

BACHELOR of ECONOMICS



**Thammasat University
Faculty of Economics
Bachelor of Economics (International Program)**

AC201 Fundamental Accounting

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Course Materials

Topic:

Time Value of Money Concept

Session:

Session #9

Instructor:

Assistant Professor Dr. Orapan Yolrabil



Chapter 9: Reporting and Interpreting Liabilities

CHAPTER SUMMARY

Liabilities are obligations of either a known or estimated amount. Detailed information about the liabilities of an entity is important to many decision makers, whether internal or external, to the enterprise, because liabilities represent claims against the resources of an entity. The existence and amount of liabilities sometimes are easy to conceal from outsiders. The accounting model and the verification by an independent CPA are the best assurances that all liabilities are disclosed.

Current liabilities are short-term obligations that will be paid within the coming year or the normal operating cycle of the business, whichever is longer. All other liabilities (except contingent liabilities) are reported as long-term liabilities. A contingent liability is a potential claim due to some event or transaction that has happened and may lead to a liability, but whether it will materialize as an effective liability is not certain because it depends on some future event or transaction. At the end of the accounting period, a contingent liability must be recorded (as a debit to a loss account and a credit to a liability account) if (a) it is probable that a loss will occur and (b) if the amount of the loss can be reasonably estimated. Contingent liabilities that are reasonably possible must be disclosed in the notes to the financial statements.

The current ratio and accounts payable turnover ratio are liquidity ratios which provides an indication of whether a company can pay its current obligations as they come due.

Often, future and present value concepts must be applied in accounting for liabilities. These concepts focus on the time value of money (i.e., interest). Future value is the amount that a principal amount will increase in the future due to compound interest. Present value is the amount that a future principal amount is worth today. It is computed by a process of compounding or discounting future cash flows. Future and present values are related to (a) a single amount or (b) a series of equal periodic amounts (called annuities). Typical applications of future and present values are to create a fund, determine the cost of an asset, account for notes payable, and account for installment debts and receivables.

CHAPTER OBJECTIVES

- LO1 Define, measure, and report current liabilities.
- LO2 Use the current ratio.
- LO3 Analyze the accounts payable turnover ratio.
- LO4 Report notes payable and explain the time value of money.
- LO5 Report contingent liabilities.
- LO6 Explain the importance of working capital and its impact on cash flows.
- LO7 Report long-term liabilities.
- LO8 Compute present values.
- LO9 Apply present value concepts to liabilities.

CHAPTER OUTLINE

I. UNDERSTANDING BUSINESS

1. Businesses finance the acquisition of their assets from funds supplied by creditors (debt) and funds provided by owners (equity). The mixture of debt and equity used by a business is called its capital structure.
2. The factors managers consider when selecting a capital structure are risk and cost.
 - a. Debt is more risky than equity because principal and interest payments must be made on debt.
 - b. Equity is less risky since dividend payments to owners are not legal obligations until declared by the board of directors.
3. Most companies include some debt (borrowed funds) in their capital structure because these funds may be used to earn a higher rate of return for the stockholders. Financial leverage is borrowing at one rate and earning at a different rate.
4. Companies determine the proper balance of short-term and long-term debt for their specific purposes.

II. LO1 DEFINE, MEASURE, AND REPORT CURRENT LIABILITIES.

A. Liabilities:

1. Liabilities are probable future sacrifices of economic benefits that arise from past transactions.
2. Liabilities are liquidated (paid off) by transferring assets or providing services to the creditor.
3. A liability is measured in terms of its cash equivalent (the cash that the creditor would accept to settle the liability) to settle the liability immediately.
 - a. Interest to be paid on the debt is not included initially because interest accrues over time.
 - b. After it has accrued, interest becomes a liability.
4. The list of liabilities on the balance sheet varies from one company to another.

B. Current Liabilities:

1. Current liabilities are short-term obligations that will be paid within the current operating cycle or one year, whichever is longer.
2. Specific operating activities of companies are usually financed, at least in part, by related current liabilities.
3. Current liability accounts that appear on most balance sheets:
 - a. Accounts Payable (A/P or Trade Payable)
 1. Accounts payable includes amounts that are the obligations to pay suppliers in the normal course of business for the purchase of goods and services.
 2. For many companies, trade credit is a relatively inexpensive way to finance the purchase of inventory because interest doesn't normally accrue on accounts payable.
 3. Credit terms provide for the due date of payments.
 - a. These terms may include cash discount provisions for early payment.
 - b. Interest does not normally accrue on A/P if paid within the credit period.
 4. It is advisable for a company to pay A/P before the credit period ends.
 - a. Late payments may jeopardize a positive working relationship with suppliers and threaten a source of quality goods and services.
 - b. Financial analysts consider timely payments to suppliers in evaluating the "health" of a company.

b. Accrued Liabilities

1. Accrued liabilities are recorded for expenses that have been incurred but have not been paid by the end of the accounting period. The expense is recognized in one period, but the payment is made in another period.
2. These liabilities are typically recorded as adjusting entries (matching principle) at the end of the period since no cash transaction has taken place.
3. Examples of accrued expenses include:
 - a. Accrued Taxes Payable
 - i. A current liability computed by applying the applicable tax rates to taxable income earned by corporations.
 - ii. The amount of income tax payable is the amount accrued but not paid at the end of the year.
 - b. Accrued Compensation and Related Costs
 - i. Accrued amounts associated with unpaid salaries and wages.
 - ii. They may be reported as part of accrued liabilities or as a separate item on the balance sheet.
 - iii. Salaries and wages payable are incurred but unpaid employee compensation.
 - iv. A company reports employee income taxes withheld as a current liability since the company is an agent of the government. The withholding amounts are to be remitted to the federal (and perhaps state and local) government at a specified time.
 - v. Payroll taxes include FICA (Social Security) tax. This liability arises from two sources. This tax is withheld from employees' gross wages based on a statutory percentage. This amount is also "matched" by the employer. Both the withholding and the matching amounts are current liabilities of the company. Additional types of payroll taxes may also be appropriate.
 - vi. Other liabilities may result from employee benefits such as accrued vacations. In conformity with the matching principle, the cost of vacation time must be recorded in the year the employee performs services to earn the vacation. Other benefits include retirement programs and health insurance.
 - c. Current Portion of Long-Term Debt
 - i. The distinction between current and long-term debt is important to managers and financial analysts since current debt must usually be paid within the next year. Sufficient cash is needed to pay current liabilities.
 - ii. If long-term debt is paid in installments, the amount due in the upcoming year is reclassified as a current liability. Also, when the payoff of long-term debt is due in the next accounting period, the entire amount is reclassified as a current liability.
 - d. Deferred Revenues
 - i. When a company collects cash before a product is delivered or a service is provided, a deferred or unearned revenue (a liability) is recorded.
 - ii. This is a liability to the company since the goods must be delivered or the service must be performed before revenue can be recognized (the revenue principle).
 - iii. If the promised act does not take place, the company must refund the money.

III. LO2 USE THE CURRENT RATIO.

- A. Liquidity: the ability of a company to pay current obligations.
- B. Current Ratio: a measure of liquidity.

$$\text{Working Capital} = \text{Current Assets} - \text{Current Liabilities}$$

$$\text{Current Ratio} = \frac{\text{Current Assets}}{\text{Current Liabilities}}$$

C. Interpretation

- 1. Most companies use techniques for managing working capital. This is critical for the survival of a business.
- 2. The Current Ratio restates Working Capital as a ratio rather than as a flat number.
- 3. It shows the relationship of current assets to current liabilities rather than just the net.

IV. LO3 ANALYZE THE ACCOUNTS PAYABLE TURNOVER RATIO.

A. Accounts Payable Turnover Ratio

$$\text{Accounts Payable Turnover} = \frac{\text{Cost of Goods Sold}}{\text{Average Accounts Payable}}$$

$$\text{Average Accounts Payable} = \frac{\text{AP balance at beginning of period} + \text{AP balance at end of period}}{2}$$

B. Interpretation

- 1. Evaluates effectiveness in managing payables; i.e., how quickly management is paying trade accounts.
- 2. A high ratio normally indicates that a company is paying its suppliers in a timely manner.
- 3. Cautions:
 - a. The A/P turnover ratio is an average based on all accounts payable.
 - b. Might not reflect reality if a company pays only some creditors on time.
 - c. Subject to manipulation, as managers can “catch up” on paying creditors at year-end to bring the ratio to an acceptable level.

V. LO4 REPORT NOTES PAYABLE AND EXPLAIN THE TIME VALUE OF MONEY.

A. Notes Payable

- 1. Many companies need to borrow to finance their operations.
- 2. The creditors are compensated for the use of the money they loan to businesses with interest.
- 3. Notes payable provide for interest over the lending term.
- 4. Notes payable are evidenced by written contracts that show all of the terms of the debt.
- 5. A note payable can be a current or non-current obligation, depending on its due date.
- 6. The time value of money is interest that is associated with the use of money over time. To the borrower, interest is an expense. To the lender, interest is revenue.

