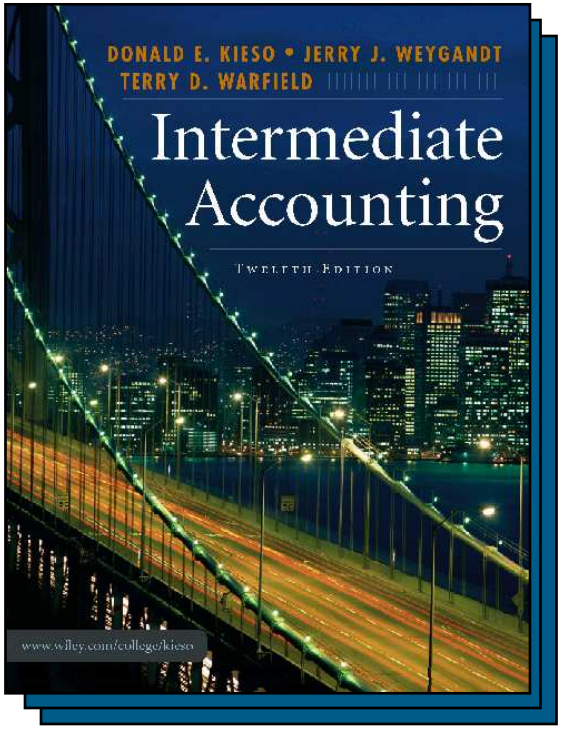
Present Value Concepts and Measurement

Chapter 6

Intermediate Accounting
12th Edition
Kieso, Weygandt, and Warfield



Prepared by Coby Harmon, University of California, Santa Barbara

Learning Objectives

1. Identify accounting topics where the time value of money is relevant.
2. Distinguish between simple and compound interest.
3. Use appropriate compound interest tables.
4. Identify variables fundamental to solving interest problems.
5. Solve future and present value of 1 problems.
6. Solve future value of ordinary and annuity due problems.
7. Solve present value of ordinary and annuity due problems.
8. Solve present value problems related to deferred annuities and bonds.
9. Apply expected cash flows to present value measurement.

Accounting and the Time Value of Money

Basic Time Value Concepts

- Applications
- The nature of interest
- Simple interest
- Compound interest
- Fundamental variables

Single-Sum Problems

- Future value of a single sum
- Present value of a single sum
- Solving for other unknowns

Annuities

- Future value of ordinary annuity
- Future value of annuity due
- Examples of FV of annuity
- Present value of ordinary annuity
- Present value of annuity due
- Examples of PV of annuity

More Complex Situations

- Deferred annuities
- Valuation of long-term bonds
- Effective-interest method of bond discount/ premium amortization

Present Value Measurement

- Expected cash flow illustration

Basic Time Value Concepts

Time Value of Money

In accounting (and finance), the term indicates that a dollar received today is worth more than a dollar promised at some time in the future.

LO 1 Identify accounting topics where the time value of money is relevant.

Basic Time Value Concepts

Applications to Accounting Topics:

1. Notes
2. Leases
3. Pensions and Other Postretirement Benefits
4. Long-Term Assets
5. Sinking Funds
6. Business Combinations
7. Disclosures
8. Installment Contracts

LO 1 Identify accounting topics where the time value of money is relevant.

Basic Time Value Concepts

Nature of Interest

- Payment for the use of money.
- Excess cash received or repaid over the amount borrowed (principal).

Variables involved in financing transaction:

1. **Principal** - Amount borrowed or invested.
2. **Interest Rate** - A percentage.
3. **Time** - The number of years or portion of a year that the principal is outstanding.

LO 1 Identify accounting topics where the time value of money is relevant.

Simple Interest

- Interest computed on the principal only.

ILLUSTRATION:

On January 2, 2007, Tomalczyk borrows $20,000 for 3 years at a rate of 7% per year. Calculate the annual interest cost.

FULL YEAR

Principal	$20,000
Interest rate	x 7%
Annual interest	$ 1,400

Federal law requires the disclosure of interest rates on an **annual basis** in all contracts.

LO 2 Distinguish between simple and compound interest.

Simple Interest

ILLUSTRATION continued:

On March 31, 2007, Tomalczyk borrows $20,000 for 3 years at a rate of 7% per year. Calculate the interest cost for the year ending December 31, 2007.

PARTIAL YEAR

Principal		$20,000
Interest rate	x	7%
Annual interest		$ 1,400
Partial year	x	9/12
Interest for 9 months		$ 1,050

LO 2 Distinguish between simple and compound interest.

Compound Interest

- Computes interest on
  - the principal and
  - on interest earned to date (assuming interest is left on deposit).
- Compound interest is the typical interest computation applied in business situations.

LO 2 Distinguish between simple and compound interest.

Compound Interest

ILLUSTRATION:

On January 2, 2007, Tomalczyk borrows $20,000 for 3 years at a rate of 7% per year. Calculate the total interest cost for all three years, assuming interest is compounded annually.

Date	Compound Interest Calculation	Interest	Accumulated Balance
Jan. 2007			$ 20,000
2007	$20,000 x 7%	$ 1,400	21,400
2008	$21,400 x 7%	1,498	22,898
2009	$22,898 x 7%	1,603	24,501
		$ 4,501	

LO 2 Distinguish between simple and compound interest.

Compound Interest Tables

Five Tables in Chapter 6

Table 1 - Future Value of 1

Table 2 - Present Value of 1

Table 3 - Future Value of an Ordinary Annuity of 1

Table 4 - Present Value of an Ordinary Annuity of 1

Table 5 - Present Value of an Annuity Due of 1

Number of Periods = number of years x the number of compounding periods per year.

Compounding Period Interest Rate = annual rate divided by the number of compounding periods per year.

LO 3 Use appropriate compound interest tables.

Compound Interest

Compounding can substantially affect the rate of return. A 9% annual interest compounded daily provides a 9.42% yield.

How compounding affects Effective Yield for a $10,000 investment.

