Step-by-Step Solutions
For Your HP Calculator

Business Finance
and Accounting

HP-17B
HP-19B
HP-27S
Business Finance and Accounting

Step-by-Step Solutions for Your HP-17B, HP-19B, or HP-27S Calculator

HEWLETT PACKARD

HP Part No. 00017-90020
Printed in Canada September 1991
Edition 3
Notice

This book and any keystroke programs contained herein are provided “as is” and are subject to change without notice. Hewlett-Packard Company makes no warranty of any kind with regard to this book or the keystroke programs contained herein, including, but not limited to, the implied warranties of merchantability and fitness for a particular purpose. Hewlett-Packard Company shall not be liable for any errors or for incidental or consequential damages in connection with the furnishing, performance, or use of this book or the keystroke programs contained herein.

© Hewlett-Packard Co. 1987. All rights reserved. Reproduction, adaptation, or translation of this book, including any programs, is prohibited without prior written permission of Hewlett-Packard Company, except as allowed under the copyright laws. Hewlett-Packard Company grants you the right to use any program contained in this book in a Hewlett-Packard calculator.

The programs that control your calculator are copyrighted and all rights are reserved. Reproduction, adaptation, or translation of those programs without prior written permission of Hewlett-Packard Company is also prohibited.

Corvallis Division
1000 N.E. Circle Blvd.
Corvallis, OR 97330, U.S.A.

Printing History

Edition 1 .................................................. December 1987
Edition 2 .................................................. March 1989
Edition 3 .................................................. September 1991
Contents

7 How to Use This Book

1 Financial Management
11 Break-Even Analysis
12 Break-Even Analysis
14 Forecasting Based on History
21 Simple Payback Period
23 Using NPV and IRR% To Make Investment Decisions
26 Economic Ordering Quantity
27 EOQ Using Discount and Tax Rates
29 Cost of Failing To Take a Cash Discount
31 Degree of Leverage
31 Operating Leverage
32 Financial Leverage
33 Combined Leverage
35 Cost of Capital
35 Cost of Debt
36 Cost of Preferred Stock
37 Cost of Common Stock (Constant Growth Valuation Approach)
38 Cost of Common Stock (Capital Asset Pricing Model
39 Weighted Average Cost of Capital
41 Rights Valuation
41 Rights On
42 Rights Off
2 44 Financial Statement Analysis
45 Return on Equity
47 Bond Interest Coverage Ratio
49 Price-to-Earnings Ratio
51 Return on Investment
53 Financial Statement Ratios

3 57 Cost Accounting and Auditing
58 Overhead Application Rate
60 Labor, Material, and Overhead Variance
60 Rate Variance of Direct Labor
61 Efficiency Variance of Direct Labor
62 Price Variance of Direct Materials
63 Quantity Variance of Direct Materials
64 Spending Variance of Factory Overhead
65 Volume Variance of Factory Overhead
66 Overhead Variance on Direct Labor
68 Selecting Random Numbers
70 Calculating the Standard Normal Variate
72 Estimating Inventory Value Using Random Sampling
72 Calculating the Sample Size Required
74 Calculating a Point Estimate of the Total Inventory
74 Estimating the Confidence Interval
<table>
<thead>
<tr>
<th>Page</th>
<th>Title</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>Production and Inventory Analysis</td>
</tr>
<tr>
<td>76</td>
<td>Priority Scheduling Rule</td>
</tr>
<tr>
<td>77</td>
<td>Daily Production Rate</td>
</tr>
<tr>
<td>79</td>
<td>Predicting Labor Hours Using Learning Rates</td>
</tr>
<tr>
<td>81</td>
<td>Forecasting Manufacturing Rates of Accessories</td>
</tr>
<tr>
<td>83</td>
<td>Estimating Inventory Availability</td>
</tr>
<tr>
<td>85</td>
<td>Replacing Equipment</td>
</tr>
<tr>
<td>87</td>
<td>Estimating Inventory Investment Versus Expected Shipment Dollars</td>
</tr>
<tr>
<td>92</td>
<td>Evaluation of Costs Associated With Seasonal or Perishable Inventory</td>
</tr>
<tr>
<td>94</td>
<td>Manufacturing Strategy Analysis</td>
</tr>
<tr>
<td>97</td>
<td>Work Sample Survey Size</td>
</tr>
<tr>
<td>99</td>
<td>Productivity Measurements</td>
</tr>
<tr>
<td>99</td>
<td>Single Resource Productivity Measurement</td>
</tr>
<tr>
<td>103</td>
<td>Multiple Resource Plus Inflation Productivity Measurement</td>
</tr>
<tr>
<td>5</td>
<td>Depreciation, NPV, and IRR% Calculations on the HP-27S</td>
</tr>
<tr>
<td>108</td>
<td>Depreciation Calculations on the HP-27S</td>
</tr>
<tr>
<td>109</td>
<td>Straight-Line Depreciation</td>
</tr>
<tr>
<td>111</td>
<td>Sum-of-the-Years'-Digits Depreciation</td>
</tr>
<tr>
<td>112</td>
<td>Declining-Balance Depreciation</td>
</tr>
<tr>
<td>114</td>
<td>Accelerated Cost Recovery System</td>
</tr>
<tr>
<td>116</td>
<td>Net Present Value and Internal Rate of Return on the HP-27S</td>
</tr>
<tr>
<td>117</td>
<td>Ungrouped Cash Flows</td>
</tr>
<tr>
<td>121</td>
<td>Grouped Cash Flows</td>
</tr>
</tbody>
</table>

Contents
How To Use This Book

The Business Finance and Accounting book provides sets of keystrokes and routines to assist you in making finance and accounting decisions. These routines can be used by anyone involved in finance or accounting in any business. This book is designed to show you how your HP business calculator can help in these areas.

Before you use the solutions in this book, you should be familiar with the following concepts from the owner’s manual:

- The basics of your calculator – how to do arithmetic calculations, move from menu to menu, and use the menu keys to do calculations.
- Cash-flow sign convention (cash paid out is entered as a negative number and cash received is entered as a positive number).
- How to enter cash flows in a cash-flow list. (This function is not available on the HP-27S.)
- How to enter numbers for statistics.
- How to enter and use equations in the Solver.

Keys and Menu Selection

A key on the calculator keyboard is represented like this: [EXIT]. A shifted function appears with a shift key, like this: [CLEAR DATA]. A menu label is represented like this: %CH (found in the %CHG menu). The arrow keys are represented by [ ] and [ ].

This book can be used with the HP-17B, HP-19B, and HP-27S calculators. Generally, the same keystrokes are used on all three calculators to perform a particular operation. However, there are some differences, which are summarized in the following table. Note that the cash-flow menus are available on the HP-27S using a Solver equation.
Keystroke Differences

<table>
<thead>
<tr>
<th>HP-17B</th>
<th>HP-19B</th>
<th>HP-27S</th>
</tr>
</thead>
<tbody>
<tr>
<td><img src="image.png" alt="Picture of calculator keys" /></td>
<td><img src="image.png" alt="Picture of calculator keys" /></td>
<td><img src="image.png" alt="Picture of calculator keys" /></td>
</tr>
</tbody>
</table>

To store a Solver equation and its menu:

To edit a Solver equation:

To display the cash-flow (CFLO) menu:

To display the correct menu for entering numbers into a sum list:

**Display Formats**

The examples in this book show numbers displayed to two decimal places. If your display setting is otherwise, the answers in your display will not match exactly what is in this book. Refer to your owner’s manual for more information about changing the number of decimal places in the display.

**Entering Equations**

When entering equations into your HP calculator, follow the Solver instructions in your owner’s manual. The following hints help you with some common questions and error situations:

1. If the calculator displays INVALID EQUATION when you press ![Picture of calculator keys](image.png), the calculator does not understand something in the equation. When the equation returns to the display, the cursor blinks where the calculator detected the error. Check the equation in the
display against the equation in the book. Make sure the parentheses match and that the operators are where they should be.

2. If the calculator accepts the equation but your answer does not match the example, check the values stored in the variables by recalling them (press \[ \text{RCL} \], then the menu key). If the values are correct, return to the SOLVE menu and check the equation. (Press \[ \text{EXIT} \] to return to the SOLVE menu and press \[ \text{EDIT} \] to view and edit the equation.) Check the equation against the one in this book for accuracy. When you find an error, edit the equation.

3. If the calculator displays INSUFFICIENT MEMORY when you press \[ \text{INPUT} \] or \[ \text{CALC} \], you must clear portions of memory. Refer to your owner’s manual for additional information.

The equations in this book use variable names that are intended to remind you of what to store. Feel free to change them.
Financial Management
Break-Even Analysis

Break-even analysis is a technique for analyzing the relationships among fixed costs, variable costs, and income. Until the break-even point is reached (total costs equal total income), the producer operates at a loss. After the break-even point, each unit produced and sold makes a profit. The variables in the equation below are fixed costs, variable costs per unit, sales price per unit, number of units sold, and gross profit.

Entering and Using the PROFIT Equation:

1. Enter the PROFIT equation into the Solver.
   
   \[
   \text{PROFIT} = \#\text{SOLD} \times (\text{PRICE} - \text{VARC}) - \text{FIXC}
   \]

2. Display the PROFIT equation menu.

3. Store or calculate the following variables:
   
   - Gross profits in PROFI.
   - Number of units sold in #SOL.
   - Price per unit in PRICE.
   - Variable costs per unit in VARC.
   - Fixed costs in FIXC.

Example: Part 1. Your product sells for $13. The fixed costs are $12,000. Variable costs are $6.75 per unit. Calculate the number of units that must be sold to break even (profit equals zero).

Display the PROFIT equation menu.
### Keys:

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFI</td>
<td>PROFIT = 0.00 Stores break-even profit of zero.</td>
</tr>
<tr>
<td>PRICE</td>
<td>PRICE = 13.00 Stores price per unit.</td>
</tr>
<tr>
<td>VARC</td>
<td>VARC = 6.75 Stores variable costs per unit.</td>
</tr>
<tr>
<td>FIXC</td>
<td>FIXC = 12,000.00 Stores fixed costs.</td>
</tr>
<tr>
<td>SOLD</td>
<td>#SOLD = 1,920.00 Calculates number that must be sold to break even.</td>
</tr>
</tbody>
</table>

### Part 2. Calculate the gross profit if 2,500 units are sold.

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFI</td>
<td>PROFIT = 3,625.00 Calculates gross profit.</td>
</tr>
</tbody>
</table>

### Part 3. You want a gross profit of $4,500 at the sales volume in part 2 (2,500 units). What should the sales price be?

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>PROFI</td>
<td>PROFIT = 4,500.00 Stores required gross profit.</td>
</tr>
<tr>
<td>PRICE</td>
<td>PRICE = 13.35 Calculates required sales price.</td>
</tr>
</tbody>
</table>
Forecasting Based on History

One method of forecasting is to look at historical trends. Once you have historical data, the data are fit to a curve with time on the x-axis and the quantity you are forecasting on the y-axis. Linear curve fit is appropriate if you have a fairly constant growth rate; exponential curve fit is appropriate with compound growth, such as sales for a new product.

Use the following steps to forecast based on history:

1. In the SUM menu, * enter the time data (x data). Press [INPUT] after each item.
2. Name your list.
3. Get a new list and enter the historical data (y data).
4. Name your list.
5. In the FRCST menu, select the time list as your x-variable and the historical data list as your y-variable.†
6. If necessary, select the forecast model.
7. Key in the known value and press the menu key for that variable.
8. Press the menu key for the variable whose value you want to forecast.

Example 1: Forecasting Using Linear Curve Fit. You want to determine the sales forecast for the next two years using a linear curve fit. The following data represents your sales for the past five years.

---

* On the HP-27S, press [STAT] to display the STAT menu.
† On the HP-19B, you don’t select the y-variable. The current list is used.
The keystrokes for statistics on the HP-17B and HP-27S are slightly different than on the HP-19B. Two sets of steps follow. The first set is for the HP-17B and HP-27S. The second set, beginning on page 16, is for the HP-19B.

**HP-17B and HP-27S Steps:**
On the HP-17B, display the SUM menu. On the HP-27S, display the STAT menu.

**Keys:**

| CLEAR DATA | YES | YES | ITEM(1) = ? | CLEARS current list or gets a new one. |
| GET | *NEW | 1 | INPUT | Enters time values. |
| 2 | INPUT | 3 | INPUT | 4 | INPUT | 5 | INPUT | TOTAL = 15.00 |
| EXIT | NAME | YEAR | INPUT | Names the list. |
| GET | *NEW | ITEM(1) = ? | Displays a new list. |
| 130600 | INPUT | 160750 | INPUT | 205900 | INPUT | 210000 | INPUT | 240650 | INPUT | TOTAL = 947,900.00 |
| EXIT | NAME | SALES | INPUT | Names the list. |
CALC  MORE
FRCST
YEAR
SALES
SELECT X VARIABLE
SELECT Y VARIABLE
LINEAR
SALES = 270,385.00
SALES = 297,320.00
YEAR = 6.00
YEAR = 7.00

HP-19B Steps:
On the HP-19B, display the SUM menu.

Keys:                      Display:                      Description:
CLEAR DATA YES or GET *NEW
1 INPUT
2 INPUT
3 INPUT
4 INPUT
5 INPUT
NAME YEAR INPUT
GET *NEW
ITEM(1) =

TOTAL = 15.00
ITEM(1) =

Clears current list or gets a new one.
Enters time values.
Names the list.
Displays a new list.

* If LINEAR is not displayed, press MORE MODL LIN to change the model.
130600 INPUT
160750 INPUT
205900 INPUT
210000 INPUT
240650 INPUT
TOTAL = 947,900.00

NAME = SALES INPUT
CALC = MORE
FRCST
YEAR
SELECT X VARIABLE
SELECT A MODEL
LIN
XLIST = 6.00
YLIST = 270,385.00
YLIST = 297,320.00

Example 2: Forecasting Using Exponential Curve Fit. The
sales history for your new product is shown below for the first six months
after introduction. You would like to estimate the sales for December.

<table>
<thead>
<tr>
<th>Month</th>
<th>Sales ($K)</th>
</tr>
</thead>
<tbody>
<tr>
<td>June</td>
<td>31.7</td>
</tr>
<tr>
<td>July</td>
<td>52.5</td>
</tr>
<tr>
<td>August</td>
<td>48.3</td>
</tr>
<tr>
<td>September</td>
<td>56.6</td>
</tr>
<tr>
<td>October</td>
<td>72.7</td>
</tr>
<tr>
<td>November</td>
<td>90.9</td>
</tr>
</tbody>
</table>

The keystrokes for statistics on the HP-17B and HP-27S are slightly
different from those used on the HP-19B. Two sets of steps follow. The
first set is for the HP-17B and HP-27S. The second set, beginning on page
19, is for the HP-19B.
**HP-17B and HP-27S Steps:**

**Part 1.** Using the exponential model, estimate the sales for December.

On the HP-17B, display the SUM menu. On the HP-27S, display the STAT menu.

### Keys:

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>[CLEAR DATA] YES</td>
<td>ITEM(1) = ?</td>
<td>Clears current list or gets a new one.</td>
</tr>
<tr>
<td>or</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[GET] *NEW</td>
<td>ITEM(1) = ?</td>
<td>Displays a new list.</td>
</tr>
<tr>
<td></td>
<td>TOTAL = 21.00</td>
<td>Enters month numbers.</td>
</tr>
<tr>
<td>1 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>6 INPUT</td>
<td>TOTAL = 352.70</td>
<td>Enters sales data.</td>
</tr>
<tr>
<td>EXIT NAME MONTH</td>
<td></td>
<td>Names the list.</td>
</tr>
<tr>
<td>INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[GET] *NEW</td>
<td>ITEM(1) = ?</td>
<td></td>
</tr>
<tr>
<td>31.7 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>52.5 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>48.3 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>56.6 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>72.7 INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>90.9 INPUT</td>
<td>TOTAL = 352.70</td>
<td></td>
</tr>
<tr>
<td>EXIT NAME MSLS</td>
<td></td>
<td>Names the list.</td>
</tr>
<tr>
<td>INPUT</td>
<td></td>
<td></td>
</tr>
<tr>
<td>[CALC] MORE</td>
<td></td>
<td>Displays the FRCST menu.</td>
</tr>
<tr>
<td>FRCST</td>
<td>SELECT X VARIABLE</td>
<td>Selects MONTH as x-variable.</td>
</tr>
<tr>
<td>MONT</td>
<td>SELECT Y VARIABLE</td>
<td></td>
</tr>
<tr>
<td>MSLS</td>
<td>LINEAR</td>
<td>Selects MSLS as y-variable.</td>
</tr>
</tbody>
</table>
Part 2. Calculate the monthly compound growth rate.

Calculates estimate of monthly compound growth rate as a percent.

HP-19B Steps:

Part 1. Using the exponential model, estimate the sales for December. On the HP-19B, display the SUM menu.

Keys: 

Display: 

Description:

Clears current list or gets a new one.

Enters month numbers.

Names the list.

Displays a new list.
31.7 [INPUT] 52.5 [INPUT] 48.3 [INPUT] 56.6 [INPUT] 72.7 [INPUT] 90.9 [INPUT] TOTAL = 352.70

- NAME = MSLS [INPUT]
- CALC = MORE
- FRCST
- MONT

Selects MONTH as x-variable.

- EXP

Selects exponential model.

7 [XLIST] XLIST = 7.00

Stores month 7 as the x-value.

- YLIST YLIST = 105.78

Calculates projected sales for December, month 7.

Part 2. Calculate the monthly compound growth rate.

- M [×] 100 = 18.29

Calculates estimate of monthly compound growth rate as a percent.

Enters sales data.

Names the list.

Displays the FRCST menu.

Selects exponential model.

Calculates projected sales for December, month 7.
Simple Payback Period

The simple payback period method determines the length of time (in years) required for a business to recover its entire investment in a capital expenditure. Capital expenditures are purchases of assets, such as machinery or equipment, that have service periods of one year or more.

The shorter the payback period, the better; the sooner the investment is recovered, the sooner funds can be used for another project. For a capital expenditure to be considered profitable, its service period must exceed the length of the payback period.

