



HP-12C
Leasing Application
Handbook

HEWLETT-PACKARD

HP-12C
LEASING
APPLICATIONS HANDBOOK

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HP-12C

Leasing Applications Handbook

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December 1982

00012-90021

Printed in U.S.A.

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Introduction

Getting Started

A prospect tells you that a used piece of equipment that will serve his needs is available to him under a 48 month lease with one payment in advance and no residual value. The monthly lease payment for this lease is \$420.

You have a comparable piece of equipment valued at \$14,000 and you need a return of 2% per month. Can you structure a proposal with similar terms, but which will include a residual value and also have a lower monthly payment, say \$400 per month?

The following keystrokes on your HP-12C will start you on the way.

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
9 BEG		Sets payments to beginning of period.
48 n	48.00	Lease period in months.
2 i	2.00	Your required return.
14000 CHS PV	-14,000.00	Value of equipment.
400 PMT	400.00	Proposed lease payment.
FV	3,842.75	Residual value.

The residual value of \$3,842.75 is the amount which you must receive at the end of 48 months under the given conditions to produce a return of 2% per month compounded. In other words: at 2% interest compounded monthly, \$14,000 now is equivalent to a promise of 48 payments of \$400 paid at the beginning of each month plus \$3,842.75 paid at the end of 48 months.

Your HP-12C and this handbook will provide answers to many questions like the one above. For instance, you may need to calculate the yield on a proposed or existing lease, or you may wish to calculate what a particular payment must be. Also, you may want to compare leasing with buying as alternative ways of acquiring the use of equipment. All

of these types of problems, as well as many others, are explained and solved in the following pages, and every application includes a fully worked-out solution to an example problem.

Purpose of the Handbook

This handbook was designed and written for the professional practitioner in the leasing industry and the applications solve real problems drawn from today's active financial markets. This is a practical applications handbook, not a textbook about leasing. The presentation of the applications is organized to proceed from the simpler techniques and types of applications to the more complex, but there will be no discussion of which techniques are better than others. In most cases, your choice of method will depend on what information is available.

This handbook is not an instructional or reference manual for the HP-12C calculator. Refer to the *HP-12C Owner's Handbook and Problem-Solving Guide* for information on calculator operation. (That publication is referred to as the "owner's handbook" throughout this leasing handbook.) Section 1 of this leasing handbook contains a review of some of the features of the HP-12C that are most frequently used in the applications developed here. This handbook assumes, however, that you are either familiar with the operation of the HP-12C or are willing to spend some time with the owner's handbook to learn to use the features of the calculator that are used here.

About the Design of the Handbook

There are two significant design features incorporated into this handbook which you should be aware of.

Calculator Procedures Instead of Programs

All of the applications in this handbook are presented in the form of calculator procedures (keystroke procedures) rather than programs—although two of the procedures are also duplicated as programs. While a calculator program can help save time and keystroke errors, many of the applications here are not suited to a generalized program solution. The procedures will focus your attention on the process and concepts that are being developed—rather than the final result. Once you understand the principles involved, you will likely want to derive your own procedures and programs to customize the applications to your needs.

Focus on Concepts and Process

The step-by-step solutions given for each of the examples are designed to illustrate the concepts behind the process. Because of this emphasis on understanding the process, numbers which are carried from one step to the next are often reentered as rounded values so that the numerical results do not obscure the process. Once you are familiar with a particular procedure, you may chose to continue directly from one step to the next without reentering numbers from previous steps.

You should be aware that when you carry numbers from previous calculations rather than reentering them, the results you obtain will vary slightly from those obtained by following the procedure of reentering the numbers in each step. The variance occurs because the calculator stores results with 10 decimal digits of precision, while the handbook asks you to reenter numbers rounded to the nearest dollar. There are several exceptions to this practice, where you are invited to check a previous calculation for validity, and these instances will be clearly noted.

Organization of the Handbook

The topics covered by the five sections of this handbook have been selected to give broad coverage of the different types of problems that you might encounter in leasing applications. The five sections are organized as follows:

Section 1, "Basic Calculator Techniques in Leasing Applications," reviews eight basic techniques that are used throughout the handbook. You can use the material in that section for review or as a reference when working with the applications in other sections.

Section 2, "Yield Analysis," develops solution procedures for six different applications in which you calculate the yield on a lease.

Section 3, "Structuring Pretax Lease Payments," develops eight applications for calculating the lease payment, security deposit, or residual value needed to achieve a required yield. The applications include skipped payment as well as increasing payment type leases.

Section 4, "After-Tax Lease Payment Structuring," develops a complete procedure for determining the lease payment necessary to achieve a required yield on an after-tax basis. The section presents the solution as both a calculator procedure and a program procedure.

Section 5, "Lease Versus Buy Analysis," develops a complete calculator procedure using worksheets, for analyzing the lease or buy decision.

Using the Handbook

It is suggested that after you finish reading this introduction, you turn to section 1 and read the concepts presented there. If you feel the need for further review on some topic, refer to the indicated topic in the owner's manual.

When you are comfortable with the concepts discussed in section 1, skim through the rest of the handbook for solutions which fit your particular needs. When you find an application that you can use, read the description and work throught he example problem. Use the application on some of your own problems for which you know the expected result. You will soon gain the confidence to use the application for solving new problems. Once you become familiar with an application, you can easily modify it to more closely fit your own needs.

Technical Assistance

The keystroke procedures and program material are supplied with the assumption that the user has a working knowledge of the concepts and terminology used. Hewlett-Packard's technical support of this product is limited to explanations of operating procedures used in the handbook and verification of answers given in the examples. If you have technical problems when using this handbook, consult your *HP-12C Owner's Handbook and Problem-Solving Guide*. Should you need further assistance, you may write to:

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Section 1

Basic Calculator Techniques in Leasing Applications

While this handbook does not replace any other publication, several concepts and techniques originally presented in the HP-12C owner's or solutions handbooks are reviewed in this section and used in subsequent sections. Thus, before you proceed with sections 2 through 5, you should ensure that you understand these concepts and techniques. If you feel that you need more information than is provided here, refer to the earlier HP-12C publications.

The techniques and concepts presented in this chapter are:

- Using the cash flow sign convention.
- Calculating the sum of a column of signed numbers.
- Distinguishing between *pretax* dollars and *after-tax* dollars.
- Using the basic financial variables.
- Amortizing a loan.
- Internal Rate of Return (*IRR*) and Net Present Value (*NPV*) of grouped cash flows.
- Converting monthly interest rates to an equivalent annual or quarterly interest rate.
- Accelerated Cost Recovery System (ACRS) tax benefit.

The Cash Flow Sign Convention in Financial Calculations

The HP-12C financial functions use a convention that adds considerably to the power of the machine and, at the same time, is simple and is a useful way of thinking about cash flows for solving financial problems of all types. It is a convention that the user of the HP-12C must learn, because that is the way the machine operates. The convention is used consistently throughout this handbook. The full development of the convention is in section 3 of the owner's handbook.

The essence of the convention is quite simple:

1. Always think of a problem from either the lessee's point of view, or from the lessor's point of view.
2. Money paid out carries a negative sign, money received carries a positive sign.

In this handbook, negative numbers will always show the minus sign (−). Since the HP-12C's display uses the minus sign instead of parentheses, this handbook does *not* use parentheses to indicate negative numbers. Positive numbers will sometimes carry a plus sign (+), if emphasis or clarity is needed.

Example: A lessor buys equipment for \$50,000 and leases it at \$1,200 per month with a requirement of a security deposit of \$1,000 and two advance payments.

From the viewpoint of the lessor, the cash flows would be represented as \$−50,000 for the purchase of the equipment, \$+1,000 for the receipt of the security deposit, and \$+2,400 for the receipt of the advance payments. From the viewpoint of the lessee, the signs of the security deposit and the payments would be negative, that is \$−1,000 for the security deposit payment and \$−2,400 for the advance payments.

Nearly all of the examples in this handbook are structured from the viewpoint of the lessor. The primary exception is the final section on lease versus buy. In that section, the viewpoint is that of the lessee, but all money figures are viewed and discussed as costs, rather than cash flows. Thus, while a lease payment would be a negative cash flow to the lessee, it is a "positive" cost, and positive cash receipts are "negative" costs. This one violation of the cash flow sign convention is used to maintain consistency with the use of terms in the many articles and publications about the lease versus buy decision.

The explanations and techniques of this handbook do not use the cash flow time line diagrams that are used in the owner's handbook. The diagrams are very helpful, and you may wish to supplement the discussion in the following sections by drawing your own time line diagrams. However, because the procedures used here include many simple arithmetic examples, printing of the time line diagrams would become redundant and would obscure the development of the examples.

Calculating the Sum of a Column of Signed Numbers

The most frequent use of a calculator is to add and subtract numbers. This is also true in this handbook. Because of the use of the cash flow sign convention, you may find the following examples helpful.

Example 1: What is the sum of \$3,898 and \$2,643?

Keystrokes	Display	
3898 [ENTER]	3,898.00	Enter the first number.
2643 [+]	6,541.00	Enter second number and calculate the sum.

Example 2: To the sum in example 1 (still in the display of the machine), add \$-1,657.

It is important to note that the example asks you to *add* a negative number to another number. This can be accomplished in either of two ways:

Method A: (Presumes that 6,541.00 is still in the display from example 1.)

Keystrokes	Display	
	6,541.00	Display from Example 1.
1657 [-]	4,884.00	Enters 1657 and subtracts the positive number 1657 from 6,541.

Method B: (Presumes that 6,541.00 is still in the display from example 1.)

Keystrokes	Display	
	6,541.00	Display from Example 1.
1657 [CHS]	-1,657.	Enters 1657 and changes its sign to negative.
[+]	4,884.00	Adds the -1,657 to +6,541.

Both methods give the same result, as they must. The technique you use is a matter of convenience to you. In the sections to follow, many

of the steps will present a table of the signed cash flows that affect a decision. What is needed is the sum of the (signed) numbers. You should use a procedure that you are comfortable with. The following is an example of one procedure.

Example 3: The following is a list of cash flow items that make up the net cash flow at the inception of a lease. The cash flows carry the sign convention from the viewpoint of the lessor. What is the sum of the cash flows?

\$ - 110,000	Equipment cost.
- 1,500	Initial indirect costs.
+ 4,630	Pretax value of the security deposit.
+ 18,190	Pretax value of the investment tax credit.
+ 4,800	Advance lease payments.
- 200	Special license fee.
\$ - 84,080	Total net cash flow at inception.

Solution:

Keystrokes	Display	
110000 [CHS] [ENTER]	-110,000.00	Enters the equipment cost as a negative number.
1500 [-]	-111,500.00	Subtracts 1,500 from -110,000 (adds a negative 1,500 to a negative 110,000).
4630 [+]	-106,870.00	Adds 4,630.
18190 [+]	-88,680.00	Adds 18,190.
4800 [+]	-83,880.00	Adds 4,800.
200 [-]	-84,080.00	Adds a negative 200 to the sum (subtracts 200 from the sum) to give the grand total of -84,080

Straight arithmetic calculations are fully explained in section 1 of the owner's handbook. That discussion, along with the additional discussion of the automatic memory stack of the HP-12C in appendix A of the owner's handbook will help you develop many time saving and powerful calculating techniques for simple arithmetic problems.

Pretax Dollars and After-Tax Dollars

Children are told in grade school not to add apples and oranges. This simple concept extends to lease analysis—do not add values which are not comparable to one another. For example, if you receive an advance lease payment of \$500 and a security deposit of \$750, it is not completely accurate to simply add the two amounts together and say that the value of the amount received is \$1,250. It is true that you have received checks totaling \$1,250. But you, in turn, will probably have to pay taxes on the lease payment, whereas the security deposit is probably nontaxable. The point is that the *value* of the amount received depends on whether the amount is taxable or nontaxable and on whether your analysis is done on a pretax or after-tax basis.

In one instance, you may decide that your analysis must be performed on the dollar values before any taxes have been paid. In this handbook, the term *pretax* will be used for this case. Taxes are not ignored—as if they don't exist—instead, dollar amounts of all variables and factors are converted, as illustrated in the example below, to the equivalent pretax values. The term "pretax" should not be confused with "before-tax"—their meanings are quite different. Before-tax analysis implies that the tax environment, specifically income tax, is ignored and all calculations are made as if taxes did not exist.

On another occasion, you may decide that your analysis must be performed on the dollar values after taxes have been paid. In this handbook, the term *after-tax* will be used for this case. In this case, dollar amounts of all variables and factors are converted to the equivalent after-tax values.

This handbook has applications which are solved on both a *pretax* and an *after-tax* basis. The examples below illustrate how amounts can be converted to both pretax and after-tax equivalent values.

After-Tax Analysis

Example: A lease payment of \$1,200 is fully taxable to the lessor while the security deposit of \$700 is not taxable, and is expected to be returned to the lessee at the end of the lease term. If the lessor's tax bracket is 46%, express the lease payment and the security deposit on an *after-tax* basis.

Solution: The tax on the lease payment would be 46% of \$1,200 or \$552. Therefore the after-tax value of the lease payment is \$1,200-\$552, which can be expressed as:

$$\$1,200 \times (1 - .46) = \$1,200 \times .54 = \$648.$$

In general, for any pretax value, we have:

$$\text{Pretax Value} \times (1 - t) = \text{After-Tax Value}$$

where $(1 - t) = 1$ minus the decimal tax rate, t .

The security deposit is not taxable. After taxes are paid, it is still \$700. Thus, no adjustment of the nontaxable security deposit is required to express it on an after-tax basis.

The after-tax values to compare are \$648 for the lease payment and \$700 for the security deposit.

Pretax Analysis

Example: What taxable lease payment amount would be equivalent to a \$700 nontaxable security deposit if the lessor's tax bracket is 46%?

Solution: It is clear that a lease payment of \$700 would not be equivalent to the \$700 security deposit, since taxes will be paid on the lease payment. The solution to this problem lies in finding a value which, when reduced by the amount of taxes, will result in \$700. This value can be found in the following way:

$$\text{Pretax Value} = \frac{\text{After-Tax Value}}{(1 - t)} = \frac{\$700}{(1 - .46)} = \$1,296.30$$

The \$1,296 amount is the pretax value of a taxable value equivalent to a \$700 nontaxable security deposit.

In the examples in the following sections, if the analysis is on a pretax basis, both the dollar amount and its pretax equivalent will be given. Likewise, if the analysis is on an after-tax basis, both the dollar amount and its after-tax equivalent will be given. The calculations needed for the conversion will not be shown unless they are required for clarity.

Calculating the Basic Financial Variables

The five basic financial variables are used frequently in leasing applications and an understanding of their use and calculation is essential. In

leasing applications the five financial variables are used primarily for the following values.

- n* The number of periods over which a series of periodic payments occur.
- i* The periodic interest rate or the periodic rate of return as a percent.
- PV* The present value of a series of cash flows or the investment amount or the loan amount.
- PMT* The amount of the periodic payment in a series of cash flows.
- FV* The future value of a series of cash flows or the residual amount or the balloon amount.

The example presented at the beginning of the handbook was an illustration of the use of these five financial variables. It is very important that you be completely familiar with the use and calculation of the basic financial variables. You should study section 3 "Basic Financial Functions" in the owner's handbook if you are not comfortable with the use of these variables.

Amortizing a Loan to Principal and Interest

If a conventional loan of \$9,000 carries monthly payments of \$270 per month at 1.5% per month interest, each payment is first applied to the interest accrued on the loan during the preceding month, and the difference between the payment amount and the amount applied to interest is applied to reduction of the principal amount. The **AMORT** function of the HP-12C performs the amortization of the loan in this way. It can be used to develop the schedule of amortization over the term of the loan. It can also be used to calculate the imputed principal and interest portions of a capital lease. The full use of the **f AMORT** key is discussed in section 3 of the owner's handbook. The following example illustrates the basic use of the **f AMORT** function.

Example: Develop an amortization schedule for each of the first 3 months and then calculate the total amount applied to interest and to principal for the following 12 months. Assume that the loan amount is \$9,000, the payment amount is \$275, and the monthly interest rate is 1.5%.

Keystrokes	Display	
f CLEAR FIN		Clears financial registers.
9000 PV	9,000.00	Loan amount.
275 CHS PMT	-275.00	Payment amount (uses the sign convention from the borrower's point of view).
1.5 i	1.50	Monthly interest rate.
1 f AMORT	-135.00	Calculates the amount to interest for the first month.
x^y	-140.00	Amount of principal reduction in the first month.
1 f AMORT	-132.80	Calculates the amount to interest for the second month.
x^y	-142.10	Amount to principal reduction, second month.
1 f AMORT	-130.77	Amount to interest for the third month.
x^y	-144.23	Amount to principal reduction, third month.
12 f AMORT	-1,390.83	Total amount to interest over months 4 through 15.
x^y	-1,909.17	Amount by which the principal is reduced over months 4 through 15.
RCL PV	6,684.50	Remaining balance of the loan at the end of month 15.