Illustration 6-5

Interest Rate	Compounding Periods				
	Annually	Semiannually	Quarterly	Monthly	Daily
8%	8.00% $800	8.16% $816	8.24% $824	8.30% $830	8.33% $833
9%	9.00% $900	9.20% $920	9.31% $931	9.38% $938	9.42% $942
10%	10.00% $1,000	10.25% $1,025	10.38% $1,038	10.47% $1,047	10.52% $1,052

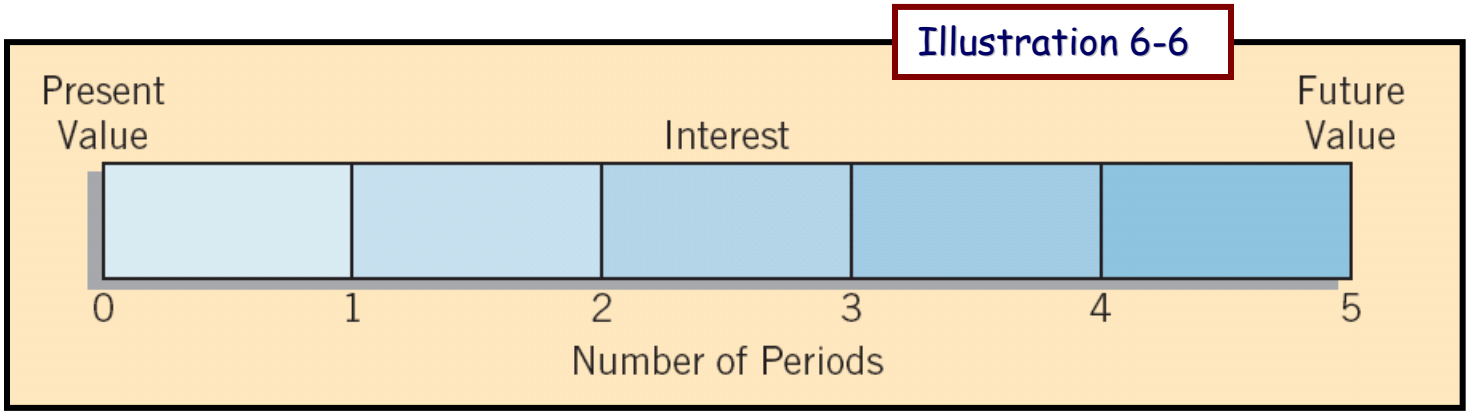
LO 3 Use appropriate compound interest tables.

Compound Interest

Variables Fundamental to Compound Interest

- Rate of Interest
- Number of Time Periods
- Present Value
- Future Value

Illustration 6-6



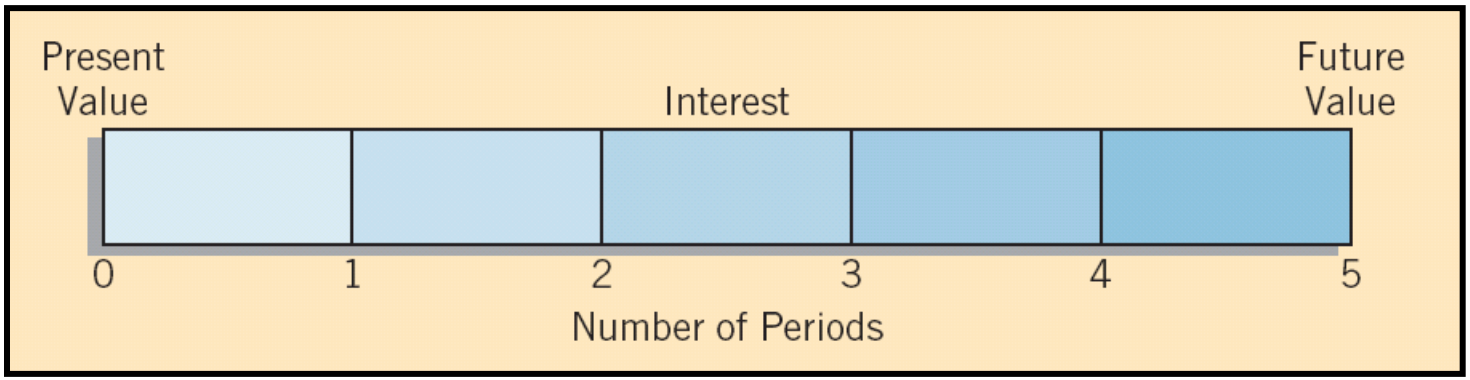
LO 4 Identify variables fundamental to solving interest problems.

Single-Sum Problems

Generally Classified into Two Categories

Unknown **Present Value**

Unknown **Future Value**



LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Future Value of a Single Sum

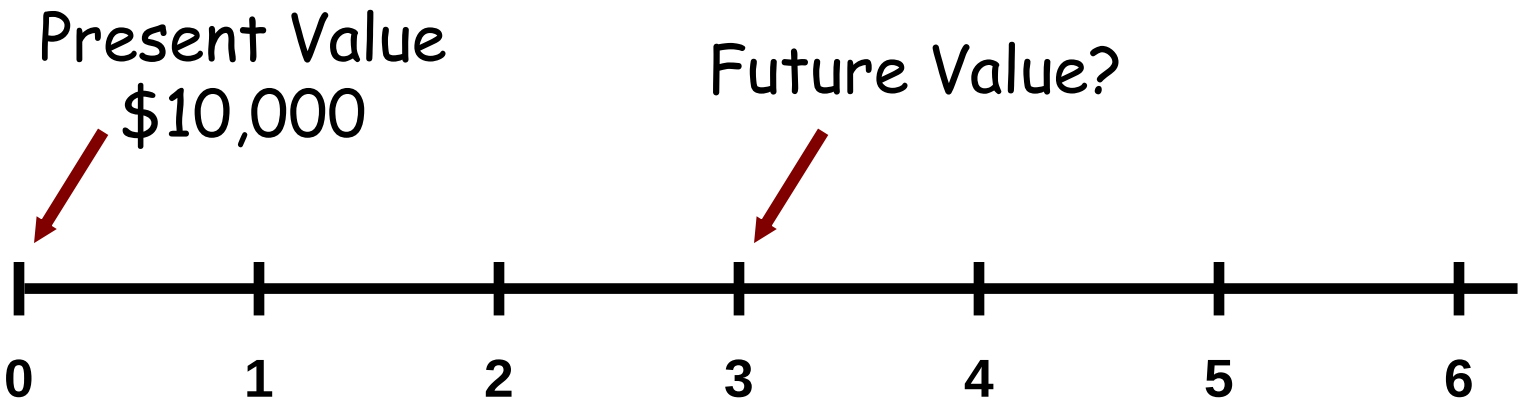
Multiply the future value factor by its present value (principal).

Illustration:

BE6-1 Steve Allen invested $10,000 today in a fund that earns 8% compounded **annually**. To what amount will the investment grow in 3 years?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems



BE6-1 Steve Allen invested $10,000 today in a fund that earns 8% compounded **annually**. To what amount will the investment grow in 3 years?