Entering and Using the PBK Equation:

1. Enter the PBK equation into the Solver.

   \[ PBK = Inv \div Flow \]

2. Display the PBK equation menu.

3. Store or calculate the following variables:
   - Length of time in years required to recover investment in \( PBK \).
   - Investment in capital expenditure in \( Inv \).
   - Annual cash inflow for the life of the purchase in \( Flow \).

Example: Part 1. You are considering a new machine costing $100,000. The annual cash inflow for the service period of the machine is $15,000. What is the payback period?

Display the PBK equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>100000 ( Inv )</td>
<td>( Inv = 100,000.00 )</td>
<td>Stores investment.</td>
</tr>
<tr>
<td>15000 ( Flow )</td>
<td>( Flow = 15,000.00 )</td>
<td>Stores yearly inflow.</td>
</tr>
<tr>
<td>( PBK )</td>
<td>( PBK = 6.67 )</td>
<td>Calculates payback period in years.</td>
</tr>
</tbody>
</table>
Part 2. Your company desires a payback period of five years. What must the investment be to meet this goal?

\[ PBK = 5.00 \] Stores required payback period.

\[ INV = 75,000.00 \] Calculates investment.
Using NPV and IRR% To Make Investment Decisions

These procedures cannot be done on the HP-27S. For an equation to calculate NPV and IRR% on the HP-27S, refer to “Net Present Value and Internal Rate of Return on the HP-27S” on page 116.

Net present value (NPV) and internal rate of return (IRR%) are used to determine if an investment is acceptable. The built-in CFLO menu makes it easy to calculate these two values.

The method on the next page helps the decision-making process when choosing between two mutually exclusive options, such as deciding between two pieces of equipment. This method looks at the period-by-period difference between the two investments, then uses these differences as cash flows. The investment becomes the difference between option A and option B. If the net present value is positive at the desired rate of return, the more expensive option is the better one; otherwise, the less expensive option is better.

When the differences result in a conventional series of cash flows (one sign change), you can also look at the IRR% to determine which is the better investment. (Refer to your owner’s manual for the definition of “conventional series of cash flows.”) If the IRR% is higher than your required percent, the investment in the more expensive machine is a good investment.

If the differences are not a conventional series of cash flows (multiple sign changes), you can still use NPV to analyze the investment.
Use the following steps to calculate the NPV and IRR%:

1. Calculate the difference between the cash flows for the two options for each period (net cash flows).

2. In the CFLO menu, enter the net cash flows and number of periods into the cash-flow number list.

3. In the CFLO CALC menu:
   - To calculate the net present value, enter the periodic interest rate as a percent in \( \text{\%} \), then press \( \text{NPV} \).
   - To calculate the internal rate of return, press \( \text{IRR\%} \).

**Example.** You want to choose between two equipment options. The table below summarizes the initial flows, the cash flows over the five-year life of the machines, and the difference between the two options (net cash flows).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>A-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Investment</td>
<td>$-35,000</td>
<td>$-25,000</td>
<td>$-10,000</td>
</tr>
<tr>
<td>Cost in year 1</td>
<td>-200</td>
<td>-1,300</td>
<td>1,100</td>
</tr>
<tr>
<td>Cost in year 2</td>
<td>-200</td>
<td>-1,400</td>
<td>1,200</td>
</tr>
<tr>
<td>Cost in year 3</td>
<td>-200</td>
<td>-2,500</td>
<td>2,300</td>
</tr>
<tr>
<td>Cost in year 4</td>
<td>-800</td>
<td>-2,500</td>
<td>1,700</td>
</tr>
<tr>
<td>Cost in year 5</td>
<td>15,000</td>
<td>7,000</td>
<td>8,000</td>
</tr>
</tbody>
</table>

Calculate the NPV and IRR% to determine which machine should be purchased. (Note that A-B is a conventional series of cash flows.) The required rate of return is 10%.

Display the CFLO menu.
Keys:  | Display: | Description:
--- | --- | ---
[CLEAR DATA][YES][YES] | FLOW(0) = ?* | Clears current list or gets a new one.
\[or\] | \[or\] | \[or\]
\[GET][*NEW\] | 10000 [+/-][INPUT] | FLOW(1) = ?* Stores the initial cash flow.
1100 [INPUT][INPUT] | FLOW(2) = ? | Stores FLOW(1).
1200 [INPUT][INPUT] | FLOW(3) = ? | Stores FLOW(2).
2300 [INPUT][INPUT] | FLOW(4) = ? | Stores FLOW(3).
8000 [INPUT] | #TIMES(5) = 1 | Stores FLOW(5).

Skip the next step (pressing [EXIT]) if you have the HP-19B.

[EXIT][CALC] | Displays the CALC menu.
10 [1%] | I% = 10.00 Stores required return on investment.
[NPV] | NPV = -151.75 Calculates net present value.
[IRR%] | IRR% = 9.56 Calculates internal rate of return.

Option B is the better choice because NPV is negative. The IRR% calculation tells you the same thing, that because IRR% is less than the required 10%, option B is the better choice.

* On the HP-19B, these prompts are INIT = and FLOW(1) =.
Economic Ordering Quantity

The economic ordering quantity (EOQ) is the optimum quantity to order each time an order is placed. It is based on the cost of placing and receiving an order, annual sales, holding cost (including warehousing costs, interest on funds tied up in inventory, insurance, and obsolescence), and the purchase price of the goods.

The equation assumes that usage is at a constant rate and that delivery lead times are constant.

Entering and Using the EOQ Equation:

1. Enter the EOQ equation into the Solver.*

   \[
   EOQ = \sqrt{\frac{2 \times CPO \times \text{#UNITS}}{(HOLD\% \div 100 \times CPU)}}
   \]

2. Display the EOQ equation menu.

3. Store or calculate the following variables:
   - Economic ordering quantity in \(\text{EOQ}\).
   - Cost of placing an order in \(\text{CPO}\).
   - Annual units sales in \(\text{#UNITS}\).
   - Holding costs as a percent of inventory value in \(\text{HOLD}\%\).
   - Cost per unit in \(\text{CPU}\).

Example. Your annual sales are 10,000 units. Cost per unit is $4.73. Holding cost is 20% of inventory value, and the cost of placing and receiving an order is $35. What is the economic ordering quantity?

Display the EOQ equation menu.

---

To key in the square-root function (SQRT), press \(\sqrt{x}\).
Keys: Display: Description:
35  CPO  CPO=35.00  Stores cost of placing order.
10000 #UNITS  #UNITS=10,000.00  Stores annual sales in units.
20  HOLD%  HOLD%=20.00  Stores holding cost.
4.73  CPU  CPU=4.73  Stores cost per unit.
EOQ  EOQ=860.21  Calculates economic ordering quantity.

**EOQ Using Discount and Tax Rates**

The economic ordering quantity equation in this section includes the variables in the first equation, plus variables for the total tax rate and discount rate on the cost of capital.

**Entering and Using the EOQ2 Equation:**

1. Enter the \( EOQ_2 \) equation into the Solver. *

\[
EOQ_2 = \sqrt{\frac{2 \times (1 - TAX\% \div 100) \times CPO \times #UNITs}{((1 - TAX\% \div 100) \times HOLD\% \div 100 \times CPU + DISC\% \div 100 \times CPU)}}
\]

2. Display the \( EOQ_2 \) equation menu.

---

* To key in the square-root function (SQRT), press \( \sqrt{x} \).
3. Store or calculate the following variables:

- Economic ordering quantity in \( \text{EOQ2} \).
- Tax rate as a percent in \( \text{TAX\%} \).
- Cost of placing an order in \( \text{CPO} \).
- Annual unit sales in \( \#\text{UNI} \).
- Holding costs as a percent of inventory value in \( \text{HOLD\%} \).
- Cost per unit in \( \text{CPU} \).
- Discount rate as a percent in \( \text{DISC\%} \).

**Example.** A manufacturing company uses 1,500 units per year of a special part and estimates that it costs $30 to place an order. The inventory manager has estimated that holding costs are 4% per year. The finance department uses an 8% discount rate and a 40% tax rate. These units cost $21 per unit for all order quantities. What is the economic ordering quantity?

Display the \( \text{EOQ2} \) equation menu.

**Keys:**

<table>
<thead>
<tr>
<th>Key</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>( \text{TAX%} = 40.00 )</td>
<td>Stores tax rate.</td>
</tr>
<tr>
<td>30</td>
<td>( \text{CPO} = 30.00 )</td>
<td>Stores cost of placing order.</td>
</tr>
<tr>
<td>1500</td>
<td>( #\text{UNI} = 1,500.00 )</td>
<td>Stores annual sales in units.</td>
</tr>
<tr>
<td>4</td>
<td>( \text{HOLD%} = 4.00 )</td>
<td>Stores holding cost.</td>
</tr>
<tr>
<td>21</td>
<td>( \text{CPU} = 21.00 )</td>
<td>Stores cost per unit.</td>
</tr>
<tr>
<td>8</td>
<td>( \text{DISC%} = 8.00 )</td>
<td>Stores discount rate.</td>
</tr>
<tr>
<td>More</td>
<td>( \text{EOQ2} = 157.24 )</td>
<td>Calculates economic ordering quantity.</td>
</tr>
</tbody>
</table>
A cash discount gives a buyer a reduction in price if payment is made within a specified time period. For example, “2/10, net 30” means that the buyer can deduct 2 percent if payment is made within 10 days after the date of billing. If payment is not made within 10 days, the full amount must be paid by the 30th day.

The equation below calculates the cost of failing to take the cash discount. The cost is calculated as an annual interest rate charged for delaying payment.

**Entering and Using the COST% Equation:**

1. Enter the COST% equation into the Solver.
   
   \[
   \text{COST\%} = \text{DISC\%} + \frac{(100 - \text{DISC\%}) \times 360}{(\text{TOTDA} - \text{DISCDA}) \times 100}
   \]

2. Display the COST% equation menu.

3. Store the following variables:
   - Discount percent if the payment is made within the discount period in \(\text{DISC\%}\).
   - Total number of days until the bill must be paid in \(\text{TOTDA}\).
   - Number of days for which the discount is available in \(\text{DISCDA}\).

4. Press \(\text{COST\%}\) to calculate the cost of failing to take the discount, expressed as an annual percentage interest rate.

**Example 1.** You receive a bill with credit terms 2/10, net 30. What is the cost of not taking the cash discount?

Display the COST% equation menu.
**Example 2.** Another bill has credit terms 3/30, net 180. What is the cost of not taking this discount?

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 <strong>DISC%</strong></td>
<td>DISC% = 3.00</td>
<td>Stores discount rate.</td>
</tr>
<tr>
<td>180 <strong>TOTDA</strong></td>
<td>TOTDA = 180.00</td>
<td>Stores total days.</td>
</tr>
<tr>
<td>30 <strong>DISCDA</strong></td>
<td>DISCDA = 30.00</td>
<td>Stores number of days discount is available.</td>
</tr>
<tr>
<td></td>
<td>COST% = 7.42</td>
<td>Calculates annual cost of not taking the cash discount.</td>
</tr>
</tbody>
</table>
Degree of Leverage

Leverage analyzes the fixed costs that are part of the cost of doing business. Equations for operating leverage, financial leverage, and combined leverage are included in this section.

Operating Leverage

Operating leverage focuses on a company's fixed operating costs. These costs include administrative costs, rent, and depreciation expenses and do not include interest on debt.

The degree of operating leverage is defined as the percentage change in earnings before interest and taxes as a result of a percentage change in units sold. The greater a firm's degree of operating leverage, the more its earnings before interest and taxes vary with unit sales fluctuations.

Entering and Using the OPLEV Equation:

1. Enter the OPLEV equation into the Solver.
   
   \[
   \text{OPLEV} = 1 + \frac{1}{\text{FIXCO}} \times \left( \frac{\#\text{UNITS} \times (\text{PRICE} - \text{VARCO})}{\#\text{UNITS}} \right) 
   \]

2. Display the OPLEV equation menu.

3. Store or calculate the following variables:
   - Fixed costs in FIXCO.
   - Number of units sold in #UNIT.
   - Price per unit in PRICE.
   - Variable costs per unit in VARCO.
   - Degree of operating leverage in OPLEV.

Example 1. Your company sold 10,000 units last year at $20 each. Fixed costs were $50,000; variable costs per unit were $5. Calculate the degree of operating leverage.

Display the OPLEV equation menu.
### Financial Leverage

Financial leverage focuses on a company's financial fixed costs. The primary example of such a cost is the interest expense on borrowed funds.

The degree of financial leverage is defined as the percentage change in earnings per share that results from a percentage change in earnings before interest and taxes. The greater a firm's degree of financial leverage, the more the return on owner's equity fluctuates with changes in unit sales. The equation in this section includes the variables in the $OPLEV$ equation plus interest expense.

#### Entering and Using the FLEV Equation:

1. Enter the $FLEV$ equation into the Solver.
   
   $$FLEV = 1 \div (1 - $INT \div (#UNITS \times (PRICE - VARCO) - FIXCO))$$

2. Display the $FLEV$ equation menu.
3. Store or calculate the following variables:

- Annual interest expense in $\text{INT}$.  
- Number of units sold in $\text{#UNI}$.  
- Price per unit in $\text{PRICE}$.  
- Variable costs per unit in $\text{VARCO}$.  
- Fixed costs in $\text{FIXCO}$.  
- Degree of financial leverage in $\text{FLEV}$.  

**Example 2.** Your company sold 10,000 units last year at $20 each. Fixed costs were $50,000; variable costs per unit were $5. Your company’s interest expense was $20,000. Four variables ($\text{#UNITS}$, $\text{PRICE}$, $\text{VARCO}$, and $\text{FIXCO}$) are the same as example 1 and need not be reentered if they are still stored.

Display the $\text{FLEV}$ equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$\text{#UNI}=10,000$</td>
<td>$\text{#UNITS}=10,000.00$</td>
<td>Stores units sold.</td>
</tr>
<tr>
<td>$\text{PRICE}=20$</td>
<td>$\text{PRICE}=20.00$</td>
<td>Stores price per unit.</td>
</tr>
<tr>
<td>$\text{VARCO}=5$</td>
<td>$\text{VARCO}=5.00$</td>
<td>Stores variable costs per unit.</td>
</tr>
<tr>
<td>$\text{FIXCO}=50,000$</td>
<td>$\text{FIXCO}=50,000.00$</td>
<td>Stores fixed costs.</td>
</tr>
<tr>
<td>$\text{INT}=20,000$</td>
<td>$\text{INT}=20,000.00$</td>
<td>Stores interest expense.</td>
</tr>
<tr>
<td>$\text{FLEV}=1.25$</td>
<td>$\text{FLEV}=1.25$</td>
<td>Calculates financial leverage.</td>
</tr>
</tbody>
</table>

**Combined Leverage**

The degree of combined leverage measures the total leverage caused by both fixed operating costs and fixed financial costs.

Degree of combined leverage measures the percentage change in net after-tax earnings due to a one percent change in sales. Combined leverage increases as operating leverage and financial leverage increase. The degree of combined leverage measures the impact of the operating fixed costs and financial fixed costs on the variability of net income.
**Entering and Using the COLEV Equation:**

1. Enter the COLEV equation into the Solver.

\[ \text{COLEV} = 1 \div \left(1 - \left(\frac{\text{FIXCO} + \text{$INT}}{\#\text{UNITS} \times (\text{PRICE} - \text{VARCO})}\right)\right) \]

2. Display the COLEV equation menu.

3. Store or calculate the following variables:
   - Fixed costs in \( \text{FIXCO} \).
   - Annual interest expense in \( \text{$INT} \).
   - Number of units sold in \( \#\text{UNITS} \).
   - Price per unit in \( \text{PRICE} \).
   - Variable costs per unit in \( \text{VARCO} \).
   - Degree of combined leverage in \( \text{COLEV} \).

**Example 3.** Your company sold 10,000 units last year at $20 each. Fixed costs were $50,000; variable costs per unit were $5. Your company's interest expense was $20,000. Five variables (#UNITS, PRICE, VARCO, FIXCO, and $INT) are the same as example 2 and need not be reentered if they are still stored.

Display the COLEV equation menu.

**Keys:**

<table>
<thead>
<tr>
<th>Key Value</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>50000</td>
<td>FIXCO = 50,000.00</td>
<td>Stores fixed costs.</td>
</tr>
<tr>
<td>20000</td>
<td>$INT = 20,000.00</td>
<td>Stores interest expense.</td>
</tr>
<tr>
<td>10000</td>
<td>#UNITS = 10,000.00</td>
<td>Stores units sold.</td>
</tr>
<tr>
<td>20</td>
<td>PRICE = 20.00</td>
<td>Stores price per unit.</td>
</tr>
<tr>
<td>5</td>
<td>VARCO = 5.00</td>
<td>Stores variable costs per unit.</td>
</tr>
<tr>
<td></td>
<td>COLEV = 1.88</td>
<td>Calculates combined leverage.</td>
</tr>
</tbody>
</table>
Cost of Capital

The cost of capital is a concept that determines the appropriate discount rate that a company (or a department of the firm) uses in evaluating various investment opportunities. The cost of capital is used as the interest rate in net present value calculations. This concept requires that a firm earn a return that is equal to or exceeds the cost of the funds used. Included in this section are the cost of debt, cost of preferred stock, cost of common stock (both the constant growth valuation approach and capital asset pricing model), and a weighted average cost of all capital.

Cost of Debt

The cost of debt to a firm is measured by the effective yield to maturity on the company's bonds. Since the interest paid to bond holders is tax deductible, the effective cost of debt is less than the yield to maturity.

Entering and Using the CD% Equation:

1. Enter the CD% equation into the Solver.
   \[ \text{CD\%} = \text{YLD\%} \times (1 - \text{TAX\%} \div 100) \]
2. Display the CD% equation menu.
3. Store or calculate the following variables:
   - Cost of debt as a percent in CD%.
   - Yield to maturity on bonds as a percent in YLD%.
   - Tax bracket as a percent in TAX%.

Example. Your company has outstanding debt in the form of bonds. The yield to maturity on these bonds is 12%, and your firm is in the 40% tax bracket. Calculate the cost of debt.