7. The calculation of simple interest is :

$$\text{Interest (I)} = \text{Principal (P)} \times \text{Interest Rate (R)} \times \text{Time (T)}$$

- a. Principal is the amount borrowed or loaned.
 - b. Interest Rate is the annual rate unless stated otherwise.
 - c. Time is the term of the loan in years or part of a year.
 - d. The formula for the computation of simple interest is the same for short-term and long-term notes payable.
 - e. Usually any accrued interest is a current liability (depending on the terms of the loan agreement).
8. Interest is an expense in the period the money is used (borrowed). In conformity with the matching principle, interest expense is recorded when it is incurred rather than when it is paid.
- B. Time Value of Money
1. Creditors are willing to lend cash because they will earn interest in return for giving up the use of the money for a period.
 2. Interest is the rent that is charged for the use of money.

VI. LOS REPORT CONTINGENT LIABILITIES.

- A. Estimated Liabilities on the balance Sheet
1. Some recorded liabilities are based on estimates because the exact amount will not be known until a future date.
 2. Whether a situation produces a contingent liability depends on two factors:
 - a. The liability must be probable, and
 - b. The liability must be reasonably estimated
 3. Before determining if a contingent liability should be recorded, an understanding of probability of occurrence is necessary.
 - a. Probable - the future event is likely to occur.
 - b. Reasonably possible - the chance of the occurrence of the future event is more than remote but less than probable.
 4. Remote - the chance of occurrence of the future event is slight.
 5. The conditions that can exist and how they should be handled are:

Condition	Probable	Reasonably Possible	Remote
Subject to estimation	Record as liability	Disclose in note	Disclosure not required
Not subject to estimate	Disclose in note	Disclose in note	Disclosure not required

6. Many businesses incur obligations related to the environment.
 - a. After natural resources are extracted, companies are often expected to restore the land to its former condition.
 - b. The cost of cleaning up pollution in the future is another environmental cost. These costs should be estimated and recorded as liabilities.

VII. LO6 EXPLAIN THE IMPORTANCE OF WORKING CAPITAL AND ITS IMPACT ON CASH FLOWS.

A. Working Capital Management

$$\text{Working Capital} = \text{Current Assets} - \text{Current Liabilities}$$

1. Working Capital is stated in dollars, not as a percent.
 2. Working Capital is important to both managers and financial analysts. It has a significant impact on the success of a company.
 3. Working Capital accounts must be actively managed to achieve a balance between costs and benefits.
 - a. Too little working capital is risky. A company might not be able to meet its current obligations to creditors.
 - b. Too much working capital might mean the company has tied up resources in unproductive assets.
- B. Effect on Statement of Cash Flows**
- Changes in working capital accounts have a direct impact on cash flows from operating activities.

VIII. LO7 REPORT LONG-TERM LIABILITIES.

A. Long-Term Liabilities

1. Noncurrent liabilities; i.e., all liabilities not properly classified as current liabilities.
2. Often incurred to finance the acquisition of operational (long-lived) assets.
 - a. This is a wise move if the rate of return from using the asset exceeds the rate of interest to finance the asset acquisition.
 - b. Long-term borrowing often allows an interest rate to be "locked-in" for a long period.
 - c. Therefore, the uncertainty regarding future fluctuations of interest rates is removed for long-term debt compared to short-term borrowing.
3. Long-term liabilities include long-term notes payable, bonds payable, and mortgages payable. The borrowing agreement specifies the amount borrowed, the interest rate imposed, and the repayment schedule.
4. The borrowing agreement may also require that the borrower pledge specific assets as security for the liability.
 - a. This type of pledge typically supports mortgage liabilities. Pledges of assets are common when purchasing real estate.
 - b. This type of borrowing is called secured debt.
 - c. Unsecured debt is when the creditor relies primarily on the integrity and general earning power of the borrower. Unsecured debt is typically more risky to the creditor than secured debt.
5. Long-term liabilities are presented on the balance sheet immediately following current liabilities.

B. Long-Term Notes Payable and Bonds

1. Companies may borrow long-term debt from financial organizations such as banks, insurance companies, or pension plans.
 - a. This debt is often called a note payable, which is a written promise to pay a stated sum at one or more specified future dates (maturity dates).
 - b. Borrowing from banks, insurance companies, pension plans, or other financial institutions is also called "private placement."
2. Publicly traded debt includes the issuance of bonds. After bonds are issued, they may be traded in established markets. Bonds are also evidenced by written payment promises. They are discussed in detail in Chapter 10.
3. Accounting for long-term notes payable and bonds is based on the same concepts for recording short-term debt.

C. Lease Liabilities

1. Companies may lease rather than purchase assets.
2. Lease contracts permit a company to pay in the future for an asset it will use in the future.
3. There are two classifications of leases:
 - a. Operating lease
 1. Generally does not create an immediate liability.
 2. Lease payment amounts are recorded as incurred.
 3. This type of lease is on a short term basis.
 - b. Capital lease
 1. Represents the purchase and financing of the asset “acquired” through a lease agreement.
 2. Generally recorded as an asset (for the purchase) and a liability (for the financing) if at least one of the following four criteria is met.
 - a. The lease term is 75% or more of the asset's expected economic life.
 - b. Ownership of the asset is transferred to the lessee at the end of the lease term.
 - c. The lease contract permits the lessee to purchase the asset at a price that is lower than its fair market value.
 - d. The present value of the lease payments is 90% or more of the fair market value of the asset when the lease is signed.
4. Most managers would prefer to record a lease as operating, because they would be required to report less long-term debt on the balance sheet.

IX. LO8 COMPUTE PRESENT VALUES.

A. Present Value Concepts

1. Present value (PV) focuses on the time value of money.
 - a. A dollar received today is worth more than a dollar received in the future (such as a year from now).
 - b. This is true because a dollar can be invested today and earns interest during that future period.
 - c. It is also true because the buying power of a dollar decreases in time due to inflation.
2. Managers may know the dollar amount of a cash flow that occurs in the future but they need to determine its value today. Also, managers may know the dollar amount of a cash flow that occurs today but they need to determine its value in the future.

B. Present Value of a Single Amount

1. The worth to you today of receiving a certain amount at some time in the future. It is a future amount discounted for compound interest.

$$\text{Present Value (PV) of a Single Amount} = \frac{1}{(1+i)^n}$$

2. This calculation is appropriate if you know what an investment will pay you in the future and you need to determine its value today (the amount to invest now). Three items must be known to find the PV of a single amount:
 - a. The amount to be received in the future.
 - b. The applicable discount rate (i) to be earned.
 - c. The number of periods (n) in which interest will be earned.
3. The amount of interest to be earned is subtracted from the future value.
 - a. This is referred to as compound discounting.
 - b. By using the PV table (Table A.1), the amount to be received in the future times the appropriate PV table factor will result in the PV amount.
4. Most analysts use present value tables, calculators, or Excel for computations rather than the PV formula.

C. Present Value of an Annuity

1. Annuity

- a.** A series of periodic cash receipts or cash payments that are characterized by
 - 1. An equal payment (in amount) each interest period.
 - 2. Annuities involve multiple cash flows over more than one period rather than a single amount.
 - 3. Interest periods are of equal length
 - 4. Interest rate remains constant over the annuity period.
- b.** Examples of common annuities are equipment payments, mortgage payments, and retirement benefits.
- c.** The equation for an annuity factor is:

$$\text{Present Value (PV) of an Annuity} = \frac{1 - \frac{1}{(1+i)^n}}{i}$$

X. LO9 APPLY PRESENT VALUE CONCEPTS TO LIABILITIES.

- There are many business transactions that require the use of FV and PV concept applications. Examples of these applications include the financing of operational asset purchases and investments in bond sinking funds.

XI. CHAPTER SUPPLEMENT A: INCOME TAXES AND RETIREMENT BENEFITS

1. Deferred Taxes

- a.** There are separate rules that govern the preparation of financial statements (GAAP) and tax returns (Internal Revenue Code).
 - 1. Deferred tax liabilities are obligations that exist due to timing (temporary) differences caused by reporting revenues and expenses according to GAAP on a company's income statement while reporting items on the tax return according to the laws specified in the Internal Revenue Code.
 - 2. Net income on the income statement often differs from taxable income on the tax return.
- b.** The matching principle requires that the tax expense on the income statement be based on the related income on that statement. Yet, the taxes currently payable are based on the amount reported on the tax return.
 - 1. The difference of the tax expense and the taxes currently payable is reported in an account called Deferred Taxes.
 - 2. This account can have either a debit balance (asset) or a credit balance (liability). Typically it is a liability.
- c.** Deferred tax exists due to the differences between GAAP and IRS requirements relating to when revenues and expenses are recognized.
 - 1. These temporary differences are timing differences that give rise to deferred income taxes.
 - 2. These differences will reverse (turn around) in the future.
 - 3. When a temporary difference reverses, the deferred tax amount is reduced. An example of an item, which commonly causes a timing difference, is depreciation since the tax law method does not generally relate to the economic use of an operational asset for a business.