What table do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-1

Number of Periods	Discount Rate 2%	4%	6%	8%	10%
1	1.02000	1.04000	1.06000	1.08000	1.10000
2	1.04040	1.08160	1.12360	1.16640	1.21000
3	1.06121	1.12486	1.19102	1.25971	1.33100
4	1.08243	1.16986	1.26248	1.36049	1.46410
5	1.10408	1.21665	1.33823	1.46933	1.61051

What factor do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-1

Number of Periods	Discount Rate 2%	4%	6%	8%	10%
1	1.02000	1.04000	1.06000	1.08000	1.10000
2	1.04040	1.08160	1.12360	1.16640	1.21000
3	1.06121	1.12486	1.19102	1.25971	1.33100
4	1.08243	1.16986	1.26248	1.36049	1.46410
5	1.10408	1.21665	1.33823	1.46933	1.61051

$10,000	x	1.25971	=	$12,597
Present Value		Factor		Future Value

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

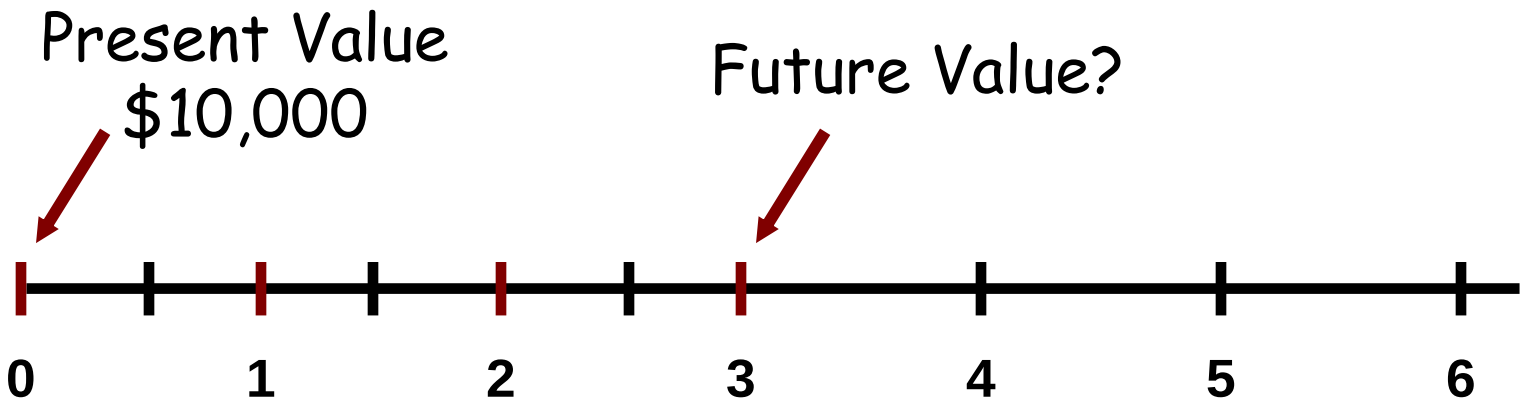
PROOF - Future Value of a Single Sum

Year	Beginning Balance		Rate		Interest		Previous Balance		Year-End Balance
1	$ 10,000	x	8%	=	800	+	10,000	=	$ 10,800
2	10,800	x	8%	=	864	+	10,800	=	11,664
3	11,664	x	8%	=	933	+	11,664	=	12,597

BE6-1 Steve Allen invested $10,000 today in a fund that earns 8% compounded **annually**. To what amount will the investment grow in 3 years?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems



BE6-1 Steve Allen invested $10,000 today in a fund that earns 8% compounded **semiannually**. To what amount will the investment grow in 3 years?

What table do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-1

Number of Periods	Discount Rate 2%	4%	6%	8%	10%
1	1.02000	1.04000	1.06000	1.08000	1.10000
2	1.04040	1.08160	1.12360	1.16640	1.21000
3	1.06121	1.12486	1.19102	1.25971	1.33100
4	1.08243	1.16986	1.26248	1.36049	1.46410
5	1.10408	1.21665	1.33823	1.46933	1.61051
6	1.12616	1.26532	1.41852	1.58687	1.77156

What factor do we use?

- 6 compounding periods
- 4% interest per period

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-1

Number of Periods	Discount Rate 2%	4%	6%	8%	10%
1	1.02000	1.04000	1.06000	1.08000	1.10000
2	1.04040	1.08160	1.12360	1.16640	1.21000
3	1.06121	1.12486	1.19102	1.25971	1.33100
4	1.08243	1.16986	1.26248	1.36049	1.46410
5	1.10408	1.21665	1.33823	1.46933	1.61051
6	1.12616	1.26532	1.41852	1.58687	1.77156

$10,000 x 1.26532 = $12,653

Present Value Factor Future Value

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Present Value of a Single Sum

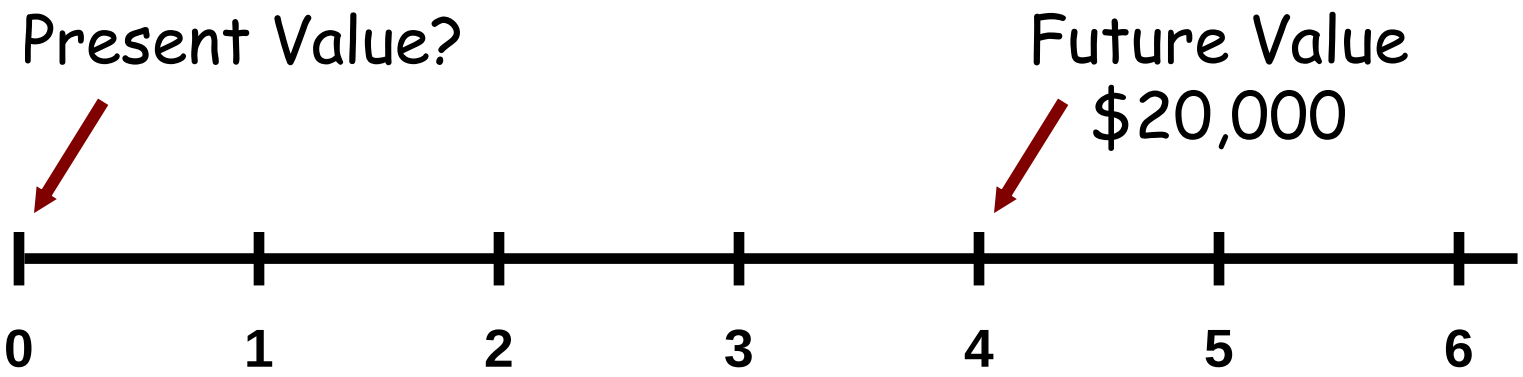
Multiply the present value factor by the future value.

Illustration:

BE6-2 Itzak Perlman needs $20,000 in 4 years. What amount must he invest today if his investment earns 12% compounded annually?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems



BE6-2 Itzak Perlman needs $20,000 in 4 years. What amount must he invest today if his investment earns 12% compounded **annually**?