Internal Rate of Return (IRR) and Net Present Value (NPV) of Grouped Cash Flows

In many of the leasing applications in the following sections, the series of lease payments and cash flows are not the same from one period to the next, they reflect an "uneven" series of cash flows. Several very powerful features of the HP-12C will be used to solve these problems. This set of features is called the "grouped uneven cash flow" functions.

They are **f** **IRR**, **f** **NPV**, **g** **CF0**, **g** **CFj**, and **g** **Nj**. These features are fully explained in section 4 of the owner's handbook.

Example 1: Calculate the capitalized value (the discounted value) of the irregular series of lease payments below using an interest rate of 2.25% per month.

Months	Payment
Advance	\$ 1,500
1,2,3	3,800
4-9	0
10	15,000
11-30	700
31-47	4,500

Solution: First, it is helpful to add two columns to the table above.

Months	Group (j)	Payment (CF _j)	No. of Pmts. (N _j)
Advance	0	1,500	1
1,2,3	1	3,800	3
4-9	2	0	6
10	3	15,000	1
11-30	4	700	20
31-47	5	4,500	17
			48

The first and third columns are duplicates from the first table above. The heading of the third column is *CF_j*, indicating that it is the cash flow (*CF*) for group *j*, with *j* being the number of the group (in the second column). The groups are numbered, beginning with the initial cash flow (the advance of \$1,500), as *CF₀*, then the three payments of \$3,800 as *CF₁*, and so forth down through *j* = 5 for which the cash flow is \$4,500. The fourth column, *N_j*, indicates the number of payments in that group: 1 payment for group 0, 3 payments for group 1, through 17 for group 5. The total number of payments (including the 6 skipped payments in months 4 through 9) is 48.

Second, use the cash flow keys to calculate the capitalized value:

Keystrokes	Display	
1500 g CF0	1,500.00	Stores the advance payment as the initial cash flow and initializes the grouped cash flow functions.
3800 g CF1	3,800.00	Cash flow for group 1.
3 g N1	3.00	Number of payments in group 1.
0 g CF2	0.00	Zero as the payment amount in the second group.
6 g Nj	6.00	Number of zero value payments.
15000 g CF3	15,000.00	Payment amount for group 3.
1 g Nj	1.00	Number of payments in group 3. (Refer to note 1 below.)
700 g CF4	700.00	Payment amount in group 4.
20 g Nj	20.00	Number of payments in group 4.
4500 g CF5	4,500.00	Payment amount for group 5.
17 g Nj	17.00	Number of payments in group 5.
2.25 i	2.25	Monthly interest rate.
f NPV	65,671.04	Calculates the net present value of the series of payments discounted at 2.25% per month.

Note: Leave the values from this example intact in the calculator as they will be required for the next example.

The capitalized value of this lease at 2.25% per month is \$65,671.04. The number just calculated is also called the net present value (NPV) of the cash flow series, discounted at 2.25% per month.

Note the following:

1. Look again at the keystrokes for entering the information for the third group (\$15,000, 1 payment). The HP-12C automatically enters "1" as the number of times a payment is made, unless you enter some other number using **[9] [N]**. So it was not necessary to perform the **1 [9] [N]** step here. It didn't hurt, but it was not necessary. Some HP-12C calculator users like to do it, just to make sure and to keep the procedure consistent and simple. Refer to section 4 of the owner's handbook for an explanation of this feature of the calculator.
2. It is essential that you begin the entire procedure by keying in some number (even zero) and pressing **[9] [Cf0]**. (In this example the procedure started with **1500 [9] [Cf0]**.) The **[9] [Cf0]** key does more than just store the initial cash flow, it also initializes the entire procedure.
3. The cash flow sign convention must be followed when the grouped cash flow functions are used. In this example, all payments are receipts to the lessor and considered before any taxes are paid, so all figures are positive. Most problems will have both positive and negative cash flows.
4. If you want to solve for the *yield* of a series of grouped, uneven cash flows, the procedure is identical to the one illustrated above except that the **[IRR]** function is used instead of the **[NPV]** function. The next example illustrates this function.
5. If you program your HP-12C, remember that using more than eight lines of program memory reduces the number of memory registers available for cash flow entries. If there are not enough registers available for the number of cash flows entered, **ERROR 6** is displayed. If this occurs, refer to appendix C, Error Conditions, in your *HP-12C Owner's Handbook and Problem-Solving Guide*.

Example 2: If the capitalized value of the series of lease payments in the previous example is \$75,000, what is the monthly yield?

Solution:

1. Calculate the initial cash flow at time "0" (group 0).

\$ -75,000	Capitalized value, use the sign convention.
1,500	Advance payment.
\$ -73,500	Total net initial cash flow.

2. Since the cash flow information is still in the calculator from the previous example, we will merely change the initial value in the calculator from \$1,500 to \$-73,500. This procedure is discussed fully in section 4 of the owner's handbook.

Keystrokes	Display	
73500 [CHS]	-73,500.	Negative initial value.
[STO] 0	-73,500.00	Stores \$-73,500 as the initial cash flow.
[I] [IRR]	1.70	Calculates the monthly yield as a percent. The calculator will blink "running" for about half a minute.

Converting Monthly Interest Rate to Equivalent Quarterly or Annual Rate

The month is the standard payment period that is used in the leasing applications in this handbook. However, occasionally a problem requires that annual or quarterly periodic payments be considered—for example annual license fees or quarterly tax payments. A decision must be made about how to handle the present value calculation of such cash flow series along with other payment series that are monthly.

Quarterly Payments

We will examine quarterly payments first. An example using annual payments begins on page 23.

Example: Consider quarterly tax payments of \$2,000 and monthly lease payments of \$1,500. The payment series will occur as illustrated in the following table. All payments are made at the end of the period.

Month	Quarter	Tax Payment	Lease Payment
1		\$ 0	\$1,500
2		0	1,500
3	1	2,000	1,500
4		0	1,500
5		0	1,500
6	2	2,000	1,500
7		0	1,500
8		0	1,500
9	3	2,000	1,500
10		0	1,500
11		0	1,500
12	4	2,000	1,500

What is the present value of each series if the discount rate is 2.25% per month?

Solution for the series of lease payments:

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
12 n	12.00	Number of months.
2.25 i	2.25	Monthly interest rate.
1500 CHS PMT	-1,500.00	Payment amount (using the sign convention).
PV	15,622.17	Calculates the present value of the series of 12 payments.

Solution for the quarterly tax payments:

It is important to make sure that all cash flows in a series are compared using the same time period. The basic period used in this handbook is the month.

There are two ways to calculate the present value of the quarterly tax payments on a basis equivalent to the monthly lease payments: 1) Grouped Uneven Cash Flow, and 2) Quarterly Interest. Both ways are shown below. Although either method can be used, applications in this handbook employ the second method.

Method A: (Using the grouped uneven cash flow functions.)

Keystrokes	Display	
0 g CF0	0.00	Initial cash flow of zero.
0 g CF1	0.00	First two payments of zero.
2 g N1	2.00	Number of payments of zero.
2000 g CF1	2,000.00	First quarterly payment.
0 g CF1	0.00	Zero payment for months 4 and 5.
2 g N1	2.00	Number of months.
2000 g CF1	2,000.00	Second quarterly payment.
0 g CF1	0.00	Zero as the payment for months 7 and 8.
2 g N1	2.00	Number of zero payments.
2000 g CF1	2,000.00	Third quarterly payment.
0 g CF1	0.00	Zero as the payment for months 10 and 11.
2 g N1	2.00	Number of zero payments.
2000 g CF1	2,000.00	Final quarterly payment.
2.25 i	2.25	Monthly rate of interest.
I NPV	6,789.28	Present value of the series of tax payments over 12 months.

This method leaves all of the payments in terms of payments per month, with zero paid for two months, followed by a payment of \$2,000 for the ending month of each quarter. The present value of this series is expressed in terms equivalent (months) to the lease payment series above.

Method B:

1. Calculate a quarterly interest rate that is equivalent to the monthly rate.

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Keystrokes	Display	
1 4		Sets the display to four decimal places.
1 ENTER	1.0000	
2.25 % +	1.0225	Calculates one plus the monthly required yield, not in percent form.
3 y^x	1.0690	Calculates the previous number raised to the third power.
1 – 100 x	6.9030	Calculates the quarterly equivalent % interest rate.

2. Use the equivalent quarterly rate to discount the quarterly payments.

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
4 n	4.0000	Number of quarters.
6.9030 i	6.9030	Equivalent quarterly rate.
2000 CHS PMT	-2,000.0000	Quarterly payment using the sign convention.
PV	6,789.2835	Calculates the present value of the series of four payments.

An incorrect solution:

It is incorrect merely to multiply the monthly rate by 3 to get a quarterly rate and then to discount the four quarterly payments at that rate. The error is shown by calculating the present value using this incorrect method and comparing it to the correct figure above.

Keystrokes	Display	
1 2		Resets display to two decimal places.
1 CLEAR FIN		Clears financial registers.
4 n	4.00	Number of quarters.
2.25 ENTER	2.25	Monthly rate.

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Keystrokes	Display	
3 x i	6.75	Multiplies the monthly rate by 3 and enters it as the quarterly interest rate.
2000 CHS PMT	-2,000.00	Enters the quarterly payment amount, using the sign convention.
PV	6,612.83	Calculates the present value.

Annual Payments

Annual payments are handled in a manner similar to quarterly payments.

Example: A particular lease program requires an annual license fee of \$500 to be paid at the end of each year. Other variables in this analysis will be expressed in monthly terms. What is the present value of the series of license fees if the term of the lease is 36 months and the monthly discount rate is 2.25%?

Solution: The key to this example is to recognize the relationship between the series of annual license fees and the other payments involved. The table below illustrates this relationship.

Months	License Payment	Other Payments
1	0	Payment 1
2	0	Payment 2
⋮	⋮	⋮
11	0	Payment 11
12	500	Payment 12
13	0	Payment 13
14	0	Payment 14
⋮	⋮	⋮
23	0	Payment 23
24	500	Payment 24
25	0	Payment 25
26	0	Payment 26
⋮	⋮	⋮
35	0	Payment 35
36	500	Payment 36

The procedure below uses this relationship to solve for the present value.

1. Calculate the annual rate of interest that is equivalent to a monthly interest rate of 2.25%.

Keystrokes	Display	
1 4		Sets the display to four decimal places.
1 [ENTER]	1.0000	
2.25 [%] [+]	1.0225	Calculates one plus the monthly rate, not as a percent.
12 [y ^x]	1.3060	Calculates the previous number to the 12th power.
1 [-] 100 [X]	30.6050	Calculates the annual interest rate % equivalent to the monthly rate.

2. Calculate the present value of the three annual payments discounted at the annual rate equivalent to the monthly rate.

Keystrokes	Display	
1 [CLEAR FIN]		Clears financial registers.
1 2		Resets display to two decimal places.
3 [n]	3.00	Number of years.
30.6050 [I]	30.61	Annual equivalent rate.
500 [PMT]	500.00	Annual payment amount.
[PV]	-900.39	Calculates the present value of the three annual payments.

Notice that it would be incorrect merely to multiply the 2.25% by 12. This answer (27%) is the number that is used in stating an annual percentage rate, or nominal annual rate, for a monthly payment loan or lease. But it cannot be used to discount an annual series to be compared directly (or added) to the present value of a monthly series. In this handbook, the term "nominal annual rate" will be used in those

cases in which a monthly rate is multiplied by 12 to express an annual yield. The term "equivalent annual rate" will be used where the adjustment described above is used.

In the sections to follow, we will point out the places where it is necessary to calculate the equivalent quarterly or monthly rate.

Calculating an Accelerated Cost Recovery System Tax Benefit

With the implementation of Accelerated Cost Recovery System (ACRS) in 1982, most of the declining balance and sum-of-years-digits methods for calculating depreciation are no longer used for tax purposes. In lease analysis the tax benefit from the ACRS deduction is often a crucial variable. The present value of the ACRS tax benefit is more easily calculated by using a precalculated present value factor; a procedure for calculating this factor is presented below. Where used in subsequent portions of this handbook, the factor is shown without its corresponding calculation procedure. Thus, you should refer back to this section if you need to refresh your memory regarding this procedure.

The ACRS includes a series of tables which show the percentage of the cost basis of an asset that can be deducted from income each year. The system is applied by merely multiplying the cost basis by the appropriate percentage from the table. A full description of the system and the tables is available from tax authorities. For the purpose of examples in this handbook, use only the information for a five year asset from the table in effect in 1982. A table of those percentages is given in the example below. Refer to that table for other examples involving the ACRS later in the handbook.

Calculation of an ACRS present value factor involves three steps. One further step is needed to calculate the present value of the ACRS tax benefit for any particular asset. All four steps are illustrated in the example below. The first step in this procedure is to calculate the quarterly rate equivalent to a monthly interest rate (refer to the previous section for that procedure).

Example: Calculate the ACRS tax benefit present value factor for a five year ACRS asset acquired in the second fiscal quarter of the year, using a 1.5% monthly required yield. After calculating the present

value factor, use the factor to calculate the present value of the ACRS tax benefit if the cost basis of the asset is \$100,000 and the lessor's tax bracket is 46%.

This example is based on the example on page 97 and the result obtained here will be used in that example.

Solution:

1. Calculate the quarterly rate equivalent to the nominal monthly rate of 1.5%. (This procedure is described on page 19.)

Keystrokes	Display	
1 4		Sets display to round to four decimal places.
1 [ENTER]	1.0000	
1.5 [%] [+]	1.0150	Calculates one plus the monthly required yield, not in percent form.
3 [Y ^z]	1.0457	Raises the previous number to the third power.
1 [-] 100 [x]	4.5678	Calculates the quarterly effective equivalent rate to 1.5% nominal monthly rate.

2. Schedule the quarterly ACRS deductions as the decimal equivalent of the quarterly ACRS percentages.

The table for a five year ACRS property, effective through 1984, is as follows:

Year	ACRS Percentage
1	15%
2	22%
3	21%
4	21%
5	21%

Determine the applicable first year quarterly tax deduction by dividing the annual first year percentage by the factor below.

If the asset was acquired during the:

- 1st fiscal quarter, divide by 4.

- 2nd fiscal quarter, divide by 3.
- 3rd fiscal quarter, divide by 2.
- 4th fiscal quarter, divide by 1.

In this example, the property is acquired during the second quarter so you calculate the first year ACRS by dividing 15% by 3, which is 5% per quarter for each of the remaining quarters of the first year. This result is used below in step 3.

In effect, assets acquired later during a fiscal year receive a greater quarterly tax deduction during that first year, since the full annual percentage is available over a shorter period of time.

The schedule of quarterly percentages equivalent to the annual ACRS percentages for the second and remaining years of the example is taken from the following table:

Year	Quarter	ACRS %	Quarterly Equivalent
1	1	15%	.0375
	2		.0375
	3		.0375
	4		.0375
2	5	22%	.0550
	6		.0550
	7		.0550
	8		.0550
3	9	21%	.0525
	10		.0525
	11		.0525
	12		.0525
4	13	21%	.0525
	14		.0525
	15		.0525
	16		.0525
5	17	21%	.0525
	18		.0525
	19		.0525
	20		.0525

3. Calculate the present value of the ACRS quarterly percentages from step 2, using the equivalent quarterly discount rate calculated in step 1.

Keystrokes	Display	
1 4		Sets the display to four decimal places.
4.5678 1	4.5678	Quarterly discount rate.
0 9 CF0	0.0000	Zero as the initial cash flow.
.15 ENTER 3 +	0.0500	Quarterly ACRS decimal percent for the first year.
g CF1	0.0500	
3 g N1	3.0000	Three quarters remaining in the first year.
.055 g CF1	0.0550	Quarterly ACRS decimal percent for the second year.
4 g N1	4.0000	Number of quarters in the second year.
.0525 g CF1	0.0525	Quarterly ACRS for the third and following years.
12 g N1	12.0000	Number of quarters over the third, fourth, and fifth years.
f NPV	0.6584	Calculates the present value of the ACRS quarterly percentages, which is the ACRS present value factor.

This completes the calculation of the present value factor for an asset with any cost basis. The next step applies the factor to an asset with a particular basis cost for the lessor's tax bracket. In the example, the equipment cost is \$100,000 and the tax bracket is 46%.