2. Retirement Benefits
 - a. Often employers provide retirement programs for their employees. The matching principle requires that these expenses be recorded in the year the benefits of the employees' services are received by the company.
 - b. There are two types of retirement programs:
 1. A defined contribution program obligates an employer to make required annual payments to a fund.
 - a. These are recorded as pension expense.
 - b. The fund invests the money so that revenue can be generated.
 - c. The contributions along with the revenue earned (if any) in the fund provide payments to employees when they retire. The investing success (or lack of) determines the amounts available to retirees.
 2. A defined benefit program bases employees' retirement benefits on a percentage of the employee's compensation at retirement or a certain number of dollars for each year of employment or combination of the two.
 - a. The pension expense to be recorded each year by the employer is based on the change in the current cash value of the employee's retirement package.
 - b. Current value changes occur because:
 - i. An employee is closer to receiving benefits.
 - ii. Higher compensation or longer service increases retirement benefits.
 - iii. Life expectancies of employees change.
 - c. A liability is incurred for the results of these changes and their impact on the amount not yet funded.
 - c. Pension expense and associated liabilities may be significant amounts for many companies. Therefore, they are of particular interest to analysts who are forecasting the future cash flows of a company.
 - d. Employer-provided health care benefit programs that provide coverage to employees after retirement pose some complex accounting issues.
 1. The expense must be recorded during the period when employees provide services to the company.
 2. Estimates must be used to determine the amount of expense in the current period. In the health care arena, this is particularly challenging.

XII. CHAPTER SUPPLEMENT B: FEDERAL INCOME TAX CONCEPTS

1. Sole proprietorships and partnerships are not taxable entities per se. Corporations, being separate legal entities, are often subject to income taxes.
2. Corporations (regular) are liable for income taxes based on taxable income.
 - a. The tax liability of a corporation is determined by applying the applicable tax rates to the taxable income of the company.
 - b. Graduated rates are currently used for federal income tax purposes.
3. Differences often exist in net income for books and taxable income. Some common differences are:
 - a. Municipal bond interest is included in net income but is excluded from taxable income.
 - b. Rent collected in advance is excluded from net income but is included in taxable income.
 - c. Proceeds from life insurance policies (e.g. key executive insurance) are included in net income but is excluded from taxable income.
 - d. When corporations own less than 20% of another corporation's stock they may exclude 70% of the dividend received from taxable income. They can exclude 80% of the dividend if they own between 20 – 80% and they may exclude 100% of the dividend if they own over 80% of the stock in another company. Yet, the entire dividend is included in book income.
 - e. As mentioned, depreciation methods are also frequently different for tax and book purposes. For tax purposes, companies must use MACRS while there are several methods they can choose for book purposes.

4. Corporations spend considerable resources (time and money) to minimize the tax liability.
 - a. Tax planning strategies are important considerations for management.
 - b. The "least and latest rule" encourages companies to legally pay the smallest amounts. Tax payments are planned for the latest possible date.
 - c. Tax evasion involves illegal means to avoid paying taxes that are due. Tax planning involves legal means to postpone paying taxes.

XIII. CHAPTER SUPPLEMENT C: PRESENT VALUE CONCEPTS USING EXCEL

1. Most present value problems in business are solved with financial calculators or Excel spreadsheets.
2. The formula for the present value of a single amount is

$$= \text{Payment} / (1+i)^n$$

Where
Payment is the cash payment made at some point in the future.
i is the interest rate each period
n is the number of periods in the problem
3. The formula for the present value of an annuity is built into Excel.
 Click on the insert function button (f_x)
 In the dropdown box:
 - a. Enter the interest rate as a decimal in the *Rate* field.
 - b. Enter the number of periods in the *Nper* field.
 - c. Enter the payment as a negative amount in the *Payment* field.

XIV. CHAPTER SUPPLEMENT D: FUTURE VALUE CONCEPTS

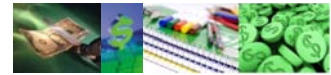
1. Future value of a single amount

$$\text{Future Value (FV) of a Single Amount} = (1+i)^n$$
 - a. This calculation is appropriate if you plan to invest money today and you need to determine its value at a future date.
 - b. Three items must be known to find FV of a single amount:
 1. The amount to be invested today.
 2. The applicable interest rate (*i*) to be earned.
 3. The number of periods (*n*) in which interest will be earned.
 - c. The amount of interest earned (accrued) in one period is added to the invested amount. This sum earns interest for the next period and so forth. This is referred to as compound interest.
 - d. By using the FV tables, the amount to be invested (PV) times the appropriate FV table factor will result in the FV amount.

2. Future Value of an Annuity

$$\text{Future Value (FV) of an Annuity} = \frac{(1+i)^n - 1}{i}$$

- a. This includes compound interest on each payment from the date of payment to the end of the annuity term. Each payment accumulates less interest than the prior payments because the number of remaining periods decreases.
- b. Three items must be known to find it:
 1. The amount of each periodic payment.
 2. The applicable interest rate (*i*) to be earned.
 3. The number of periods (*n*) in which payments will be made.
- c. The amount of interest earned (accrued) in the first period is added to the first payment. When the second period's payment is made, it is added to the accumulated amount to earn (accrue) interest for that period and so on.
- d. By using the FV of an annuity tables, the amounts invested (PV) times the appropriate FV table factor will result in the future value amount.



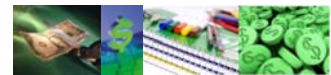
BACHELOR of ECONOMICS



TIME VALUE OF MONEY: PRESENT AND FUTURE VALUES

Assistant Professor Dr. Orapan Yolrabil
Department of Accounting
Thammasat Business School
Thammasat University

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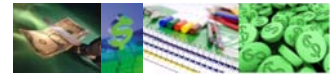
Time Value of Money

- **Time value of money concept** refers to costs or benefits derived from holding or not holding money over time.
 - **Interest** is the cost of using money for a specific period.
 - **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.



“Time is money”

2



Simple Interest

Example of simple interest:

- The Company accepts an 8 percent, 30,000 Baht note due in 90 days. How much will the Company receive at that time?

- The interest is calculated as follows:

$$\begin{aligned} \text{Interest} &= \text{Principal} \times \text{Rate} \times \text{Time} \\ &= 30,000 \times 8/100 \times 90/365 \\ &= 591.78 \text{ Baht} \end{aligned}$$

- Therefore, the total that the Company will receive is 30,591 Baht, calculated as follows:

$$\begin{aligned} \text{Total} &= \text{Principal} + \text{Interest} \\ &= 30,000 + 591.78 \\ &= 30,591.78 \text{ Baht} \end{aligned}$$

3



Compound Interest

Example of compound interest:

- The Company deposits 5,000 Baht in an account that pays 6 percent interest. It 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?

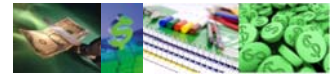
- Assume that the interest is paid at the end of the year and is added to the principal at that time, and that this total in turn earns interest.

- 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 x 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, the Company will have 5,955.08 Baht in its account.

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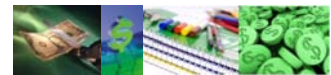


Future Value

- ◆ **Future value** is the amount an investment will be worth at a future date if invested at compound interest.
 - ◆ An example of question asking about future value is *“what is the future value of a single sum (5,000 Baht) at compound interest (6 percent) for three years?”*



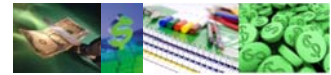
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Future Value of a Single Sum (FV)

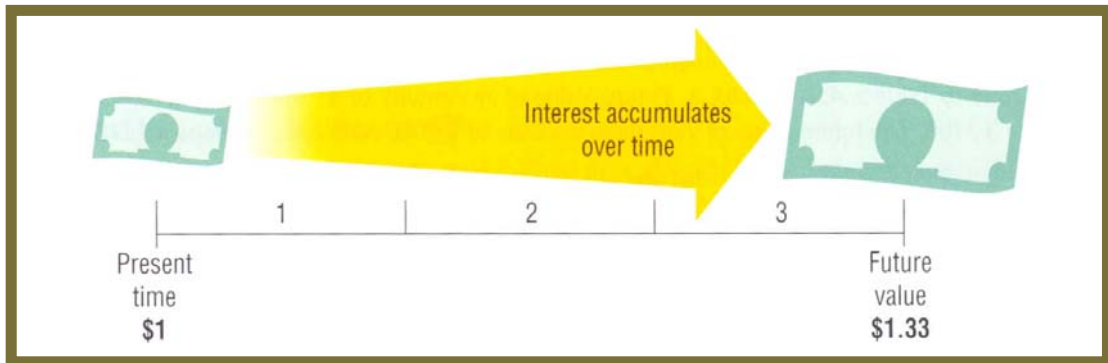
- ◆ In future value of a single amount problems, you will be asked to calculate how much money you will have in the future as the result of investing a certain amount in the present.
 - ◆ If you were to receive a gift of 10,000 Baht, for instance, you might decide to put it in a savings account and use the money as a down payment on a house after you graduate. The future value computation would tell you how much money will be available when you graduate.
 - ◆ To solve a future value problem, you need to know three items:
 - ◆ Amount to be invested
 - ◆ Interest rate (i) the amount will earn
 - ◆ Number of periods (n) in which the amount will earn interest

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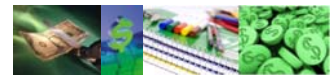


Future Value of a Single Sum (Cont.)

- Since the future value concept is based on compound interest, the amount of interest for each period is calculated by multiplying the principal plus any interest not paid out in prior periods.
 - Graphically, the calculation of the future value of 1 Baht for three periods and an interest rate of 10 percent may be represented as follows:



7



Future Value of a Single Sum (Cont.)