Display the CD% equation menu.
### Cost of Preferred Stock

The cost of preferred stock compares the annual dividend of the stock (usually a fixed amount) to the stock's market price. The annual dividend payment is divided by the net proceeds that the firm will receive from the sale of the preferred stock.

**Entering and Using the CPS% Equation:**

1. Enter the \( CPS\%\) equation into the Solver.
   \[
   CPS\% = \frac{DIV}{(PRICE-SCOST) \times 100}
   \]

2. Display the \( CPS\%\) equation menu.

3. Store or calculate the following variables:
   - Cost of preferred stock as a percent in \( CPS\% \).
   - Annual dividend in \( DIV \).
   - Price of preferred stock in \( PRICE \).
   - Cost to sell the stock in \( SCOST \).

**Example.** Your company is considering selling preferred stock to finance a proposed expansion. The stock is expected to sell for $110 per share, and would pay annual dividends of $10 per share. The cost to sell the stock is $5 per share. Calculate the cost of capital for preferred stock.

Display the \( CPS\%\) equation menu.
<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 DIV</td>
<td>DIV = 10.00</td>
<td>Stores annual dividend.</td>
</tr>
<tr>
<td>110 PRICE</td>
<td>PRICE = 110.00</td>
<td>Stores price per share.</td>
</tr>
<tr>
<td>5 SCOST</td>
<td>SCOST = 5.00</td>
<td>Stores cost per share to sell.</td>
</tr>
<tr>
<td>CPS%</td>
<td>CPS% = 9.52</td>
<td>Calculates percent cost of preferred stock.</td>
</tr>
</tbody>
</table>

**Cost of Common Stock (Constant Growth Valuation Approach)**

This approach for determining the cost of common stock requires that the firm estimate what investors expect for future dividends. The assumed constant rate of growth and the current price of the stock are used to determine the stock holder's expected rate of return.

**Entering and Using the CCS1% Equation:**

1. Enter the CCS1% equation into the Solver.
   
   $$\text{CCS1\%} = 100 \times (\text{DIV1} + \text{PRICE} + \text{GRW\%} + 100)$$

2. Display the CCS1% equation menu.
3. Store or calculate the following variables:
   - Cost of common stock as a percent in CCS1%.
   - Dividend at end of year one in DIV1.
   - Price of stock today in PRICE.
   - Assumed constant rate of growth in dividends as a percentage in GRW%.

**Example.** Your company's common stock is currently selling for $50 per share, and you plan to pay dividends at the end of the first year of $3 per share. Your firm also plans a growth rate of 8% per year in dividends. Calculate the cost of capital for common stock using the constant growth valuation approach.

Display the CCS1% equation menu.
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>3 DIV1</td>
<td>DIV1 = 3.00</td>
<td>Stores first year dividend.</td>
</tr>
<tr>
<td>50 PRICE</td>
<td>PRICE = 50.00</td>
<td>Stores today's price per share.</td>
</tr>
<tr>
<td>8 GRW%</td>
<td>GRW% = 8.00</td>
<td>Stores growth rate of dividends.</td>
</tr>
<tr>
<td>CCS1%</td>
<td>CCS1% = 14.00</td>
<td>Calculates percent cost of common stock.</td>
</tr>
</tbody>
</table>

**Cost of Common Stock (Capital Asset Pricing Model)**

This approach for determining the cost of common stock is based on the beta value for the firm's common stock. The beta value is a measure of the volatility of the return on a particular stock relative to the market. Stocks with a beta of 1.0 have a risk equal to that of the market. Stocks with beta values exceeding 1.0 are riskier than the market; stocks with betas less than 1.0 are less risky than the market. Beta values can be found in stock market price publications available at public libraries.

**Entering and Using the CCS2% Equation:**

1. Enter the $CCS2\%$ equation into the Solver.

   $$CCS2\% = RTN\% + BETA \times (EXPT\% - RTN\%)$$

2. Display the $CCS2\%$ equation menu.

3. Store or calculate the following variables:
   - Cost of common stock as a percent in $CCS2\%$.
   - Risk-free rate of return in the market in $RTN\%$.
   - Beta coefficient in $BETA$.
   - Expected rate of return for the market as a whole in $EXPT\%$. 

38 1: Cost of Capital
Example. Your company has collected the following data to calculate the cost of capital for common stock. The beta coefficient for the company is 1.6. The risk-free rate of return (the current rate of Treasury Bill securities) is 8%. The expected rate of return for the market as a whole is 10%. Calculate the cost of capital for common stock using the capital asset pricing model.

Display the CCS2% equation menu.

Keys: Display: Description:

| 8 | RTN% | RTN% = 8.00 | Stores risk-free rate of return. |
| 1.6 | BETA | BETA = 1.60 | Stores beta coefficient. |
| 10 | EXPT% | EXPT% = 10.00 | Stores expected rate of return. |
|  | CCS2% | CCS2% = 11.20 | Calculates percent cost of common stock. |

Weighted Average Cost of Capital

The weighted average cost of capital reflects the cost of each component of capital (debt, preferred stock and common stock) weighted by the relative amount of each from the company’s capital structure.

Entering and Using the WAV% Equation:

1. Enter the WAV% equation into the Solver.
   
   \[ \text{WAV}\% \times 100 = \text{DEBT}\% \times \text{CD}\% + \text{PS}\% \times \text{CPS}\% + \text{CS}\% \times \text{CCS}\% \]

2. Display the WAV% equation menu.

3. Store or calculate the following variables:
   - Weighted average cost of capital as a percent in WAV%.
   - Proportion of capital that is debt in DEBT%.
   - Cost of debt as a percent in CD%.
   - Proportion of capital that is preferred stock in PS%.
   - Cost of preferred stock as a percent in CPS%.
• Proportion of capital that is common stock in CS%.
• Cost of common stock as a percent in CCS%.

Example. Calculate the weighted average cost of capital of a corporation with the following capital structure:

<table>
<thead>
<tr>
<th>% of Capital</th>
<th>% Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>Debt</td>
<td>40</td>
</tr>
<tr>
<td>Preferred stock</td>
<td>10</td>
</tr>
<tr>
<td>Capital stock</td>
<td>50</td>
</tr>
</tbody>
</table>

Display the WAV% equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 DEBT%</td>
<td>DEBT% = 40.00</td>
<td>Stores percent capital that is debt.</td>
</tr>
<tr>
<td>8 CD%</td>
<td>CD% = 8.00</td>
<td>Stores cost of debt.</td>
</tr>
<tr>
<td>10 PS%</td>
<td>PS% = 10.00</td>
<td>Stores percent capital that is preferred stock.</td>
</tr>
<tr>
<td>11 CPS%</td>
<td>CPS% = 11.00</td>
<td>Stores cost of preferred stock.</td>
</tr>
<tr>
<td>MORE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>50 CS%</td>
<td>CS% = 50.00</td>
<td>Stores percent capital that is common stock.</td>
</tr>
<tr>
<td>14 CCS%</td>
<td>CCS% = 14.00</td>
<td>Stores cost of common stock.</td>
</tr>
<tr>
<td>MORE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>WAV%</td>
<td>WAV% = 11.30</td>
<td>Calculates weighted average cost of capital.</td>
</tr>
</tbody>
</table>
Rights Valuation

Many corporations have charters that contain a preemptive right provision. This provision requires that the current holders of common stock be given the first option to buy any new shares sold by the firm. Stockholders may choose to exercise their rights or to sell these rights in the marketplace. This section includes equations for rights on and rights off situations.

Rights On

The term “rights on” refers to the situation in which the purchase of a share of common stock includes a right to buy additional shares of common stock—usually at a favorable price. This situation is also referred to as “cum rights.”

Entering and Using the RTON Equation:

1. Enter the RTON equation into the Solver.
   \[ \text{RTON} = \frac{(\text{MVAL} - \text{PRICE})}{(\#\text{RTS} + 1)} \]

2. Display the RTON equation menu.

3. Store or calculate the following variables:
   - Value of one right in \( \text{RTON} \).
   - Market value, rights on, in \( \text{MVAL} \).
   - Subscription price in \( \text{PRICE} \).
   - Number of rights required to purchase a new share of stock in \( \#\text{RTS} \).

Example. Your corporation has issued a rights offering to its common stockholders. The subscription price is $50, and five rights are required to purchase one of the new shares of stock. The stock is selling for $60 rights on. What is the value of one right?

Display the RTON equation menu.
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>MVAL=60.00</td>
<td>Stores market value.</td>
</tr>
<tr>
<td>50</td>
<td>PRICE=50.00</td>
<td>Stores subscription price.</td>
</tr>
<tr>
<td>5</td>
<td>#RTS=5.00</td>
<td>Stores number of rights required to purchase share.</td>
</tr>
<tr>
<td></td>
<td>RTON=1.67</td>
<td>Calculates value of one right.</td>
</tr>
</tbody>
</table>

**Rights Off**

The term “rights off” refers to the situation in which the purchase of common stock no longer includes any rights to buy additional shares of common stock in this firm. This situation is also referred to as “ex-rights.”

**Entering and Using the RTOFF Equation:**

1. Enter the $RTOFF$ equation into the Solver.

\[ RTOFF = \frac{(MVAL - PRICE)}{#RTS} \]

2. Display the $RTOFF$ equation menu.

3. Store or calculate the following variables:
   - Value of one right in $\underline{RTOFF}$.
   - Market value ex-rights in $\underline{MVAL}$.
   - Subscription price in $\underline{PRICE}$.
   - Number of rights required to purchase a new share of stock in $\underline{#RTS}$.

**Example.** Your corporation has issued a rights offering to its common stockholders. Eight rights plus $40 will buy one new share. The current market price of the stock is $56 ex-rights. What is the value of one right?

Display the $RTOFF$ equation menu.
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>56 MVAL</td>
<td>MVAL = 56.00</td>
<td>Stores market value.</td>
</tr>
<tr>
<td>40 PRICE</td>
<td>PRICE = 40.00</td>
<td>Stores subscription price.</td>
</tr>
<tr>
<td>8 #RTS</td>
<td>#RTS = 8.00</td>
<td>Stores number of rights required to purchase share.</td>
</tr>
<tr>
<td>#RTOFF</td>
<td>RTOFF = 2.00</td>
<td>Calculates value of one right.</td>
</tr>
</tbody>
</table>
Financial Statement Analysis
Return on Equity

The return on equity ratio measures the profitability of a company relative to the amount of equity (ownership) capital invested. The measure is usually calculated each year; year-to-year comparisons identify trends in this measure. Return on equity is also used to compare companies or industries.

Entering and Using the ROE% Equation:

1. Enter the ROE% equation into the Solver.

\[
\text{ROE\%} = \frac{\text{INCOME}}{\text{EQUI}} \times 100
\]

2. Display the ROE% equation menu.

3. Store or calculate the following variables:
   - Return on equity as a percent in ROE%.
   - Total net income after taxes in INCO.
   - Equity capital invested in the company (assets minus liabilities) in EQUI.

Example: Part 1. Your company has after-tax earnings of $2.5 million. The net worth is $18 million. What is the return on equity?

Display the ROE% equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>2500000 INCO</td>
<td>INCOME = 2,500,000.00</td>
<td>Stores income after</td>
</tr>
<tr>
<td></td>
<td>EQU = 18,000,000.00</td>
<td>taxes.</td>
</tr>
<tr>
<td></td>
<td>ROE% = 13.89</td>
<td>Calculates percent</td>
</tr>
<tr>
<td></td>
<td></td>
<td>return on equity.</td>
</tr>
</tbody>
</table>
Part 2. Your industry averages 14.76% ROE. Given the equity investment in part 1, what after-tax income would you need to match that return on equity?

\[ \text{ROE\%} = 14.76 \]

Stores industry return on equity.

\[ \text{INCOME} = 2,656,800.00 \]

Calculates income after taxes.
Bond Interest Coverage Ratio

The bond interest coverage ratio is a measure of a bond’s quality and financial safety. It is a ratio of the funds available to pay interest during a given year to the interest requirements associated with a bond issue.

The calculation can be made several ways, depending on the legal status of different issues of bonds, interest costs on other than bond debt, and whether the company has issued preferred stock.

All other things being equal, the higher the coverage ratio, the higher the quality of the bond.

**Entering and Using the COVER Equation:**

1. Enter the COVER equation into the Solver.
   
   \[ \text{COVER} = \frac{(\text{EARN} + \$\text{INT})}{\$\text{INT}} \]

2. Display the COVER equation menu.

3. Store or calculate the following variables:
   - Coverage ratio in \( \text{COVER} \).
   - Earnings before taxes in \( \text{EARN} \).
   - Annual interest payments in \( \$\text{INT} \).

**Example: Part 1.** What is the interest coverage ratio of a bond with annual interest payments of $2 million and corporate earnings before taxes of $8 million?

Display the COVER equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>8000000 ( \text{EARN} )</td>
<td>( \text{EARN} = \text{8,000,000.00} )</td>
<td>Stores corporate earnings.</td>
</tr>
<tr>
<td>2000000 ( $\text{INT} )</td>
<td>( $\text{INT} = \text{2,000,000.00} )</td>
<td>Stores annual interest payments.</td>
</tr>
<tr>
<td>( \text{COVER} )</td>
<td>( \text{COVER} = \text{5.00} )</td>
<td>Calculates bond interest coverage ratio.</td>
</tr>
</tbody>
</table>
Five dollars of funds are available to pay each dollar of bond interest.

**Part 2.** Suppose the average bond interest coverage ratio in your industry is 4.85. Calculate how much you could pay in annual interest payments if you borrowed additional funds so that your bond interest coverage ratio matched that of the industry.

\[
4.85 = \text{COVER} = 4.85 \quad \text{Stores bond interest coverage ratio.}
\]

\[
\$\text{INT} = 2,077,922.08* \quad \text{Calculates annual interest payments.}
\]

* The Solver searches for an iterative solution and displays intermediate estimates.
Price-to-Earnings Ratio

The price-to-earnings ratio is used by investors to indicate how much they are investing to obtain one dollar of earnings. Individual securities are often compared to the ratios of stock market indexes or averages.

Entering and Using the PERATIO Equation:

1. Enter the PERATIO equation into the Solver.
   \[ \text{PERATIO} = \frac{\text{PRICE}}{\text{EARN}} \]

2. Display the PERATIO equation menu.

3. Store or calculate the following variables:
   - Price-to-earnings ratio in \( \text{PERAT} \).
   - Current market price of one share of common stock in \( \text{PRICE} \).
   - Current earnings per share in \( \text{EARN} \).

Example: Part 1. Your company stock is selling for $75 per share and has earnings of $6 per share. Calculate the price-to-earnings ratio.

Display the PERATIO equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>75 ( \text{PRICE} )</td>
<td>\text{PRICE} = 75.00</td>
<td>Stores price per share.</td>
</tr>
<tr>
<td>6 ( \text{EARN} )</td>
<td>\text{EARN} = 6.00</td>
<td>Stores earnings per share.</td>
</tr>
<tr>
<td>( \text{PERAT} )</td>
<td>\text{PERATIO} = 12.50</td>
<td>Calculates price-to-earnings ratio.</td>
</tr>
</tbody>
</table>

Part 2. The Dow Jones Industrial Average (DJIA) is $2,550. Earnings are $231.82. Is your stock doing better or worse than the DJIA in terms of price-to-earnings ratio?
The price-to-earnings ratio for your stock is higher than that of the DJIA, indicating your stock is more attractive relative to the average stock.
Return on Investment

One way of evaluating a new investment is through a simple return on investment (ROI) analysis. Return on investment is the ratio of net profit after taxes to the assets used to make the net profit.

Although this calculation is simple to do on any calculator, using SOLVE makes it easy to try what-if situations and to analyze what you can do to meet a minimum return on investment.

Entering and Using the ROI% Equation:

1. Enter the $ROI\%$ equation into the Solver.
   
   \[ ROI\% = \left( \frac{REV \times PROF\%}{100} \right) \div INV \times 100 \]

2. Display the $ROI\%$ equation menu.

3. Store or calculate the following variables:
   - Return on investment as a percent in $ROI\%$.
   - Total revenues in $REV$.
   - Net profit as a percent of revenue in $PROF\%$.
   - Capital investment in the project or business in $INV$.

Example: Part 1. A new store requires $480,000 in new assets. The anticipated revenues the first year are $1 million. Your net profit goal is 10%. Assuming the net profit goal is met, calculate the return on investment.

Display the $ROI\%$ equation menu.
### Keys:

<table>
<thead>
<tr>
<th>Key</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1000000</td>
<td>$REV = 1,000,000.00</td>
</tr>
<tr>
<td>10</td>
<td>PROF% = 10.00</td>
</tr>
<tr>
<td>480000</td>
<td>$INV = 480,000.00</td>
</tr>
<tr>
<td>ROI%</td>
<td>ROI% = 20.83</td>
</tr>
</tbody>
</table>

### Display:

<table>
<thead>
<tr>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>$REV = 1,000,000.00</td>
<td>Stores total anticipated revenues.</td>
</tr>
<tr>
<td>PROF% = 10.00</td>
<td>Stores net profit percent.</td>
</tr>
<tr>
<td>$INV = 480,000.00</td>
<td>Stores investment.</td>
</tr>
<tr>
<td>ROI% = 20.83</td>
<td>Calculates percent return on investment.</td>
</tr>
</tbody>
</table>

### Part 2.
The store's sales are actually $750,000 in the first year. Calculate the return on investment.

| 750000 | $REV = 750,000.00 |
| ROI% | ROI% = 15.63 |

### Part 3.
At the level of revenues in part 2, what total investment can you make to achieve an ROI of 18%.

| 18 | ROI% = 18.00 |
| $INV | $INV = 416,666.67 |

### Part 4.
Suppose you realize a 5% net profit on revenues of $750,000 (you stored this value in part 2). Your investments are $480,000. Calculate the return on investment.

| 5 | PROF% = 5.00 |
| 480000 | $INV = 480,000.00 |
| ROI% | ROI% = 7.81 |

52 2: Return on Investment
Financial Statement Ratios

This section lists ratios that are used to analyze and interpret the information in financial statements. Financial ratios for a particular company are significant when they are compared to the past performance of the company and to industry averages for other firms in the same industry.