4. Determine the tax benefit of the ACRS deductions by multiplying the equipment cost by the ACRS present value factor calculated in step 3 above and by the lessor's decimal tax rate.

$$\$100,000 \times .6584 \times .46 = \$30,286.40$$

This result is the one that will be used in the example on page 97.

Section 2

Yield Analysis

To make effective investment decisions, lessors need to analyze the expected yield from leases. This section describes five methods which provide progressively more detailed descriptions for calculating expected yield. When only pretax information is known, the first method can be used to calculate the gross pretax return on assets. When tax information is available, a second method can be used to calculate the gross after-tax return on assets—including consideration of Accelerated Cost Recovery System tax benefits. When general and administrative (G&A) expenses are also known, a third method can be used to calculate the net after-tax yield (equivalent to *IRR*). The fourth and fifth methods are used to calculate net after-tax return on equity. In addition to these lease yield calculations, this section also contains a description of the standard accounting method for leases.

Gross Pretax Return on Assets

In analyzing leases, lessors frequently need to know the gross pretax yield implicit in a particular lease. The gross pretax yield is equivalent to a pretax return on assets (*ROA*). This yield is useful in competitive lease structuring and is most often employed when there is insufficient information to calculate either a net or an after-tax yield.

Return on assets (*ROA*) is not to be confused with return on equity (*ROE*). Return on equity is discussed in the section beginning on page 39.

Gross pretax yield is calculated using the following variables:

- Equipment cost.
- Initial direct costs (commissions, etc.).
- Nontaxable refundable security deposits.
- Residual value (purchase options, etc.).
- Number of lease payments.
- Lease payment amount.

- Number of advance lease payments.
- Investment tax credit and its recapture when appropriate.

To calculate a gross pretax yield, three basic analytical steps must be followed:

1. Calculate the net outflow of lease costs at the inception of the lease.
2. Calculate the net residual value at the termination of the lease, including any deposit refunds and investment tax credit recapture.
3. Calculate the gross pretax *ROA* yield using the **IRR** key.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts, refer to page 13.

Example: Calculate the gross pretax yield based on the following assumptions:

Equipment cost:	\$100,000.
Initial direct costs (commissions, etc.):	\$1,500.
Lessor tax bracket:	46%.
Refundable security deposit:	\$2,500 (\$4,630 pretax equivalent).
Purchase option:	15% or 15,000.
Lease payment terms:	48 payments of \$2,400 (two payments in advance).
Investment tax credit (ITC):	\$10,000 (\$18,519 pretax equivalent).
ITC recapture:	20% or \$2,000 (\$3,704 pretax equivalent).

Solution:

1. Calculate the net outflow at the inception of the lease (time "0") using minus signs for outflows and plus signs for inflows.

\$ - 100,000	Equipment cost.
- 1,500	Initial indirect costs.
+ 4,630	Pretax value of security deposit.
+ 18,519	Pretax value of investment tax credit.
+ 4,800	Two advance lease payments.
\$ - 73,551	Initial net outflow.

2. Calculate the net residual value. Be sure to include the deposit refund and any ITC recapture (20% in this case).

\$ + 15,000	Purchase option.
- 4,630	Pretax security deposit refund.
- 3,704	Pretax value of ITC recapture (20% of \$18,519).
\$ + 6,666	Net pretax residual value.

3. Calculate the gross pretax *ROA* yield.

Keystrokes	Display	
2		Resets display to two decimal places.
73551 CHS 9 CF0	-73,551.00	Initial net outflow as a negative cash flow occurring at time "0".
2400 9 CF	2,400.00	Lease payment as a cash flow.
46 9 N	46.00	Number of lease payments (after the advance payments).
0 9 CF	0.00	Cash flow of zero in the 47th month of the lease.
6666 9 CF	6,666.00	Net residual value as the 48th payment.

Keystrokes	Display	
1 IRR	2.05	Percent monthly <i>ROA</i> yield.
12 x	24.61	Percent nominal annual <i>ROA</i> yield.

Gross After-Tax Return on Assets

The gross after-tax return on assets (*ROA*), demonstrates to the lessor the significant impact of:

- The investment tax credit (*ITC*).
- The nontaxable, refundable security deposit.
- Accelerated Cost Recovery (ACRS).
- The timing of the receipt of the tax benefits.

The gross after-tax *ROA*, like the gross pretax *ROA*, is used in competitive lease structuring, although it is more complex to calculate than the gross pretax yield. The gross after-tax *ROA* is especially useful since it can be compared directly to the lessor's after-tax cost of debt.

To calculate a gross after-tax yield, five basic analytical steps must be followed:

1. Calculate the net after-tax outflow of lease costs at the inception of the lease.
2. Calculate the net after-tax residual value at the termination of the lease, including:
 - Tax expense or gain on the exercise of purchase option.
 - Investment tax credit recapture when appropriate.
 - Refund of security deposit.
3. Calculate the ACRS tax shield benefit on a monthly basis.
4. Calculate the total after-tax cash inflow.
5. Calculate the gross after-tax *ROA* yield using the **IRR** key.

Note: Use the after-tax equivalent dollars wherever specified. For the calculation of after-tax equivalent amounts, refer to page 12.

Example: Calculate the gross after-tax *ROA* yield, based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	46%.
Initial direct costs:	\$2,778 (\$1,500 after-tax equivalent).
Refundable security deposit:	\$2,500.
Purchase option:	15% or \$15,000.
Lease terms:	48 payments of \$2,400 with two payments in advance (\$1,296 after-tax equivalent).
ACRS property class:	5 year, purchased July 1, calendar year corporation.
Investment tax credit (<i>ITC</i>):	\$10,000.
<i>ITC</i> recapture:	20% or \$2,000.

Solution:

1. Calculate net outflow at the inception of the lease, time "0".

\$ -100,000	Equipment cost.
-1,500	After-tax initial direct costs.
+2,500	Security deposit.
+10,000	Investment tax credit (<i>ITC</i>).
+2,592	Two advance payments, after tax.
<hr/>	
\$ -86,408	Net after-tax initial outflow.

2. Calculate the net residual value.

- a. Calculate the book value of the asset after the 48th month:

\$100,000	Equipment cost.
-15,000	First year ACRS.
-22,000	Second year ACRS.
-21,000	Third year ACRS.
-21,000	Fourth year ACRS (no fifth year ACRS).
<hr/>	
\$ 21,000	Book value.

b. Calculate the tax benefit or expense of exercising the purchase option:

\$ 21,000	Book value.
-15,000	Purchase option.
\$ 6,000	Tax loss from exercising purchase option.
× .46	Tax bracket as a decimal.
\$ 2,760	Tax benefit.

c. Finally calculate the net residual value:

\$ 15,000	Purchase option.
+2,760	Benefit from tax loss.
-2,500	Deposit refund.
-2,000	ITC recapture (20% of \$10,000 ITC).
\$ +13,260	Net after-tax residual value.

3. Calculate the monthly tax shield benefit of the Accelerated Cost Recovery. Note that in this example, the ACRS in the first year will be spread over six months only. Also, no recovery is allowed in the year of disposal. The tax shield benefit is calculated monthly (rather than using the more complex method on page 25) to become a component of the monthly cash flow calculated in step 5 below.

Year	ACRS %	ACRS Amount	Tax Rate	Annual Tax Benefit	Number of Months	Monthly Tax Benefit
1	15	\$15,000 × .46 = \$ 6,900	/ 6	= \$1,150		
2	22	22,000 × .46 = 10,120	/ 12	= 843		
3	21	21,000 × .46 = 9,660	/ 12	= 805		
4	21	21,000 × .46 = 9,660	/ 12	= 805		
5		No ACRS Allowed in Year of Disposal				

4. Calculate the total monthly after-tax cash inflow:

Months	Total No. of Months	Revenue	ACRS Benefit	Total Cash Flow
1—6	6	\$ 1,296	+ \$ 1,150	= \$ 2,446
7—18	12	1,296	+ 843	= 2,139
19—42	24	1,296	+ 805	= 2,101
43—46	4	1,296	+ 0	= 1,296
47	1	0	+ 0	= 0
48	1	13,260	+ 0	= 13,260

5. Calculate the gross after-tax ROA yield:

Keystrokes	Display	
86408 [CHS] [g] [CF0]	-86,408.00	Net outflow at time "0".
2446 [g] [CF1]	2,446.00	Monthly cash flow for first six months.
6 [g] [N1]	6.00	Number of cash flows during first six months.
2139 [g] [CF1]	2,139.00	Monthly cash flow for second year.
12 [g] [N1]	12.00	Number of cash flows during second year.
2101 [g] [CF1]	2,101.00	Monthly cash flow for third and fourth years.
24 [g] [N1]	24.00	Number of cash flows.
1296 [g] [CF1]	1,296.00	Monthly cash flow for first four months of the last year.
4 [g] [N1]	4.00	Number of cash flows.
0 [g] [CF1]	0.00	Cash flow of zero for the 47th month.
13260 [g] [CF1]	13,260.00	Last cash flow, the net residual value.
[f] [IRR]	0.97	Percent monthly gross after-tax yield.
12 [x]	11.59	Percent nominal annual gross after-tax yield.

Net After-Tax Return on Assets

The net after-tax yield is the same as the conventional internal rate of return (IRR) used frequently in capital budgeting analysis by lessors. This yield can be compared directly to the firm's incremental, after-tax, weighted-average cost of capital. In general, if the net after-tax IRR is greater than or equal to the cost of capital, the lessor assumes that the lease is an acceptable investment.

The distinction between the net after-tax yield being discussed here and the gross after-tax yield discussed in the previous section is the following: the term "net" implies that general and administrative (G&A) expenses of the lessor are deducted from income in the calculations, where these expenses are ignored in the "gross" calculations. Thus, in the calculation of "net" yield G&A expenses will appear as negative (-) cash flows.

The calculation of net after-tax yield requires five basic analytical steps:

1. Calculate the net after-tax outflow of lease costs at the inception of the lease.
2. Calculate the net after-tax residual value at the termination of the lease, including:
 - Tax expense or gain on exercising the purchase option.
 - Investment tax credit recapture when appropriate.
 - Refund of security deposit.
3. Calculate the ACRS tax shield benefit on a monthly basis.
4. Calculate the total after-tax cash inflows.
5. Calculate the net after-tax IRR yield, using the **IRR** key.

Note: Use the after-tax equivalent dollars wherever specified. For the calculation of after-tax equivalent amounts, refer to page 12.

Example: Calculate the net after-tax return on assets (IRR) based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	46%.

Initial direct cost:	\$2,778 (\$1,500 after-tax equivalent).
Refundable security deposit:	\$2,500.
Purchase option:	15% or \$15,000.
Lease terms:	60 payments of \$2,106, with two payments in advance (\$1,137 after-tax equivalent).
ACRS property class:	5 year, leased Jan. 1, calendar year corporation.
Investment tax credit (ITC):	\$10,000 (no recapture).
G&A expense allocation (including bad debt expense):	\$200 per month (\$108 after-tax equivalent).

1. Calculate the net outflow at time "0", using negative numbers for outflows. For the example, the relevant figures are summed below.

\$ -100,000	Equipment cost.
- 1,500	Initial after-tax direct costs.
+ 2,500	Security deposit.
+ 10,000	Investment tax credit.
+ 2,274	Two After-tax advance payments. $(4,212 \times (1 - .46))$.
<hr/>	
\$ - 86,726	Net after-tax initial cash outflow.

2. Calculate the net residual value.
 - a. The book value of the asset at the end of the 5th year of ACRS deductions would be zero. Therefore, any purchase option exercised would be fully taxable to the lessor as ordinary income.
 - b. After-tax purchase option: $$15,000 \times (1 - .46) = \$8,100$.
 - c. Net residual value:

\$ + 8,100	Tax adjusted purchase option.
- 2,500	Deposit refund.
<hr/>	
\$ + 5,600	Net after-tax residual value.

3. Calculate the tax shield benefit of the Accelerated Cost Recovery (ACRS).

Year	ACRS %	ACRS Amount	Tax Rate	Annual Tax Benefit	Number of Months	Monthly Tax Benefit
1	15	\$15,000 × .46 =	\$ 6,900	/ 12 =	\$ 575	
2	22	22,000 × .46 =	10,120	/ 12 =	843	
3	21	21,000 × .46 =	9,660	/ 12 =	805	
4	21	21,000 × .46 =	9,660	/ 12 =	805	
5	21	21,000 × .46 =	9,660	/ 12 =	805	

4. Calculate the total after-tax cash flow.

Months	Total No. of Months	After-Tax Lease Pay.	ACRS Benefit	G & A Expenses	Net Cash Flow
1-12	12	\$ 1,137	+\$ 575	-\$ 108	= \$ 1,604
13-24	12	1,137	+	843	= 1,872
25-58	34	1,137	+	805	= 1,834
59	1	0	+	805	= 697
60	1	5,600	+	805	= 6,297

5. Calculate the net after-tax ROA.

Keystrokes	Display	
86726 CHS 9 CFD	-86,726.00	Net after-tax cash outflow at inception of lease, i.e., time "0".
1604 9 CFI	1,604.00	Monthly cash flow for first year.
12 9 NI	12.00	Number of cash flows during first year.
1872 9 CFI	1,872.00	Monthly cash flow for second year.

Keystrokes	Display	
12 9 NI	12.00	Number of cash flows during second year.
1834 9 CFI	1,834.00	Monthly cash flow for the next 34 months.
34 9 NI	34.00	Number of cash flows.
697 9 CFI	697.00	Cash flow for 59th month.
6297 9 CFI	6,297.00	Cash flow for 60th month.
1 IRR	0.81	Percent monthly net after-tax yield (IRR).
12 x	9.71	Percent nominal annual net after-tax yield (IRR).

Net After-Tax Return on Equity (Assuming Matched Funded Debt)

The net after-tax return on equity (ROE) yield represents the return the owners can expect on the equity in a particular lease. This yield should not be confused with the return on assets (ROA) yields developed in the previous sections. Return on equity represents the rate of return on equity after both debt and interest on the debt have been paid in full. Once the debt that is used to fund the lease and interest on the debt has been paid, any remaining cash flow would belong to the equity holders.

It is important to note that in this section, the calculation assumes matched debt funding, which means that the lease is funded with self-liquidating debt that will be paid-off at the termination of the lease. Therefore, throughout the lease it is assumed that the debt-to-equity ratio implicit in the lease investment is constantly decreasing. Single investor leases and some lease companies frequently own lease investments for which the underlying debt financing is systematically being paid off over the lease term.

The next section develops the method for calculating ROE assuming that the ratio of debt-to-equity stays constant.

The distinction between the yield calculated in this section and the yield calculated in the previous section is that cash payments to pay for interest and principal reduction are considered here, but they were not in the previous case.

To calculate a net after-tax return on equity, six basic analytical steps must be followed:

1. Calculate the net equity outflow at the inception of the lease.
2. Calculate the net after-tax residual value at the termination of the lease.
3. Calculate the ACRS tax shield benefit on a monthly basis.
4. Calculate the debt repayment schedule (principal and interest) and the tax shield benefit of the interest on the matched funded debt.
5. Calculate the total after-tax cash flow.
6. Calculate the net after-tax *ROE* yield.

Note: Use after-tax equivalent dollars wherever specified. For the calculation of after-tax equivalent amounts, refer to page 12.

Example: Calculate the net after-tax return on equity (*ROE*), assuming matched funded debt, based on the following assumptions:

Equipment cost:	\$100,000.
Lessors capital structure:	20% equity and 80% debt at a 16% annual rate, payable monthly over the term of the lease in the amount of \$1,945.44 at the end of each month for 60 months.
Lessor's tax bracket:	46%.
Initial direct costs:	\$2,778 (\$1,500 after-tax equivalent).
Refundable security deposit:	\$2,500.
Purchase option:	15% or \$15,000.
Lease terms:	60 payments of \$2,106, with two payments in advance (\$1,137 after-tax equivalent).
Investment tax credit (<i>ITC</i>):	\$10,000.
G&A expense allocation:	\$200 per month (\$108 after-tax equivalent).

1. Calculate the net equity outflow at time "0", using negative values for outflows and positive values for inflows. For the example, the following is the sum of the relevant values.

\$ -20,000	20% Equity investment in equipment.
-1,500	After-tax initial direct costs.
+2,500	Security deposit.
+10,000	Investment tax credit.
+2,274	Two advance payments (after-tax).
<hr/>	
\$ -6,726	Net after-tax initial cash outflow.