What table do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-2

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
2	.92456	.89000	.85734	.82645	.79719
4	.85480	.79209	.73503	.68301	.63552
6	.79031	.70496	.63017	.56447	.50663
8	.73069	.62741	.54027	.46651	.40388

What factor do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

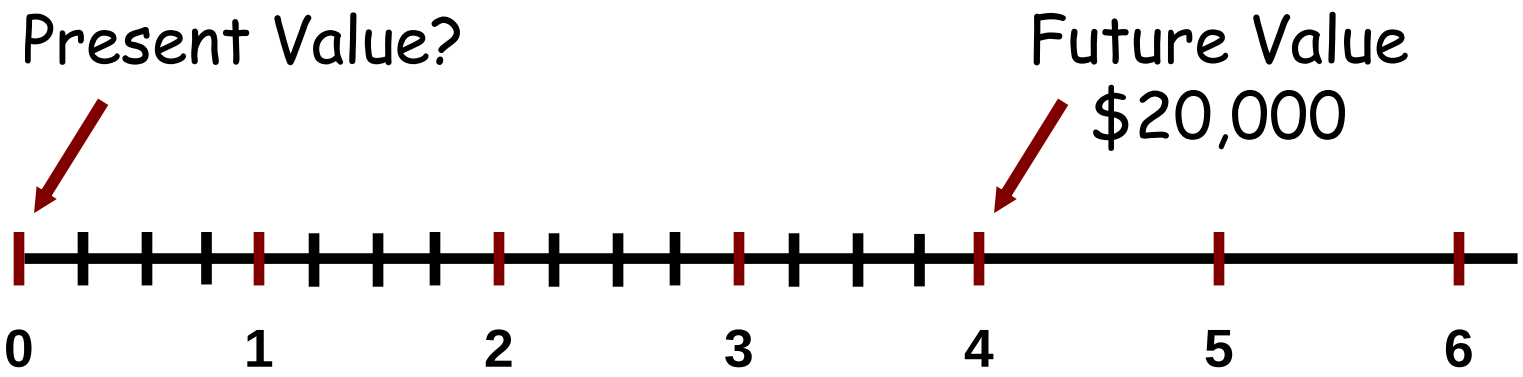
Table 6-2

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
2	.92456	.89000	.85734	.82645	.79719
4	.85480	.79209	.73503	.68301	.63552
6	.79031	.70496	.63017	.56447	.50663
8	.73069	.62741	.54027	.46651	.40388

$20,000	x	.63552	=	$12,710
Future Value		Factor		Present Value

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems



BE6-2 Itzak Perlman needs $20,000 in 4 years. What amount must he invest today if his investment earns 12% compounded **quarterly**?

What table do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-2

Number of Periods	Discount Rate 3%	4%	6%	9%	12%
4	0.88849	0.85480	0.79209	0.70843	0.63552
8	0.78941	0.73069	0.62741	0.50187	0.40388
12	0.70138	0.62460	0.49697	0.35554	0.25668
16	0.62317	0.53391	0.39365	0.25187	0.16312

What factor do we use?

LO 5 Solve future and present value of 1 problems.

Single-Sum Problems

Table 6-2

Number of Periods	Discount Rate 3%	4%	6%	9%	12%
4	0.88849	0.85480	0.79209	0.70843	0.63552
8	0.78941	0.73069	0.62741	0.50187	0.40388
12	0.70138	0.62460	0.49697	0.35554	0.25668
16	0.62317	0.53391	0.39365	0.25187	0.16312

$20,000 x .62317 = $12,463

Future Value Factor Present Value

LO 5 Solve future and present value of 1 problems.

Annuities

Annuity requires the following:

(1) Periodic payments or receipts (called rents) of the same amount,

(2) The same-length interval between such rents, and

(3) Compounding of interest once each interval.

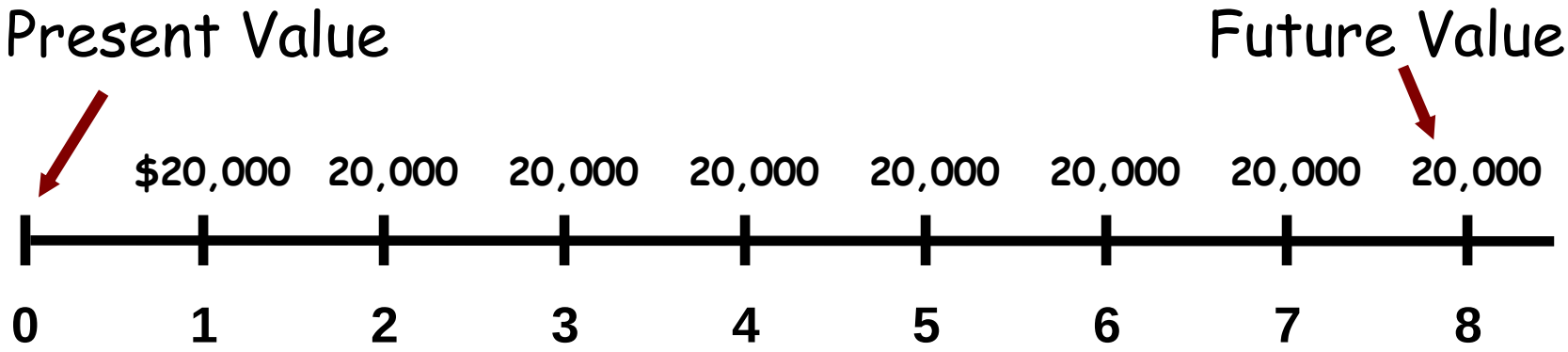
Two Types	**Ordinary annuity** - rents occur at the end of each period. **Annuity Due** - rents occur at the beginning of each period.

LO 6 Solve future value of ordinary and annuity due problems.

Annuities

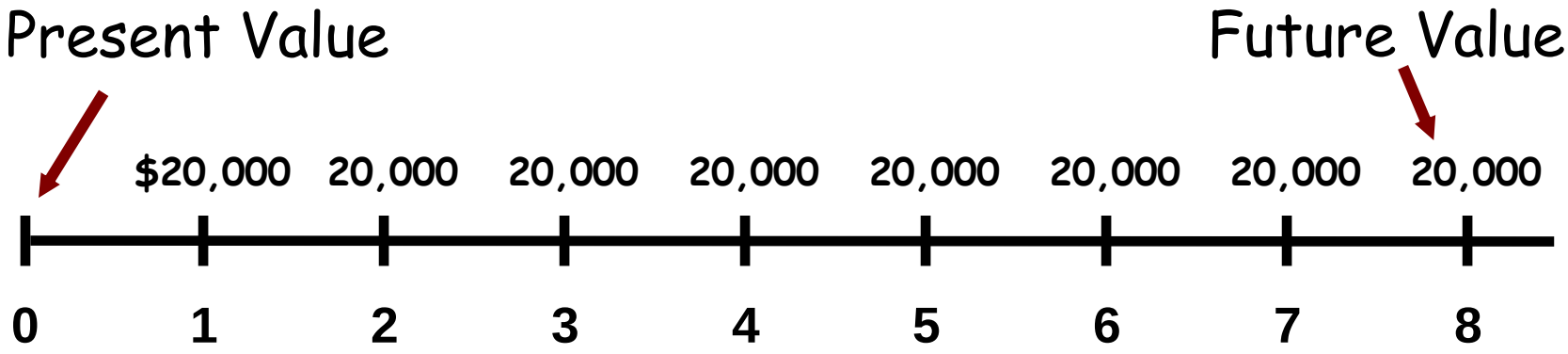
Future Value of an Ordinary Annuity

- Rents occur at the end of each period.
- No interest during 1st period.