There are differing approaches to calculating the ratios presented in this section. The approach used to calculate the ratios should be the same as the approach used to calculate the ratios for the industry averages.

<table>
<thead>
<tr>
<th>Ratio:</th>
<th>Equation:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>Earnings per share</td>
<td>EPS=INC/#SHR [Net income ÷ shares of stock outstanding]</td>
<td>Amount of profit per share of stock.</td>
</tr>
<tr>
<td>Dividend yield %</td>
<td>YLD%=DIV/PRICE ×100 [Annual dividend per share ÷ current market price per share × 100]</td>
<td>Rate earned by the stockholders of the company.</td>
</tr>
<tr>
<td>Price-to-earnings ratio</td>
<td>PER=PRICE/EARN [Current market price per share ÷ earnings per share]</td>
<td>Compares current market price of a stock to earnings per share for the company.</td>
</tr>
<tr>
<td>Book value per share</td>
<td>BVS=EQUI/#SHR [Total stockholders’ equity ÷ shares of stock outstanding]</td>
<td>Value of firm’s net assets per share of stock in company.</td>
</tr>
<tr>
<td>Financial Statement Ratios</td>
<td>Formula</td>
<td>Description</td>
</tr>
<tr>
<td>---------------------------</td>
<td>---------</td>
<td>-------------</td>
</tr>
<tr>
<td>Rate of return on assets%</td>
<td>RA% = ( \frac{\text{OPINC} + \text{ASSET}}{\text{ASSET} \times 100} )</td>
<td>Compares profit from operations (profits before interest and taxes) to average assets used.</td>
</tr>
<tr>
<td>Rate of return on stockholders’ equity%</td>
<td>RSE% = ( \frac{\text{INC} + \text{EQUI}}{\text{EQUI} \times 100} )</td>
<td>Compares profits earned by company to average stockholder investment.</td>
</tr>
<tr>
<td>Inventory turnover</td>
<td>IT = ( \frac{\text{CGS} \div \text{INV}}{\text{INV}} )</td>
<td>Indicates how quickly inventory is turning over.</td>
</tr>
<tr>
<td>Accounts receivable turnover</td>
<td>ART = ( \frac{\text{SLS} \div \text{AR}}{\text{AR}} )</td>
<td>Indicates how quickly accounts receivable are being collected.</td>
</tr>
<tr>
<td>Average collection period</td>
<td>ACP = ( \frac{\text{AR} \div \text{SLS}}{\text{SLS}} )</td>
<td>Indicates how quickly accounts receivable are being collected.</td>
</tr>
<tr>
<td>Asset turnover</td>
<td>AT = ( \frac{\text{SLS} \div \text{ASSET}}{\text{ASSET}} )</td>
<td>Indicates extent of asset utilization.</td>
</tr>
<tr>
<td>Working capital</td>
<td>WC = ( \frac{\text{ASSET} - \text{LIAB}}{\text{LIAB}} )</td>
<td>Measure of liquidity or ability to pay short-term debt.</td>
</tr>
<tr>
<td>Current ratio</td>
<td>CR = ( \frac{\text{ASSET} \div \text{LIAB}}{\text{LIAB}} )</td>
<td>Broad measure of a firm’s short-term ability to pay debt.</td>
</tr>
<tr>
<td>Quick ratio</td>
<td>QR = ( \frac{(\text{ASSET} - \text{INV}) \div \text{LIAB}}{\text{LIAB}} )</td>
<td>Restrictive measure of a firm’s liquidity (also called the acid test ratio).</td>
</tr>
</tbody>
</table>
Times interest earned  \[\text{TIE} = \frac{\text{OPI\textsc{nc}}}{\text{INT}}\]  Extent to which a firm can pay (cover) its interest expense.

Debt ratio\%  \[\text{DR\%} = \frac{\text{LIAB}}{\text{ASSET}} \times 100\]  Indicates the amount of leverage employed.

Equity ratio\%  \[\text{ER\%} = \frac{\text{EQUI}}{\text{ASSET}} \times 100\]  Indicates the amount of leverage employed.

Gross profit\%  \[\text{GP\%} = \frac{\text{PROF}}{\text{SALES}} \times 100\]  Indicates extent of mark-up used by the company.

**Entering and Using the Financial Ratios:**

1. Enter the equation into the Solver.
2. Display the equation menu.
3. Store the variables you know.
4. Press the ratio menu key to calculate the ratio.

**Example 1: Earnings Per Share.** Your company's net income is $90,000; 60,000 shares of stock are outstanding. Calculate the earnings per share.

Enter the \(\text{EPS}\) equation into the Solver.

\[\text{EPS} = \frac{\text{INC}}{\#\text{SHR}}\]

Display the \(\text{EPS}\) equation menu.
### Example 2: Dividend Yield

Your company’s annual dividend per share is $0.70; the current market price per share is $20. Calculate the dividend yield.

Enter the \( YLD\% \) equation into the Solver.

\[
YLD\% = \frac{\text{DIV}}{\text{PRICE}} \times 100
\]

Display the \( YLD\% \) equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>.7 ( \Rightarrow \text{DIV} )</td>
<td>DIV = 0.70</td>
<td>Stores dividend per share.</td>
</tr>
<tr>
<td>20 ( \Rightarrow \text{PRICE} )</td>
<td>PRICE = 20.00</td>
<td>Stores current market price per share.</td>
</tr>
<tr>
<td>( \Rightarrow \text{YLD%} )</td>
<td>YLD% = 3.50</td>
<td>Calculates dividend yield.</td>
</tr>
</tbody>
</table>
3

Cost Accounting and Auditing
Overhead Application Rate

Manufacturing (factory) overhead is an indirect manufacturing cost because it relates to the entire manufacturing operation. An overhead application rate is a method of allocating total overhead to either specific jobs or to individual units of inventory.

**Entering and Using the OHD% Equation:**

1. Enter the $OHD\%$ equation into the Solver.
   
   \[ OHD\% = \frac{OEXP}{DEXP} \times 100 \]

2. Display the $OHD\%$ equation menu.

3. Store or calculate the following variables:
   - Overhead application rate as a percent in $OHD\%$.
   - Overhead expense in $OEXP$.
   - Direct expense (raw materials or direct labor, for example) in $DEXP$.

**Example.** Your manufacturing firm has the following account balances for the year:

- Raw material used $500,000
- Direct labor $100,000
- Factory overhead $250,000

**Part 1.** Calculate the overhead application rate using direct labor as the direct expense.

Display the $OHD\%$ equation menu.
**Keys:**

250000 [OEXP]

100000 [DEXP]

[OHD%]

**Display:**

OEXP = 250,000.00

DEXP = 100,000.00

OHD% = 250.00

**Description:**

Stores overhead expense.

Stores direct labor expense.

Calculates percent overhead application rate.

**Part 2.** Calculate the overhead application rate using raw material as the direct expense.

500000 [DEXP]

[OHD%]

**Display:**

DEXP = 500,000.00

OHD% = 50.00

**Description:**

Stores raw material expense.

Calculates percent overhead application rate.
Labor, Material, and Overhead Variance

One objective of cost accounting systems is to determine the actual unit cost to manufacture a product. Cost systems are more useful when budgeted amounts are calculated prior to the start of operations. These budgeted amounts are called standard costs and are compared with the actual costs for a particular job or a particular department. Cost variances are the differences between standard costs and actual costs.

Rate Variance of Direct Labor

The rate variance for direct labor is the variance (difference) between the actual wage paid and the standard wage.

Entering and Using the RVAR Equation:

1. Enter the $RVAR$ equation into the Solver.

\[ RVAR = (RATE - STRT) \times HOURS \]

2. Display the $RVAR$ equation menu.

3. Store or calculate the following variables:
   - Rate variance for direct labor in $RVAR$
   - Direct labor rate paid in $RATE$
   - Standard direct labor rate in $STRT$
   - Labor hours in $HOURS$

Example 1. Your standard labor rate is $8.50$ per hour. Last month, 460 hours were worked at an actual labor rate of $9.30. Calculate the rate variance for direct labor.

Display the $RVAR$ equation menu.
Keys: | Display: | Description:
--- | --- | ---
9.3 =RATE= | RATE = 9.30 | Stores actual labor rate paid.
8.5 =STRT= | STRT = 8.50 | Stores standard labor rate.
460 = HOURS = | HOURS = 460.00 | Stores actual hours worked.
= RVAR = | RVAR = 368.00 | Calculates rate variance in dollars.

This is an unfavorable variance as you spent $368 more in direct labor than expected.

**Efficiency Variance of Direct Labor**

The efficiency variance for direct labor is the variance (difference) between the actual amount of labor used and the standard labor figure at a particular level of production.

**Entering and Using the EVAR Equation:**

1. Enter the EVAR equation into the Solver.
   
   EVAR = (HOURS - STHR x #UNT) x STRT

2. Display the EVAR equation menu.

3. Store or calculate the following variables:
   - Efficiency variance for direct labor in **EVAR**.
   - Labor hours in **HOURS**.
   - Standard hours per unit in **STHR**.
   - Number of units produced in **#UNT**.
   - Standard direct labor rate in **STRT**.
Example 2. Each table requires 2.5 standard labor hours, at the standard labor rate of $8.50. To produce 190 tables, direct labor worked 460 hours. Calculate the efficiency variance for direct labor.

Display the $EVAR$ equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>460</td>
<td>HOURS $= 460.00$</td>
<td>Stores hours worked.</td>
</tr>
<tr>
<td>2.5</td>
<td>STHR $= 2.50$</td>
<td>Stores standard labor hours per unit.</td>
</tr>
<tr>
<td>190</td>
<td>#UNT $= 190.00$</td>
<td>Stores units made.</td>
</tr>
<tr>
<td>8.5</td>
<td>STRT $= 8.50$</td>
<td>Stores standard labor rate.</td>
</tr>
<tr>
<td></td>
<td>EVAR $= -127.50$</td>
<td>Calculates efficiency variance, in dollars.</td>
</tr>
</tbody>
</table>

This is a favorable variance, as you spent $127.50 less in direct labor costs than expected.

Price Variance of Direct Materials

Price variance for direct materials is the variance (difference) between the actual price paid for materials and the standard price.

Entering and Using the $PVAR$ Equation:

1. Enter the $PVAR$ equation into the Solver.
   $$PVAR = (PRICE - STPR) \times QUAN$$

2. Display the $PVAR$ equation menu.

3. Store or calculate the following variables:
   - Price variance for direct materials in $PVAR$.
   - Price paid for material in $PRICE$.
   - Standard price of material in $STPR$.
   - Quantity of material used in $QUAN$. 
Example 3. Your company manufactures plastic tables for children. Last month, 770 pounds of plastic, at $5.80 per pound, were used. The standard price per pound is $6. Calculate the price variance for direct materials.

Display the $PVAR$ equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>5.8  PRICE</td>
<td>PRICE = 5.80</td>
<td>Stores price.</td>
</tr>
<tr>
<td>6    STPR</td>
<td>STPR = 6.00</td>
<td>Stores standard price.</td>
</tr>
<tr>
<td>770  QUAN</td>
<td>QUAN = 770.00</td>
<td>Stores quantity used.</td>
</tr>
<tr>
<td>PVAR</td>
<td>PVAR = -154.00</td>
<td>Calculates the price variance, in dollars.</td>
</tr>
</tbody>
</table>

Since $PVAR$ is negative, this is a favorable variance. The lower material price saved you $154.

**Quantity Variance of Direct Materials**

The quantity variance for direct materials is the variance (difference) between the actual quantity of materials used and the standard quantity that should have been used for a particular level of production.

**Entering and Using the $QVAR$ Equation:**

1. Enter the $QVAR$ equation into the Solver.
   
   $QVAR = (QUAN - STQU \times #UNT) \times STPR$

2. Display the $QVAR$ equation menu.

3. Store or calculate the following variables:
   - Quantity variance for direct material in $QVAR$.
   - Quantity of material used in $QUAN$.
   - Standard quantity of material used per unit in $STQU$.
   - Number of units produced in $#UNT$.
   - Standard price for material in $STPR$.
Example 4. Last month you made 190 tables, using 770 pounds of plastic. The standard quantity of plastic used in each table is 4 pounds. The standard price per pound of plastic is $6. Calculate the quantity variance for direct materials.

Display the $QVAR$ equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>770</td>
<td>QUAN = 770.00</td>
<td>Stores quantity used.</td>
</tr>
<tr>
<td>4</td>
<td>STQU = 4.00</td>
<td>Stores standard quantity per table.</td>
</tr>
<tr>
<td>190</td>
<td>#UNT = 190.00</td>
<td>Stores units made.</td>
</tr>
<tr>
<td>6</td>
<td>STPR = 6.00</td>
<td>Stores standard price.</td>
</tr>
<tr>
<td></td>
<td>QVAR = 60.00</td>
<td>Calculates quantity variance, in dollars.</td>
</tr>
</tbody>
</table>

This is an unfavorable variance, as you spent more on material than expected.

Spending Variance of Factory Overhead

The spending variance for factory overhead is the variance (difference) between the actual factory overhead and the budgeted factory overhead for the level of production attained.

Entering and Using the $SVAR$ Equation:

1. Enter the $SVAR$ equation into the Solver.
   
   \[ SVAR = OHD - (VAROH + FIXOH) \]

2. Display the $SVAR$ equation menu.
3. Store or calculate the following variables:
- Spending variance in overhead in $SVAR$.
- Overhead in $OHD$.
- Budgeted variable overhead in $VAROH$.
- Budgeted fixed overhead in $FIXOH$.

**Example 5.** The overhead costs incurred for the month were $4,600. The budgeted fixed overhead was $1,938 and the budgeted variable overhead for the month was $2,907.00. Calculate the spending variance for factory overhead.

Display the $SVAR$ equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>4600 $OHD$</td>
<td>$OHD = 4,600.00$</td>
<td>Stores overhead.</td>
</tr>
<tr>
<td>2907 $VAROH$</td>
<td>$VAROH = 2,907.00$</td>
<td>Stores variable overhead.</td>
</tr>
<tr>
<td>1938 $FIXOH$</td>
<td>$FIXOH = 1,938.00$</td>
<td>Stores fixed overhead.</td>
</tr>
<tr>
<td>$SVAR$</td>
<td>$SVAR = -245.00$</td>
<td>Calculates spending overhead variance, in dollars.</td>
</tr>
</tbody>
</table>

This is a favorable variance, as your overhead was lower than expected.

**Volume Variance of Factory Overhead**

The volume variance for factory overhead is the variance (difference) between budgeted overhead and the actual factory overhead.

**Entering and Using the VVAR Equation:**

1. Enter the $VVAR$ equation into the Solver.

   $VVAR = BFOH - APFOH$

2. Display the $VVAR$ equation menu.
3. Store or calculate the following variables:
   - Volume variance in overhead in \( m \)
   - Budgeted factory overhead in \( BFOH \)
   - Applied factory overhead in \( APFOH \)

**Example 6.** The factory overhead applied to 190 tables is $4,692, and the total budgeted overhead for 190 tables is $4,845. Calculate the volume variance for factory overhead.

Display the \( VVAR \) equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>4845 ( BFOH )</td>
<td>BFOH = 4,845.00</td>
<td>Stores budgeted overhead.</td>
</tr>
<tr>
<td>4692 ( APFOH )</td>
<td>APFOH = 4,692.00</td>
<td>Stores applied overhead.</td>
</tr>
<tr>
<td>( VVAR )</td>
<td>VVAR = 153.00</td>
<td>Calculates volume variance in overhead.</td>
</tr>
</tbody>
</table>

This is an unfavorable variance, as your volume overhead variance was higher than expected.

**Overhead Variance on Direct Labor**

The overhead variance on direct labor is the variance (difference) between the actual labor hours used and the standard (budgeted) labor hours multiplied by the standard wage. The result is multiplied by the standard overhead rate.

**Entering and Using the OVAR Equation:**

1. Enter the \( OVAR \) equation into the Solver.

   \[
   OVAR = (ACTHR - STDHR) \times STDRT \times STOHD \div 100
   \]

2. Display the \( OVAR \) equation menu.
3. Store or calculate the following variables:
   - Overhead variance on direct labor in $OVAR$. 
   - Actual hours worked in $ACTHR$. 
   - Standard hours in $STDHR$. 
   - Standard labor rate in $STDRT$. 
   - Standard overhead rate, as a percentage, in $STOHD$. 

Example 7. You estimated that you would recover overhead based on 475 standard labor hours, using a standard labor rate of $8.50 per hour. Instead of working 475 hours, you actually worked 460 hours. The standard overhead rate is 120%. Calculate the overhead variance on direct labor.

Display the $OVAR$ equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>475 $STDHR$</td>
<td>$STDHR = 475.00$</td>
<td>Stores standard labor hours.</td>
</tr>
<tr>
<td>460 $ACTHR$</td>
<td>$ACTHR = 460.00$</td>
<td>Stores actual hours worked.</td>
</tr>
<tr>
<td>8.50 $STDRT$</td>
<td>$STDRT = 8.50$</td>
<td>Stores standard labor rate.</td>
</tr>
<tr>
<td>120 $STOHD$</td>
<td>$STOHD = 120.00$</td>
<td>Stores the standard overhead rate.</td>
</tr>
<tr>
<td>$OVAR$</td>
<td>$OVAR = -153.00$</td>
<td>Calculates the overhead variance on direct labor.</td>
</tr>
</tbody>
</table>

This is a favorable variance, as your overhead recovery on the labor is lower than expected.
Selecting Random Numbers

This procedure cannot be done on the HP-17B.

Note

Generating a list of random numbers within a range is useful when you want to look at a random sample of anything—for example, random inspection of products coming off an assembly line, questionnaires distributed to a random number of employees, or audit a random selection of invoices.

The equation below selects random numbers within a range that you enter.