- Example of Future Value of a Single Sum:**
 - Assume that on January 1, 2009, you deposit 1,000 Baht in a savings account at 10 percent annual interest, compounded annually.
 - At the end of three years, the 1,000 Baht will have increased to 1,331 Baht as follows:

(1) Year	(2) Principal Amount at Beginning of Year	(3) Annual Amount of Interest (Col. 2 x 10%)	(4) Accumulated Amount at End of Year (Col. 2 + Col. 3)
1	1,000.00	100.00	1,100.00
2	1,100.00	110.00	1,210.00
3	1,210.00	121.00	1,331.00

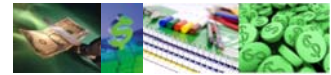
- FV Table:**

- FV = PV x FV Factor
 - 1,331 = 1,000 x 1.3310

- Financial calculator:**

- PV = 1,000, I = 10%, n = 3 → FV = 1,331

8

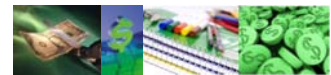


Future Value of An Annuity (FVA)

- **Ordinary annuity** is a series of equal payments made at the end of equal intervals of time, with compound interest of these payments.
 - The future value of an annuity includes compound interest on each payment from the date of payment to the end of the term of the annuity. Each new payment accumulates less interest than prior payments, only because the number of periods remaining in which to accumulate interest decreases.

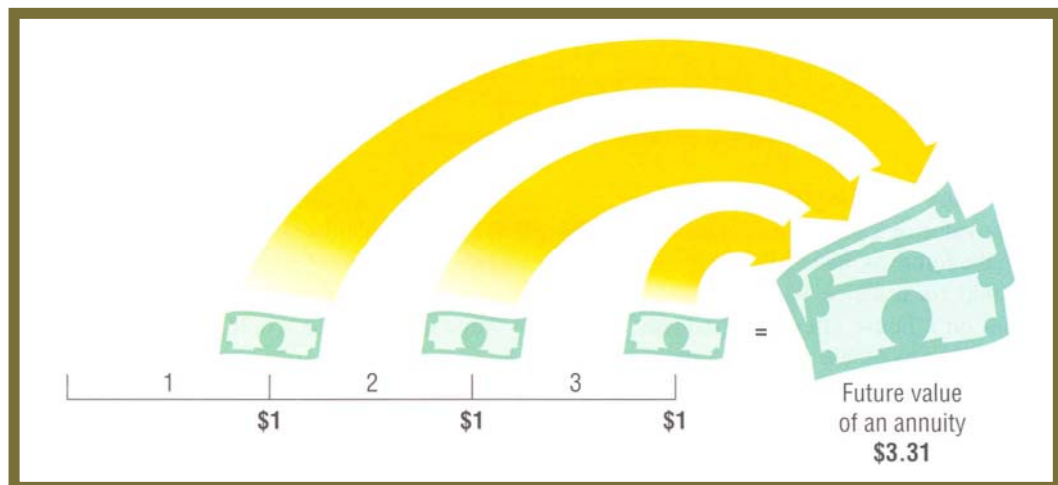


9



Future Value of An Annuity (Cont.)

- The future value of annuity of 1 Baht for three periods at 10 percent may be represented graphically as:



10

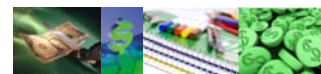


Future Value of An Annuity (Cont.)

Example of Future Value of an Annuity:

- Assume that each year for three years, you deposit 1,000 Baht cash in a savings account at 10 percent interest per year. You make the first 1,000 Baht deposit on December 31, 2009, the second one on December 31, 2010, and the third and last one on December 31, 2011.
 - The first 1,000 Baht deposit earns compound interest for two years (for a total principal and interest of 1,210 Baht); the second deposit earns interest for one year (for a total principal and interest of 1,100 Baht). The third deposit earns no interest because it was made on the day that the balance is computed.
 - Thus, the total amount in the savings account at the end of three years is 3,310 Baht (1,210 + 1,100 + 1,000).

11



Future Value of An Annuity (Cont.)

Compound interest calculation:

(1) Year	(2) Principal Amount at Beginning of Year	(3) Annual Amount of Interest (Col. 2 x 10%)	(4) Periodic Payment	(5) Total Amount Accumulated at the End of the Year (Col. 2 + Col.3 + Col. 4)
1	-	-	1,000.00	1,000.00
2	1,000.00	100.00	1,000.00	2,100.00
3	2,100.00	210.00	1,000.00	3,310.00

FV Table:

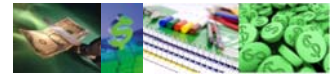
$$FV = PMT \times FVA \text{ Factor}$$

$$3,310 = 1,000 \times 3.3100$$

Financial calculator:

$$PMT = 1,000, I = 10\%, n = 3 \rightarrow FV = 3,310$$

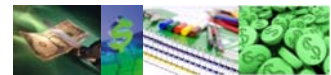
12



Present Value

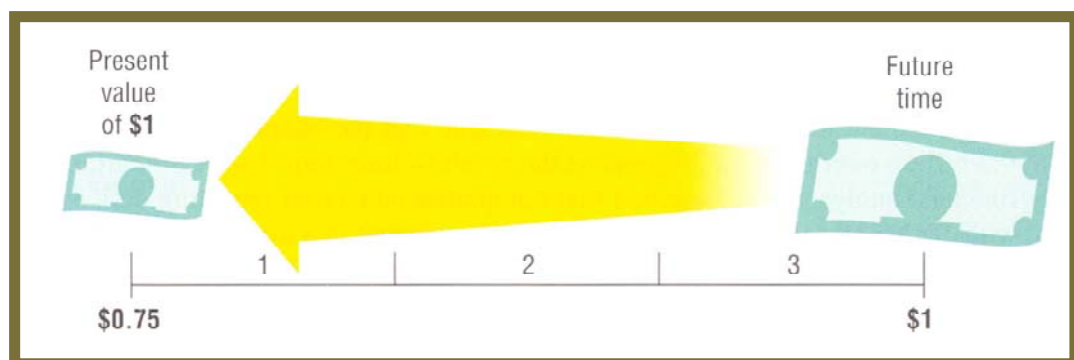
- ◆ **Present value is the amount that must be invested today at a given rate of interest to produce a given future value.**
 - The amount to be received in the future (future value) is not worth as much as today as an amount received today (present value).
 - Example:
 - ◆ The Company needs 1,000 Baht one year from now. How much does she have to invest today to achieve that goal if the interest rate is 5 percent?
- | | | |
|-----------|-----------------------|----------------------|
| ● Recall: | $PV \times (1 + i)^n$ | = FV |
| ● | PV | = $FV / (1 + i)^n$ |
| ● Thus, | PV | = $1,000 / (1.05)^1$ |
| ● | PV | = 952.38 Baht |

13

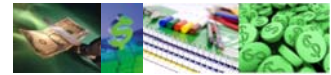


Present Value of a Single Sum (PV)

- ◆ **Present value of a single sum**
 - The present value of a single amount is the worth to you today of receiving that amount some time in the future.
 - Graphically, the present value of 1 Baht due at the end of the third period with an interest rate of 10 percent can be represented as follows:



14



Present Value of a Single Sum (Cont.)

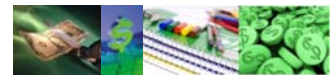
Example of Present Value of a Single Sum

- Suppose the Company wants to be sure of having 4,000 Baht at the end of three years. How much must it invest today in a 5 percent savings account to achieve this goal?
- The calculation is presented as follows:

(1) Year	(2) Amount at the End of Year	÷	(3) Divided by (1 + i)	(4) Present Value at the Beginning of Year (Col. 2 ÷ Col. 3)
1	4,000.00	÷	1.05	3,809.52
2	3,809.52	÷	1.05	3,628.12
3	3,628.12	÷	1.05	3,455.35

- The Company must invest 3,455.35 Baht $(4,000/(1.05)^3)$ today to achieve a value of 4,000 Baht in three years.

15

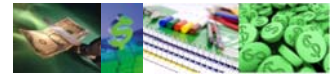


Present Value of a Single Sum (Cont.)

- PV Table:
 - PV = FV x PV factor
3,455.35 = 4,000 x 0.8640
- Financial calculator:
 - FV = 4,000, I = 10%, n = 3 → PV = 3,455.35



16

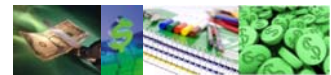


Present Value of an Annuity (PVA)

• Present value of an ordinary annuity

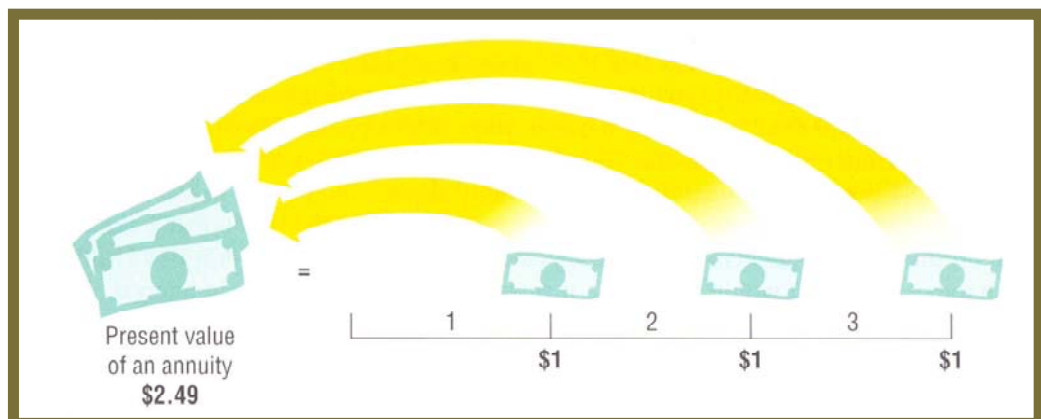
- Recall that an annuity is a series of consecutive payments characterized by
 - An equal dollar amount each interest period.
 - Interest periods of equal length (year, half a year, quarter, or month)
 - An equal interest rate each interest period.
- The present value of an annuity is the value now of a series of equal amounts to be received (or paid out) for some specified number of periods in the future. It is computed by discounting each of the equal periodic amounts.