LO 6 Solve future value of ordinary and annuity due problems.

Future Value of an Ordinary Annuity



BE6-13 Bayou Inc. will deposit $20,000 in a 12% fund at the end of each year for 8 years beginning December 31, Year 1. What amount will be in the fund immediately after the last deposit?

What table do we use?

LO 6 Solve future value of ordinary and annuity due problems.

Future Value of an Ordinary Annuity

Table 6-3

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
2	2.04000	2.06000	2.08000	2.10000	2.12000
4	4.24646	4.37462	4.50611	4.64100	4.77933
6	6.63298	6.97532	7.33592	7.71561	8.11519
8	9.21423	9.89747	10.63663	11.43589	12.29969
10	12.00611	13.18079	14.48656	15.93743	17.54874

What factor do we use?

LO 6 Solve future value of ordinary and annuity due problems.

Future Value of an Ordinary Annuity

Table 6-3

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
2	2.04000	2.06000	2.08000	2.10000	2.12000
4	4.24646	4.37462	4.50611	4.64100	4.77933
6	6.63298	6.97532	7.33592	7.71561	8.11519
8	9.21423	9.89747	10.63663	11.43589	12.29969
10	12.00611	13.18079	14.48656	15.93743	17.54874

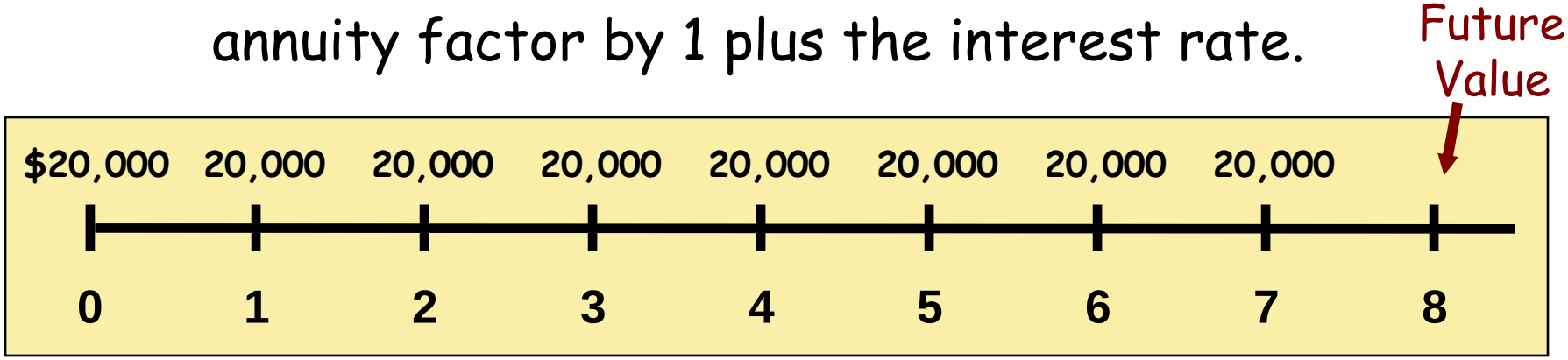
$20,000	x	12.29969	=	$245,994
Deposit		Factor		Future Value

LO 6 Solve future value of ordinary and annuity due problems.

Annuities

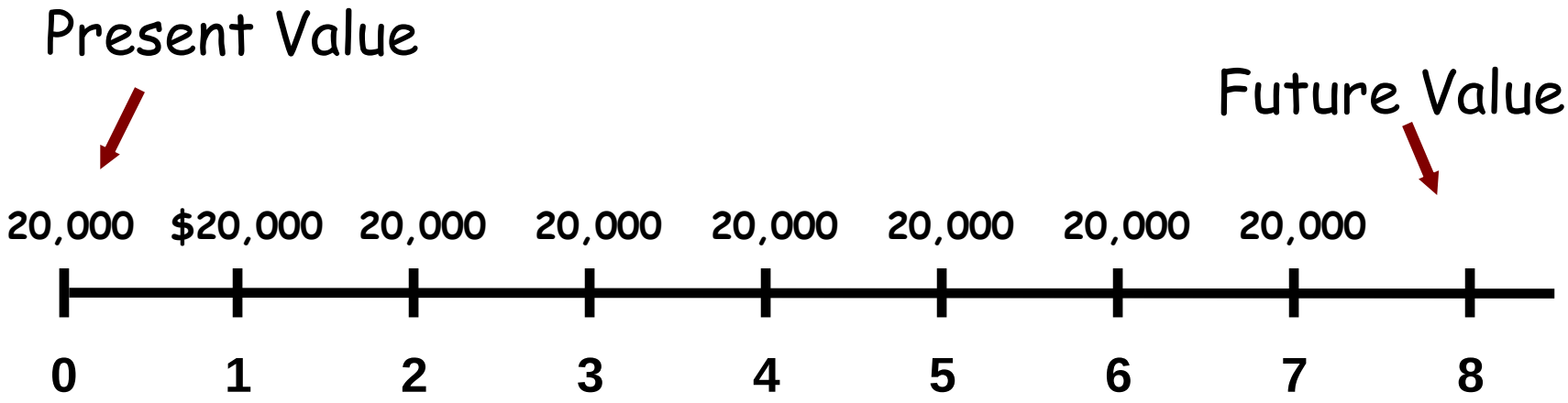
Future Value of an Annuity Due

- Rents occur at the beginning of each period.
- Interest will accumulate during 1st period.
- Annuity Due has one more interest period than Ordinary Annuity.
- Factor = multiply future value of an ordinary annuity factor by 1 plus the interest rate.



LO 6 Solve future value of ordinary and annuity due problems.

Future Value of an Annuity Due



Bayou Inc. will deposit $20,000 in a 12% fund at the beginning of each year for 8 years beginning January 1, Year 1. What amount will be in the fund at the end of Year 8?

What table do we use?

LO 6 Solve future value of ordinary and annuity due problems.

Future Value of an Annuity Due

Table 6-3

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
2	2.04000	2.06000	2.08000	2.10000	2.12000
4	4.24646	4.37462	4.50611	4.64100	4.77933
6	6.63298	6.97532	7.33592	7.71561	8.11519
8	9.21423	9.89747	10.63663	11.43589	12.29969
10	12.00611	13.18079	14.48656	15.93743	17.54874

What factor do we use?