**Entering and Using the RAND Equation:**

1. Enter the `RAND` equation into the Solver.

   \[ RAND = LO + \text{IP} \left( \frac{\text{MOD}(\text{RAN#}(\text{HI} - \text{LO} + 1) : \text{HI} - \text{LO} + 1)}{\text{HI} - \text{LO} + 1} \right) \]

2. Display the `RAND` equation menu.

3. Store the following variables:
   - Lowest number in the range in `LO`.
   - Highest number in the range in `HI`.

4. Press `RAND` to calculate the random number.
When you use the `RAND` equation, remember the following:

- Use integers only for `LO` and `HI`.
- `HI` must be greater than `LO`.
- The values in `LO` and `HI` are included in the numbers that can be generated. In the example below, 12,001 and 13,500 could be calculated.
- The same number may be calculated more than once.
- Calculate all at once the numbers you want to use. For example, if you want 25 numbers, calculate all 25 in a sequence.

**Example.** An auditor wants to look at 25 invoices selected at random from a set of invoices numbered 12,001 through 13,500. Generate the numbers of the invoices to audit.

Display the `RAND` equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td><code>12001</code></td>
<td><code>LO = 12,001.00</code></td>
<td>Stores the low invoice number.</td>
</tr>
<tr>
<td><code>13500</code></td>
<td><code>HI = 13,500.00</code></td>
<td>Stores the high invoice number.</td>
</tr>
<tr>
<td><code>RAND</code></td>
<td><code>RAND = 13,371.00*</code></td>
<td>Calculates first invoice number.</td>
</tr>
<tr>
<td><code>RAND</code></td>
<td><code>RAND = 13,047.00*</code></td>
<td>Calculates second invoice number.</td>
</tr>
</tbody>
</table>

Continue pressing `RAND` for additional invoice numbers.

---

* The random numbers you calculate will probably not be the same as the random numbers calculated in this example. The calculator uses the time on the system clock as the "seed" to initiate the sequence of numbers.
Calculating the Standard Normal Variate

Your calculator can be used to calculate the standard normal variate (Z). The Z value calculated is the same value you would find in a statistical table that gives Z for a two-tailed region, as shown below:

The CONFIDENCE equation is used to calculate the Z value for a specified confidence level. There are always two possible solutions for Z, only one of which is positive. The useful range for Z is a positive number between 0 and 4. Therefore, the guesses you enter to estimate Z should be between 0 and 4.
Entering and Using the CONFIDENCE Equation:

1. Enter the CONFIDENCE equation into the Solver.*

\[
\text{CONFIDENCE} : 1 \div (1 - \text{CON\%} \div 100) = \\
(1 + 0.049867347 \times Z + 0.0211410061 \times Z^2 \\
+ 0.0032776263 \times Z^3 + 3.80036 \times 5 \times Z^4 + \\
4.88906 \times 5 \times Z^5 + 5.383 \times 6 \times Z^6)^{\frac{1}{16}}
\]

2. Display the CONFIDENCE equation menu.

3. Store or calculate the following variables:
   - Confidence level estimate as a percentage in \( \text{CON\%} \).
   - Standard normal variate in \( Z \).

Example 1. You would like to estimate the actual dollar value of your company's inventory with 90% confidence. Calculate \( Z \).

Display the CONFIDENCE equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>90 ( \equiv \text{CON%} )</td>
<td>( \text{CON%} = 90.00 )</td>
<td>Stores confidence level.</td>
</tr>
<tr>
<td>0 ( \equiv Z )</td>
<td>( Z = 0.00 )</td>
<td>Stores first guess for ( Z ).</td>
</tr>
<tr>
<td>4 ( \equiv Z )</td>
<td>( Z = 4.00 )</td>
<td>Stores second guess for ( Z ).</td>
</tr>
<tr>
<td>( Z )</td>
<td>( Z = 1.64 )</td>
<td>Calculates ( Z ).</td>
</tr>
</tbody>
</table>


To key in * on the HP-17B and HP-27S, press \( [\sqrt{x}] \).

---

3: Calculating the Standard Normal Variate 71
Estimating Inventory Value Using Random Sampling

Four steps are involved in estimating inventory value using random sampling.

1. Calculate the standard normal variate (Z) for the desired confidence level.
2. Calculate the sample size required for the desired confidence interval.
3. Calculate a point estimate of the total inventory, in dollars.
4. Calculate the confidence interval estimate.

Calculating the Sample Size Required

To calculate the sample size, you will need the standard normal variate (Z) and standard deviation (S). Z can be found using the procedures on pages 70 and 71, or it can be looked up in a statistics text. S can be obtained from analysis of historical data. With Z and a reasonable choice for S, you can estimate inventory value using the SIZE equation.

Entering and Using the SIZE Equation:

1. Enter the SIZE equation into the Solver.*

\[
\text{SIZE: } D = Z \times \sqrt{\frac{S}{\text{POP}} \times 2 + \frac{S \times \text{SIZE}}{2}} \times \frac{\text{POP} - \text{SIZE}}{2}
\]

2. Display the SIZE equation menu.
3. Store or calculate the following variables:

* To key in the square-root function (SQRT), press \( \boxed{\sqrt{x}} \).
To key in \( \wedge \) on the HP-17B and HP-27S, press \( \boxed{\wedge} \).
Example 1. You would like to estimate the actual dollar value of your company's inventory. The estimate should be within $5,000 (5% of estimated inventory) with 90% confidence. Your firm has 1,015 types of parts in inventory. Similar data collected last year produced an estimate of the standard deviation for the part value of $20.78.

A sample size of at least 46 types of parts must be taken from the population of 1,015 part type numbers.

* The Solver searches for an iterative solution and displays intermediate estimates.
Calculating a Point Estimate of the Total Inventory

A point estimate of the total inventory size is obtained by finding the mean of the sample and multiplying it by the total number of part types.

Example 2. The sample of 46 types of parts is taken from the population of 1,015 part types.

To calculate the point estimate of the total inventory, you must:

1. Choose at random the part types to be counted. The number of part types must be greater than or equal to \( SSIZE \).

2. For each part type, count the number of parts. Multiply the number of parts by the value per part. Enter this value into a SUM (HP-17B or HP-19B) or STAT (HP-27S) list.

3. Calculate the mean and standard deviation of the data in the list. (Refer to your owner’s manual if you are not familiar with how to do this.)

4. Multiply the total number of part types by the mean to calculate the point estimate of the total inventory value.

Suppose that after completing the four steps above, you arrive at a mean of $100.17 and a standard deviation of $19.18.

The point estimate of the total inventory dollars is then:

\[ 1015 \times \$100.17 = \$101,672.55 \]

Estimating the Confidence Interval

The confidence interval for the total inventory value can then be calculated as follows:
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>19.18=S=</td>
<td>S = 19.18</td>
<td>Stores standard deviation.</td>
</tr>
<tr>
<td>46 = SSIZE =</td>
<td>SSIZE = 46.00</td>
<td>Stores sample size.</td>
</tr>
<tr>
<td>D =</td>
<td>D = 4,599.48</td>
<td>Calculates one-half the confidence interval, in dollars.</td>
</tr>
</tbody>
</table>

With 90% confidence, you can conclude that the total dollar value of inventory is:

$$\$101,672.55 \pm 4,599.48 \ (97,073.07 \text{ to } 106,272.03)$$

Production and Inventory Analysis
Priority Scheduling Rule

Priority scheduling rules are used to determine the order in which customer orders should be worked. The priority scheduling rule in this section uses an index based on the number of work hours until the delivery date, the processing time for the order, and the number of operations remaining to complete the order. The lower the index, the higher the priority. The equation assumes that eight hours are worked per day.

Entering and Using the INDX Equation:

1. Enter the INDX equation into the Solver.
   \[ \text{INDX} = \left( \frac{\#\text{DAY} \times 8 - \text{TIME}}{\#\text{OPS}} \right) \]
2. Display the INDX equation menu.
3. Store or calculate the following variables:
   - Days until delivery date in \#DAY.
   - Total processing time in TIME.
   - Number of remaining operations in #OPS.
   - Priority index in INDX.

Example: Part 1. You have an order to ship in two weeks (ten days). The job has 30 hours of processing time and five operations remaining. What is the priority index?

Display the INDX equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10 #DAY</td>
<td>#DAY = 10.00</td>
<td>Stores days to delivery date.</td>
</tr>
<tr>
<td>30 TIME</td>
<td>TIME = 30.00</td>
<td>Stores remaining processing time.</td>
</tr>
<tr>
<td>5 #OPS</td>
<td>#OPS = 5.00</td>
<td>Stores remaining operations.</td>
</tr>
<tr>
<td>INDX</td>
<td>INDX = 10.00</td>
<td>Calculates priority index.</td>
</tr>
</tbody>
</table>
Part 2. You have another customer whose order is also due in ten days. That order has four operations remaining, which take 45 hours. Which order has the highest priority?

\[
\begin{align*}
45 &\quad \text{TIME} = 45.00 & \text{Stores remaining processing time.} \\
4 &\quad \text{#OPS} = 4.00 & \text{Stores remaining operations.} \\
&\quad \text{INDX} = 8.75 & \text{Calculates priority index.}
\end{align*}
\]

This order has a lower priority index, and thus, the higher priority.

Part 3. Your second customer changes the specifications on his order. The changes decrease your processing time to 39 hours. Which order now has the higher priority?

\[
\begin{align*}
39 &\quad \text{TIME} = 39.00 & \text{Stores remaining processing time.} \\
&\quad \text{INDX} = 10.25 & \text{Calculates priority index.}
\end{align*}
\]

Customer one now has the higher priority.

Daily Production Rate

Knowing a daily production rate helps manufacturers spread production and shipping needs over the month for the most efficient use of people and equipment. The daily production rate equation can also be used to compare production, shipment, or order rates for months with different numbers of working days.

Although production rate is simple to calculate, using the Solver means you don’t have to reenter values when you have many calculations to do, or to try what-if situations.

Entering and Using the RATE Equation:

1. Enter the RATE equation into the Solver.
   
   \[ \text{RATE} = \frac{\text{UNIT}}{\text{DAYS}} \]

2. Display the RATE equation menu.

3. Store or calculate the following variables:
   - Daily rate in \( \text{RATE} \).
   - Total units for the month in \( \text{UNIT} \).
   - Number of work days in the month in \( \text{DAYS} \).

Example: Part 1. The production goal for January is 1,760 units. January has 22 work days. What quantity must be produced each day to meet the plan?

Display the RATE equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>1760 ( \text{UNIT} )</td>
<td>UNIT = 1,760.00</td>
<td>Stores production for the month.</td>
</tr>
<tr>
<td>22 ( \text{DAYS} )</td>
<td>DAYS = 22.00</td>
<td>Stores number of work days in the month.</td>
</tr>
<tr>
<td>( \text{RATE} )</td>
<td>RATE = 80.00</td>
<td>Calculates daily production rate.</td>
</tr>
</tbody>
</table>
Part 2. You have to calculate daily production rates for other products as well. The monthly production rates on three other products are:

<table>
<thead>
<tr>
<th>Product</th>
<th># Units Per Month</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2477</td>
</tr>
<tr>
<td>2</td>
<td>700</td>
</tr>
<tr>
<td>3</td>
<td>4800</td>
</tr>
</tbody>
</table>

Keys: Display: Description:

2477 UNIT UNIT = 2,477.00 Stores units.
\[ \text{RATE} = \text{RATE} = 112.59 \] Calculates daily rate for product #1.

700 UNIT UNIT = 700.00 Stores units.
\[ \text{RATE} = \text{RATE} = 31.82 \] Calculates daily rate for product #2.

4800 UNIT UNIT = 4,800.00 Stores units.
\[ \text{RATE} = \text{RATE} = 218.18 \] Calculates daily rate for product #3.

Part 3. Capacity constraints prevent producing more than 225 units per day of product #3. February has only 19 work days. What is the maximum number of units of product #3 that can be produced?

225 RATE RATE = 225.00 Stores maximum daily rate.

19 DAYS DAYS = 19.00 Stores number of work days in the month.

UNIT UNIT = 4,275.00 Calculates units that can be produced in February.
Predicting Labor Hours Using Learning Rates

Learning curves are useful in analyzing new production processes to determine how productivity will improve over time. As the production team becomes more proficient, labor hours per unit decrease, leading to lower costs.

Entering and Using the LHRS Equation:

1. Enter the LHRS equation into the Solver.*

\[ \text{LHRS} = \text{U1HRS} \times \text{UNIT}^\# \times (\ln (\frac{\text{LRN} \%}{100}) + \ln(2)) \]

2. Display the LHRS equation menu.

3. Store or calculate the following variables:
   - Average time to produce each unit in units of LHRS.
   - Time to produce the first unit in units of U1HRS.
   - Number of the unit of interest in units of UNIT.
   - Learning rate as a percent in LRN%.

Example 1: Calculate the Learning Rate From Historical Data

For a certain production process, you know that the first unit took 100 hours to produce, and that by the 16th unit, you were averaging 41 hours per unit. What is the learning rate for this process?

Display the LHRS equation menu.

* To key in ^ on the HP-17B and HP-27S, press [yX].
Example 2: Calculate the Hours To Produce a Unit. You are starting production on a new item. You expect the learning rate on the new product to be 80%. The first unit took 70 hours. Calculate the average production rate when you reach unit 20.

Keys: Display: Description:
70  U1HRS  U1HRS = 70.00 Stores hours to produce unit 1.
20  UNIT  UNIT# = 20.00 Stores unit number.
80  LRN%  LRN% = 80.00 Stores learning rate.
LHRS  LHRS = 26.68 Calculates average hours to produce unit 20.

* The Solver searches for an iterative solution and displays intermediate estimates.
Forecasting Manufacturing Rates of Accessories

Many products have optional accessories or peripheral products. For example, cars have lots of extras, and computers have software and optional equipment.

The production rates of these optional items are often based on a percentage of the sales of the main product. The following equation helps determine production rates of these optional products.

Although this calculation is simple to do on any calculator, using the Solver means you don't have to reenter values to calculate many optional products for one main product, or to try what-if situations.

Entering and Using the %MAIN Equation:

1. Enter the %MAIN equation into the Solver.
   \[ \text{%MAIN} = \frac{\#\text{OPT}}{\text{MAIN}} \times 100 \]

2. Display the %MAIN equation menu.

3. Store or calculate the following variables:
   - Percent of main product in \( \%\text{MAI} \).
   - Units of the optional product in \( \#\text{OPT} \).
   - Units of the main product in \( \text{MAIN} \).

Example: Part 1. Seventy-five percent of your customers are expected to order a particular software product to use with your computer. The computer is forecasted to sell 1,100 units per month. What should your manufacturing plan be for the software product?

Display the %MAIN equation menu.
### Keys: Display: Description:

| 75 = %MAI | %MAIN = 75.00 | Stores percent expected to buy the software. |
| 1100 = MAIN | MAIN = 1,100.00 | Stores computer forecast. |
| #OPT | #OPT = 825.00 | Calculates number of optional units to manufacture. |

**Part 2.** Last month, computer orders were 900 and software orders were 750. The computer forecast is 1,100 units. How much software should be produced to reflect last month’s actual sales rate?

| 750 = #OPT | #OPT = 750.00 | Stores number of software products sold. |
| 900 = MAIN | MAIN = 900.00 | Stores number of computers sold. |
| %MAI | %MAIN = 83.33 | Calculates percent of computer sales. |
| 1100 = MAIN | MAIN = 1,100.00 | Stores computer forecast. |
| #OPT | #OPT = 916.67 | Calculates new forecast for software. |
Estimating Inventory Availability

Availability estimates tell you approximately how long your inventory will last, based on forecasted rates or use rates. The equation below can be applied to finished goods or production parts.

This equation calculates availability in weeks, based on inventory on hand and use per month. The equation assumes 4.33 weeks per month. You can alter the equation to fit other situations. For example, if you omit $\times 4.33$, the equation calculates availability in months.

**Entering and Using the AVAIL Equation:**

1. Enter the `AVAIL` equation into the Solver.

   \[ AVAIL = \left( \frac{INV}{USE} \right) \times 4.33 \]

2. Display the `AVAIL` equation menu.

3. Store or calculate the following variables:
   - Availability in weeks in `AVAIL`.
   - Inventory on hand in `INV`.
   - Forecasted or use per month in `USE`.

**Example: Part 1.** You have 800 units available at the end of the month. The forecast for the next month is 1,200 units. How long will your supply last?

Display the `AVAIL` equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>800 INV</td>
<td>INV = 800.00</td>
<td>Stores current inventory.</td>
</tr>
<tr>
<td>1200 USE</td>
<td>USE = 1,200.00</td>
<td>Stores forecast.</td>
</tr>
<tr>
<td></td>
<td>AVAIL = 2.89</td>
<td>Calculates weeks of availability.</td>
</tr>
</tbody>
</table>
Part 2. You like to keep seven weeks of supply on hand. What should your inventory be?

7 \text{AVAIL} \quad \text{AVAIL} = 7.00 \quad \text{Stores weeks of availability.}

\text{INV} \quad \text{INV} = 1,939.95 \quad \text{Calculates inventory needs.}
Replacing Equipment

Mechanical equipment depreciates in value while the cost of maintenance and operation goes up. As these costs rise, an optimal point in time is reached when the equipment should be replaced. This optimal point can be determined by looking at the optimum service life and the minimum average total cost (ATC) of the equipment. These values can be calculated if you know the purchase price, the operation and maintenance costs for the first year, and the annual rates of increase in operation and maintenance costs.

**Entering and Using the ATC and LIFE Equations:**

1. Enter the average total cost (ATC) equation into the Solver.
   \[ \text{ATC} = \text{LIFE} - \frac{(\text{OPIN} + \text{MTIN})}{2} + \text{OPCO}_1 + \text{MTCO}_1 \]
2. Enter the service life (LIFE) equation into the Solver.*
   \[ \text{LIFE} = \sqrt{\frac{2 \times \text{PRICE}}{(\text{OPIN} + \text{MTIN})}} \]
3. Display the LIFE equation menu.
4. Store the following variables:
   - Purchase price (less any trade-in) in \( \text{PRICE} \).
   - Yearly dollar increase in operating costs in \( \text{OPIN} \).
   - Yearly dollar increase in maintenance costs in \( \text{MTIN} \).
5. Press \( \text{LIFE} \) to calculate the optimum service life.
6. Display the ATC equation menu.
7. Store the following variables:
   - First year operating costs in \( \text{OPCO}_1 \).
   - First year maintenance costs in \( \text{MTCO}_1 \).
   - \( \text{LIFE} \), \( \text{OPIN} \), and \( \text{MTIN} \) variables are already stored.
8. Press \( \text{ATC} \) to calculate the minimum average total cost.