2. Calculate the net residual value.

a. The book value of the asset after the 5th year of ACRS deductions would be zero. Thus, any purchase option exercised would be fully taxable to the lessor as ordinary income. There would be no *ITC* recapture in this example.

b. After-tax purchase option: $\$15,000 \times (1 - .46) = \$8,100$.

c. Net residual value:

\$ +8,100	Tax adjusted purchase option.
-2,500	Deposit refund.
\$ +5,600	Net after-tax residual value.

3. Calculate the tax shield benefit of the Accelerated Cost Recovery (ACRS).

Year	ACRS %	ACRS Amount	Tax Rate	Annual Tax Benefit	Number of Months	Monthly Tax Benefit
1	15	$\$15,000 \times .46 = \$ 6,900$	/	12	=	\$ 575
2	22	$22,000 \times .46 = 10,120$	/	12	=	843
3	21	$21,000 \times .46 = 9,660$	/	12	=	805
4	21	$21,000 \times .46 = 9,660$	/	12	=	805
5	21	$21,000 \times .46 = 9,660$	/	12	=	805

4. Calculate the debt repayment schedule and the tax shield benefit of the interest on the match funded debt at 16% interest (\$80,000 loan at 1,945.44/month). Refer to page 14 in section 1 for the procedure to determine the yearly interest shown below.

There are two parts to consider:

- The monthly loan payment of \$1,945.44.
- The tax shield benefit on the interest portion of each payment:

Year	Annual Interest Amt.	Tax Rate	Annual Tax Benefit	No. of Mos.	Monthly Tax Benefit
1	\$11,991	× .46	= \$5,516	/ 12 =	\$460
2	10,035	× .46	= 4,616	/ 12 =	385
3	7,742	× .46	= 3,561	/ 12 =	297
4	5,054	× .46	= 2,325	/ 12 =	194
5	1,903	× .46	= 875	/ 12 =	73

5. Calculate the total after-tax cash flow. Setting up a columnar spread sheet facilitates the completion of this step.

No. of Mos.	Tot. Mos.	After-Tax Lease Pmt.	ACRS Benefits	Interest Benefits	G & A Costs	Loan Pmt.	Net Cash Flow
1-12	12	\$1,137 +	\$575 +	\$460 -	\$108 -	\$1,945 =	\$ 119
13-24	12	1,137 +	843 +	385 -	108 -	1,945 =	312
25-36	12	1,137 +	805 +	297 -	108 -	1,945 =	186
37-48	12	1,137 +	805 +	194 -	108 -	1,945 =	83
49-58	10	1,137 +	805 +	73 -	108 -	1,945 =	-38
59	1	0 +	805 +	73 -	108 -	1,945 =	-1,175
60	1	5,600 +	805 +	73 -	108 -	1,945 =	4,425
		60					

6. Calculate the net after-tax ROE yield.

Keystrokes	Display	
6726 [CHS] [g] [CFc]	-6,726.00	Net cash outflow at inception of lease, time "0".
119 [g] [CF]	119.00	Monthly cash flow for first year.
12 [g] [N]	12.00	Number of cash flows during first year.
312 [g] [CF]	312.00	Cash flow for second year.
12 [g] [N]	12.00	Number of cash flows during second year.
186 [g] [CF]	186.00	Cash flow for third year.
12 [g] [N]	12.00	Number of cash flows during third year.
83 [g] [CF]	83.00	Cash flow for fourth year.
12 [g] [N]	12.00	Number of cash flows during fourth year.
38 [CHS] [g] [CF]	-38.00	Negative cash flow for portion of fifth year.
10 [g] [N]	10.00	Number of cash flows during fifth year.
1175 [CHS] [g] [CF]	-1,175.00	Negative cash flow during 11th month of fifth year.
4425 [g] [CF]	4,425.00	Cash flow for 60th month, last month of the five years.
1 [IRR]	1.78	Percent monthly net after-tax return on equity (ROE).
12 [x]	21.40	Percent nominal annual net after-tax ROE.

Net After-Tax Return on Equity (Constant Debt to Equity Ratio)

The net after-tax return on owner's equity (ROE) represents the return that the owner can expect from a particular lease. In the previous section, the debt-to-equity ratio changes throughout the term of the lease. If you wish to calculate the ROE assuming a constant debt-to-equity ratio, the procedure developed in this section is appropriate. The as-

umption of a constant debt-to-equity ratio is commonly used by leasing companies.

The calculation of net after-tax *ROE* with a constant debt-to-equity ratio is an adjustment to the *ROA* calculation. You begin by making that calculation, which appears on page 37. You then convert that *ROA* yield to an *ROE* yield. The conversion is explained below.

Example: Using the *ROA* yield calculated in the example on page 36, solve for the net after-tax return on equity (*ROE*) with the assumption that the ratio of debt-to-equity stays constant.

The assumptions are the same as those on page 36 except that the lease is funded with 80% debt with 16% annual interest. The internal rate of return solution in the *ROA* example is 9.71%. That figure is used below. The solution consists of four steps:

1. Determine the lessor's after-tax borrowing rate by multiplying the lessor's pretax borrowing rate by one minus the tax rate.

$$16 \times (1 - .46) = 8.64\%$$

2. Determine the weighted average cost of debt by multiplying the after-tax borrowing rate (above) by the percentage of debt in the capital structure of the lessor, 80% in this case:

$$8.64 \times .80 = 6.91\%$$

3. Deduct the weighted average after-tax cost of debt (step 2) from the net after-tax *ROA* yield (9.71%). The difference is the lessor's weighted average *ROE*:

$$\begin{array}{r}
 9.71 \quad \text{ROA} \\
 - 6.91 \quad \text{Weighted average cost of debt} \\
 \hline
 2.80\% \quad \text{Weighted average ROE}
 \end{array}$$

4. Convert the weighted *ROE* into its unweighted *ROE* counterpart by dividing the weighted *ROE* (step 3 above) by the percentage of equity in the lessor's capital structure, 20% in this case.

$$\frac{2.80}{.2} = 14.00\% \text{ ROE}$$

Financial Accounting Standards Board (FASB) Statement No. 13 Implicit Rate

The FASB No. 13 Implicit Rate in a lease has two important uses in lease accounting:

- To determine whether a lease is an operating lease or a capital lease.
- To separate lease payments received by the lessor into their implicit principal and interest portions.

Operating leases do not show up on the balance sheet of the lessee and are frequently preferred to capital leases by lessees. The lessee uses the lower of his incremental pretax borrowing rate or the implicit rate in the lease to determine whether the lease is an operating lease or not. Thus, both lessors and lessees must be able to calculate this yield.

Caution should be exercised if you use this yield for purposes other than accounting since it is defective from a financial point of view. Some of the characteristics that you should be aware of are the following:

- The investment tax credit is not converted to its pretax equivalence in the FASB analysis.
- Refundable security deposits are ignored in the FASB analysis.
- In the FASB analysis initial direct costs are only considered by the lessor when the lease is a capital lease of the direct financing type and are ignored for the capital lease of the sales type.

These inconsistencies make it unusable for financial decision making, but useful in accounting.

There are only two analytical steps required to calculate an implicit rate in a lease. There is a slight adjustment to step 1 if the lease is a sales type lease. This adjustment is shown after the example is worked below.

1. Calculate the initial cash outflow (at time "0").
2. Calculate the implicit rate in the lease from the initial cash outflow and the amount of the lease payment.

Example: Calculate the implicit rate for a lease based on the following assumptions.

Equipment cost:	\$100,000.
Lessor tax bracket:	46%.
Initial direct costs:	\$1500 pretax basis.
Refundable security deposit:	\$2,500.
Purchase option or unguaranteed residual value:	15% or \$15,000.
Lease terms:	48 payments of \$2,400, two payments in advance.
Investment tax credit (ITC):	\$10,000.
ITC recapture:	\$2,000.
ACRS property class:	5 year.
Lease type:	Direct financing, with ITC retained by the lessor.

1. Calculate net outflow at time "0", excluding the security deposit.

\$ -100,000	Equipment cost.
+8,000	Investment tax credit net of recapture.
+4,800	Two advance payments.
-1,500	Initial direct costs (for direct financing leases only).
<hr/>	
\$ -88,700	Net initial outflow.

2. Calculate the implicit rate in the lease.

Keystrokes	Display	
88700 [CHS] [9] [CFO]	-88,700.00	Initial cash outflow.
2400 [9] [CF]	2,400.00	Lease payment amount.
46 [9] [N]	46.00	Number of lease payments after the two paid in advance.

Keystrokes	Display	
0 [9] [CF]	0.00	Cash flow of zero in the 47th month.
15000 [9] [CF]	15,000.00	Purchase option or unguaranteed residual.
[F] [IRR]	1.40	Percent monthly implicit rate.
12 [x]	16.79	Percent nominal annual implicit rate.

If the preceding lease had been a sales-type lease, the initial direct costs would have been ignored and the yield would be calculated as follows:

1. Net outflow for a sales-type capital lease.

\$ -100,000	Equipment cost.
+8,000	Investment tax credit net of recapture.
+4,800	Two advance lease payments.
<hr/>	
\$ -87,200	Net outflow.

2. Implicit rate computation.

Keystrokes	Display	
87200 [CHS] [9] [CFO]	-87,200.00	Initial net outflow as negative number.
2400 [9] [CF]	2,400.00	Lease payment amount.
46 [9] [N]	46.00	Number of lease payments after the two paid in advance.
0 [9] [CF]	0.00	Payment of zero in the 47th month.
15000 [9] [CF]	15,000.00	Purchase option or unguaranteed residual value.
[F] [IRR]	1.47	Percent monthly implicit rate.
12 [x]	17.68	Percent nominal annual implicit rate.

Section 3

Structuring Pretax Lease Payments

Gross Lease Payment to Achieve a Pretax Yield

Lessors frequently structure leases on a gross pretax nominal yield basis. Structuring a lease on a gross basis means that general, administrative, and interest expenses are ignored. Pretax structuring implies that the tax shield benefit of the Accelerated Cost Recovery System (ACRS) is ignored and all cash flows are considered on a pretax basis. However, the benefit of the investment tax credit (ITC) is considered since the ITC is, in effect, a government grant given as an incentive to acquire new equipment.

Structuring a lease on a gross pretax basis is very useful to lease salesmen who must generally structure leases in a competitive environment in which little is known about the tax situation of the competitor. Therefore, leases must be structured without regard to the tax benefit of ACRS deductions taken by the competitors.

The following variables are considered when structuring a lease on a gross pretax basis:

- Equipment cost.
- Lessor's incremental tax bracket.
- Initial direct costs.
- Refundable security deposit.
- Residual value (purchase option, etc.).
- Number of lease payments.
- Number of lease payments in advance.
- Pretax yield required by lessor.
- Investment tax credit retained by lessor.
- ITC Recapture.

Five steps are required to calculate a lease payment that meets a particular gross pretax nominal yield requirement:

1. Calculate the net pretax residual value.
2. Calculate the present value of the net residual value.
3. Calculate the net pretax outflow of costs at the inception of the lease.
4. Calculate the required lease rate factor.
5. Calculate the monthly lease payment.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example 1: Calculate the lease payment that will return a gross pretax yield of 3% per month (36% nominal annual rate) based on the following assumptions:

Equipment cost:	\$50,000.
Lessor tax bracket:	40%.
Initial direct costs:	\$1,000 pretax basis.
Refundable security:	\$2,000 (\$3,333 pretax equivalent).
Lease terms:	48 payments with 3 payments in advance.
Purchase option:	15% or \$7,500.
Investment tax credit (ITC):	\$5,000 (\$8,333 pretax equivalent).
ITC recapture:	20% or \$1,000 (\$1,667 pretax equivalent).

Solution:

1. Calculate the pretax net residual value.

\$ + 7,500	Purchase option.
- 3,333	Pretax deposit refund.
- 1,667	20% of pretax ITC recapture (.2 x \$8,333.).
<hr/>	
\$ + 2,500	Pretax net residual value.

2. Calculate present value of the net residual value.

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
36 g 12+	3.00	Required monthly yield.
48 n	48.00	Term of the lease in months.
2500 CHS FV	-2,500.00	Pretax residual value.
PV	605.00	Calculates the present value of the residual value.

3. Calculate net outflow at the inception of the lease (time "0"), including the present value of the residual.

\$ -50,000	Cost of equipment.
+8,333	Pretax ITC.
+3,333	Deposit.
+605	Present value of residual value.
-1,000	Initial direct costs.
\$ -38,729	Pretax initial net outflow.

4. Calculate the required lease rate factor.

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
3 i	3.00	Monthly interest rate.
45 n	45.00	Number of required remaining payments, after advance payments.
1 CHS PMT	-1.00	Factor payment of 1.
PV	24.52	Present value of 45 payments of 1.
f 6	24.518713	Sets display to six decimal places.
3 +	27.518713	Calculates the adjusted present value, recognizing the three advance payments.
1/x	0.036339	Converts the adjusted present value to the lease rate factor.

5. Calculate the monthly lease payment by multiplying the pretax net outflow (step 3) by the lease rate factor.

$$\$38,729 \times .036339 = 1,407.373131$$

that is \$1,407.37.

Verification: The lease payment can be shown to be correct by the following calculation:

1. Calculate the pretax initial net outflow for the lease.

\$ -50,000	Equipment cost.
+8,333	Pretax ITC.
+3,333	Deposit.
+4,222	Pretax value of the three advance payments, (3 x \$1,407.37).
-1,000	Initial direct costs.
\$ -35,112	Pretax net initial cash outflow.

2. Calculate the yield on the lease payments.

Keystrokes	Display	
f 2		Resets display to two decimal places.
35112 CHS g CF0	-35,112.00	Initial cash outflow.
1407.37 g CF1	1,407.37	Calculated lease payment.
45 g N1	45.00	Number of lease payments after the three advance payments.
0 g CF1	0.00	Cash flow of zero for the 46th and 47th payments.
2 g N1	2.00	Number of zero cash flows for the 46th and 47th payments.
2500 g CF1	2,500.00	Pretax net residual value.
f IRR	3.00	Monthly ROA yield.
12 x	36.00	Nominal annual ROA yield, which checks with the required yield.

Example 2: Calculate the lease payment that will achieve a 2.5% monthly (30% nominal annual rate) gross pretax *ROA* yield based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	46%.
Initial direct costs:	\$2,000.
Refundable security:	\$4,000 (\$7,407 pretax equivalent).
Purchase option:	\$10,000.
Lease terms:	36 payments, with 4 in advance.
Investment tax credit (ITC):	\$10,000 (\$18,519 pretax equivalent).
ITC recapture:	40% or \$4,000 (\$7,407 pretax equivalent).

Solution:

1. Calculate the net pretax residual value.

\$ + 10,000	Purchase option.
− 7,407	Deposit refund.
− 7,407	Pretax ITC recapture.
\$ − 4,814	Pretax residual value.

2. Calculate present value of net residual value.

Keystrokes	Display	
[CLEAR FIN]		Clears financial registers.
30 [9] [12+]	2.50	Required monthly yield.
36 [n]	36.00	Total number of months in lease term.
4814 [FV]	4,814.00	Residual value.
[PV]	−1,979.01	Calculates the present value of the net residual value.

3. Calculate the initial pretax net outflow.

\$ − 100,000	Equipment cost.
+ 18,519	Pretax ITC.
+ 7,407	Deposit.
− 1,979	Present value of the pretax net residual value.
− 2,000	Initial direct cost.
\$ − 78,053	Pretax initial net outflow, including present value of residual.

4. Calculate the required lease rate factor.

Keystrokes	Display	
[CLEAR FIN]		Clears financial registers.
30 [9] [12+]	2.50	Monthly required yield.
32 [n]	32.00	Number of lease payments minus the four advance payments.
[CHS] [PMT]	−1.00	Payment of 1.
[PV]	21.85	Calculates the present value of 32 payments of 1.
[1] 6	21.849178	Sets display to six decimals.
4 [+]	25.849178	Calculates present value adjusted to include four advance payments.
[1/x]	0.038686	Calculates the lease rate factor.

5. Calculate the monthly lease payment.

Initial net outflow multiplied by the lease rate factor, that is,

$$\$78,053 \times .038686 = 3,019.558358$$

or \$3,019.56.

Program to Structure Gross Pretax Lease Payments

The following HP-12C program calculates the lease payment required to achieve a given gross pretax lease yield. It makes the same calculations that the previous calculator procedure does, but does so automatically. The program is flexible in that it allows the user to consider the following variables: number of lease payments and advance payments, equipment cost and initial direct costs, investment tax credit and recapture, security deposits, and net residual value.

