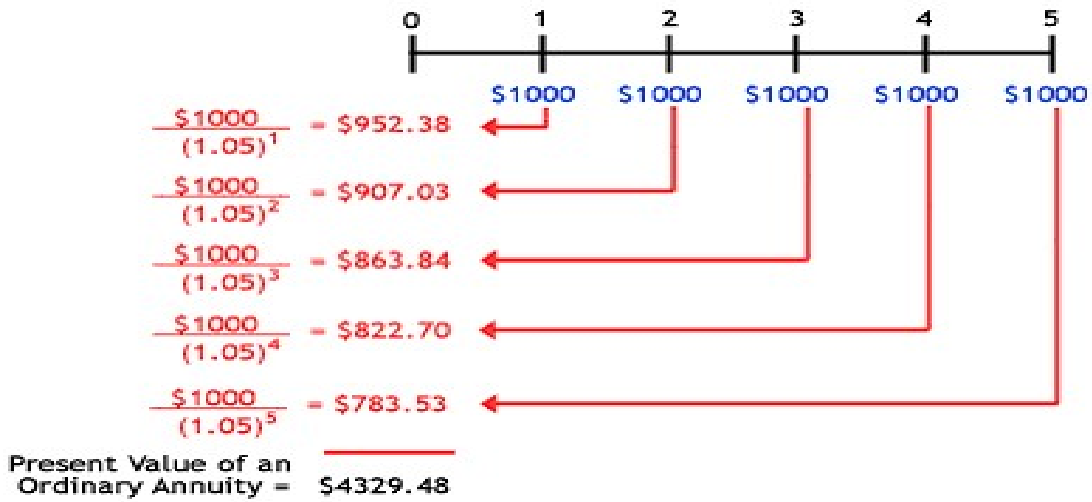
An investment that involves a series of identical cash flows at the end of each year is called an annuity.

Future Value of Annuity



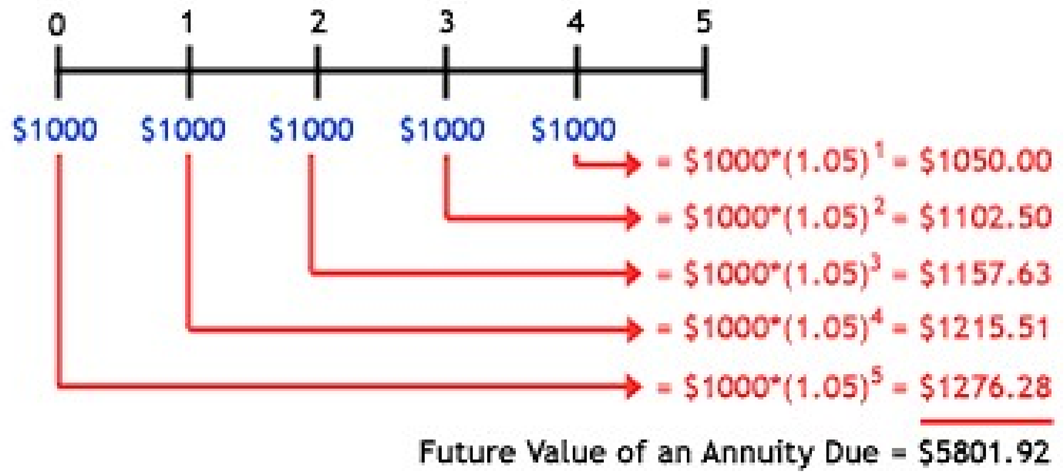
$$FV_{\text{Ordinary Annuity}} = C * \left[\frac{(1+i)^n - 1}{i} \right]$$

Present Value of Annuity



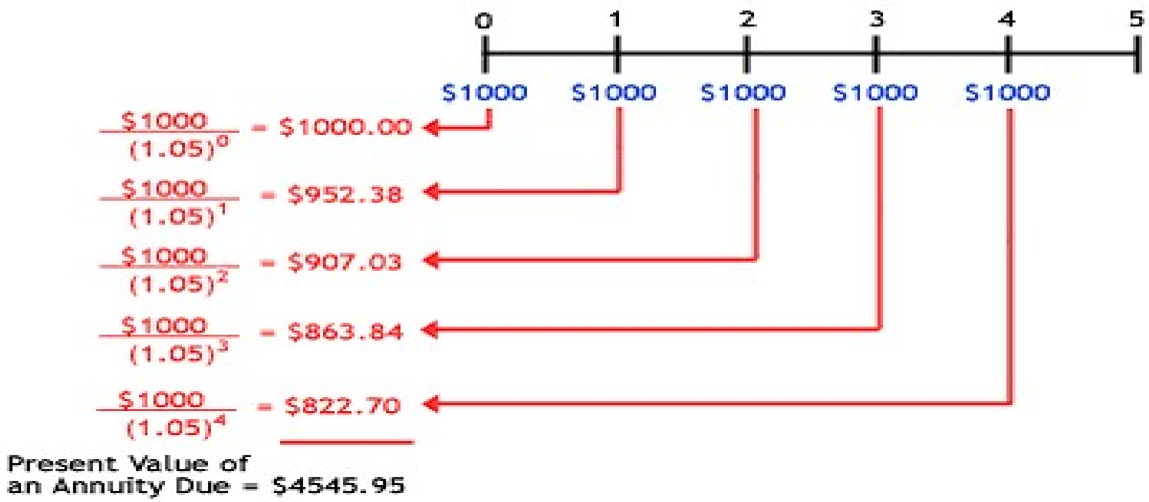
$$PV_{\text{Ordinary Annuity}} = C * \left[\frac{1 - (1+i)^{-n}}{i} \right]$$

Future Value of Annuity Due



$$FV_{Annuity\ Due} = C * \left[\frac{(1+i)^n - 1}{i}\right] * (1+i)$$

Present Value of Annuity Due



$$PV_{\text{Annuity Due}} = C * \left[\frac{1-(1+i)^{-n}}{i}\right] * (1+i)$$

Present Value of a Series of Cash Flows – Example – Part 1

Lacey Inc. purchased a tract of land on which a $60,000 payment will be due each year for the next five years. What is the present value of this stream of cash payments when the discount rate is 12%?

Present Value of a Series of Cash Flows – Example – Part 2

We could solve the problem like this . . .

Present Value of an Annuity of $1			
Periods	10%	12%	14%
1	0.909	0.893	0.877
2	1.736	1.690	1.647
3	2.487	2.402	2.322
4	3.170	3.037	2.914
5	3.791	3.605	3.433

$60,000 × 3.605 = $216,300

Quick Check 2

If the interest rate is 14%, how much would you have to put in the bank today so as to be able to withdraw $100 at the end of each of the next five years?

a. $34.33

b. $500.00

c. $343.30

d. $360.50

Quick Check 2a

If the interest rate is 14%, how much would you have to put in the bank today so as to be able to withdraw $100 at the end of each of the next five years?

a. $34.33

b. $500.00

c. $343.30

d. $360.50

$100 × 3.433 = $343.30

End of Appendix 7A