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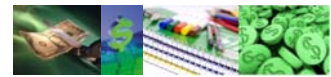


Present Value of an Annuity (Cont.)

- The present value of an annuity of 1 Baht for three periods at 10 percent interest may be represented graphically as follows:



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Present Value of an Annuity (Cont.)

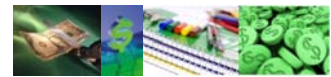
• Example of Present Value of an Annuity:

- The Company has sold a piece of property and is to receive 15,000 Baht in three equal annual payments of 5,000 Baht beginning one year from today. What is the present value of this sale if the current interest rate is 5 percent?

• PV Table:

Future Receipt (Annuity)			Present		Present
Year 1	Year 2	Year 3		Value Factor	Value
5,000.00			x	0.952 =	฿4,760.00
	5,000.00		x	0.907 =	฿4,535.00
		5,000.00	x	0.864 =	฿4,320.00
					<u>฿13,615.00</u>

19



Present Value of an Annuity (Cont.)

• Or PVA Table:

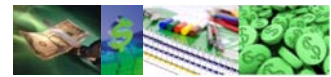
- PV = PMT x PVA Factor
- 13,615 = 5,000 x 2.723

• Financial calculator:

- PMT = 5,000, I = 5%, n = 3 → PV = 13,615



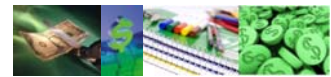
20



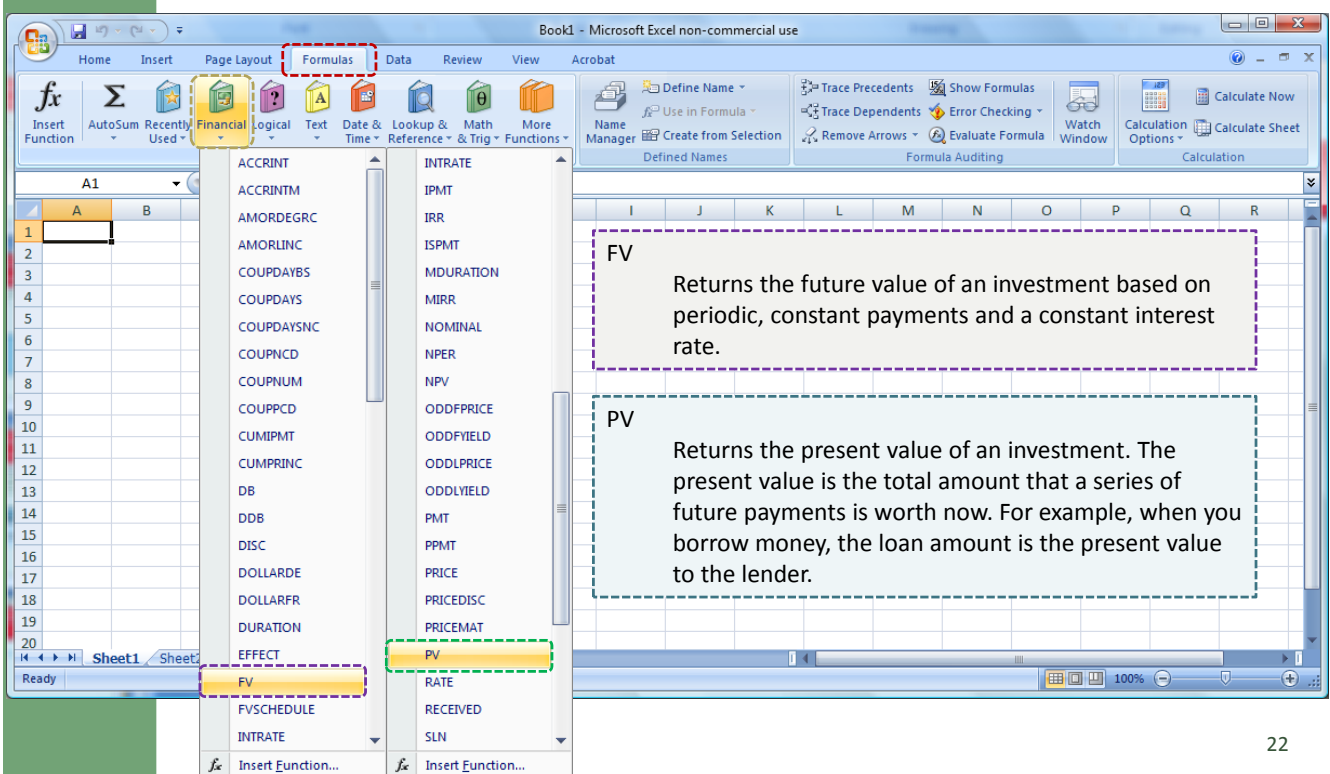
Using Formulas to Determine FV and PV

- **Future Value of a Single Sum**
 - $FV = PV \times (1 + i)^n$
- **Future Value of an Annuity**
 - $FVA = PMT \left[\frac{(1 + i)^n - 1}{i} \right]$
- **Present Value of a Single Sum**
 - $PV = FV / (1 + i)^n$
- **Present Value of an Annuity**
 - $PVA = PMT \left[\frac{1 - (1 / (1 + i)^n)}{i} \right]$

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Using Excel to determine FV and PV



Book1 - Microsoft Excel non-commercial use

Formulas

Financial Functions

FV

Returns the future value of an investment based on periodic, constant payments and a constant interest rate.

PV

Returns the present value of an investment. The present value is the total amount that a series of future payments is worth now. For example, when you borrow money, the loan amount is the present value to the lender.

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Future Value Calculation with Excel

Function Arguments

FV

Rate		= number
Nper		= number
Pmt		= number
Pv		= number
Type		= number

Returns the future value of an investment based on periodic, constant payments and a constant interest rate.

Rate is the interest rate per period. For example, use 6%/4 for quarterly payments at 6% APR.

Formula result =

[Help on this function](#)

OK Cancel

Rate is the interest rate per period.

Nper is the total number of payment periods in an annuity.

Pmt is the payment made each period; it cannot change over the life of the annuity. Typically, pmt contains principal and interest but no other fees or taxes. If pmt is omitted, you must include the pv argument.

Pv is the present value, or the lump-sum amount that a series of future payments is worth right now. If pv is omitted, it is assumed to be 0 (zero), and you must include the pmt argument.

Type is the number 0 or 1 and indicates when payments are due. If type is omitted, it is assumed to be 0.

Syntax

FV(rate,nper,pmt,pv,type)

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Function Arguments

FV

Rate	10%	= 0.1
Nper	3	= 3
Pmt		= number
Pv	1000	= 1000
Type		= number

Returns the future value of an investment based on periodic, constant payments and a constant interest rate.

Pv is the present value, or the lump-sum amount that a series of future payments is worth now. If omitted, Pv = 0.

Formula result = -\$1,331.00

[Help on this function](#)

OK Cancel

Future Value of a Single Sum

Function Arguments

FV

Rate	10%	= 0.1
Nper	3	= 3
Pmt	1000	= 1000
Pv		= number
Type		= number

Returns the future value of an investment based on periodic, constant payments and a constant interest rate.

Pmt is the payment made each period; it cannot change over the life of the investment.

Formula result = -\$3,310.00

[Help on this function](#)

OK Cancel

Future Value of an Annuity

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Present Value Calculation with Excel

Function Arguments

PV

Rate		= number
Nper		= number
Pmt		= number
Fv		= number
Type		= number

Returns the present value of an investment: the total amount that a series of future payments is worth now.

Rate is the interest rate per period. For example, use 6%/4 for quarterly payments at 6% APR.

Formula result =

[Help on this function](#) OK Cancel

Syntax

PV(rate,nper,pmt,fv,type)

Rate is the interest rate per period.

Nper is the total number of payment periods in an annuity.

Pmt is the payment made each period and cannot change over the life of the annuity. Typically, pmt includes principal and interest but no other fees or taxes. If pmt is omitted, you must include the fv argument.

Fv is the future value, or a cash balance you want to attain after the last payment is made. If fv is omitted, it is assumed to be 0 (the future value of a loan, for example, is 0). You could then make a conservative guess at an interest rate and determine how much you must save each month. If fv is omitted, you must include the pmt argument.

Type is the number 0 or 1 and indicates when payments are due.

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Function Arguments

PV

Rate	10%	= 0.1
Nper	3	= 3
Pmt		= number
Fv	1000	= 1000
Type		= number

Returns the present value of an investment: the total amount that a series of future payments is worth now.

Fv is the future value, or a cash balance you want to attain after the last payment is made.

Formula result = -8751.31

[Help on this function](#) OK Cancel

Present Value of a Single Sum

Function Arguments

PV

Rate	10%	= 0.1
Nper	3	= 3
Pmt	1000	= 1000
Fv		= number
Type		= number

Returns the present value of an investment: the total amount that a series of future payments is worth now.