KEYSTROKES	DISPLAY	KEYSTROKES	DISPLAY
[F] P/R		PV	19- 13
[F] CLEAR [PRGM]	00-	RCL 5	20- 45 5
[G] END	01- 43 8	+	21- 40
[F] CLEAR [FIN]	02- 42 34	CNS	22- 16
RCL 2	03- 45 2	RCL 7	23- 45 7
[n]	04- 11	RCL 6	24- 45 6
RCL 4	05- 45 4	+	25- 40
[F]	06- 12	RCL [n] 0	26-45 48 0
RCL 8	07- 45 8	+	27- 10
RCL 9	08- 45 9	+	28- 40
RCL 7	09- 45 7	STO 1	29- 44 1
+	10- 40	0	30- 0
1	11- 1	FV	31- 15
RCL [n] 1	12-45 48 1	RCL [n]	32- 45 11
%	13- 25	RCL 3	33- 45 3
-	14- 30	-	34- 30
STO [n] 0	15-44 48 0	[n]	35- 11
+	16- 10	1	36- 1
-	17- 30	CNS	37- 16
FV	18- 15	PMT	38- 14

KEYSTROKES	DISPLAY	KEYSTROKES	DISPLAY
PV	39- 13	[x] 7	43- 34
RCL 3	40- 45 3	[+]	44- 10
+	41- 40	CNS	45- 16
RCL 1	42- 45 1	[F] P/R	

REGISTERS			
n : Used	i : Used	PV : Used	PMT : Used
FV : Used	R₁ : Used	R₂ : Used	R₂ : # Lease Pmts.
R₃ : # Advance Pmts.	R₄ : Monthly Yield %	R₅ : Costs	R₆ : ITC
R₇ : Security deposit	R₈ : Residual value value	R₉ : ITC Recap.	R₁₀ : Used
R₁₁ : Lessor's tax rate			

Procedure:

Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

1. Key in the program.
2. Key in the total number of lease payments to be made including any in advance, then press **STO 2**.
3. Key in the number of payments in advance, then press **STO 3**.
4. Key in the monthly gross pretax yield as a percentage, then press **STO 4**.
5. Add the equipment cost to any initial direct costs (commissions, legal fees, etc.), key in the total dollar amount, then press **STO 5**.
6. Key in the dollar amount of the investment tax credit, then press **STO 6**.
7. Key in the dollar amount of any refundable security deposit, then press **STO 7**.

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8. Key in the dollar amount of the residual value or purchase option, then press **STO** 8.
9. Key in the dollar amount of the investment tax credit recapture, then press **STO** 9. If no recapture is expected, enter zero and press **STO** 9.
10. Key in the lessor's incremental tax rate as a percentage, then press **STO** 1.
11. Press **R/S** to calculate the gross pretax lease payment.

Example: Structure a 48-month lease with two payments in advance that meets the lessor's required pretax yield of 3% monthly (36% nominal annual rate). The equipment to be leased costs \$100,000 and will require initial direct costs of \$1,500. The lessor will retain the full \$10,000 investment tax credit, but will be obliged to recapture \$2,000 at the end of the 48 month lease period. The lease contains a \$2,000 refundable security deposit and a \$15,000 (15%) purchase option which is expected to be exercised at the end of the lease. The lessor is in a 46% tax bracket.

Note: This program automatically converts the investment tax credit and the nontaxable refundable security deposit to a pretax equivalent so the resulting lease payment is structured on a completely pretax basis.

Solution:

Keystrokes	Display	
f 2		Resets display to two decimals.
48 STO 2	48.00	Number of lease payments.
2 STO 3	2.00	Number of advance payments.
3 STO 4	3.00	Percent monthly pretax yield.
100000 ENTER	100,000.00	Equipment cost.
1500 + STO 5	101,500.00	Calculates and stores cost plus initial direct costs.
10000 STO 6	10,000.00	Investment tax credit.

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Keystrokes	Display	
2000 STO 7	2,000.00	Security deposit.
15000 STO 8	15,000.00	Purchase option.
2000 STO 9	2,000.00	ITC recapture.
46 STO 1	46.00	Percent incremental tax rate.
R/S	2,892.22	Calculates the monthly lease payment.

Verification: You can check the validity of the lease payment calculated above by following the three steps below:

1. Calculate the cash outflow at the inception of the lease.

\$ -100,000	Equipment cost.
+18,518	Pretax equivalent of \$10,000 ITC.
+3,704	Pretax equivalent of \$2,000 security deposit.
-1,500	Initial direct costs.
<u>+ 5,784</u>	Two advance payments.
<u>\$ - 73,494</u>	Net pretax initial cash outflow.

2. Calculate the pretax net residual value.

\$ +15,000	Purchase option.
-3,704	Pretax equivalent of deposit refund.
<u>- 3,704</u>	Pretax equivalent of ITC recapture.
<u>\$ + 7,592</u>	Pretax net residual value.

3. Calculate the yield.

Keystrokes	Display	
73494 CHS g CFO	-73,494.00	Initial cash outflow.
2892.22 g CFj	2,892.22	Lease payment amount.
46 g Nj	46.00	Number of lease payments minus two advance payments.
0 g CFj	0.00	Cash flow of zero for the 47th month.

Keystrokes	Display	
7592 9 CFj	7,592.00	Net residual value cash flow.
f IRR 12 x	3.00 36.00	Percent monthly yield. Percent nominal annual yield, which checks with the required yield used to solve for the lease payment.

Payment Required to Qualify As an FASB No. 13 Operating Lease

The Financial Accounting Standards Board (FASB) Statement Number 13 on lease accounting requires that before a lease can be considered an operating lease, the present value of the minimum lease payments must be less than 90 percent of the difference between the leased asset's fair market value (cash equivalent cost to lessee) and any investment tax credit retained by the lessor. The lessee is generally the party who wants the lease to be an operating lease so it will not be reported on his balance sheet. The lessee must use, for purposes of the 90% present value test, a discount rate that is the lower of:

- The implicit rate in the lease, or
- The lessee's incremental pretax borrowing rate.

Calculation of the FASB implicit lease rate was developed in an earlier section (refer to page 45).

Calculation of the payment required to qualify as an FASB 13 Operating Lease, consists of three steps:

1. Calculate the required FASB 13 operating lease comparison base.
2. Calculate the lease rate factor.
3. Calculate the monthly lease payment.

Example: Calculate the minimum lease payment that will qualify as an FASB operating lease based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	40%.
Security deposit:	\$2,000.

Residual value:	Unknown.
Lease terms:	60 payments with two paid in advance.
Required pretax gross yield:	21%.
Lessor ITC (retained by lessor):	\$10,000 (no recapture).

A 20% Nominal annual pretax borrowing rate will be used as the appropriate discount rate.

Solution:

1. Calculate the required FASB statement 13 operating lease comparison base, which is 90% of the asset's fair market value reduced by any ITC retained by the lessor.

\$ -100,000 Equipment cost.
 10,000 ITC.

 \$ -90,000
 x .9

 \$ -81,000 Base for FASB operating lease comparison.

2. Calculate the lease rate factor.

Keystrokes	Display	
20 9 12+	1.67	Monthly pretax borrowing rate.
2 9 CFO	2.00	Two advance payments of 1.
1 9 CFj	1.00	Monthly payment of 1.
58 9 Nj	58.00	Number of payments of 1 after the advance payments.
f 6	58.000000	Sets display to six decimal places.
f NPV	38.996531	Calculates present value of payments of 1.
1/x	0.025643	Calculates lease rate factor.

3. Calculate the monthly lease payment by multiplying the FASB 13 operating lease base by the lease rate factor. We suggest that you reduce the base by \$10 to insure that the present value of the lease payments is less than the base.

$$(\$81,000 - \$10) \times .025643 = 2,076.826570$$

that is, \$2,076.83.

Verification: You can verify the result very easily as follows:

Keystrokes	Display	
1 2		Resets display to two decimal places.
20 [g] [12+]	1.67	Monthly pretax borrowing rate.
2076.83 [ENTER] [+]	4,153.66	Calculates sum of two advance payments.
[g] [CF0]	4,153.66	Two advance payments as the initial cash flow.
2076.83 [g] [CF1]	2,076.83	Lease payment amount.
58 [g] [N]	58.00	Number of lease payments after the two paid in advance.
[f] [NPV]	80,969.16	Calculates FASB operating lease comparison base.

The calculated base is \$10.84 less than the cutoff of \$81,000.

Note that the lessor must now rely on the residual value to obtain his required yield. The method for calculating the required residual value, given the lease payment amount, is explained in the section beginning on page 66. Also note that the security deposit and the initial direct costs were not considered in the analysis. The investment tax credit was not included on a pretax equivalent basis, as would be required in a financial analysis basis. All of these omitted items represent important distinctions between the FASB method and a financial decision making method. Thus, lessors frequently structure leases that include large deposits in order to avoid dependence on large (and uncertain) residual values.

Amount of a Refundable Security Deposit Given a Predetermined Monthly Lease Payment and Residual Value.

To meet the operating lease structuring requirements of FASB 13, lessors must either increase residual values (purchase options, etc.) or increase refundable security deposits in order to maintain a given gross pretax yield, while at the same time keeping the lease payments small enough to meet the 90% rule for an operating lease (explained in the previous section). Once the residual value and the lease payments are fixed in a lease, the lessor must look to the security deposit as the last remaining variable that can be increased to achieve a given yield. This section describes the procedure for calculating the amount of the security deposit. The next section describes a procedure for calculating the residual value.

There are seven steps required to calculate the amount of a security deposit that is needed to maintain the status as a FASB 13 operating lease, while at the same time maintaining the lessor's required yield.

1. Calculate the net outflow of costs at the inception of the lease.
2. Calculate the net residual value, including any ITC recapture.
3. Calculate the present value of the lease rental payments and the net residual value using the lessor's required yield rate as the discount rate.
4. Calculate the difference between the net outflow of costs (step 1) and the present value of the inflows (step 3).
5. Calculate the present value factor for the deposit refund.
6. Divide the difference between the net outflows (step 1) and the present value of the net inflows (step 4) by the factor calculated in step 5 above. The quotient is the required pretax equivalent of the refundable security deposit.
7. Convert the gross pretax equivalent refundable security deposit to its after-tax equivalent by multiplying it by one minus the lessor's tax rate. The result represents the actual dollar amount of the deposit paid in cash by the lessee.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example: Calculate the amount of a refundable security deposit based on the following assumptions:

Equipment cost:	\$100,000.
Lessor's incremental tax bracket:	46%.
Initial direct costs:	\$2,000.
Purchase option:	\$15,000.
Lease terms:	\$2,500 payments for 48 months with 2 payments in advance.
Lessor's required gross pretax nominal annual yield:	30%.
Investment tax credit (ITC)	\$10,000 (\$18,519 pretax equivalent).
ITC recapture:	\$2,000 (\$3,704 pretax equivalent).

Solution:

1. Calculate the net outflow of costs at the inception of the lease.

\$ -100,000	Equipment cost.
+ 18,519	Pretax investment tax credit.
- 2,000	Initial direct costs.
<hr/>	\$ -83,481 Net pretax initial outflow.

2. Calculate the net residual value including any investment tax recapture. The pretax recapture in this example is 20% of \$18,519, that is, \$3,704.

\$ +15,000	Purchase option.
<hr/>	- 3,704 Pretax ITC Recapture.
<hr/>	\$ +11,296 Net pretax residual value.

3. Calculate the present value of the lease rental payments (\$2,500) and the net pretax residual value (\$11,296 from step 2) discounted at the lessor's required before-tax yield rate of 30%.

Keystrokes	Display	
30 [g] [12+]	2.50	Monthly yield rate.
2500 [ENTER]	2,500.00	Payment amount.
2 [x]	5,000.00	Calculates the total amount of advance payments.
[g] [CFO]	5,000.00	Advance payments as the initial cash inflow.
2500 [g] [CF]	2,500.00	Regular lease payment.
46 [g] [N]	46.00	Number of lease payments after the advance payments.
0 [g] [CF]	0.00	Zero as the 47th payment.
11296 [g] [CF]	11,296.00	Net residual value as the 48th cash flow.
[f] [NPV]	76,338.29	Calculates the present value of the cash inflows.

4. Calculate the sum of the net outflow of costs in step 1 (\$-83,481) and the present value of the inflows in step 3 (\$76,338):

\$ -83,481	Initial outflows.
<hr/>	+ 76,338 Present value of inflows.
<hr/>	\$ -7,143 Present value of net deficit.

The deficit represents the amount to be made up from the deposit. However, the amount does not equal the deposit, since the value of the deposit is the difference between what the lessee must pay at the beginning of the lease and the present value of the amount to be refunded at the end of the lease. Therefore, further adjustment is necessary. The calculations for these adjustments follow.

5. Calculate the present value factor for the deposit refund. In words, the factor is one minus the present value of a payment of 1 at the end of 48 months, using the lessor's required yield rate as the discount rate. You calculate this factor by the following keystrokes.

Keystrokes	Display	
1 CLEAR FIN		Clears the financial registers.
30 g 12+	2.50	Monthly required yield.
48 n	48.00	Number of months in the lease term.
1 FV	1.00	Value of 1 at the end of 48 months.
PV	-0.31	Calculates the present value of 1.
f 4	-0.3057	Sets display to four decimal places.
1 +	0.6943	Calculates the present value factor for the residual value.

The difference represents the amount paid by the lessee at the inception of the lease minus the present value of the deposit refund at the end of the lease.

6. Divide the "difference" between the net outflows and the present value of the inflows (\$7,143, from step 4) by the factor calculated in step 5 above, (.6943). The quotient is the required pretax equivalent of the refundable security deposit.

$$\frac{\$7,143}{.6943} = 10,288.0599$$

or a pretax security deposit of \$10,288.06.

7. Convert the gross pretax equivalent of the refundable security deposit to its after-tax equivalent by multiplying it by one minus the lessor's tax rate. The result represents the actual cash amount to be paid by the lessee as a security deposit:

$$\$10,288.06 \times (1 - .46) = \$5,555.55$$

Verification: You can check the validity of the calculated value of the security deposit by the following procedure:

1. Calculate the net outflow at the lease's inception:

\$ -100,000	Equipment cost.
+18,519	Pretax investment tax credit.
-2,000	Initial direct costs.
+5,000	Two advance payments.
<u>+10,288</u>	Calculated pretax security deposit.
\$ -68,193	Net initial pretax outflow.

2. Calculate the net residual value:

\$ +15,000	Purchase option.
-3,704	Pretax ITC recapture (20% of \$18,519).
<u>-10,288</u>	Calculated pretax security deposit refund.
\$ +1,008	Net pretax residual value.

3. Compute the lease yield:

Keystrokes	Display	
f 2		Resets display to two decimal places.
68193 CHS g CF0	-68,193.00	Initial cash outflow.
2500 g CF1	2,500.00	Lease payment amount.
46 g N1	46.00	Number of lease payments after the two advance payments.
0 g CF1	0.00	Zero as the 47th payment amount.
1008 g CF1	1,008.00	Net residual value.
f IRR	2.50	Calculates the monthly yield rate.
12 x	30.00	Calculates the annual yield rate, which checks with the required rate assumed in the example.

Amount of a Residual Given a Fixed Payment, Yield, and Security Deposit

In the preceding section the lease payment and residual value were fixed and the security deposit was varied to achieve the required yield. In this section we will consider the case where the lease payment and security deposit are fixed so that the residual value must be varied to achieve the required yield. There are five steps required to calculate the amount of a residual value needed to maintain a lease's status as an FASB 13 operating lease.

1. Calculate the net outflow of costs at the inception of the lease.
2. Calculate the total of any investment tax credit recapture, plus any refund of the security deposit.
3. Calculate the present value of the inflows, including the remaining payment stream, along with the *ITC* recapture and security deposit refund from step 2.
4. Calculate the earnings deficit by subtracting the present value of the inflows (step 3) from the net outflows (step 1).
5. Calculate the future value of the earnings deficit which is the required gross residual value.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example: Calculate the gross residual value based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	50%.
Initial direct costs:	\$2,000.
Deposit:	\$5,000 (\$10,000 pretax equivalent).
Residual value:	Unknown.
Lease terms:	48 payments of \$2,500 with first payment in advance.
Lessor's required gross pretax nominal annual yield:	36%.

Investment tax credit (<i>ITC</i>):	\$10,000 (\$20,000 pretax equivalent).
<i>ITC</i> recapture:	\$2,000 (\$4,000 pretax equivalent).