* To key in the square-root function (SQRT), press \( \sqrt{} \).
Example. Your company has a piece of equipment that was purchased for $28,000. The maintenance costs in the first year were $2,000; operating costs were $14,000. Maintenance costs are expected to increase by $1,200 each year; operating costs are expected to increase by $1,500 each year. What is the optimum service life and minimum average total cost?

Display the \( \textit{LIFE} \) equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>28000 (\text{PRICE})</td>
<td>(\text{PRICE} = 28,000.00)</td>
<td>Stores purchase price.</td>
</tr>
<tr>
<td>1500 (\text{OPIN})</td>
<td>(\text{OPIN} = 1,500.00)</td>
<td>Stores yearly increase in operating costs.</td>
</tr>
<tr>
<td>1200 (\text{MTIN})</td>
<td>(\text{MTIN} = 1,200.00)</td>
<td>Stores yearly increase in maintenance costs.</td>
</tr>
<tr>
<td>(\text{LIFE})</td>
<td>(\text{LIFE} = 4.55)</td>
<td>Calculates optimum service life.</td>
</tr>
<tr>
<td>EXIT (\downarrow) or (\uparrow)</td>
<td>(\text{ATC} = \text{LIFE} - (\text{OPIN} + \text{MTIN}))</td>
<td>Displays SOLVE menu. Selects (\text{ATC}) equation. Displays ATC menu.</td>
</tr>
<tr>
<td>(\text{CALC})</td>
<td>(\text{OPCO1} = 14,000.00)</td>
<td>Stores first year operating costs.</td>
</tr>
<tr>
<td>14000 (\text{OPCO1})</td>
<td>(\text{MTCO1} = 2,000.00)</td>
<td>Stores first year maintenance costs.</td>
</tr>
<tr>
<td>2000 (\text{MTCO1})</td>
<td>(\text{ATC} = 14,654.55)</td>
<td>Calculates minimum average total cost.</td>
</tr>
</tbody>
</table>

According to this model, average annual costs are decreasing for the first 4.5 years. After that time, costs are increasing.
Estimating Inventory Investment Versus Expected Shipment Dollars

It is useful to know the inventory cost required to produce units and to compare inventory costs to the expected revenue from shipping those products. This procedure uses three equations to calculate the three parts: the dollars shipped, the dollars in inventory, then the difference between the two. If you’re interested only in the difference, the three equations are combined into one on page 91.

Entering and Using the Equations:

1. Enter the $DIFF equation into the Solver.
   \[
   \text{$DIFF = $SHIP - $INV}
   \]

2. Enter the $SHIP equation into the Solver.
   \[
   \text{$SHIP = (PRICE \times (1 - \%DISC \div 100)) \times \#UNT}$
   \]

3. Enter the $INV equation into the Solver.
   \[
   \text{$INV = COSTS \times \#UNT}$
   \]

4. Display the $INV equation menu.

5. Store the following variables:
   - Standard cost per unit (labor, material, overhead) in COSTS.
   - Number of units produced and shipped in \#UNT.

6. Press $INV to calculate the inventory investment.

7. Display the $SHIP equation menu.

8. Store the following variables:
   - Price of the product in PRICE.
   - Discount rate as a percent at shipment in %DISC.
   - Number of units produced and shipped in \#UNT. (If this value was stored in step 5, you don’t have to store it again.)

9. Press $SHIP to calculate the expected shipment dollars.

10. Display the $DIFF equation menu.
11. Press $DIF$ to calculate the difference between inventory investment and the expected shipment dollars. (Values were calculated and stored in $INV$ and $SHI$ in steps 6 and 9.)

Example. You plan to ship 100 units. The list price per unit is $3,000, and the units are shipped at a 40% discount. The production cost per unit is $1,500. What is the difference between inventory investment and shipment dollars?

Display the $INV$ equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500 costs</td>
<td>COSTS = 1,500.00</td>
<td>Stores cost per unit.</td>
</tr>
<tr>
<td>100 #unt</td>
<td>#UNT = 100.00</td>
<td>Stores number of units.</td>
</tr>
<tr>
<td>$INV$</td>
<td>$INV = 150,000.00</td>
<td>Calculates dollars of inventory.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
<td>Displays SOLVE menu.</td>
</tr>
<tr>
<td>↓ or ↑ CALC</td>
<td>$SHIP = (PRICE \times</td>
<td>Selects $SHIP$ equation.</td>
</tr>
<tr>
<td>3000 price</td>
<td>PRICE = 3,000.00</td>
<td>Displays $SHIP$ menu.</td>
</tr>
<tr>
<td>40 %disc</td>
<td>%DISC = 40.00</td>
<td>Stores discount rate.</td>
</tr>
<tr>
<td>$SHI$</td>
<td>$SHIP = 180,000.00</td>
<td>Calculates dollars of shipments.</td>
</tr>
<tr>
<td>exit</td>
<td></td>
<td>Displays SOLVE menu.</td>
</tr>
<tr>
<td>↓ or ↑ CALC</td>
<td>$DIFF = $SHIP - $INV</td>
<td>Selects $DIFF$ equation.</td>
</tr>
<tr>
<td>$DIFF$</td>
<td>$DIFF = 30,000.00</td>
<td>Calculates dollar difference between shipments and inventory.</td>
</tr>
</tbody>
</table>

90 4: Estimating Inventory Investment Versus Expected Shipment Dollars
Combining the Equations:
You may not be interested in the values for $SHIP and $INV, but only the final value, $DIFF. The three equations on page 89 can be combined into one, as follows:

\[ \$DIFF = \#UNT \times (\text{PRICE} \times (1 - \frac{\%DISC}{100}) - \text{COST}) \]

To use this equation, store or calculate the following variables:

- Dollar difference between inventory investment and expected shipments in $DIFF$.
- Number of units produced and shipped in $\#UNT$.
- Price of the product in $\text{PRICE}$.
- Discount rate as a percent at shipment in $\%DISC$.
- Standard cost per unit (labor, material, overhead) in $\text{COST}$.
Evaluation of Costs Associated With Seasonal or Perishable Inventory

Excess inventory of seasonal or fad products may have a salvage value below cost. You may even have to pay to dispose of excess inventory of perishable goods, which results in a negative salvage value. However, if insufficient inventory is available, costs in the form of lost sales, good will, and customer loyalty are incurred. The equation below helps evaluate the relationship among these costs.

Entering and Using the SCOST Equation:

1. Enter the SCOST equation into the Solver.

\[ \text{SCOST} = (\text{COST} - \text{SALV}) + \text{PROB}\% \times 100 - \text{PRICE} + \text{SALV} \]

2. Display the SCOST equation menu.

3. Store or calculate the following variables:
   - Shortage cost per unit in \( \text{SCOST} \).
   - Unit cost of the product in \( \text{COST} \).
   - Unit salvage value (negative, if you must pay to dispose of the product) in \( \text{SALV} \).
   - Probability of stockout in \( \text{PROB}\% \).
   - Unit price of the product in \( \text{PRICE} \).

Example: Part 1. A store is considering the sale of poinsettias at Christmas. Each poinsettia costs $6 and the selling price is $11. You estimate that at an inventory of 1,000, the probability of excess inventory is 15%. The salvage value is $4. Calculate the shortage cost per unit.

Display the SCOST equation menu.
**Keys:**

<table>
<thead>
<tr>
<th></th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>6</td>
<td>COST = 6.00</td>
<td>Stores unit cost of the product.</td>
</tr>
<tr>
<td>11</td>
<td>PRICE = 11.00</td>
<td>Stores unit price of the product.</td>
</tr>
<tr>
<td>15</td>
<td>PROB% = 15.00</td>
<td>Stores probability of stockout.</td>
</tr>
<tr>
<td>4</td>
<td>SALV = 4.00</td>
<td>Stores unit salvage value.</td>
</tr>
<tr>
<td></td>
<td>SCOST = 6.33</td>
<td>Calculates cost of stockout shortage.</td>
</tr>
</tbody>
</table>

**Part 2.** What is the optimal probability of stockout if the cost of stockout shortage is the gross profit ($11 minus $6) plus $10 per unit for lost goodwill, customer loyalty, and future sales to the customer who comes in expecting to participate in your seasonal special?

\[
11 - 6 + 10 = SCOST = 15.00
\]

Stores cost of stockout shortage.

\[
PROB% = 9.09
\]

Calculates probability of stockout.

This value indicates that you should order enough stock so that you have a 9% or less chance of running out during the seasonal selling season.

Manufacturing Strategy Analysis

If your firm has similar production facilities at two locations, you may want to evaluate the financial impact of changing the production of a component or product from one location to another. The equation below helps you analyze such a decision, based on the estimated costs and savings in making the change.

**Entering and Using the INV Equation:**

1. Enter the *INV* equation into the Solver. *
   \[ INV = FRCST \times (CURR - NEW - ADDIT) \times USPV (I\% : #PER) \]

2. Display the *INV* equation menu.

3. Store or calculate the following variables:
   - Initial investment required to make the change in **INV**.
   - Periodic forecast or production volume in **FRCST**.
   - Current manufacturing cost of each item in **CURR**.
   - New manufacturing cost if the change is made in **NEW**.
   - Any additional costs per item created by the change (such as freight, duty, or increased overhead) in **ADDIT**.
   - Interest rate per period as a percent in **I\%**.
   - Number of periods to break even in **#PER**.

---

* The equation contains the USPV function, which must be keyed in exactly as indicated in the equation. To key in: on the HP-17B and HP-27S, press **WXYZ** **OTHER** **;** .

† If **PER** is negative, the new cost plus additional costs is greater than current costs, indicating this is not a good investment, and will never break even.
Example: Part 1. A company is currently manufacturing an item for $110. By moving the operation to another site, certain economies and additional costs would be incurred. You estimate that the same item could be manufactured for $90. The move would cost $150,000, including equipment, training of new workers, retraining of the current workers, and relocation of key personnel. Freight costs of $5.30 per item would also be required to move the product back to the distribution center. If the company requires a 20% annual return on investment, how long will it take for this move to break even? The forecast is 4,500 units per year.

Display the INV equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>150000  INV</td>
<td>INV = 150,000.00</td>
<td>Stores initial investment.</td>
</tr>
<tr>
<td>4500  FRCST</td>
<td>FRCST = 4,500.00</td>
<td>Stores forecasted production.</td>
</tr>
<tr>
<td>110  CURR</td>
<td>CURR = 110.00</td>
<td>Stores current manufacturing costs.</td>
</tr>
<tr>
<td>90  NEW</td>
<td>NEW = 90.00</td>
<td>Stores new manufacturing costs.</td>
</tr>
<tr>
<td>5.3  ADDIT</td>
<td>ADDIT = 5.30</td>
<td>Stores additional freight costs.</td>
</tr>
<tr>
<td>MORE</td>
<td></td>
<td></td>
</tr>
<tr>
<td>20  I%</td>
<td>I% = 20.00</td>
<td>Stores required annual return on investment.</td>
</tr>
<tr>
<td>#PER</td>
<td>#PER = 3.31*</td>
<td>Calculates number of years to break even.</td>
</tr>
</tbody>
</table>

* The Solver searches for an iterative solution and displays intermediate estimates.
**Part 2.** If the additional freight cost rose to $8.80, how long would it take to break even?

\[ \text{ADDIT} = 8.80 \]

Stores new freight cost.

\[ \#\text{PER} = 4.96^* \]

Calculates number of years to break even.

* The Solver searches for an iterative solution and displays intermediate estimates.
Work Sample Survey Size

Work sampling can be used to collect information about work flow and idle time. The equation below helps determine the number of operations needed to assure that your work sampling will give you accurate results. It uses the standard normal variate (Z), which you can find using the procedures on pages 70 and 71 or look up in a statistics text. The equation assumes you have made a small number of observations, and thus, have a preliminary estimate of the survey results.

Entering and Using the SSIZE Equation:

1. Enter the SSIZE equation into the Solver.*

   \[ SSIZE = Z^2 + (\%ACC \times 100)^2 \times (1 - \frac{#OCC}{#OBS}) \div #OCC \times #OBS \]

2. Display the SSIZE equation menu.

3. Store or calculate the following variables:
   - Sample size in \#SSIZE.
   - Normal distribution value in \#Z.
   - Desired percentage accuracy in \#%ACC.
   - Number of occurrences in your small sample in \#OCC.
   - Number of observations in your small sample in \#OBS.

Example: Part 1. You wish to identify the amount of idle time in your service department. You made 20 random observations, and on three occasions, an employee was idle. Now you want to conduct a statistically valid survey. How many observations are needed to be 95% sure of your results (normal distribution value = 1.96) with an accuracy of ±10%?

Display the SSIZE equation menu.

---

* To key in ^ on the HP-17B and HP-27S, press \[ y^x \].
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1.96</td>
<td>Z = 1.96</td>
<td>Stores normal distribution.</td>
</tr>
<tr>
<td>10</td>
<td>%ACC = 10.00</td>
<td>Stores accuracy you desire.</td>
</tr>
<tr>
<td>3</td>
<td>#OCC = 3.00</td>
<td>Stores number of occurrences from your preliminary sample.</td>
</tr>
<tr>
<td>20</td>
<td>#OBS = 20.00</td>
<td>Stores number of preliminary observations.</td>
</tr>
<tr>
<td>SSIZE</td>
<td>SSIZE = 2,176.91</td>
<td>Calculates number of observations to assure desired accuracy.</td>
</tr>
</tbody>
</table>

**Part 2.** You have the time and budget for 1500 observations only. With that number of observations, what is your accuracy?

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1500</td>
<td>SSIZE = 1,500.00</td>
<td>Stores sample size.</td>
</tr>
<tr>
<td>%ACC</td>
<td>%ACC = 12.05</td>
<td>Calculates accuracy achieved with 1500 observations.</td>
</tr>
</tbody>
</table>

Productivity Measurements

There are many ways to measure productivity. This section looks at productivity as a ratio of outputs to inputs—an index—first with a single resource, then with multiple resources.

Single Resource Productivity Measurement

Labor is a common resource for productivity measurement. A comparison of several ratios of output in units or dollars to labor input in units or dollars results in a productivity index that indicates whether labor productivity is increasing or decreasing.

Entering and Using the INDEX Equation:

1. Enter the INDEX equation into the Solver.*

   \[
   \text{INDEX: } IF \left( \frac{\text{OUT1}}{\text{IN1}} - \text{NDX1} : \right. \\
   \left. \frac{\text{OUT2}}{\text{IN2}} - \text{NDX2} : \right) \\
   \left( \text{NDX2} - \text{NDX1} \right) \\
   \left. + \text{NDX1} \times 100 - \%\text{CHG} \right)
   \]

2. Display the INDEX equation menu.

3. Store or calculate the following variables:
   - Output in units or dollars for first period in OUT1.
   - Input in units or dollars for first period in IN1.
   - Productivity index for first period in NDX1.
   - Output in units or dollars for second period in OUT2.
   - Input in units or dollars for second period in IN2.
   - Productivity index for second period in NDX2.
   - Percent change in the index in %CHG.

* To key in: on the HP-17B and HP-27S, press \text{WXYZ OTHER}. 

4: Productivity Measurements 99
Example. Last month you produced 600 units, worth $1,400, in 80 hours at $7.00 per labor hour. This month 660 units were produced, worth $1,500, in 85 hours at $7.20 per labor hour (a 2.86% increase in hourly labor cost).

Part 1. Calculate the unit productivity index (number of units produced divided by labor hours) for last month and this month, then find the percent change in the index.

Display the INDEX equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>600 OUT1</td>
<td>OUT1 = 600.00</td>
<td>Stores unit output for last month.</td>
</tr>
<tr>
<td>80 IN1</td>
<td>IN1 = 80.00</td>
<td>Stores labor input for last month.</td>
</tr>
<tr>
<td>NDX1</td>
<td>NDX1 = 7.50</td>
<td>Calculates unit productivity for last month.</td>
</tr>
<tr>
<td>660 OUT2</td>
<td>OUT2 = 660.00</td>
<td>Stores unit output for this month.</td>
</tr>
<tr>
<td>85 IN2</td>
<td>IN2 = 85.00</td>
<td>Stores labor input for this month.</td>
</tr>
<tr>
<td>MORE NDX2</td>
<td>NDX2 = 7.76</td>
<td>Calculates unit productivity for this month.</td>
</tr>
<tr>
<td>%CHG</td>
<td>%CHG = 3.53</td>
<td>Calculates percent change from last month to this month.</td>
</tr>
</tbody>
</table>

Unit productivity rose from last month to this month by 3.53%.

Part 2. Calculate value productivity (dollar value of units produced divided by dollar value of labor) for last month and this month, then find the percent change. The dollar value of the units produced last month was $1,400; for this month it was $1,500. The labor cost last month was 80 hours at $7 per hour; for this month, it was 85 hours at $7.20 per hour.
Value productivity declined from last month to this month by 1.96%.

**Part 3.** Calculate the unit sales price (dollar value of units produced divided by units produced) for last month and this month, then find the percent change. Dollar sales last month were $1,400; this month they were $1,500. Last month 600 units were produced; this month 660 units were produced.
Unit sales price declined from last month to this month by 2.6%.

**Part 4.** Calculate unit labor cost productivity (dollar value of labor divided by units produced) for last month and this month, then find the percent change. Last month you produced 600 units in 80 hours at $7 per hour. This month you produced 660 units in 85 hours at $7.20 per hour.

\[ 7 \times 80 = 560.00 \] Stores labor costs last month.

\[ 600 \] Stores number of units produced last month.

\[ \text{NDX1} = 0.93 \] Calculates unit labor cost last month.

\[ 7.2 \times 85 = 612.00 \] Stores labor costs this month.

\[ 660 \] Stores units produced this month.

\[ \text{MORE} \]

\[ \text{NDX2} = 0.93 \] Calculates unit labor costs this month.

\[ \%\text{CHG} = -0.65 \] Calculates percent change in unit labor cost.