Pmt is the payment made each period and cannot change over the life of the investment.

Formula result = -82,486.85

[Help on this function](#) OK Cancel

Present Value of an Annuity

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BA II Plus™ Calculator



BA II PLUS™ Calculator

TVM and Amortization Worksheet Variables

Variable	Key	Display	Type of Variable
Number of periods	N	N	Enter-or-compute
Interest rate per year	I/Y	I/Y	Enter-or-compute
Present value	PV	PV	Enter-or-compute
Payment	PMT	PMT	Enter-or-compute
Future value	FV	FV	Enter-or-compute
Number of payments per year	2nd P/Y	P/Y	Enter-only
Number of compounding periods per year	↓	C/Y	Enter-only
End-of-period payments	2nd [BGN]	END	Setting
Beginning-of-period payments	2nd [SET]	BGN	Setting
Starting payment	2nd [AMORT]	P1	Enter-only
Ending payment	↓	P2	Enter-only
Balance	↓	BAL	Auto-compute
Principal paid	↓	PRN	Auto-compute
Interest paid	↓	INT	Auto-compute

Resetting the TVM and Amortization Worksheet Variables

- To reset all calculator variables and formats to default values (including TVM and amortization variables), press **2nd** **[RESET]** **[ENTER]**:

Variable	Default	Variable	Default
N	0	END/BGN	END
I/Y	0	P1	1
PV	0	P2	1
PMT	0	BAL	0
FV	0	PRN	0
P/Y	1	INT	0
C/Y	1		

- To reset only the TVM variables (**N**, **I/Y**, **PV**, **PMT**, **FV**) to default values, press **2nd** **[CLR TVM]**.
- To reset **P/Y** and **C/Y** to default values, press **2nd** **[P/Y]** **2nd** **[CLR WORK]**.
- To reset the Amortization worksheet variables (**P1**, **P2**, **BAL**, **PRN**, **INT**) to default values, press **2nd** **[CLR WORK]** while in the Amortization worksheet.
- To reset **END/BGN** to the default value, press **2nd** **[BGN]** **2nd** **[CLR WORK]**.



BA II Plus™ Calculator (Cont.)

Examples: Computing Value in Savings

These examples show you how to compute the future and present values of a savings account paying 0.5% compounded at the end of each year with a 20-year time frame.

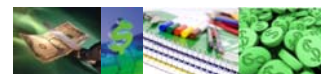
Computing Future Value

Example: If you open the account with \$5,000, how much will you have after 20 years?

To	Press	Display
Set all variables to defaults.	2nd [RESET] [ENTER]	RST 0.00
Enter number of payments.	20 [N]	N= 20.00 ◀
Enter interest rate.	.5 [I/Y]	I/Y= 0.50 ◀
Enter beginning balance.	5000 [+/-] [PV]	PV= -5,000.00 ◀
Compute future value.	[CPT] [FV]	FV= 5,524.48*

Answer: The account will be worth \$5,524.48 after 20 years.

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BA II Plus™ Calculator (Cont.)

Computing Present Value

Example: How much money must you deposit to have \$10,000 in 20 years?

To	Press	Display
Enter final balance.	10000 [FV]	FV= 10,000.00 ◀
Compute present value.	[CPT] [PV]	PV= -9,050.63*

Answer: You must deposit \$9,050.63.

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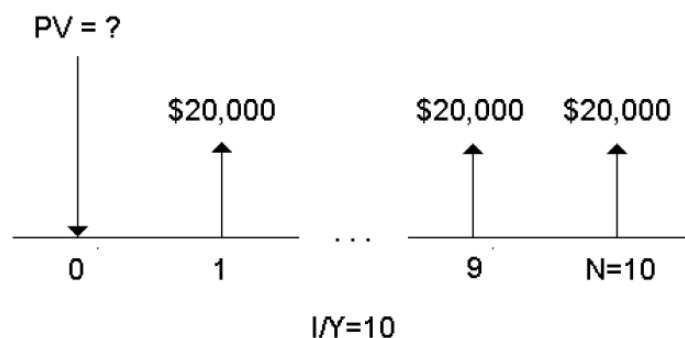


BA II Plus™ Calculator (Cont.)

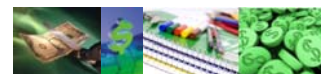
Example: Computing Present Value in Annuities

The Furros Company purchased equipment providing an annual savings of \$20,000 over 10 years. Assuming an annual discount rate of 10%, what is the present value of the savings using an ordinary annuity and an annuity due?

Cost Savings for a Present-Value Ordinary Annuity



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BA II Plus™ Calculator (Cont.)

To	Press	Display
Set all variables to defaults.	2nd [RESET] [ENTER]	RST 0.00
Enter number of payments.	10 [N]	N= 10.00 ◀
Enter interest rate per payment period.	10 [I/Y]	I/Y= 10.00 ◀
Enter payment.	20000 [+/-] [PMT]	PMT= -20,000.00 ◀
Compute present value (ordinary annuity).	[CPT] [PV]	PV= 122,891.34*

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TABLE 1 Future Value of \$1 FV = \$1 (1 + i) ⁿ																		
n/i	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	1.01000	1.01500	1.02000	1.02500	1.03000	1.03500	1.04000	1.04500	1.05000	1.05500	1.06000	1.07000	1.08000	1.09000	1.10000	1.11000	1.12000	1.20000
2	1.02010	1.03022	1.04040	1.05063	1.06090	1.07123	1.08160	1.09203	1.10250	1.11303	1.12360	1.14490	1.16640	1.18810	1.21000	1.23210	1.25440	1.44000
3	1.03030	1.04568	1.06121	1.07689	1.09273	1.10872	1.12486	1.14117	1.15763	1.17424	1.19102	1.22504	1.25971	1.29503	1.33100	1.36763	1.40493	1.72800
4	1.04060	1.06136	1.08243	1.10381	1.12551	1.14752	1.16986	1.19252	1.21551	1.23882	1.26248	1.31080	1.36049	1.41158	1.46410	1.51807	1.57352	2.07360
5	1.05101	1.07728	1.10408	1.13141	1.15927	1.18769	1.21665	1.24618	1.27628	1.30696	1.33823	1.40255	1.46933	1.53862	1.61051	1.68506	1.76234	2.48832
6	1.06152	1.09344	1.12616	1.15969	1.19405	1.22926	1.26532	1.30226	1.34010	1.37884	1.41852	1.50073	1.58687	1.67710	1.77156	1.87041	1.97382	2.98598
7	1.07214	1.10984	1.14869	1.18869	1.22987	1.27228	1.31593	1.36086	1.40710	1.45468	1.50363	1.60578	1.71382	1.82804	1.94872	2.07616	2.21068	3.58318
8	1.08286	1.12649	1.17166	1.21840	1.26677	1.31681	1.36857	1.42210	1.47746	1.53469	1.59385	1.71819	1.85093	1.99256	2.14359	2.30454	2.47596	4.29982
9	1.09369	1.14339	1.19509	1.24886	1.30477	1.36290	1.42331	1.48610	1.55133	1.61909	1.68948	1.83846	1.99900	2.17189	2.35795	2.55804	2.77308	5.15978
10	1.10462	1.16054	1.21899	1.28008	1.34392	1.41060	1.48024	1.55297	1.62889	1.70814	1.79085	1.96715	2.15892	2.36736	2.59374	2.83942	3.10585	6.19174
11	1.11567	1.17795	1.24337	1.31209	1.38423	1.45997	1.53945	1.62285	1.71034	1.80209	1.89830	2.10485	2.33164	2.58043	2.85312	3.15176	3.47855	7.43008
12	1.12683	1.19562	1.26824	1.34489	1.42576	1.51107	1.60103	1.69588	1.79586	1.90121	2.01220	2.25219	2.51817	2.81266	3.13843	3.49845	3.89598	8.91610
13	1.13809	1.21355	1.29361	1.37851	1.46853	1.56396	1.66507	1.77220	1.88565	2.00577	2.13293	2.40985	2.71962	3.06580	3.45227	3.88328	4.36349	10.69932
14	1.14947	1.23176	1.31948	1.41297	1.51259	1.61869	1.73168	1.85194	1.97993	2.11609	2.26090	2.57853	2.93719	3.34173	3.79750	4.31044	4.88711	12.83918
15	1.16097	1.25023	1.34587	1.44830	1.55797	1.67535	1.80094	1.93528	2.07893	2.23248	2.39656	2.75903	3.17217	3.64248	4.17725	4.78459	5.47357	15.40702
16	1.17258	1.26899	1.37279	1.48451	1.60471	1.73399	1.87298	2.02237	2.18287	2.35526	2.54035	2.95216	3.42594	3.97031	4.59497	5.31089	6.13039	18.48843
17	1.18430	1.28802	1.40024	1.52162	1.65285	1.79468	1.94790	2.11338	2.29202	2.48480	2.69277	3.15882	3.70002	4.32763	5.05447	5.89509	6.86604	22.18611
18	1.19615	1.30734	1.42825	1.55966	1.70243	1.85749	2.02582	2.20848	2.40662	2.62147	2.85434	3.37993	3.99602	4.71712	5.55992	6.54355	7.68997	26.62333
19	1.20811	1.32695	1.45681	1.59865	1.75351	1.92250	2.10685	2.30786	2.52695	2.76565	3.02560	3.61653	4.31570	5.14166	6.11591	7.26334	8.61276	31.94800
20	1.22019	1.34686	1.48595	1.63862	1.80611	1.98979	2.19112	2.41171	2.65330	2.91776	3.20714	3.86968	4.66096	5.60441	6.72750	8.06231	9.64629	38.33760
21	1.23239	1.36706	1.51567	1.67958	1.86029	2.05943	2.27877	2.52024	2.78596	3.07823	3.39956	4.14056	5.03383	6.10881	7.40025	8.94917	10.80385	46.00512
25	1.28243	1.45095	1.64061	1.85394	2.09378	2.36324	2.66584	3.00543	3.38635	3.81339	4.29187	5.42743	6.84848	8.62308	10.83471	13.58546	17.00006	95.39622
30	1.34785	1.56308	1.81136	2.09757	2.42726	2.80679	3.24340	3.74532	4.32194	4.98395	5.74349	7.61226	10.06266	13.26768	17.44940	22.89230	29.95992	237.37631
40	1.48886	1.81402	2.20804	2.68506	3.26204	3.95926	4.80102	5.81636	7.03999	8.51331	10.28572	14.97446	21.72452	31.40942	45.25926	65.00087	93.05097	1469.77160