Solution:

1. Calculate the net outflow at the inception of the lease.

\$ - 100,000	Equipment cost.
+ 20,000	Pretax <i>ITC</i> .
+ 10,000	Pretax deposit.
<u>- 2,000</u>	Initial direct costs.
\$ - 72,000	Net pretax outflow at time "0".

2. Calculate the total of any investment tax credit recapture refund of the security deposit.

\$ - 10,000	Deposit refund, pretax basis.
<u>- 4,000</u>	Pretax <i>ITC</i> recapture.
\$ - 14,000	Total.

3. Calculate the present value of the remaining payment stream, including the deposit refund and *ITC* recapture, all discounted at the required 36% gross pretax nominal annual yield.

Keystrokes	Display	
36 [g] [12 nd]	3.00	Monthly required yield.
2500 [g] [CF0]	2,500.00	One payment in advance entered as the initial cash flow.
[g] [CF]	2,500.00	Lease payment amount as the next cash flow.
47 [g] [N]	47.00	Number of lease payments after the advance payments.
14000 [CHS] [g] [CF]	-14,000.00	Negative cash flow at the end of the lease term (from step 2).
[f] [NPV]	61,573.79	Calculates the net present value of the cash flows.

4. Calculate the earnings deficit by adding the present value of the inflows from step 3 (\$61,674) and the net outflows in step 1 (\$ - 72,000).

-\$ 72,000	Net initial outflow.
+61,674	Net present value of inflow.
\$ -10,326	Net present value earnings deficit.

This amount represents the net present value of the gross residual value.

5. Calculate the future value of the earnings deficit, which becomes the required residual. Use the required gross pretax yield for the lease as the interest rate.

Keystrokes	Display	
[F] CLEAR [FIN]		Clears the financial registers.
36 [9] [12+]	3.00	Required monthly yield.
48 [n]	48.00	Term of the lease in months.
10326 [CHS] [PV]	-10,326.00	Earnings deficit as the present value.
[FV]	42,669.63	Calculates the pretax residual value needed to make up for the earnings deficit at the inception of the lease.

Verification: You can check the validity of these calculations by following the steps below.

1. Calculate net residual value.

\$ + 42,670	Residual value calculated above.
- 4,000	Pretax ITC recapture.
- 10,000	Pretax deposit.
\$ + 28,670	Net pretax residual value.

2. Calculate the IRR as the gross pretax yield.

Keystrokes	Display	
69500 [CHS] [g] [CF0]	-69,500.00	Net outflow minus the advance payment.
2500 [g] [CF]	2,500.00	Lease payment amount.
47 [g] [N]	47.00	Number of lease payments after the advance.
28670 [g] [CF]	28,670.00	Net pretax residual value.
[1] [IRR]	3.00	Calculates the monthly yield.
12 [x]	36.00	Calculates the nominal annual yield, which checks with the required yield.

Structuring a Lease Having Multiple Skipped Payments

Lessors frequently structure leases to meet the lessee's changing cash flow requirements. Such leases often have skipped payments during the months the lessee's cash flow is low. The HP-12C calculator easily determines the required payment for a wide variety of skipped payment patterns. There are five steps to follow in structuring skipped payment leases:

1. Calculate the net residual value at the end of the lease.
2. Calculate the present value of the net residual value.
3. Calculate the net outflow of costs at the inception of the lease.
4. Calculate the required lease rate factor for the skipped payment cash flow configuration.
5. Calculate the monthly lease payment.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example: Calculate the lease payment that will meet the following assumptions for a skipped payment lease:

Equipment cost: \$540,000.
 Lessor tax bracket: 45%.
 Initial direct costs: \$8,000.
 Security deposit: \$13,500 (\$25,000 pretax equivalent).
 Purchase option: 10% or \$54,000.
 Lease terms: 60 month lease with three payments in advance and skipped payments as listed below:

Time 0: 3R
 Year 1: 1R 2S 9R
 Year 2: 3S 9R
 Year 3: 3S 9R
 Year 4: 3S 9R
 Year 5: 3S 6R 3S
 S = Skipped payment
 R = Regular payment

Lessor's required gross pretax nominal annual yield: 36% (3% per month).
 Investment tax credit (ITC): \$54,000 (\$100,000 pretax equivalent).
 ITC recapture: None.

Solution:

1. Calculate the net residual value.

\$ +54,000	Purchase option.
—25,000	Pretax deposit refund.
\$ +29,000	Net pretax residual value.

2. Calculate the present value of the net residual value.

Keystrokes	Display	
1 CLEAR [FIN]		Clears the financial registers.
36 [9] 12+	3.00	Required monthly yield.

Keystrokes	Display	
29000 [CHS] [FV]	-29,000.00	Residual value.
60 [n]	60.00	Number of months in the term of the lease.
[PV]	4,922.26	Calculates the present value of the net pretax residual value.

3. Calculate the net outflow at the inception of the lease.

\$ -540,000	Equipment cost.
+100,000	Pretax ITC.
+25,000	Pretax deposit.
+4,922	Present value of the net pretax residual value.
—8,000	Initial direct costs.
\$ -418,078	Net present value pretax outflow.

4. Calculate the present value of the skipped payment stream. To enter regular payments (R), press 1 [g] [CF]; to enter skipped payments (S), press 0 [g] [CF]—all in the chronological sequence in which they occur. Discount this series at the required gross pretax discount rate designated by the lessor.

Keystrokes	Display	
36 [g] 12+	.3.00	Monthly required yield.
3 [g] [CF]	3.00	Three advance payments of 1 each.
1 [g] [CF]	1.00	First regular payment.
0 [g] [CF]	0.00	First skipped payment.
2 [g] [N]	2.00	Number of skipped payments.
1 [g] [CF]	1.00	Next regular payment (year 1).
9 [g] [N]	9.00	Number of regular payments.
0 [g] [CF]	0.00	Next skipped payment.

Keystrokes	Display	
3 [S] [N]	3.00	Number of skipped payments.
1 [9] [CF]	1.00	Next regular payment (year 2).
9 [S] [N]	9.00	Number of regular payments.
0 [9] [CF]	0.00	Next skipped payment.
3 [9] [N]	3.00	Number of skipped payments.
1 [9] [CF]	1.00	Next regular payment (year 3).
9 [9] [N]	9.00	Number of regular payments.
0 [9] [CF]	0.00	Next skipped payment.
3 [9] [N]	3.00	Number of skipped payments.
1 [9] [CF]	1.00	Next regular payment (year 4).
9 [9] [N]	9.00	Number of regular payments.
0 [9] [CF]	0.00	Next skipped payment.
3 [9] [N]	3.00	Number of skipped payments.
1 [9] [CF]	1.00	Next regular payment (year 5).
6 [9] [N]	6.00	Number of regular payments, ending at the end of year 5.
[F] [NPV]	23.26	Calculates the present value of the series of regular payments and skips.
[F] 6	23.257294	Sets display to six decimal places.

Note: Considerable time can be saved during the verification procedure that follows if the information entered above is left in the calculator registers.

5. Convert the present value of the payment stream to a lease rate factor by pressing $1/x$.

Keystrokes	Display	
$1/x$	0.042997	Lease rate factor (reciprocal of present value).

6. Calculate the monthly lease payment by multiplying the net equipment cost by the lease rate factor from step 5.

$$\$418,078 \times .042997 = 17,976.09977$$

or \$17,976.10.

Verification: You can check the validity of the calculation of the lease payment by following the steps below. The procedure below presumes that the note to step 4 was followed.

1. Calculate the net outflow.

\$ -423,000	Net outflow before the advance payments and residual.
+53,928	Three advance payments of \$17,976 each.
+4,922	Present value of the residual.
\$ -364,150	Net outflow at inception of the lease.

2. Calculate the *IRR* yield of the net outflow and the series of payments:

One method of making this calculation is to repeat step 4 above, inserting the net outflow at the inception (\$ -364,150) in place of the "3" as the initial cash flow in step 4, and inserting the calculated lease payment (\$17,976) in place of the "1's" as the regular payments in step 4.

However, if you left the information in step 4 stored in the machine, far fewer keystrokes will be required. The keystroke procedure below assumes that the information is still there and simply changes the information already stored in the calculator to the actual values that were calculated. The payment amounts were entered in step 4 as 1's and 0's. We will replace them with the calculated values by storing new information (the calculated figures) over the old information.

Keystrokes	Display
1 2	Resets display to two decimal places.
364150 CHS STO 0	-364,150.00
17976 STO 1	17,976.00
STO 3	17,976.00
STO 5	17,976.00
STO 7	17,976.00
STO 9	17,976.00
STO 1 1	17,976.00
11 n	11.00
1 IRR	3.00
12 x	36.00

Step-Up Lease with Fixed Initial Payments

To meet a particular lessee's cash flow requirements, lessors are sometimes requested to structure leases with low initial payments that in-

crease to higher amounts during the latter part of the lease term. This type of lease is called a *step-up* lease. Frequently, the lessee will specify that the lease payments must be a certain value during the the initial part of the lease term. The lessor must therefore calculate the amount the remaining payments must be to achieve a particular gross pretax yield.

Five steps are required to calculate the step-up lease payment amount needed to meet a particular yield requirement when the initial payment amount is known:

1. Calculate the net residual value.
2. Calculate the present value of the net residual value and the pre-established lease payments.
3. Calculate the net outflow of costs at the inception of the lease, including the present value of the pre-established lease payments and the net residual value.
4. Calculate the lease rate factor for the unknown remaining payments.
5. Calculate the remaining lease payments by multiplying the lease rate factor (step 4) by the net outflow (step 3).

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example: Calculate the required payment for a step-up lease based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	54%.
Initial direct costs:	\$1,500.
Security deposit:	\$2,500 (\$4,630 pretax equivalent).
Purchase option:	15% or \$15,000.

Lease terms:	60 payments in the following initial amounts: First 12: \$1,500 each Second 12: \$1,750 each Third 12: \$2,000 each Last 22: Unknown amount (to be calculated). 2 advance payments in the same amount as the 22 unknown payments.
Lessor's required gross pretax nominal annual yield:	24%.
Investment tax credit (ITC):	\$10,000 (\$18,519 pretax equivalent).
ITC recapture:	None.

Solution:

1. Calculate the net residual value.

\$ +15,000	Purchase option.
—4,630	Pretax deposit refund.
<hr/>	
\$ +10,370	Net pretax residual value.

2. Calculate the present value of the net residual value and pre-established lease payments. Use zero as the payment for the periods in which the unknown payment will occur. In this example that will be 23. There are 24 payments remaining, the last of which will not include a lease payment, but will include the net residual value.

Keystrokes	Display	
24 [g] [12+]	2.00	Required monthly yield.
0 [g] [Cf0]	0.00	Zero as the initial cash flow.
1500 [g] [Cf1]	1,500.00	First known payment amount.
12 [g] [N]	12.00	Number of months for the first payment amount.

Keystrokes	Display	
1750 [g] [Cf1]	1,750.00	Second known payment amount.
12 [g] [N]	12.00	Number of months for the third payment amount.
2000 [g] [Cf1]	2,000.00	Third known payment amount.
12 [g] [N]	12.00	Fourth known payment amount.
0 [g] [Cf1]	0.00	Zero for the rest of the months of the loan, except for the last.
23 [g] [N]	23.00	Number of months remaining (minus the last payment).
10370 [g] [Cf1]	10,370.00	Net residual value.
[f] [NPV]	46,785.96	Calculates the present value of the known cash flows.

3. Calculate net outflow at time "0" including the present value of the pre-established payments and net residual value.

\$ —100,000	Equipment cost.
—1,500	Initial direct costs.
+18,519	Pretax investment tax credit.
+4,630	Pretax security deposit.
+46,766	Present value of the pre-established payments and residual value.
<hr/>	
\$ —31,585	Net present value of pretax outflow.

4. Calculate the lease rate factor for the remaining payments using the numeral 1 for the unknown lease payments. Include the known payments in the computation as zeros. (These values are considered in step 3.)

Keystrokes	Display	
24 [g] [12+]	2.00	Required monthly yield.
2 [g] [Cf0]	2.00	Two advance payments of 1.

Keystrokes	Display	
0 [g] [CF]	0.00	Zero as the values for the known payments.
36 [g] [N]	36.00	Number of months for which payments are known.
1 [g] [CF]	1.00	Regular and unknown payment of 1.
22 [g] [N]	22.00	Number of regular payments of 1 after the two advance payments.
[f] [NPV]	10.56	Calculates the present value of the series of payments of \$1.
[1/x] [f] 6	0.093840	Calculates the lease rate factor and sets the display to six places.

5. Calculate the amount of the lease payments by multiplying the net outflow (step 3) by the lease rate factor (step 4).

$$\$31,585 \times .093840 = 2,963.936400,$$

that is, a lease payment of \$2,963.94.

Verification: You can check the validity of the calculated lease payment by the following procedure:

1. Calculate the Net Outflow at Time "0":

\$ -100,000	Equipment cost.
-1,500	Initial direct costs.
+18,519	Pretax investment tax credit.
+4,630	Pretax security deposit.
+5,928	Two advance payments ($2 \times \$2,963.95$).
\$ -72,423	Net pretax initial outflow.

2. Calculate the IRR yield:

Keystrokes	Display	
[f] 2		Resets display to two decimal places.
72423 [CHS] [g] [CF0]	-72,423.00	Initial outflow.
1500 [g] [CF]	1,500.00	First known payment amount.
12 [g] [N]	12.00	Number of months.
1750 [g] [CF]	1,750.00	Second known payment amount.
12 [g] [N]	12.00	Number of months.
2000 [g] [CF]	2,000.00	Third known payment amount.
12 [g] [N]	12.00	Number of months.
2964 [g] [CF]	2,964.00	Calculated payment amount.
22 [g] [N]	22.00	Number of months for the calculated payment amount, less the two advance payments.
0 [g] [CF]	0.00	Zero as the second-to-last payment amount.
10370 [g] [CF]	10,370.00	Residual value.
[f] [IRR]	2.00	Calculates the monthly yield. (This calculation takes about a minute.)
12 [x]	24.00	Calculates the nominal annual yield, which checks with the required yield assumed for the example.

Step-Up or Step-Down Lease With Constant Amount Increases or Decreases

To meet lessee cash flow requirements, lessors frequently structure leases with low initial payments that increase each month by a constant amount throughout the life of the lease. The structuring problem facing the lessor is to calculate how much the initial payment must be, given that the payment will increase by a fixed amount each month thereafter.

The calculation of the required beginning lease payment, given a fixed constant monthly increase consists of the following five steps:

1. Calculate the net residual value.
2. Calculate the present value of the net residual.
3. Calculate the net outflow of costs at the inception of the lease.
4. Calculate the lease rate factor for a lease payment that will grow at a constant amount each month.
5. Calculate the lease payment.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example: Calculate the beginning lease payment for a lease based on the following assumptions:

Equipment cost:	\$100,000.
Lessor tax bracket:	46%.
Initial direct costs:	\$1,500.
Security deposit:	\$2,500 (\$4,630 pretax equivalent).
Purchase option:	15% or \$15,000.
Lease terms:	48 payments at the end of each month, with payments increasing by 1% of the amount of the first payment each month. (Note: This is not an increase of 1% per month compounded.)
Lessor's required gross pretax nominal annual yield:	24%
Investment tax credit (ITC):	\$10,000 (\$18,519 pretax equivalent).
ITC recapture:	20% or \$2,000 (\$3,704 pretax equivalent).

Solution:

1. Calculate the net residual value.

\$ 15,000	Purchase option.
-4,630	Pretax deposit refund.
<u>-3,704</u>	Pretax ITC Recapture (20% of 18,519).
\$ +6,666	Net residual.

2. Calculate the present value of net residual.

Keystrokes	Display	
[1] CLEAR [FIN]		Clears financial registers.
6666 [CHS] [FV]	-6,666.00	Net residual value.
48 [n]	48.00	Number of months.
24 [g] [12+]	2.00	Monthly required yield.
[PV]	2,576.66	Calculates the present value of the residual.

3. Calculate the net outflow at time "0", including the present value of the net residual.

\$ - 100,000	Equipment cost.
- 1,500	Initial direct cost.
+18,519	Pretax investment tax credit.
+4,630	Pretax security deposit.
<u>+2,577</u>	Present value of the net residual value.
\$ - 75,774	Net outflow.

4. Calculate the lease rate factor for a lease payment growing at one percent of the initial payment each month. The fixed monthly increase must be expressed as a percentage of the unknown starting payment.