LO 6 Solve future value of ordinary and annuity due problems.

Future Value of an Annuity Due

Table 6-3

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
2	2.04000	2.06000	2.08000	2.10000	2.12000
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6	6.63298	6.97532	7.33592	7.71561	8.11519
8	9.21423	9.89747	10.63663	11.43589	12.29969
10	12.00611	13.18079	14.48656	15.93743	17.54874

12.29969 x 1.12 = 13.775652

$20,000 x 13.775652 = $275,513

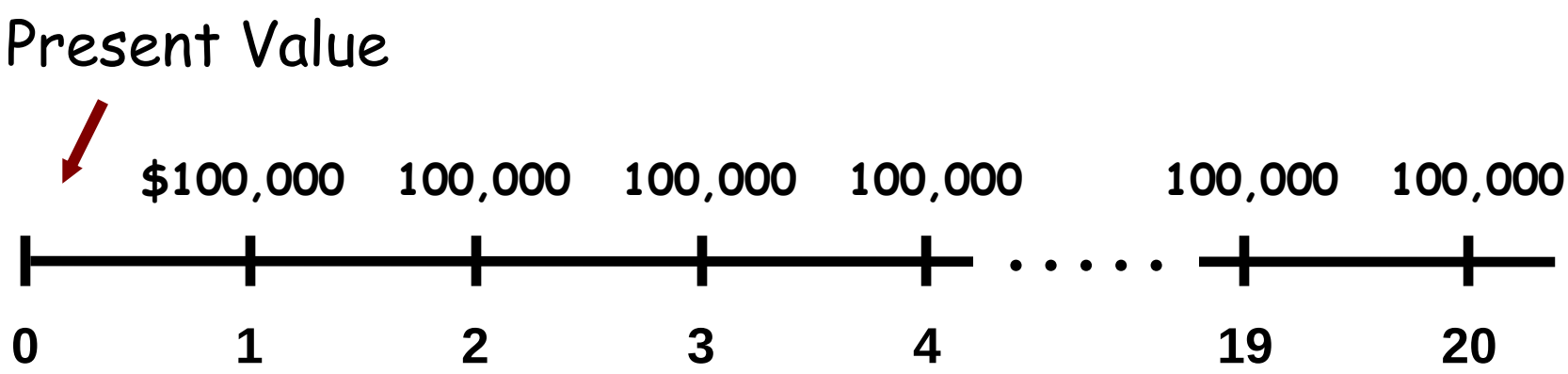
Deposit Factor Future Value

LO 6 Solve future value of ordinary and annuity due problems.

Present Value of an Ordinary Annuity

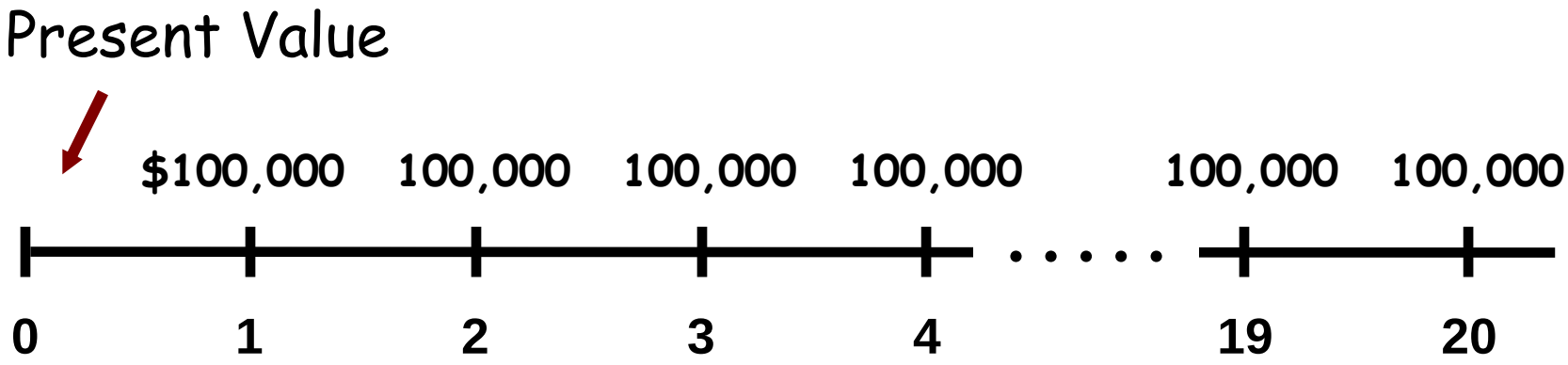
Present Value of an Ordinary Annuity

- Present value of a series of equal amounts to be withdrawn or received at equal intervals.
- Periodic rents occur at the end of the period.



LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Ordinary Annuity



Jaime Yuen wins $2,000,000 in the state lottery. She will be paid $100,000 at the end of each year for the next 20 years. How much has she actually won? Assume an appropriate interest rate of 8%.

What table do we use?

LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Ordinary Annuity

Table 6-4

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
1	0.96154	0.94340	0.92593	0.90900	0.89286
5	4.45183	4.21236	3.99271	3.79079	3.60478
10	8.11090	7.36009	6.71008	6.14457	5.65022
15	11.11839	9.71225	8.55948	7.60608	6.81086
20	13.59033	11.46992	9.81815	8.51356	7.46944

What factor do we use?

LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Ordinary Annuity

Table 6-4

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
1	0.96154	0.94340	0.92593	0.90900	0.89286
5	4.45183	4.21236	3.99271	3.79079	3.60478
10	8.11090	7.36009	6.71008	6.14457	5.65022
15	11.11839	9.71225	8.55948	7.60608	6.81086
20	13.59033	11.46992	9.81815	8.51356	7.46944