Unit labor costs declined from last month to this month by .65%.

These ratios are useful for analyzing performance. In this case, unit productivity increased by 3.53%, while value productivity declined by 1.96%. The causes of the decline in value productivity show up in the change in unit sales price, which declined 2.6%, and the .65% decline in unit labor costs.
Wages increased 2.86%, but unit productivity increased by 3.53%, which more than offset the wage increase. This is reflected in the lesser decline in unit labor costs when compared to unit sales price.

**Multiple Resource Plus Inflation Productivity Measurement**

The productivity index in this section is a ratio like the previous equation, but more resources are used in the index. Sales are the output; labor, energy, materials, and capital are the inputs. By watching this index over time, you can track the productivity of your company.

This equation can be used to calculate profitability as well as productivity. However, remember that prices and costs may inflate at different rates when using the index over time. The equation on page 106 can be used to calculate a partial index that includes inflation.

**Entering and Using the MRIN Equation:**

1. Enter the *MRIN* equation into the Solver.

\[
MRIN = \frac{SALES \times (1 + IS\% \div 100) + LABOR \times (1 + IL\% \div 100) + ENERGY \times (1 + IE\% \div 100) + PARTS \times (1 + IP\% \div 100) + CAPIT \times (1 + IC\% \div 100)}{(1 + IS\% \div 100) + (1 + IL\% \div 100) + (1 + IE\% \div 100) + (1 + IP\% \div 100) + (1 + IC\% \div 100)}
\]

2. Display the *MRIN* equation menu.

3. Store or calculate the following variables:
   - Sales in dollars in \(SALES\).
   - Inflation in product prices as a percentage in \(IS\%\) (must be 0 for base year).
   - Labor costs in \(LABOR\).
   - Inflation in labor costs as a percentage in \(IL\%\) (must be 0 for base year).
   - Energy costs in \(ENER\).
   - Inflation in energy costs as a percentage in \(IE\%\) (must be 0 for base year).
   - Material costs in \(PARTS\).
   - Inflation in material costs as a percentage in \(IP\%\) (must be 0 for base year).
- Capital costs in CAPIT.
- Inflation in capital costs as a percentage in IC% (must be 0 for base year).
- Productivity index in MRIN.

**Example.** The following table gives data for the base year and base year plus one.

<table>
<thead>
<tr>
<th>Resource</th>
<th>Menu key</th>
<th>Base year*</th>
<th>Base year+1</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sales</td>
<td>SALES</td>
<td>$480,000</td>
<td>$540,000</td>
</tr>
<tr>
<td>Inflation in sales price</td>
<td>IS%</td>
<td></td>
<td>6%</td>
</tr>
<tr>
<td>Labor costs</td>
<td>LABOR</td>
<td>180,000</td>
<td>203,000</td>
</tr>
<tr>
<td>Inflation in labor costs</td>
<td>IL%</td>
<td></td>
<td>7%</td>
</tr>
<tr>
<td>Energy costs</td>
<td>ENER</td>
<td>9,000</td>
<td>10,000</td>
</tr>
<tr>
<td>Inflation in energy costs</td>
<td>IE%</td>
<td></td>
<td>2%</td>
</tr>
<tr>
<td>Material costs</td>
<td>PARTS</td>
<td>210,000</td>
<td>230,000</td>
</tr>
<tr>
<td>Inflation in material costs</td>
<td>IP%</td>
<td></td>
<td>12%</td>
</tr>
<tr>
<td>Capital costs</td>
<td>CAPIT</td>
<td>41,000</td>
<td>38,000</td>
</tr>
<tr>
<td>Inflation in capital costs</td>
<td>IC%</td>
<td></td>
<td>1%</td>
</tr>
</tbody>
</table>

**Part 1.** What is the productivity index for the base year?

Display the MRIN equation menu.

**Keys:**

**Display:**

- CLEAR DATA

**Description:**

Clears MRIN variables.

---

* By definition, inflation in the base year is zero.
<table>
<thead>
<tr>
<th></th>
<th>SALES</th>
<th>LABOR</th>
<th>ENER</th>
<th>PARTS</th>
<th>CAPIT</th>
<th>MRIN</th>
</tr>
</thead>
<tbody>
<tr>
<td>480000</td>
<td>480,000.00</td>
<td>180000</td>
<td>180,000.00</td>
<td>9000</td>
<td>9,000.00</td>
<td>1.09</td>
</tr>
<tr>
<td>210000</td>
<td>210,000.00</td>
<td>41000</td>
<td>41,000.00</td>
<td>540000</td>
<td>540,000.00</td>
<td>1.15</td>
</tr>
<tr>
<td>6</td>
<td>6.00</td>
<td>203000</td>
<td>203,000.00</td>
<td>7</td>
<td>7.00</td>
<td>1.00</td>
</tr>
<tr>
<td>230000</td>
<td>230,000.00</td>
<td>38000</td>
<td>38,000.00</td>
<td>1</td>
<td>1.00</td>
<td></td>
</tr>
</tbody>
</table>

Stores known values.
Calculates productivity index for base year.
Stores productivity index in register 0.
Stores sales, costs, and inflation rates for base year plus one.
Calculates productivity index.
Stores productivity index in register 1.
Displays MAIN menu.
Displays %CHG menu.
Stores new and old indexes.
Calculates percent change in the productivity index.

* On the HP-27S, press %CHG instead of MAIN BUS %CHG.
Productivity rose 5.5%. If you are interested in breaking this information down, use the single resource index equation (SRIN) to calculate partial indexes, such as sales divided by labor or sales divided by material.

**Entering and Using the SRIN Equation:**

1. Enter the SRIN equation into the Solver.
   
   \[
   SRIN = \frac{SALES}{1+IS\%+100} \div \left( \frac{INPT}{1+II\%+100} \right)
   \]

2. Display the SRIN equation menu.

3. Store or calculate the following variables:
   
   ■ Partial productivity index in \[\text{SRIN}\].
   ■ Sales in dollars in \[\text{SALES}\].
   ■ Inflation in product prices as a percentage in \[IS\%\] (must be 0 for base year).
   ■ Dollar value of your input variable (labor, energy, materials, or capital) in \[\text{INPT}\].
   ■ Inflation in input variable as a percentage in \[II\%\] (must be 0 for base year).

**Example.** Calculate partial indexes with labor as the input variable, and find the percent change. Sales for the base period was $480,000; for the base period plus one, $540,000. Labor costs for the base period were $180,000; for the base period plus one, $203,000. Inflation rate in prices was 6%. Inflation rate in labor costs was 7%.

Display the SRIN equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>CLEAR DATA</td>
<td>SALES = 480,000.00</td>
<td>Clears SRIN variables.</td>
</tr>
<tr>
<td>480000</td>
<td>SALES = 480,000.00</td>
<td>Stores sales for base period.</td>
</tr>
</tbody>
</table>
180000 \(\equiv\) INPT \(\equiv\) INPT = 180,000.00 Stores labor costs for base period.

SRIN \(\equiv\) SRIN = 2.67 Calculates partial index for base period.

STO 0 Stores partial index in register 0.

540000 \(\equiv\) SALES \(\equiv\) SALES = 540,000.00 Stores sales for base period plus one.

6 \(\equiv\) IS\% \(\equiv\) IS\% = 6.00 Stores inflation in prices for base year plus one.

203000 \(\equiv\) INPT \(\equiv\) INPT = 203,000.00 Stores labor costs for base period plus one.

7 \(\equiv\) II\% \(\equiv\) II\% = 7.00 Stores inflation in labor costs for base plus one.

SRIN \(\equiv\) SRIN = 2.69 Calculates partial index for base plus one.

STO 1 Stores partial index in register 1.

\[\begin{align*}
\text{MAIN}^* & \quad \text{Displays MAIN menu.} \\
\text{BUS} & \quad \text{Displays %CHG menu.} \\
\text{RCL} 1 \text{ NEW} & \quad \text{NEW} = 2.69 \quad \text{Stores new and old indexes.} \\
\text{RCL} 0 \text{ OLD} & \quad \text{OLD} = 2.67 \\
\text{%CH} & \quad \text{%CHANGE} = 0.69 \quad \text{Calculates percent change in labor productivity.}
\end{align*}\]

Labor productivity rose .69\% from the base year to base year plus one. Inflation in labor costs was 7\% (from the table on page 104). According to these figures, improving labor productivity is an area that needs attention.

* On the HP-27S, press \[\text{\%CHG}\], instead of \[\text{MAIN \ BUS \ %CHG}\].
Depreciation, NPV, and IRR% Calculations on the HP-27S
Depreciation Calculations on the HP-27S

Four methods of depreciation are included in this section: straight-line, sum-of-the-years’ digits, declining-balance, and Accelerated Cost Recovery System.

Note for straight-line, sum-of-the-years’-digits, and declining-balance depreciation: If the number of months in the first calendar year is less than 12, the amount of depreciation in the first year and last year will be less than a full year’s depreciation. The actual number of years that depreciation will occur is equal to the life plus one. For example, a drill has a life of three years and is purchased three months before year end. The following time diagram shows that depreciation will occur over four calendar years.

<table>
<thead>
<tr>
<th>Year 1</th>
<th>Year 2</th>
<th>Year 3</th>
<th>Year 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

3-Year Life

Straight-Line Depreciation

Entering and Using the SL Equation:

1. Enter the SL equation into the Solver.
   \[
   SL = \frac{(BASIS - SALV)}{LIFE \times #MO / 12}
   \]

2. Display the SL equation menu.

3. Store the following variables:
   - Depreciable cost basis of the asset at acquisition in BASIS.
   - Salvage value in SALV.
   - Useful life expectancy in LIFE.
   - Number of months in the year that you depreciate the asset in #MO.

4. Press SL to calculate the straight-line depreciation on the asset for the year.
Example 1: Part 1. On September 1, your company purchased a machine for $10,000. Its useful life is five years, and the salvage value is $500. There are four months remaining in the first year. Calculate the depreciation for the first year.

Display the SL equation menu.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>10000 BASIS</td>
<td>BASIS = 10,000.00</td>
<td>Stores book value.</td>
</tr>
<tr>
<td>500 SALV</td>
<td>SALV = 500.00</td>
<td>Stores salvage value.</td>
</tr>
<tr>
<td>5 LIFE</td>
<td>LIFE = 5.00</td>
<td>Stores useful life.</td>
</tr>
<tr>
<td>4 #MO</td>
<td>#MO = 4.00</td>
<td>Stores number of months in the year asset is depreciated.</td>
</tr>
<tr>
<td>SL</td>
<td>SL = 633.33</td>
<td>Calculates straight-line depreciation for year one.</td>
</tr>
</tbody>
</table>

Part 2. Calculate the depreciation for years two, three, four, and five.

<table>
<thead>
<tr>
<th>Keys</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>12 #MO</td>
<td>#MO = 12.00</td>
<td>Stores number of months asset is depreciated.</td>
</tr>
<tr>
<td>SL</td>
<td>SL = 1,900.00</td>
<td>Calculates straight-line depreciation for years two, three, four, and five.</td>
</tr>
</tbody>
</table>

Part 3. Calculate the depreciation for year six. The remaining depreciable life is eight months.
Sum-of-the-Years’-Digits Depreciation

Entering and Using the SOYD Equation:

1. Enter the SOYD equation into the Solver.*

\[
SOYD = \text{IF} (YR\# = 1; \#MO; 12 \times (LIFE - \#MO \div 12 - YR\# + 2) \div LIFE) \times (BASIS - SALV) \div (6 \times LIFE + 6)
\]

2. Display the SOYD equation menu.

3. Store the following variables:
   - Year number in \#YR\#.
   - Number of months in the year that you depreciate the asset in \#MO.
   - Useful life expectancy in \#LIFE.
   - Depreciable cost basis of the asset at acquisition in \#BASIS.
   - Salvage value in \#SALV.

4. Press \#SOYD\# to calculate the depreciation for the year.

Example 2. On May 1, you purchased an asset for $25,000, with a useful life of 10 years and a $1,500 salvage value. There are eight months remaining in the first year. Calculate the depreciation for the first three years.

Display the SOYD equation menu.

---

* To key in : on the HP-17B and HP-27S, press WXYZ MORE \\ \\ .
<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 YR#</td>
<td>YR# = 1.00</td>
<td>Stores year number.</td>
</tr>
<tr>
<td>8 #MO</td>
<td>#MO = 8.00</td>
<td>Stores number of months in the first year asset is depreciated.</td>
</tr>
<tr>
<td>10 LIFE</td>
<td>LIFE = 10.00</td>
<td>Stores useful life.</td>
</tr>
<tr>
<td>25000 BASIS</td>
<td>BASIS = 25,000.00</td>
<td>Stores book value.</td>
</tr>
<tr>
<td>1500 SALV</td>
<td>SALV = 1,500.00</td>
<td>Stores salvage value.</td>
</tr>
<tr>
<td>=SOYD</td>
<td>SOYD = 2,848.48</td>
<td>Calculates depreciation for year one.</td>
</tr>
<tr>
<td>2 YR#</td>
<td>YR# = 2.00</td>
<td>Stores year number.</td>
</tr>
<tr>
<td>=SOYD</td>
<td>SOYD = 3,987.88</td>
<td>Calculates depreciation for year two.</td>
</tr>
<tr>
<td>3 YR#</td>
<td>YR# = 3.00</td>
<td>Stores year number.</td>
</tr>
<tr>
<td>=SOYD</td>
<td>SOYD = 3,560.61</td>
<td>Calculates depreciation for year three.</td>
</tr>
</tbody>
</table>

Declining-Balance Depreciation

Entering and Using the DB Equation:

1. Enter the $DB$ equation into the Solver.

   \[ DB = BASIS \times \left( \frac{FACT\%}{100 \times LIFE} \right) \times #MO \div 12 \]

2. Display the $DB$ equation menu.

3. Store the following variables:
   - Depreciable cost basis of the asset in BASIS.
   - Declining-balance factor as a percent in FACT%.
   - Usefull life expectancy in LIFE.
   - Number of months in the year that you depreciate the asset in #MO.

4. Press DB to calculate the depreciation for the first year.
5. For subsequent years, change #MO to 12, subtract the depreciation from the remaining depreciable cost basis, and store the new value by pressing [STO] - BASIS. Repeat step 4 to calculate depreciation for the next year.

Example 3. On September 1, you purchase a machine for $50,000. This machine has a six-year life. There are four months remaining in the first year. Calculate the depreciation for the first three years using a declining-balance factor of 150%.

Display the DB equation menu.

<table>
<thead>
<tr>
<th>Keys:</th>
<th>Display:</th>
<th>Description:</th>
</tr>
</thead>
<tbody>
<tr>
<td>50000 BASIS</td>
<td>BASIS = 50,000.00</td>
<td>Stores book value.</td>
</tr>
<tr>
<td>150 FACT%</td>
<td>FACT% = 150.00</td>
<td>Stores declining-balance factor.</td>
</tr>
<tr>
<td>6 LIFE</td>
<td>LIFE = 6.00</td>
<td>Stores useful life.</td>
</tr>
<tr>
<td>4 #MO</td>
<td>#MO = 4.00</td>
<td>Stores number of months in the year asset is depreciated.</td>
</tr>
<tr>
<td>DB</td>
<td>DB = 4,166.67</td>
<td>Calculates depreciation for year one.</td>
</tr>
<tr>
<td>STO BASIS</td>
<td>DB = 4,166.67</td>
<td>Calculates and stores remaining book value.</td>
</tr>
<tr>
<td>12 #MO</td>
<td>#MO = 12.00</td>
<td>Stores number of months in the year asset is depreciated.</td>
</tr>
<tr>
<td>DB</td>
<td>DB = 11,458.33</td>
<td>Calculates depreciation for year two.</td>
</tr>
<tr>
<td>STO BASIS</td>
<td>DB = 11,458.33</td>
<td>Calculates and stores remaining book value.</td>
</tr>
<tr>
<td>DB</td>
<td>DB = 8,593.75</td>
<td>Calculates depreciation for year three.</td>
</tr>
</tbody>
</table>
Accelerated Cost Recovery System

Tables are typically used to find the appropriate ACRS recovery percentage. (Refer to Internal Revenue Service Publication 534 on Depreciation for the ACRS tables.) The percentage varies with the life of the investment and when the investment was made. The equation below determines the depreciation amount based on your input of the recovery percentages.

The cost recovery deduction is equal to the original book value times the ACRS percentage from the appropriate table. The basis value need not be reduced by the salvage value.

**Entering and Using the ACRS Equation:**

1. Enter the ACRS equation into the Solver.
   
   \[ \text{ACRS} = \text{ACRS}\% \div 100 \times \text{BASIS} \]

2. Display the ACRS equation menu.

3. Store the following variables:
   
   - Recovery percentage from the table in \[ \text{ACRS}\% \].
   - Depreciable cost basis of the asset at acquisition in \[ \text{BASIS} \].

4. Press \[ \text{ACRS} \] to calculate the depreciation for the period.

**Example 4.** A piece of equipment was purchased for $13,950 in 1986. Find the depreciation for the equipment’s five-year life. The recovery percentages for years 1 through 5 are 20%, 32%, 24%, 16%, and 8%.