TABLE 2 Present Value of \$1

$$PV = \frac{\$1}{(1 + i)^n}$$

n/i	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	0.99010	0.98522	0.98039	0.97561	0.97087	0.96618	0.96154	0.95694	0.95238	0.94787	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286	0.83333
2	0.98030	0.97066	0.96117	0.95181	0.94260	0.93351	0.92456	0.91573	0.90703	0.89845	0.89000	0.87344	0.85734	0.84168	0.82645	0.81162	0.79719	0.69444
3	0.97059	0.95632	0.94232	0.92860	0.91514	0.90194	0.88900	0.87630	0.86384	0.85161	0.83962	0.81630	0.79383	0.77218	0.75131	0.73119	0.71178	0.57870
4	0.96098	0.94218	0.92385	0.90595	0.88849	0.87144	0.85480	0.83856	0.82270	0.80722	0.79209	0.76290	0.73503	0.70843	0.68301	0.65873	0.63552	0.48225
5	0.95147	0.92826	0.90573	0.88385	0.86261	0.84197	0.82193	0.80245	0.78353	0.76513	0.74726	0.71299	0.68058	0.64993	0.62092	0.59345	0.56743	0.40188
6	0.94205	0.91454	0.88797	0.86230	0.83748	0.81350	0.79031	0.76790	0.74622	0.72525	0.70496	0.66634	0.63017	0.59627	0.56447	0.53464	0.50663	0.33490
7	0.93272	0.90103	0.87056	0.84127	0.81309	0.78599	0.75992	0.73483	0.71068	0.68744	0.66506	0.62275	0.58349	0.54703	0.51316	0.48166	0.45235	0.27908
8	0.92348	0.88771	0.85349	0.82075	0.78941	0.75941	0.73069	0.70319	0.67684	0.65160	0.62741	0.58201	0.54027	0.50187	0.46651	0.43393	0.40388	0.23257
9	0.91434	0.87459	0.83676	0.80073	0.76642	0.73373	0.70259	0.67290	0.64461	0.61763	0.59190	0.54393	0.50025	0.46043	0.42410	0.39092	0.36061	0.19381
10	0.90529	0.86167	0.82035	0.78120	0.74409	0.70892	0.67556	0.64393	0.61391	0.58543	0.55839	0.50835	0.46319	0.42241	0.38554	0.35218	0.32197	0.16151
11	0.89632	0.84893	0.80426	0.76214	0.72242	0.68495	0.64958	0.61620	0.58468	0.55491	0.52679	0.47509	0.42888	0.38753	0.35049	0.31728	0.28748	0.13459
12	0.88745	0.83639	0.78849	0.74356	0.70138	0.66178	0.62460	0.58966	0.55684	0.52598	0.49697	0.44401	0.39711	0.35553	0.31863	0.28584	0.25668	0.11216
13	0.87866	0.82403	0.77303	0.72542	0.68095	0.63940	0.60057	0.56427	0.53032	0.49856	0.46884	0.41496	0.36770	0.32618	0.28966	0.25751	0.22917	0.09346
14	0.86996	0.81185	0.75788	0.70773	0.66112	0.61778	0.57748	0.53997	0.50507	0.47257	0.44230	0.38782	0.34046	0.29925	0.26333	0.23199	0.20462	0.07789
15	0.86135	0.79985	0.74301	0.69047	0.64186	0.59689	0.55526	0.51672	0.48102	0.44793	0.41727	0.36245	0.31524	0.27454	0.23939	0.20900	0.18270	0.06491
16	0.85282	0.78803	0.72845	0.67362	0.62317	0.57671	0.53391	0.49447	0.45811	0.42458	0.39365	0.33873	0.29189	0.25187	0.21763	0.18829	0.16312	0.05409
17	0.84438	0.77639	0.71416	0.65720	0.60502	0.55720	0.51337	0.47318	0.43630	0.40245	0.37136	0.31657	0.27027	0.23107	0.19784	0.16963	0.14564	0.04507
18	0.83602	0.76491	0.70016	0.64117	0.58739	0.53836	0.49363	0.45280	0.41552	0.38147	0.35034	0.29586	0.25025	0.21199	0.17986	0.15282	0.13004	0.03756
19	0.82774	0.75361	0.68643	0.62553	0.57029	0.52016	0.47464	0.43330	0.39573	0.36158	0.33051	0.27651	0.23171	0.19449	0.16351	0.13768	0.11611	0.03130
20	0.81954	0.74247	0.67297	0.61027	0.55368	0.50257	0.45639	0.41464	0.37689	0.34273	0.31180	0.25842	0.21455	0.17843	0.14864	0.12403	0.10367	0.02608
21	0.81143	0.73150	0.65978	0.59539	0.53755	0.48557	0.43883	0.39679	0.35894	0.32486	0.29416	0.24151	0.19866	0.16370	0.13513	0.11174	0.09256	0.02174
24	0.78757	0.69954	0.62172	0.55288	0.49193	0.43796	0.39012	0.34770	0.31007	0.27666	0.24698	0.19715	0.15770	0.12640	0.10153	0.08170	0.06588	0.01258
25	0.77977	0.68921	0.60953	0.53939	0.47761	0.42315	0.37512	0.33273	0.29530	0.26223	0.23300	0.18425	0.14602	0.11597	0.09230	0.07361	0.05882	0.01048
28	0.75684	0.65910	0.57437	0.50088	0.43708	0.38165	0.33348	0.29157	0.25509	0.22332	0.19563	0.15040	0.11591	0.08955	0.06934	0.05382	0.04187	0.00607
29	0.74934	0.64936	0.56311	0.48866	0.42435	0.36875	0.32065	0.27902	0.24295	0.21168	0.18456	0.14056	0.10733	0.08215	0.06304	0.04849	0.03738	0.00506
30	0.74192	0.63976	0.55207	0.47674	0.41199	0.35628	0.30832	0.26700	0.23138	0.20064	0.17411	0.13137	0.09938	0.07537	0.05731	0.04368	0.03338	0.00421
31	0.73458	0.63031	0.54125	0.46511	0.39999	0.34423	0.29646	0.25550	0.22036	0.19018	0.16425	0.12277	0.09202	0.06915	0.05210	0.03935	0.02980	0.00351
40	0.67165	0.55126	0.45289	0.37243	0.30656	0.25257	0.20829	0.17193	0.14205	0.11746	0.09722	0.06678	0.04603	0.03184	0.02209	0.01538	0.01075	0.00068