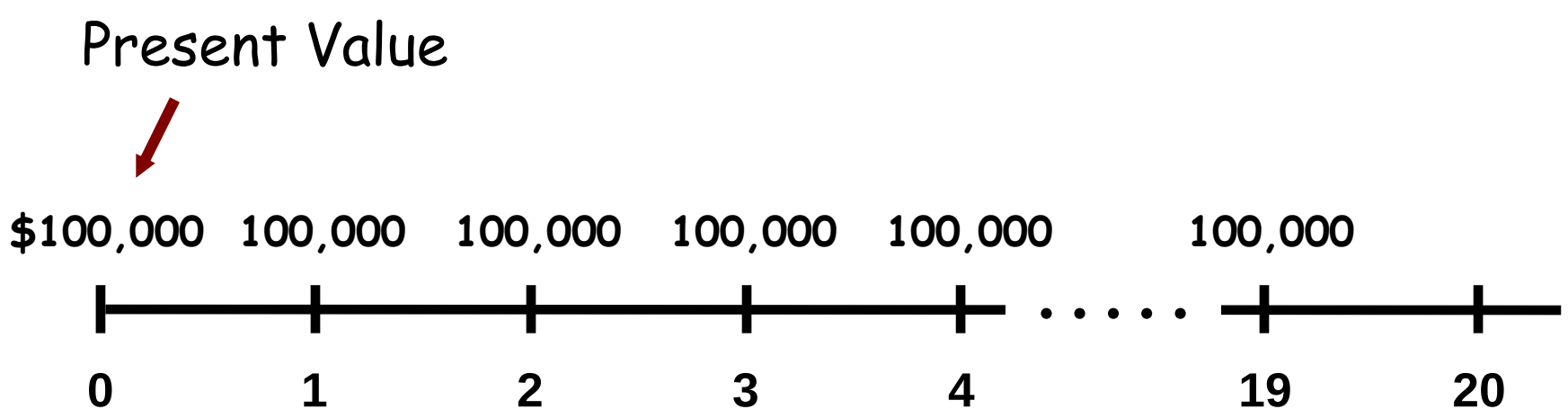
$100,000	x	9.81815	=	$981,815
Receipt		Factor		Present Value

LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Annuity Due

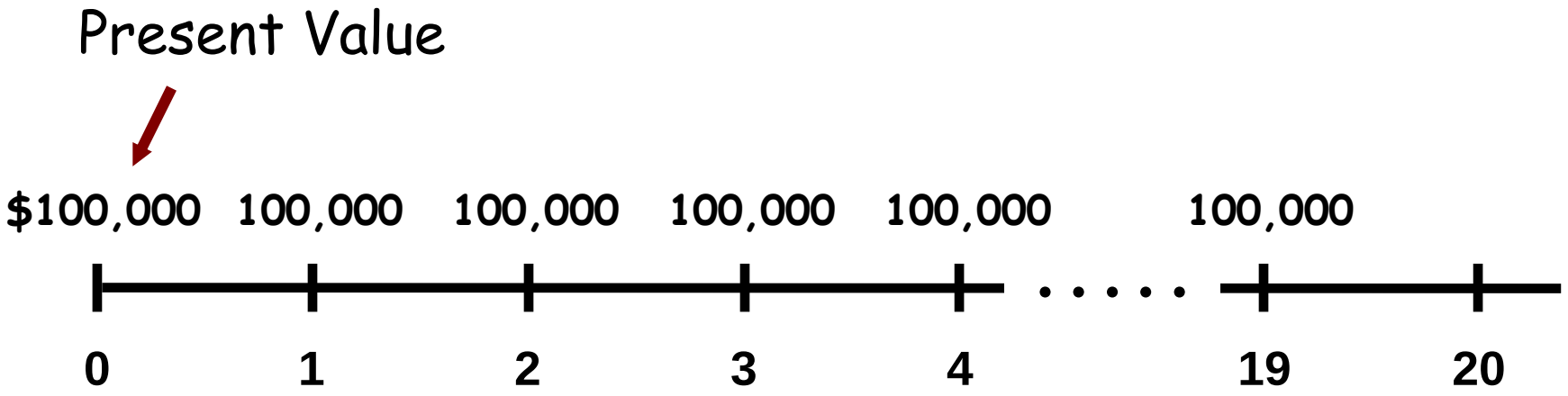
Present Value of an Annuity Due

- Present value of a series of equal amounts to be withdrawn or received at equal intervals.
- Periodic rents occur at the beginning of the period.



LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Annuity Due



Jaime Yuen wins $2,000,000 in the state lottery. She will be paid $100,000 at the beginning of each year for the next 20 years. How much has she actually won? Assume an appropriate interest rate of 8%.

What table do we use?

LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Annuity Due

Table 6-5

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
1	1.00000	1.00000	1.00000	1.00000	1.00000
5	4.62990	4.46511	4.31213	4.16986	4.03735
10	8.43533	7.80169	7.24689	6.75902	6.32825
15	11.56312	10.29498	9.24424	8.36669	7.62817
20	14.13394	12.15812	10.60360	9.36492	8.36578

What factor do we use?

LO 7 Solve present value of ordinary and annuity due problems.

Present Value of an Annuity Due

Table 6-5

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
1	1.00000	1.00000	1.00000	1.00000	1.00000
5	4.62990	4.46511	4.31213	4.16986	4.03735
10	8.43533	7.80169	7.24689	6.75902	6.32825
15	11.56312	10.29498	9.24424	8.36669	7.62817
20	14.13394	12.15812	10.60360	9.36492	8.36578

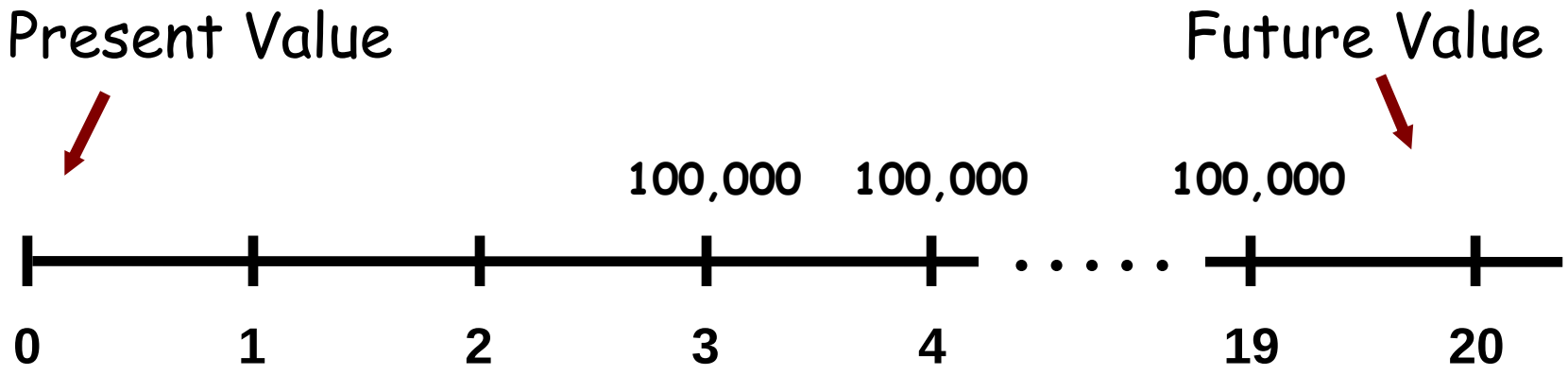
$100,000 x 10.60360 = $1,060,360

Receipt Factor Present Value

LO 7 Solve present value of ordinary and annuity due problems.