Display the ACRS equation menu.
### Keys:

<table>
<thead>
<tr>
<th>Key Combination</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>13950 BASIS</td>
<td>Stores book value.</td>
</tr>
<tr>
<td>20 ACRS%</td>
<td>Stores recovery percentage for year one.</td>
</tr>
<tr>
<td>ACRS</td>
<td>Calculates depreciation for year one.</td>
</tr>
<tr>
<td>32 ACRS%</td>
<td>Stores recovery percentage for year two.</td>
</tr>
<tr>
<td>ACRS</td>
<td>Calculates depreciation for year two.</td>
</tr>
<tr>
<td>24 ACRS%</td>
<td>Stores recovery percentage for year three.</td>
</tr>
<tr>
<td>ACRS</td>
<td>Calculates depreciation for year three.</td>
</tr>
<tr>
<td>16 ACRS%</td>
<td>Stores recovery percentage for year four.</td>
</tr>
<tr>
<td>ACRS</td>
<td>Calculates depreciation for year four.</td>
</tr>
<tr>
<td>8 ACRS%</td>
<td>Stores recovery percentage for year five.</td>
</tr>
<tr>
<td>ACRS</td>
<td>Calculates depreciation for year five.</td>
</tr>
</tbody>
</table>

### Display:

<table>
<thead>
<tr>
<th>Key Combination</th>
<th>Display</th>
</tr>
</thead>
<tbody>
<tr>
<td>BASIS</td>
<td>BASIS = 13,950.00</td>
</tr>
<tr>
<td>ACRS%</td>
<td>ACRS% = 20.00</td>
</tr>
<tr>
<td>ACRS</td>
<td>ACRS = 2,790.00</td>
</tr>
<tr>
<td>ACRS%</td>
<td>ACRS% = 32.00</td>
</tr>
<tr>
<td>ACRS</td>
<td>ACRS = 4,464.00</td>
</tr>
<tr>
<td>ACRS%</td>
<td>ACRS% = 24.00</td>
</tr>
<tr>
<td>ACRS</td>
<td>ACRS = 3,348.00</td>
</tr>
<tr>
<td>ACRS%</td>
<td>ACRS% = 16.00</td>
</tr>
<tr>
<td>ACRS</td>
<td>ACRS = 2,232.00</td>
</tr>
<tr>
<td>ACRS%</td>
<td>ACRS% = 8.00</td>
</tr>
<tr>
<td>ACRS</td>
<td>ACRS = 1,116.00</td>
</tr>
</tbody>
</table>

### Description:

- Stores book value.
- Stores recovery percentage for year one.
- Calculates depreciation for year one.
- Stores recovery percentage for year two.
- Calculates depreciation for year two.
- Stores recovery percentage for year three.
- Calculates depreciation for year three.
- Stores recovery percentage for year four.
- Calculates depreciation for year four.
- Stores recovery percentage for year five.
- Calculates depreciation for year five.
Net Present Value and Internal Rate of Return on the HP-27S

A common decision in business is choosing between two alternative investments. One way of evaluating investment alternatives is to use net present value or internal rate of return.

Included in this section are two equations for calculating net present value or internal rate of return on a series of cash flows occurring at regular intervals for a given interest (discount) rate. One equation is for cash flows (money paid out or received) that do not repeat. These are called ungrouped cash flows. The second equation is for cash flows that do repeat. These are called grouped cash flows.

The internal rate of return is the interest (discount) rate at which the net present value of the cash flows equals zero. You calculate the internal rate of return by storing 0 as the net present value (NPV) and then solving for the interest rate (I%).

The cash flows are stored in a STAT list. Money paid out is stored as a negative number; money received is stored as a positive number. (For more information about cash flows and sign conventions, refer to the HP-27S owner's manual.) Be sure to name the STAT list with the same name used in the Solver equation. The examples in this section use FLOWS as the list name. You can change the name in the equation to something other than FLOWS, if you wish.

To create a cash-flow list, be sure your cash flows are occurring at regular intervals and at the end of each period. * If a period is skipped, enter zero for its cash flow.

* If the cash flows occur at the beginning of each period, then combine the first flow with the initial flow (which can increase or decrease the flow), and move each cash flow up one period. Remember, a payment made at the beginning of period 2 is equivalent to the same payment made at the end of period 1, and so on.
If your cash flows are ungrouped, use the UNGROUPED equation, and store the cash flows in ungrouped format in a STAT list. The initial cash flow is stored in \textit{ITEM(1)}, the second cash flow is stored in \textit{ITEM(2)}, the third cash flow is stored in \textit{ITEM(3)}, and so on.

If your cash flows are grouped, use the GROUPED equation, and store the cash flows in pairs, or grouped format, in a STAT list. The data for each group is stored by entering two numbers. The first number is the cash flow amount, and the second is the number of cash flows in that group. \textit{ITEM(1)} contains the cash flow amount for the first group, \textit{ITEM(2)} contains the number of consecutive times it occurs, \textit{ITEM(3)} contains the cash flow amount for the next group, \textit{ITEM(4)} contains the number of consecutive times it occurs, and so on.

\textbf{Ungrouped Cash Flows}

In a series of ungrouped cash flows, each flow is different from the one before it. Each flow occurs one time.

\begin{center}
\begin{tikzpicture}
\begin{axis}[
width=\textwidth,
axis lines=left,
axis x line=bottom,
axis y line=left,
axis x style={->},
axis y style={-},
xtick={1,2,3,4,5,6,7,8},
xticklabels={1,2,3,4,5,6,7,8},
ytick={200,100,300,200,0,-50,125},
yticklabels={$\$200$,$\$100$,$\$300$,$\$200$,$\$0$,$\$-50$,$\$125$},

\node[below] at (axis cs:0,-700) {$\textit{FLOW(0)} =$\$-700$};
\node[above] at (axis cs:4,50) {$\#\text{TIMES} = 1$};

\foreach \i in {1,...,8} {
\node[below] at (axis cs:\i,-700) {$\textit{FLOW(\i)}$};
\draw[->,thick] (axis cs:\i,50) -- (axis cs:\i,-700);}
\end{axis}
\end{tikzpicture}
\end{center}
The horizontal timeline is divided into equal compounding periods. The vertical lines represent the cash flows. For money received, the line points up (positive); for money paid out, the line points down (negative). In this case, the investor has invested $700. This investment has generated a series of cash flows, starting at the end of the first period. Notice that there is no cash flow (a cash flow of zero) for period five, and that the investor pays a small amount in period six.

**Entering and Using the UNGROUPED Equation:**

1. Enter the UNGROUPED equation into the Solver. * FLOWS is the name of the STAT list in which you will store the cash flows.
   
   \[
   \text{UNGROUPED: } \sum (J:1:SIZES(\text{FLOWS}):1:\text{ITEM(\text{FLOWS}:J)} \times \text{SPPV(I%:J-1)}) = \text{NPV}
   \]

2. Enter all the cash flows into a STAT list. Name the list FLOWS, the same name used in the Solver equation.

3. Display the UNGROUPED equation menu.

4. To calculate net present value (NPV):
   - Store the periodic interest rate in \(1\%\).
   - Press \(\text{NPV}\) to calculate the net present value.

5. To calculate internal rate of return (IRR%):
   - Store zero in \(\text{NPV}\).
   - Press \(1\%\) to calculate the internal rate of return.

**Example 1.** You want to purchase a punch press machine. Machine A has a larger initial investment, but has lower upkeep expenses and a positive salvage value. Machine B costs less initially, but upkeep is more costly, and the salvage value is negative. You want to compare the two equipment options.

---

* To key in: on the HP-17B and HP-27S, press \(WXYZ\) \(\text{OTHER}\) \(\Sigma\). To key in \(\Sigma\), press \(WXYZ\) \(\text{OTHER}\) \(\text{MORE}\) \(\Sigma\).
The table below lists the projected costs for the two machines over their five-year lives, summarizing the initial flows, the cash flows during the five years, and the difference between the two options (net cash flows).

<table>
<thead>
<tr>
<th></th>
<th>A</th>
<th>B</th>
<th>A-B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial Investment</td>
<td>$-250,000</td>
<td>$-170,000</td>
<td>$-80,000</td>
</tr>
<tr>
<td>Cost in year 1</td>
<td>-12,000</td>
<td>-17,000</td>
<td>5,000</td>
</tr>
<tr>
<td>Cost in year 2</td>
<td>-35,000</td>
<td>-39,500</td>
<td>4,500</td>
</tr>
<tr>
<td>Cost in year 3</td>
<td>-45,000</td>
<td>-50,500</td>
<td>5,500</td>
</tr>
<tr>
<td>Cost in year 4</td>
<td>-12,000</td>
<td>-16,000</td>
<td>4,000</td>
</tr>
<tr>
<td>Cost in year 5</td>
<td>100,000</td>
<td>-15,000</td>
<td>115,000</td>
</tr>
</tbody>
</table>

The column headed A-B is treated as the investment in a net present value or internal rate of return calculation. If the investment is attractive (NPV is positive, or IRR% is greater than required), it is better to spend the additional $80,000 on machine A and get the benefit of the lower maintenance costs and the salvage value. If the investment is not attractive (NPV is negative or IRR% is less than required), it is better to buy machine B and to bear the higher maintenance costs each year.

Enter the data into the STAT list. Name the list FLOWS. Then use the UNGROUPED equation to calculate the NPV and IRR% to determine which machine should be purchased. (Note that this is a conventional series of cash flows, which means that the cash flows change sign only once.) The required rate of return is 10.5%.

Display the STAT menu.
### Keys: Display: Description:

- **MODES**  *FIX* 2  
- **INPUT**  
- **CLEAR DATA**  
- **YES**  
- **GET**  *NEW*  
- **ITEM(1) = ?**  
- **ITEM(2) = ?**  
- **ITEM(3) = ?**  
- **ITEM(4) = ?**  
- **ITEM(5) = ?**  
- **ITEM(6) = ?**  
- **ITEM(7) = ?**  
- **NAME**  
- **FLOWS**  

Sets display to two places.
Clears current list or gets a new one.
Stores the initial cash flow.
Stores cash flow for year one.
Stores cash flow for year two.
Stores cash flow for year three.
Stores cash flow for year four.
Stores cash flow for year five.
Names the list.

Display the UNGROUPED equation menu.

### Keys: Display: Description:

- **NPV**  
- **NPV = 0.00**  
- **I%**  
- **I% = 11.93**  
- **I% = 10.50**  

Stores net present value.
Calculates internal rate of return.
Stores requires return.

---

* The Solver searches for an iterative solution and displays intermediate estimates.
Option A is the better choice because $NPV$ is positive. The $I\%$ calculation tells you the same thing— that because $I\%$ is more than the required $10\%$, option A is the better choice.

**Grouped Cash Flows**

Consecutive, equal cash flows are called grouped cash flows. The series shown below is grouped into two sets of consecutive, equal cash flows:

After an initial payment of $100, the investor pays $100 at the end of periods one through five, and $200 at the end of periods six through eight. The investment returns $1,950 at the end of period nine.
Entering and Using the GROUPED Equation:

1. Enter the GROUPED equation into the Solver. *FLOWS is the name of the STAT list in which you will store the cash flows.

\[
\text{GROUPED}: \sum(J:2:SIZES(FLOWS):2:\text{ITEM}(FLOWS:J-1) \times \text{USPV}(I\%:\text{ITEM}(FLOWS:J)) \times \text{SPPV}(I\%:\sum(L:2:J-2:2:\text{ITEM}(FLOWS:L))-1)) = \text{NPV}
\]

2. Enter all the cash flows into a STAT list. For each cash flow group, enter the cash flow amount as one item, then the number of cash flows in that group as the next item. Name the list FLOWS, the name used in the Solver equation.

3. Display the GROUPED equation menu.

4. To calculate net present value (NPV):
   - Store the periodic interest rate in \( I\% \).
   - Press \( \text{NPV} \) to calculate the net present value.

5. To calculate internal rate of return (IRR%):
   - Store zero in \( \text{NPV} \).
   - Press \( I\% \) to calculate the internal rate of return.

Example 2. You have the following investment opportunity. The cash flows occur quarterly.

Your initial investment: \$20,000
Quarterly payments you receive:
- 4 at \$500
- 4 at \$1,000
- 4 at \$2,000
- 4 at \$3,000

* To key in: on the HP-17B and HP-27S, press \( \text{WXZY} \ \text{OTHER} \ \Sigma \). To key in \( \Sigma \), press \( \text{WXZY} \ \text{OTHER} \ \text{MORE} \ \text{D} \).
Enter the data into the STAT list as cash flow groups. Name the list *FLOWS*. Then use the GROUPED equation to calculate the annual internal rate of return for this investment (I%×4).

Display the STAT menu.

**Keys:**

- **MODES**
- **FIX 2**
- **INPUT**
- **CLEAR DATA**
- **YES**
- **YES**
- **GET**
- **NEW**
- **INPUT**

**Display:**

- ITEM(1) = ?
- ITEM(2) = ?
- ITEM(3) = ?
- ITEM(4) = ?

**Description:**

- Sets display to two places.
- Clears current list or gets a new one.
- Stores the initial cash flow.
- Stores number of times initial cash flow occurs.
- Stores first grouped cash flow.

---

5: NPV and IRR% on the HP-27S 123
4 [INPUT] ITEM(5) = ? Stores number of times cash flow occurs.
1000 [INPUT] ITEM(6) = ? Stores second grouped cash flow.
4 [INPUT] ITEM(7) = ? Stores number of times cash flow occurs.
4 [INPUT] ITEM(9) = ? Stores number of times cash flow occurs.
3000 [INPUT] ITEM(10) = ? Stores fourth grouped cash flow.
4 [INPUT] ITEM(11) = ? Stores number of times cash flow occurs.

EXIT [NAME] FLOWS
INPUT

Names the list FLOWS.

Display the GROUPED equation menu.

**Keys:**

<table>
<thead>
<tr>
<th></th>
<th><strong>Display:</strong></th>
<th><strong>Description:</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>0 [NPV]</td>
<td>NPV = 0.00</td>
<td>Stores net present value.</td>
</tr>
<tr>
<td>1%</td>
<td>I% = 2.43*</td>
<td>Calculates quarterly internal rate of return.</td>
</tr>
<tr>
<td>× 4 =</td>
<td>9.72</td>
<td>Calculates annual internal rate of return.</td>
</tr>
</tbody>
</table>

* The Solver searches for an iterative solution and displays intermediate estimates.
Notes on Internal Rate of Return Calculations
When calculating the internal rate of return, the Solver searches iteratively for a solution. This process may take a relatively long time, sometimes several minutes. To interrupt the calculation, press any key.

Storing guesses can help the Solver find the desired solution more quickly. To store two guesses, key in the first guess and press \( \frac{1}{=} \). Key in the second guess and press \( \frac{1}{=} \), and then press \( \frac{1}{=} \) again to calculate the result.

For a "conventional investment," only one solution exists. A conventional investment means that the sequence of cash flows changes sign only once, and the sum of the cash flows is positive.

Cash flows that do not meet the conventional investment criteria can be more complex because there may be more than one mathematical solution to the problem, or there may be no solution. In these situations, storing initial guesses is important.

For more information, refer to an HP-17B or HP-19B owner’s manual.
More Step-by-Step Solutions for Your HP-17B, HP-19B, or HP-27S Calculator

These additional books offer a variety of examples and keystroke procedures to help set up your calculations the way you need them.

Practical routines show you how to use the built-in menus to solve problems more effectively, while easy-to-follow instructions help you create personalized menus.

Real Estate, Banking, and Leasing (00017-90019)
- Use the TVM menu for real estate, banking, and leasing calculations.
- Calculate the annual percentage rate of a loan with fees.
- Calculate discounted, adjustable-rate, and bi-weekly mortgages.
- Develop menus for graduated-payment and wrap-around mortgages.
- Estimate monthly payments and mortgage insurance.
- Use menus to calculate Rule of 78s, add-on loans, constant payment loans, loans with odd first periods, and leases with multiple payments in advance.
- Work with a variety of methods to evaluate savings plans.

Marketing and Sales (00017-90021)
- Forecast sales using moving averages, exponential growth curves, and linear regression.
- Determine price, mark-up, and profit.
- Estimate the financial feasibility of a new product.
- Estimate the elasticity of demand.
- Build a "quote maker" for accurate, on-the-spot quotes.
- Base a customized menu on your company’s commission scale to calculate your commission on a product.
Personal Investment and Tax Planning (00017-90022)

- Evaluate savings and IRA plans.
- Solve for funds available upon premature distribution from an IRA.
- Calculate basic mortgage components and the annual percentage rate of a loan.
- Evaluate your investment alternatives among life insurance, treasury bills, bonds, stocks, and mutual funds.
- Calculate the Beta of your portfolio, estimate your stock price volatility, target your gains, hedge with call options, and estimate margin account gain or loss.
- Determine your tax and inflation break-even point.

Technical Applications for the HP-27S or HP-19B (00027-90044)

- Learn two new functions for writing advanced Solver equations.
- Perform numerical integration and differentiation.
- Carry out complex number functions and vector operations.
- Find the greatest common divisors and least common multiples.
- Perform geometry functions, series expansions, matrix operations, factors and primes, and coordinate transformations.
Step-by-Step Solutions for Your
HP-17B, HP-19B, or HP-27S Calculator

This book contains a variety of examples, equations, and keystrokes to provide solutions for finance, accounting, and manufacturing professions.

- **Financial Management**
  - Break-Even Analysis
  - Forecasting Based on History
  - Simple Payback Period
  - Using NPV and IRR to Make Investment Decisions
  - Economic Ordering Quantity
  - Cost of Failing to Take a Cash Discount
  - Degree of Leverage
  - Cost of Capital
  - Rights Valuation

- **Financial Statement Analysis**
  - Return on Equity
  - Bond Interest Coverage Ratio
  - Price-to-Earnings Ratio
  - Return on Investment
  - Financial Statement Ratios

- **Cost Accounting and Auditing**
  - Overhead Application Rate
  - Labor, Material, and Overhead Variance
  - Selecting Random Numbers
  - Calculating the Standard Normal Variate
  - Estimating Inventory Value Using Random Sampling

- **Production and Inventory Analysis**
  - Priority Scheduling Rule
  - Daily Production Rate
  - Predicting Labor Hours Using Learning Rates
  - Forecasting Manufacturing Rates of Accessories
  - Estimating Inventory Availability
  - Replacing Equipment
  - Estimating Inventory Investment Versus Expected Shipment Dollars
  - Evaluation of Costs Associated With Seasonal or Perishable Inventory
  - Manufacturing Strategy Analysis
  - Work Sample Survey Size
  - Productivity Measurements

- **Depreciation, NPV, and IRR Calculations on the HP-27S**
  - Depreciation Calculations on the HP-27S
  - Net present Value and Internal Rate of Return on the HP-27S

* This procedure cannot be used on the HP-17B.