Keystrokes	Display	
[1] CLEAR [FIN]		Clears financial registers and sets END mode.
[g] [END]		Required monthly yield.
24 [g] [12+]	2.00	Required monthly yield in decimal form.
[ENTER] 1 [%]	0.02	Percent increase in first payment in decimal form (not in percent form).
.01	0.01	

Keystrokes	Display	
$\boxed{+} \boxed{1/x}$	0.50	Divides and takes the reciprocal of the quotient.
$\boxed{STO} 0$	0.50	Stores the above result temporarily.
1	1.	Beginning payment of 1.
$\boxed{+} \boxed{PMT}$	1.50	Calculates and stores the adjusted payment for the lease factor.
48 \boxed{n} \boxed{ENTER}	48.00	Stores and enters the number of lease payments.
$\boxed{RCL} 0 \times$ $\boxed{CHS} \boxed{FV}$	-24.00	Calculates and stores the adjusted future value for the lease factor.
$\boxed{PV} \boxed{CHS}$	36.73	Calculates the present value of the adjusted payment and future value.
$\boxed{1/x} \boxed{f} 6$	0.027224	Calculates the lease rate factor. (Sets display to 6 decimal places.)

5. Calculate the amount of the lease payment by multiplying the net outflow (step 3) by the lease factor (step 4).

$$\$75,774 \times .027224 = 2,062.871376$$

or \$2,062.87.

The \$2,062.87 amount is the starting monthly payment. The increase will be 1%, or \$20.63 per month. Thus, the payment at the end of the second month will be \$2,062.87 + \$20.63 = \$2,083.50, the third will be \$2,104.13, the fourth will be \$2,124.76, and so forth. The 48th payment will be \$3,032.48, that is, \$2,062.87 + (47 \times 20.63).

Structuring Variable Term or Variable Residual Leases

When a lessor's underlying borrowing costs rise so significantly that reimbursement is required, there are three basic ways this can happen:

- Vary the monthly lease payment in an amount equal to the cost increase.
- Lengthen the noncancelable term of the lease to compensate the lessor.
- Increase the amount of the purchase option or guaranteed residual in the lease.

This section describes the procedure for increasing the amount of the purchase option or residual value, as well as for lengthening the term of the lease in order to recover additional costs. In either case, the lease payment amount stays the same.

Note: Use pretax equivalent dollar amounts wherever specified. For the calculation of pretax equivalent amounts refer to page 13.

Example: Based on the following assumptions, calculate separately, both of the following:

- The additional residual value and
- The additional number of periods that are necessary to cover the expected additional costs.

Assumptions:

Lease terms: 48 payments of \$2,376 with two payments in advance.

Lessor's required gross pretax nominal annual yield: 24%.

Additional interest costs incurred by the lessor to be passed on to the lessee:

25th through 36th month an additional \$75 per month.

37th through 48th month an additional \$125 per month.

Solution:

There will be two answers, one for an increased residual value and a second for an increased number of lease payments. Both will leave the lease payment amount unchanged.

- Calculate the present value of the cost increases discounted at the lessor's required yield rate, 24%. Discount the cost increases to the date the first cost increase occurred, the beginning of the 25th month in this case.

Keystrokes	Display	
1 2		Resets display to two decimal places.
24 [g] [12+]	2.00	Required monthly yield.
0 [g] [CF0]	0.00	Zero as the initial cash flow.
75 [g] [CF1]	75.00	First cost increase.
12 [g] [N]	12.00	Number of months for the first cost increase.
125 [g] [CF1]	125.00	Second cost increase.
12 [g] [N]	12.00	Number of months for the second cost increase.
1 [NPV]	1,835.47	Calculates the value of the series of cost increases at beginning of the 25th month.

- Calculate the future value at the termination of the lease of the present value amount calculated in step 1 above (\$1,835.47). Use the lessor's required yield rate as the appreciation rate in this computation.

Keystrokes	Display	
1 CLEAR [FIN]		Clears financial registers and sets END mode.
9 [END]		
24 [g] [12+]	2.00	Required monthly yield.
1835 [CHS] [PV]	-1,835.00	Present value of the increases.
24 [n]	24.00	Number of months in the lease term.

Keystrokes	Display	
[FV]	2,951.48	Calculates the additional residual value needed if the increased costs were to be recovered solely by an increase in the residual value without increasing the term of the lease.
		3. Calculate the remaining number of payments using the future value deficiency calculated in step 2 above.

Keystrokes	Display	
[1] CLEAR [FIN]		Clears the financial registers.
24 [g] [12+]	2.00	Required monthly yield.
2376 [PMT]	2,376.00	Regular lease payment amount.
2951 [CHS] [PV]	-2,951.00	Value of the increases.
[n]	2.00	Calculates the additional number of periods needed if the increases in costs were to be recovered solely by lengthening the term of the lease, the last of which is not a full payment.
[FV] [RCL] [PMT] [+]	846.70	Amount of the partial payment due at the end of the second, and last additional period.

Section 4

After-Tax Lease Payment Structuring

Determining Gross After-Tax Yield Lease Payment

In structuring leases on a gross yield basis, lessors frequently need to know what lease payment is needed to achieve a particular after-tax nominal yield. The advantage of structuring leases on an after-tax basis is that all ACRS tax savings and the timing of these benefits are considered in addition to the other variables in pretax analysis.

The solution procedure set out below is a calculator procedure. Following this solution, a calculator program solution is presented. They result in the same answers if the assumptions about the numbers in an application are the same. The calculator procedure presented here emphasizes the step-by-step analysis. The program procedure suppresses this analysis and does the many calculations automatically. You may wish to learn the procedure by the calculator method first, then try the program method.

To calculate a lease payment that meets a particular required gross after-tax nominal monthly yield you must perform five steps:

1. Calculate the present value of the ACRS tax shield, using as a discount rate a quarterly effective interest rate that is equivalent to the required nominal monthly yield.
2. Calculate the present value of the net residual after:
 - Taxes
 - ITC recapture
 - Deposit refund
3. Calculate the net outflow of costs at the inception of the lease after deducting both the present value of the ACRS tax benefits and the net residual value.

4. Calculate the lease rate factor.
5. Calculate the lease payment.

Note: Use the after-tax equivalent dollars wherever specified. For the calculation of after-tax equivalent amounts refer to page 12.

Example: Calculate the payment that will achieve a required nominal monthly yield of 1.5% based on the following assumptions:

Equipment cost:	\$100,000
Lessor tax bracket:	46%
Initial direct costs:	\$2,778 (\$1,500 after-tax equivalent).
Refundable security deposit:	\$2,500
Lease terms:	48 months with 2 advance payments.
Purchase option:	\$15,000 which can be exercised when the assets book value is \$21,000 at the end of the 48th month of the lease.
Lesor's required monthly yield:	1.5%
Investment tax credit (ITC):	\$10,000
ITC recapture:	\$2,000 in the 48th month.
ACRS property class:	5 year, acquired Jan. 1, calendar year corporation.

Solution:

1. Calculate the present value of the Accelerated Cost Recovery System tax benefit discounted at a quarterly rate equivalent to the monthly required yield. For the method of calculating the quarterly equivalent discount rate to the monthly required yield, see page 19. For the method of calculating the present value of the ACRS tax benefit see page 25. The calculations specific to this example are presented below.

a. The quarterly equivalent discount rate is equal to the monthly nominal rate raised to the 3rd power after being converted to a decimal equivalent plus the numeral one.

Keystrokes	Display	
1 4		Sets the display to four decimal places.
1.5 [ENTER]	1.5000	Monthly nominal percentage rate.
1 [%] 1 [+]	1.0150	Calculates one plus the nominal monthly rate and converts result to a decimal fraction.
3 [Y]	1.0457	Previous result raised to the third power.
1 [-] 100 [x]	4.5678	Calculates the effective quarterly percentage rate that is equivalent to a 1.5% nominal monthly rate.

b. Schedule the quarterly ACRS deductions as the decimal equivalent of the annual ACRS percentage divided by four. Schedule only for the term of the lease, 48 months in this example.

For the example only the first four years of the table on page 27 will be used. Also, the equipment is purchased at the beginning of the year, so the first year ACRS benefit will be divided by four.

Year	ACRS Percentage
1	15%
2	22%
3	21%
4	21%

Year	Quarter	ACRS %	Quarterly Equivalent
1	1	15%	.0375
	2		.0375
	3		.0375
	4		.0375
2	5	22%	.0550
	6		.0550
	7		.0550
	8		.0550
3	9	21%	.0525
	10		.0525
	11		.0525
	12		.0525
4	13	21%	.0525
	14		.0525
	15		.0525
	16		.0525

c. Calculate the present value of the ACRS deductions discounted at the effective quarterly rate.

Keystrokes	Display	
1 4		Sets display to four decimal places.
4.5678 [I]	4.5678	Quarterly effective rate.
0 [g] [CF0]	0.0000	Initial cash flow of zero.
.0375 [g] [CF1]	0.0375	First year quarterly equivalent to ACRS from step 2.
4 [g] [N]	4.0000	Number of quarters.
.0550 [g] [CF1]	0.0550	Second year quarterly equivalent to ACRS from step 2.
4 [g] [N]	4.0000	Number of quarters.
.0525 [g] [CF1]	0.0525	Third and fourth year quarterly equivalents to ACRS from step 2.

Keystrokes	Display	
8 [g] [N]	8.0000	Number of quarters for the third and fourth years combined.
[f] [NPV]	0.5407	Calculates the present value of the quarterly equivalents to ACRS.

d. Multiply the equipment cost by the present value factor calculated above and by the tax rate, not as a percent.

$$\$100,000 \times .5407 \times .46 = \$24,872.20$$

This amount represents the present value of the ACRS tax shield benefit.

2. Calculate the present value of the net residual value after-tax and after ITC recapture and deposit refund.

a. Tax benefit on refund.

\$ +21,000	Book value at the end of four years.
-15,000	Purchase option.
\$ 6,000	Loss on sale.
× .46	Tax rate.
\$ +2,760	Tax benefit on loss on sale.

b. Net residual.

\$ +15,000	Purchase option.
+2,760	Tax benefit on loss on sale.
-2,500	Refundable security deposit.
-2,000	ITC recapture.
\$ +13,260	Net residual value.

c. Present value of the net residual.

Keystrokes	Display	
[f] 2		Resets display to 2 decimal places.
[f] [CLEAR] [FIN]		Clears financial registers.
1.5 [i]	1.50	Nominal required monthly yield.
48 [n]	48.00	Number of months in lease term.
13260 [CHS] [FV]	-13,260.00	Net residual value.
[PV]	6,488.94	Calculates the present value of the residual value.

3. Calculate the net outflow at time "0", including both the present value of the ACRS tax benefits and the net residual value.

\$ -100,000	Equipment cost.
-1,500	Initial direct costs after-tax.
+2,500	Security deposit.
+10,000	Investment tax credit.
+6,489	Present value of the net residual value.
+24,870	Present value of the ACRS Benefits.
\$ -57,641	Net present value after-tax outflow.

4. Calculate the lease rate factor.

Keystrokes	Display	
[f] [CLEAR] [FIN]		Clears financial registers.
48 [ENTER]	48.00	Number of months in lease term.
2 [STO] 0 [-] [n]	46.00	Number of lease payments.
1.5 [i]	1.50	Nominal required monthly yield.
1 [CHS] [PMT]	-1.00	Payment amount of 1.
[PV]	33.06	Calculates present value payments of 1 per period.

Keystrokes	Display	
RCL 0 +	35.06	Total present value including advance payments.
1/x 1 6	0.028525	Calculates the lease rate factor and displays to six decimal places.

5. Calculate the after-tax lease payment.

$$\$57,641 \times .028525 = \$1,644.209525$$

that is \$1,644.21, before-tax,

$$\frac{\$1,644.21}{(1 - .46)} = \frac{\$1,644.21}{.54} = \$3,044.83$$

as the after-tax lease payment.

Program for After-Tax Yield Lease Payments

The following HP-12C program calculates the before-tax lease payment required to achieve a given gross after-tax yield. The solution here is the same as the previous procedure. The following variables are used in the calculation:

- Total number of lease payments
- Number of advance payments
- Equipment cost
- Initial direct costs
- Investment tax credit
- Investment tax credit recapture
- Purchase option/residual value
- Ending book value
- Security deposit
- Lessor's tax bracket
- Present value of the ACRS tax benefits (see note below)

Note: The present value of the ACRS tax benefit is determined by a separate calculation that is demonstrated in the example on pages 25 through 26. Because the next example uses the same information as that on page 87, use the result of the earlier ACRS present value calculation (page 90) instead of recalculating it here.

This program is a valuable tool when used to structure a lease payment on an after-tax basis since the user can vary any of the twelve structuring variables to see how sensitive the lease payment is to change. For example, a lease structured in the last quarter of a fiscal year will have a lower payment than one structured in the first quarter of the fiscal year. This is because of the higher present value of the ACRS tax benefits (accelerated depreciation tax shield), which is caused by receiving 15 to 20 percent of an asset's cost depreciation for one quarter rather than spreading it out over four quarters. Many lease companies are able to lower their required lease payments at the end of their fiscal year and still maintain a given after-tax yield.

KEYSTROKES	DISPLAY	KEYSTROKES	DISPLAY
I P/R		RCL 0	14-45 48 0
1 CLEAR PRGM	00-	%	15- 25
RCL 6	01- 45 6	RCL 6	16- 45 6
RCL 7	02- 45 7	+	17- 40
9 x<y	03- 43 34	RCL 8	18- 45 8
9 GTO 12	04-43,33 12	RCL 5	19- 45 5
-	05- 30	+	20- 40
RCL 0	06-45 48 0	-	21- 30
%	07- 25	FV	22- 15
CMS	08- 16	CLX	23- 35
RCL 6	09- 45 6	PMT	24- 14
+	10- 40	PV	25- 13
9 GTO 18	11-43,33 18	STO 0	26- 44 0
x>y	12- 34	1	27- 1
-	13- 30	RCL 0	28-45 48 0

KEYSTROKES	DISPLAY	KEYSTROKES	DISPLAY
%	29- 25	PMT	48- 14
-	30- 30	CLX	49- 35
RCL 3	31- 45 3	FV	50- 15
x	32- 20	PV	51- 13
RCL 2	33- 45 2	RCL 1	52- 45 1
+	34- 40	+	53- 40
RCL 9	35- 45 9	STO + 0	54-44 10 0
-	36- 30	RCL n	55- 45 11
RCL 4	37- 45 4	RCL 1	56- 45 1
-	38- 30	+	57- 40
RCL 8	39- 45 8	n	58- 11
-	40- 40	RCL 0	59- 45 0
STO + 0	41-44 40 0	1	60- 1
RCL n	42- 45 11	RCL + 0	61-45 48 0
RCL 1	43- 45 1	%	62- 25
-	44- 30	-	63- 30
n	45- 11	+	64- 10
1	46- 1	I/P/R	
CHS	47- 16		

REGISTERS			
n: Number of Payments	i: Nominal Yield	PV: Used	PMT: Used
FV: Used	R ₀ : Used	R ₁ : # Advance Payments	R ₂ : Equipment Cost
R ₃ : Direct Cost	R ₄ : ITC	R ₅ : ITC Recap.	R ₆ : Pur. Opt. or Resid. Val.
R ₇ : Ending Book Value	R ₈ : Security Deposit	R ₉ : PV ACRS	R ₁₀ : Tax Rate

Procedure:

1. Key in the program.
2. Key in the nominal monthly gross after-tax yield (as a percentage), then press **[STO] 1**.
3. Key in the total number of lease payments (including any advance payments), then press **[n]**.
4. Key in the number of advance payments, then press **[STO] 2**.
5. Key in the equipment cost, then press **[STO] 2**.
6. Key in any initial direct costs (commissions, legal fees, etc.) as a dollar amount, then press **[STO] 3**.
7. Key in the investment tax credit (dollar amount), then press **[STO] 4**.
8. Key in any investment tax credit recapture (dollar amount), then press **[STO] 5**.
9. Key in the residual value or purchase option (dollar amount), then press **[STO] 6**.
10. Determine the equipment's book value at the end of the lease term. Book value is the equipment's cost, less any ACRS (accelerated depreciation) deductions previously taken. Key in the dollar book value, then press **[STO] 7**.
11. Key in the refundable security deposit (key in zero if there is none), then press **[STO] 8**.
12. Key in the present value of the ACRS tax benefits (see computation below), then press **[STO] 9**. This value is a separate calculation and the procedure for this example is explained on page 87.
13. Key in the lessor's incremental tax rate (as a percentage), then press **[STO] 10**.
14. Press **[R/S]** for the calculation of the gross before-tax lease payment.

Example 1: Use the program above to calculate the before-tax lease payment that will result in an after-tax nominal monthly yield to the lessor of 1.5% (that is, 18% annually) based on the following assumptions: (They are the same as for the example on page 87.)