Deferred Annuities

- Rents begin after a specified number of periods.
- **Future Value** - Calculation same as the future value of an annuity not deferred.
- **Present Value** - Must recognize the interest that accrues during the deferral period.



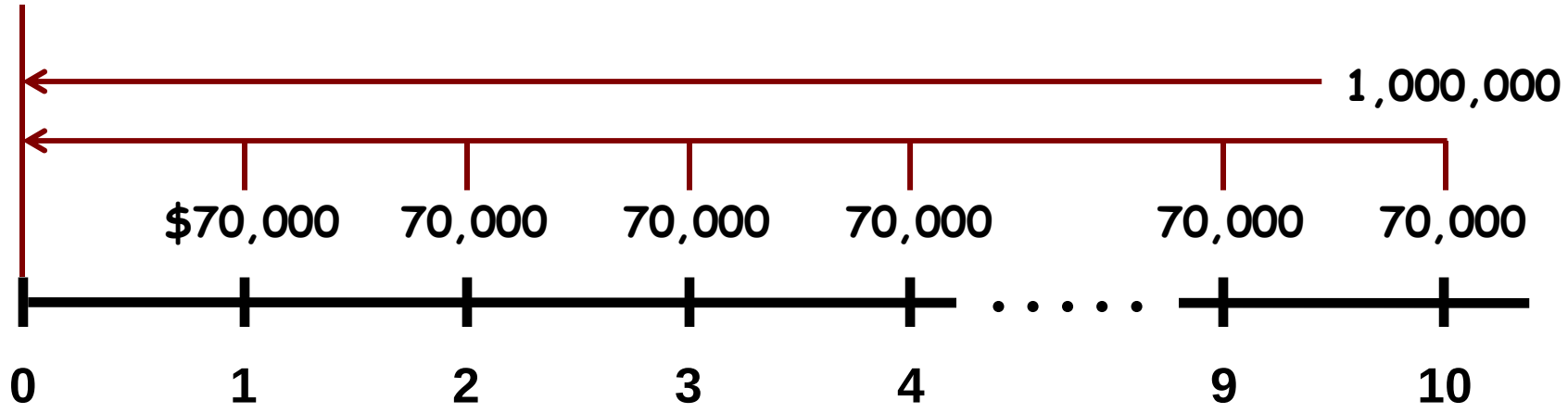
LO 8 Solve present value problems related to deferred annuities and bonds.

Valuation of Long-Term Bonds

Two Cash Flows:

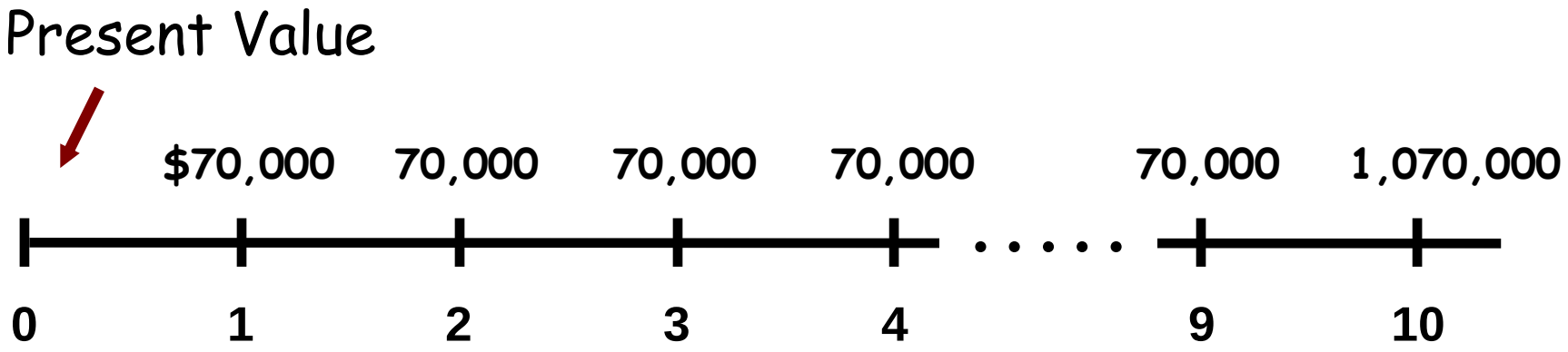
- Periodic interest payments (annuity).
- Principal paid at maturity (single-sum).

Bonds current market value is the combined present values of the both cash flows.



LO 8 Solve present value problems related to deferred annuities and bonds.

Valuation of Long-Term Bonds



BE6-15 Arcadian Inc. issues $1,000,000 of 7% bonds due in 10 years with interest payable at year-end. The current market rate of interest for bonds is 8%. What amount will Arcadian receive when it issues the bonds?

LO 8 Solve present value problems related to deferred annuities and bonds.

Valuation of Long-Term Bonds

Table 6-4 PV of Interest

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
1	0.96154	0.94340	0.92593	0.90900	0.89286
5	4.45183	4.21236	3.99271	3.79079	3.60478
10	8.11090	7.36009	6.71008	6.14457	5.65022
15	11.11839	9.71225	8.55948	7.60608	6.81086
20	13.59033	11.46992	9.81815	8.51356	7.46944

$70,000 x 6.71008 = $469,706

Interest Payment Factor Present Value

LO 8 Solve present value problems related to deferred annuities and bonds.

Valuation of Long-Term Bonds

Table 6-2 — PV of Principal

Number of Periods	Discount Rate 4%	6%	8%	10%	12%
1	0.96154	0.94340	0.92593	0.90909	0.89286
5	0.82193	0.74726	0.68058	0.62092	0.56743
10	0.67556	0.55839	0.46319	0.38554	0.32197
15	0.55526	0.41727	0.31524	0.23939	0.18270
20	0.45639	0.31180	0.21455	0.14864	0.10367

$1,000,000	x	.46319	=	$463,190
Principal Payment		Factor		Present Value

LO 8 Solve present value problems related to deferred annuities and bonds.

Valuation of Long-Term Bonds

BE6-15 Arcadian Inc. issues $1,000,000 of 7% bonds due in 10 years with interest payable at year-end.

Present value of Interest	$469,706
Present value of Principal	463,190
Bond current market value	$932,896

Date	Account Title	Debit	Credit
	Cash	932,896	
	Discount on Bonds	67,104	
	Bonds payable		1,000,000

LO 8 Solve present value problems related to deferred annuities and bonds.

Present Value Measurement

Concepts Statement No. 7 introduces an *expected cash flow approach* that uses a range of cash flows and incorporates the probabilities of those cash flows.

Choosing an Appropriate Interest Rate

Three Components of Interest:

- Pure Rate
- Expected Inflation Rate
- Credit Risk Rate

Risk-free rate of return. FASB states a company should discount expected cash flows by the risk-free rate of return.

LO 9 Apply expected cash flows to present value measurement.

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