TABLE 3 Future Value of an Ordinary Annuity of \$1

$$FVA = \frac{(1 + i)^n - 1}{i}$$

<i>n/i</i>	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000
2	2.0100	2.0150	2.0200	2.0250	2.0300	2.0350	2.0400	2.0450	2.0500	2.0550	2.0600	2.0700	2.0800	2.0900	2.1000	2.1100	2.1200	2.2000
3	3.0301	3.0452	3.0604	3.0756	3.0909	3.1062	3.1216	3.1370	3.1525	3.1680	3.1836	3.2149	3.2464	3.2781	3.3100	3.3421	3.3744	3.6400
4	4.0604	4.0909	4.1216	4.1525	4.1836	4.2149	4.2465	4.2782	4.3101	4.3423	4.3746	4.4399	4.5061	4.5731	4.6410	4.7097	4.7793	5.3680
5	5.1010	5.1523	5.2040	5.2563	5.3091	5.3625	5.4163	5.4707	5.5256	5.5811	5.6371	5.7507	5.8666	5.9847	6.1051	6.2278	6.3528	7.4416
6	6.1520	6.2296	6.3081	6.3877	6.4684	6.5502	6.6330	6.7169	6.8019	6.8881	6.9753	7.1533	7.3359	7.5233	7.7156	7.9129	8.1152	9.9299
7	7.2135	7.3230	7.4343	7.5474	7.6625	7.7794	7.8983	8.0192	8.1420	8.2669	8.3938	8.6540	8.9228	9.2004	9.4872	9.7833	10.0890	12.9159
8	8.2857	8.4328	8.5830	8.7361	8.8923	9.0517	9.2142	9.3800	9.5491	9.7216	9.8975	10.2598	10.6366	11.0285	11.4359	11.8594	12.2997	16.4991
9	9.3685	9.5593	9.7546	9.9545	10.1591	10.3685	10.5828	10.8021	11.0266	11.2563	11.4913	11.9780	12.4876	13.0210	13.5795	14.1640	14.7757	20.7989
10	10.4622	10.7027	10.9497	11.2034	11.4639	11.7314	12.0061	12.2882	12.5779	12.8754	13.1808	13.8164	14.4866	15.1929	15.9374	16.7220	17.5487	25.9587
11	11.5668	11.8633	12.1687	12.4835	12.8078	13.1420	13.4864	13.8412	14.2068	14.5835	14.9716	15.7836	16.6455	17.5603	18.5312	19.5614	20.6546	32.1504
12	12.6825	13.0412	13.4121	13.7956	14.1920	14.6020	15.0258	15.4640	15.9171	16.3856	16.8699	17.8885	18.9771	20.1407	21.3843	22.7132	24.1331	39.5805
13	13.8093	14.2368	14.6803	15.1404	15.6178	16.1130	16.6268	17.1599	17.7130	18.2868	18.8821	20.1406	21.4953	22.9534	24.5227	26.2116	28.0291	48.4966
14	14.9474	15.4504	15.9739	16.5190	17.0863	17.6770	18.2919	18.9321	19.5986	20.2926	21.0151	22.5505	24.2149	26.0192	27.9750	30.0949	32.3926	59.1959
15	16.0969	16.6821	17.2934	17.9319	18.5989	19.2957	20.0236	20.7841	21.5786	22.4087	23.2760	25.1290	27.1521	29.3609	31.7725	34.4054	37.2797	72.0351
16	17.2579	17.9324	18.6393	19.3802	20.1569	20.9710	21.8245	22.7193	23.6575	24.6411	25.6725	27.8881	30.3243	33.0034	35.9497	39.1899	42.7533	87.4421
17	18.4304	19.2014	20.0121	20.8647	21.7616	22.7050	23.6975	24.7417	25.8404	26.9964	28.2129	30.8402	33.7502	36.9737	40.5447	44.5008	48.8837	105.9306
18	19.6147	20.4894	21.4123	22.3863	23.4144	24.4997	25.6454	26.8551	28.1324	29.4812	30.9057	33.9990	37.4502	41.3013	45.5992	50.3959	55.7497	128.1167
19	20.8109	21.7967	22.8406	23.9460	25.1169	26.3572	27.6712	29.0636	30.5390	32.1027	33.7600	37.3790	41.4463	46.0185	51.1591	56.9395	63.4397	154.7400
20	22.0190	23.1237	24.2974	25.5447	26.8704	28.2797	29.7781	31.3714	33.0660	34.8683	36.7856	40.9955	45.7620	51.1601	57.2750	64.2028	72.0524	186.6880
21	23.2392	24.4705	25.7833	27.1833	28.6765	30.2695	31.9692	33.7831	35.7193	37.7861	39.9927	44.8652	50.4229	56.7645	64.0025	72.2651	81.6987	225.0256
30	34.7849	37.5387	40.5681	43.9027	47.5754	51.6227	56.0849	61.0071	66.4388	72.4355	79.0582	94.4608	113.2832	136.3075	164.4940	199.0209	241.3327	1181.8816
40	48.8864	54.2679	60.4020	67.4026	75.4013	84.5503	95.0255	107.0303	120.7998	136.6056	154.7620	199.6351	259.0565	337.8824	442.5926	581.8261	767.0914	7343.8578

TABLE 4 Present Value of an Ordinary Annuity of \$1

$$PVA = \frac{1 - \frac{1}{(1 + i)^n}}{i}$$

<i>n/i</i>	1.0%	1.5%	2.0%	2.5%	3.0%	3.5%	4.0%	4.5%	5.0%	5.5%	6.0%	7.0%	8.0%	9.0%	10.0%	11.0%	12.0%	20.0%
1	0.99010	0.98522	0.98039	0.97561	0.97087	0.96618	0.96154	0.95694	0.95238	0.94787	0.94340	0.93458	0.92593	0.91743	0.90909	0.90090	0.89286	0.83333
2	1.97040	1.95588	1.94156	1.92742	1.91347	1.89969	1.88609	1.87267	1.85941	1.84632	1.83339	1.80802	1.78326	1.75911	1.73554	1.71252	1.69005	1.52778
3	2.94099	2.91220	2.88388	2.85602	2.82861	2.80164	2.77509	2.74896	2.72325	2.69793	2.67301	2.62432	2.57710	2.53129	2.48685	2.44371	2.40183	2.10648
4	3.90197	3.85438	3.80773	3.76197	3.71710	3.67308	3.62990	3.58753	3.54595	3.50515	3.46511	3.38721	3.31213	3.23972	3.16987	3.10245	3.03735	2.58873
5	4.85343	4.78264	4.71346	4.64583	4.57971	4.51505	4.45182	4.38998	4.32948	4.27028	4.21236	4.10020	3.99271	3.88965	3.79079	3.69590	3.60478	2.99061
6	5.79548	5.69719	5.60143	5.50813	5.41719	5.32855	5.24214	5.15787	5.07569	4.99553	4.91732	4.76654	4.62288	4.48592	4.35526	4.23054	4.11141	3.32551
7	6.72819	6.59821	6.47199	6.34939	6.23028	6.11454	6.00205	5.89270	5.78637	5.68297	5.58238	5.38929	5.20637	5.03295	4.86842	4.71220	4.56376	3.60459
8	7.65168	7.48593	7.32548	7.17014	7.01969	6.87396	6.73274	6.59589	6.46321	6.33457	6.20979	5.97130	5.74664	5.53482	5.33493	5.14612	4.96764	3.83716
9	8.56602	8.36052	8.16224	7.97087	7.78611	7.60769	7.43533	7.26879	7.10782	6.95220	6.80169	6.51523	6.24689	5.99525	5.75902	5.53705	5.32825	4.03097
10	9.47130	9.22218	8.98259	8.75206	8.53020	8.31661	8.11090	7.91272	7.72173	7.53763	7.36009	7.02358	6.71008	6.41766	6.14457	5.88923	5.65022	4.19247
11	10.36763	10.07112	9.78685	9.51421	9.25262	9.00155	8.76048	8.52892	8.30641	8.09254	7.88687	7.49867	7.13896	6.80519	6.49506	6.20652	5.93770	4.32706
12	11.25508	10.90751	10.57534	10.25776	9.95400	9.66333	9.38507	9.11858	8.86325	8.61852	8.38384	7.94269	7.53608	7.16073	6.81369	6.49236	6.19437	4.43922
13	12.13374	11.73153	11.34837	10.98319	10.63496	10.30274	9.98565	9.68285	9.39357	9.11708	8.85268	8.35765	7.90378	7.48690	7.10336	6.74987	6.42355	4.53268
14	13.00370	12.54338	12.10625	11.69091	11.29607	10.92052	10.56312	10.22283	9.89864	9.58965	9.29498	8.74547	8.24424	7.78615	7.36669	6.98187	6.62817	4.61057
15	13.86505	13.34323	12.84926	12.38138	11.93794	11.51741	11.11839	10.73955	10.37966	10.03758	9.71225	9.10791	8.55948	8.06069	7.60608	7.19087	6.81086	4.67547
16	14.71787	14.13126	13.57771	13.05500	12.56110	12.09412	11.65230	11.23402	10.83777	10.46216	10.10590	9.44665	8.85137	8.31256	7.82371	7.37916	6.97399	4.72956
17	15.56225	14.90765	14.29187	13.71220	13.16612	12.65132	12.16567	11.70719	11.27407	10.86461	10.47726	9.76322	9.12164	8.54363	8.02155	7.54879	7.11963	4.77463
18	16.39827	15.67256	14.99203	14.35336	13.75351	13.18968	12.65930	12.15999	11.68959	11.24607	10.82760	10.05909	9.37189	8.75563	8.20141	7.70162	7.24967	4.81219
19	17.22601	16.42617	15.67846	14.97889	14.32380	13.70984	13.13394	12.59329	12.08532	11.60765	11.15812	10.33560	9.60360	8.95011	8.36492	7.83929	7.36578	4.84350
20	18.04555	17.16864	16.35143	15.58916	14.87747	14.21240	13.59033	13.00794	12.46221	11.95038	11.46992	10.59401	9.81815	9.12855	8.51356	7.96333	7.46944	4.86958
21	18.85698	17.90014	17.01121	16.18455	15.41502	14.69797	14.02916	13.40472	12.82115	12.27524	11.76408	10.83553	10.01680	9.29224	8.64869	8.07507	7.56200	4.89132
25	22.02316	20.71961	19.52346	18.42438	17.41315	16.48151	15.62208	14.82821	14.09394	13.41393	12.78336	11.65358	10.67478	9.82258	9.07704	8.42174	7.84314	4.94759
30	25.80771	24.01584	22.39646	20.93029	19.60044	18.39205	17.29203	16.28889	15.37245	14.53375	13.76483	12.40904	11.25778	10.27365	9.42691	8.69379	8.05518	4.97894
40	32.83469	29.91585	27.35548	25.10278	23.11477	21.35507	19.79277	18.40158	17.15909	16.04612	15.04630	13.33171	11.92461	10.75736	9.77905	8.95105	8.24378	4.99660