Equipment cost:	\$100,000
Lessor tax bracket:	46%
Initial direct costs:	\$2,778
Security deposit:	\$2,500
Remaining book value at end of lease:	\$21,000
Lease terms:	48 payments with 2 payments made in advance, 48 month lease term.
Purchase option:	\$15,000
Lessor's required gross nominal monthly after-tax yield:	1.5%
Investment tax credit (ITC):	\$10,000
ITC recapture:	\$2,000
Present value of ACRS tax benefit (calculated in the example on page 90):	\$24,872

Solution:

Keystrokes	Display	
1 2		Resets display to 2 decimal places.
1.5 i	1.50	Nominal monthly yield.
48 R	46.00	Number of payments in the lease term.
2 STO 1	2.00	Number of advance payments.
100000 STO 2	100,000.00	Equipment cost.
2778 STO 3	2,778.00	Pretax initial direct costs.
10000 STO 4	10,000.00	ITC.
2000 STO 5	2,000.00	ITC recapture.
15000 STO 6	15,000.00	Purchase option.
21000 STO 7	21,000.00	Remaining book value.
2500 STO 8	2,500.00	Security deposit.
24872 STO 9	24,872.00	Present value of the ACRS tax benefit (calcu-

Keystrokes	Display	
46 STO 0	46.00	lated in the previous section, p. 89).
R/S	3,044.78	Tax rate as a percent. Calculates the before-tax lease payment necessary to achieve a 1.5% monthly after-tax yield.

Example 2: Consider the same example as above with one exception. The difference is that the equipment is not purchased in the first quarter of the lessor's tax year, it is purchased in the second quarter. This will increase the ACRS tax benefit in the first nine months of the lease, because the full amount of the first year ACRS deduction can be taken no matter when during the tax year the equipment is purchased. The treatment of the time of the purchase in the calculation of the present value of the ACRS tax benefit is explained in detail in section 2 on page 26. In that explanation an example is solved, and the final answer is a present value of \$30,286. The example is the one required for the solution to the example here. We will use that number to solve this example. You are encouraged to look back at that portion of the handbook if you have any questions.

Solution:

Keystrokes	Display	
	3,044.78	Presumes that the information from the previous example is still stored in the HP-12C.
30286 STO 9	30,286.00	New present value of the ACRS tax benefit.
R/S	2,758.78	Calculates the new before-tax lease payment necessary to achieve a 1.5% monthly after-tax yield.

The result of moving the purchase of the equipment to the second quarter of the tax year (and beginning the lease at that time) changes the required lease payment by \$286 (\$3,044.78 - \$2,758.78).

Section 5

Lease Versus Buy Analysis

Potential lessees are frequently confronted with the decision of whether to lease or to buy equipment or buildings. The principal tool used to make such a decision is a comparison of the total after-tax present value of leasing costs to the total after-tax present value of the cost of purchasing the equipment. For this comparison to be effective, all of the pertinent costs associated with the lease or purchase must be identified and considered. Since so many factors affect the lease versus buy decision, it is not practical to carry out this analysis using a calculator program. Instead, we have developed a method of analysis based on worksheets and manual keystroke procedures. This approach provides a flexible procedure that can handle a variety of problems, a format that clearly defines the relationships among the information, and a clear audit trail for checking the analysis.

Defining the Costs

The following two tables list fourteen leasing costs and thirteen buying costs which are frequently encountered. These lists contain the minimum number of costs which could affect the decision. If you encounter other costs, you should seek the services of a qualified accountant to help determine how those other costs will affect the end result of your analysis. The columns labeled "Tax Factor" and "PV Method" are explained following the tables. Note that we have assumed that the purchase option involves installment loan financing to make the purchase.

Leasing Costs

Applicable Leasing Costs	Tax Factor	PV Method
1. Advance Lease Payments	1-t	N/A
2. Refundable Security Deposits	N/A	N/A
3. Origination or Service Fees	1-t	N/A
4. Remaining Lease Rental Payments	1-t	PV of Annuity (END)
5. Sales or Use Tax	1-t	PV of Annuity (BEG)

Leasing Costs (Continued)

Applicable Leasing Costs	Tax Factor	PV Method
6. Maintenance	1-t	PV of Annuity (BEG)
7. Excess Use Fees	1-t	PV of Annuity (END)
8. Miscellaneous	1-t	PV of Annuity (END)
9. Purchase Option Plus Sales Tax	N/A	PV of One
10. Removal & Shipping Costs	1-t	PV of One
11. Residual Guarantee Deficiency	1-t	PV of One
12. Investment Tax Credit Pass-Through	N/A	PV of One
13. Return of Security Deposit	N/A	PV of One
14. ACRS Tax Shield	t	PV of Annuity (END)

Buying Costs

Applicable Buying Costs	Tax Factor	PV Method
1. Down Payment	N/A	N/A
2. Compensating Bank Balance	N/A	N/A
3. Origination or Service Fees	1-t	N/A
4. Sales or Use Tax	1-t	N/A
5. Installment Payment Amount	N/A	PV of Annuity (END)
6. Maintenance	1-t	PV of Annuity (END)
7. Miscellaneous	1-t	PV of Annuity (END)
8. Spare Parts and Additional Facilities	1-t	PV of Annuity (END)
9. Investment Tax Credit	N/A	PV of One
10. Return of Compensating Balance	N/A	PV of One
11. ACRS Tax Shield	t	Formula
12. Interest Tax Shield	t	Formula
13. Tax Adjusted Salvage Value	N/A	Formula

The column labeled "Tax Factor" lists the factor needed to convert certain costs to an after-tax basis. Certain items are tax deductible and must be converted to an after-tax basis by multiplying them by one

minus the tax rate. Other items are not deductible—such as refundable security deposits—and no adjustment is necessary. The symbol t means the tax rate in decimal form (not as a percent) and N/A means "not applicable".

The column labeled "PV Method" tells whether the cost in each row will represent the present value of a single future cost (PV of one) or of a series of costs (PV of annuity). The word "BEG" or "END" in parentheses indicates beginning or end of period payment mode.

Because of the many different variables and payment series being considered in this analysis you may wish to review the discussion about converting quarterly or annual interest rates to equivalent monthly interest rates (page 19). (Special recognition will be given to interest rate conversion in the following worksheets.)

One factor that is not considered is recapture of the investment tax credit. This is because the full life of the asset is being analyzed. If your application requires less than full life analysis, an additional line to include the present values of the investment tax credit recapture would be helpful in the worksheets.

In general, you should use the incremental, after-tax, weighted-average cost of capital as the discount rate in determining the present value of the applicable lease costs.

The Worksheet Procedure

The individual steps of the analysis are for the most part incorporated into the body of the worksheets. However, several of the costs require more complex calculations. These calculations are detailed in the following example. The layout of each worksheet is shown below.

Cost to Lease Worksheet

Applicable Leasing Costs	Amount	Tax Factor	PV Factor	Total Cost
1. Advance Lease Rental Payments	\$ \times	$1-t$	$\times 1$	= \$
2. Refundable Security Deposit	\$ \times	1	$\times 1$	= \$
3. Origination of Service Fees	\$ \times	$1-t$	$\times 1$	= \$
4. Remaining Lease Rental Payments	\$ \times	$1-t$	$\times \text{PVA (E)}$	= \$

Cost to Lease Worksheet (Continued)

Applicable Leasing Costs	Amount	Tax Factor	PV Factor	Total Cost
5. Sales or Use Tax	\$ \times	$1-t$	$\times \text{PVA (B)}$	= \$
6. Maintenance	\$ \times	$1-t$	$\times \text{PVA (B)}$	= \$
7. Excess Use Fees	\$ \times	$1-t$	$\times \text{PVA (E)}$	= \$
8. Miscellaneous	\$ \times	$1-t$	$\times \text{PVA (E)}$	= \$
9. Purchase Option Plus Sales Tax	\$ \times	1	$\times \text{PV1}$	= \$
10. Removal and Shipping Costs	\$ \times	$1-t$	$\times \text{PV1}$	= \$
11. Residual Guarantee Deficiency	\$ \times	$1-t$	$\times \text{PV1}$	= \$
12. ITC Pass-through	\$ \times	1	$\times \text{PV1}$	= \$
13. Return of Security Deposit	\$ \times	1	$\times \text{PV1}$	= \$
14. ACRS Tax Shield	\$ \times	t	$\times \text{PVA (E)}$	= \$
Total Present Value of the Cost to Lease _____ \$				

Cost to Buy Worksheet

Applicable Buying Costs	Amount	Tax Factor	PV Factor	Total Cost
1. Down Payment	\$ \times	$1-t$	$\times 1$	= \$
2. Compensating Bank Balance	\$ \times	1	$\times 1$	= \$
3. Origination or Service Fees	\$ \times	$1-t$	$\times 1$	= \$
4. Sales or Use Tax	\$ \times	$1-t$	$\times 1$	= \$
5. Installment Payment Amount	\$ \times	1	$\times \text{PVA (E)}$	= \$
6. Maintenance	\$ \times	$1-t$	$\times \text{PVA (E)}$	= \$
7. Miscellaneous	\$ \times	$1-t$	$\times \text{PVA (E)}$	= \$

Cost to Buy Worksheet (Continued)

Applicable Buying Costs	Amount	Tax Factor	PV Factor	Total Cost
8. Spare Parts & Additional Facilities	\$ \times 1- t \times PVA (E) =			\$
9. Investment Tax Credit	\$ \times 1 \times PV1 =			\$
10. Return of Compensating Balance	\$ \times 1 \times PV1 =			\$
11. ACRS Tax Shield	FORMULA			\$
12. Interest Tax Shield	FORMULA			\$
13. Tax Adjusted Salvage Value	FORMULA			\$
Total Present Value of the Cost to Buy	—————			\$

An Example of Lease Versus Buy Analysis

The following example will help you to understand how this analysis works and also provide the detailed calculations for the more complex calculations required for certain costs.

Defining the Problem

Costs to Lease. Equipment with a retail sales price of \$100,000 can be leased over 48 months at \$2,682 per month with one lease payment paid in advance. In addition there is a \$200 service fee. The equipment can be purchased at the end of the lease by exercising a purchase option for \$15,000 plus sales tax at 5%. The regular lease payments are also subject to a 5% sales tax. A refundable security deposit of \$2,500 is required by the lessor. It is anticipated that the equipment will last one year beyond the lease, at which time it will be worthless. The lessor will pass through the \$10,000 ITC which is expected to be converted to cash savings within three months. The potential lessee's annual incremental, after-tax, weighted-average cost of capital is 1.4% per month (a nominal annual rate of 16.8%) and he is in a 46% tax bracket. Maintenance, costing \$200 per month, will be paid in addition to the lease payment. Excess use fees of \$500 are expected to be paid at the end of each year.

Costs to Buy. If purchased, the equipment will be purchased by a \$20,000 down payment combined with a loan for \$80,000 financed over 48 months at a 19% interest rate with monthly payments of \$2,392. Sales tax of 5% of cost is paid in advance on the equipment. The equipment will last 5 years, at which time it will be worthless. The owner will depreciate the equipment over 5 years, using the ACRS method. The bank requires a \$3,000 compensating bank balance, along with service fees of \$500. Maintenance is expected to cost \$250 per month, plus annual spare parts costs will be \$1,000 at the end of each year.

Solution. Each line of each worksheet will be developed below using the line numbers as step numbers in the solution procedure. There are two things you should keep in mind throughout the analysis:

- Be aware of whether the payment series being analyzed has payments made at the END or at the BEGINning of each period.
- Be aware of the period involved in each payment series—monthly, quarterly, annually, or single payment.

Converting Monthly Interest Rate to Equivalent Quarterly or Annual Rate

Step 7 of the Cost to Lease Worksheet, and Steps 8, 12, and 13 of the Cost to Buy Worksheet require calculation of the present value of non-monthly payment series. Since the month is the basic time period of the analysis, it is necessary to discount those series at a rate that is equivalent to a monthly discount rate. The procedure for this calculation is explained on page 19. Below are the procedures for calculating the quarterly rate and the annual rate equivalent to the 1.4% monthly weighted-average, after-tax cost of capital that is assumed for the example above.

Equivalent quarterly rate:

Keystrokes	Display	
1 4	1.0000	Sets display to four decimal places.
1 ENTER	1.0140	One plus the monthly interest rate, converted to a decimal fraction.
1.4 % +		

Keystrokes	Display	
3 $\boxed{x^3}$	1.0428	Raises the previous result to the third power.
1 $\boxed{-}$ 100 \boxed{x}	4.2591	Calculates the quarterly rate equivalent to the monthly rate of 1.4%.

The 4.2591% rate will be used in steps 12 and 13 of the Cost to Buy Worksheet, where the equivalent quarterly rate is required.

Equivalent annual rate:

Keystrokes	Display	
1 $\boxed{\text{ENTER}}$		
1.4 $\boxed{\%}$ $\boxed{+}$	1.0140	One plus the monthly interest rate, converted to a decimal fraction.
12 $\boxed{x^2}$	1.1816	Raises the previous result to the 12th power.
1 $\boxed{-}$ 100 \boxed{x}	18.1559	Calculates the annual rate equivalent to the monthly rate of 1.4%.

The 18.1559 % figure will be used in step 7 of the Cost to Lease Worksheet and step 8 of the Cost to Buy Worksheet where the equivalent annual rate is required.

Completing the Cost to Lease Worksheet

1. The advance lease payment of \$2,682 is fully tax deductible and must be multiplied by one minus the tax rate. No present value factor is required since this expense occurs at the inception of the lease. The entry for line 1 will look like this:
1. Advance Payments $\$2,682 \times (1 - .46) \times 1 = \$1,448$
2. The refundable security deposit of \$2,500 is not tax deductible so it is not multiplied by a tax factor. It is an inception cost and does not require further calculation. The entry for line 2 will be:
2. Security Deposit $\$2,500 \times 1 \times 1 = \$2,500$
3. The \$200 origination service fee is tax deductible and must be multiplied by one minus the tax rate to convert it to an after-tax equivalent. Line 3 will be:

3. Origination Fees $\$200 \times (1 - .46) \times 1 = \108
4. There are 47 remaining lease payments of \$2,682 each. The present value of this series of 47 payments must be calculated as the present value of an annuity in arrears (payments at the end of each period). We will calculate a present value factor which can be inserted in the worksheet as a multiplier.

Keystrokes	Display	
$\boxed{\text{f}}$ $\boxed{\text{CLEAR}}$ $\boxed{\text{FIN}}$		Clears financial registers.
$\boxed{9}$ $\boxed{\text{END}}$ $\boxed{1}$ $\boxed{4}$		Sets payment mode to END and sets display to four decimals.
1 $\boxed{\text{CHS}}$ $\boxed{\text{PMT}}$	-1.0000	Payment amount of 1.
47 \boxed{n}	47.0000	Number of remaining payments.
1.4 \boxed{i}	1.4000	Monthly interest rate.
\boxed{PV}	34.2675	Present value factor for the remaining payments.

This factor is entered along with the other information in line 4:

4. Remaining Payments $\$2,682 \times (1 - .46) \times 34.2675 = \$49,629$
5. A sales tax of 5% of each lease payment is required to be paid. Thus, the present value of an annuity in advance must be computed (sales tax on one advance payment). Use the $\boxed{9}$ $\boxed{\text{BEG}}$ keystroke in this step. The sales tax on one payment is:

$$.05 \times 2,682 = \$134.$$

The present value factor for the sales tax is:

Keystrokes	Display	
$\boxed{\text{f}}$ $\boxed{\text{CLEAR}}$ $\boxed{\text{FIN}}$		Clears financial registers and sets payment mode to BEGIN.
$\boxed{9}$ $\boxed{\text{BEG}}$		
1 $\boxed{\text{CHS}}$ $\boxed{\text{PMT}}$	-1.0000	Payment amount of 1.
1.4 \boxed{i}	1.4000	Monthly interest rate.
48 \boxed{n}	48.0000	Number of months.
\boxed{PV}	35.2675	Present value factor.

Line 5 then becomes:

$$5. \text{ Sales Tax } \$134 \times (1 - .46) \times 35.2675 = \$2,552$$

6. The monthly maintenance cost must be adjusted for the 5% sales tax. In addition, maintenance charges are usually paid along with regular lease payments, thus one maintenance charge has been paid in advance. We will handle the present value factor for the maintenance cost as a series of payments paid at the beginning of each period, using the **9 BEG** function. The total maintenance charge—including sales tax—is:

$$200 + (200 \times .05) = \$210$$

The present value factor is calculated as follows:

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers and sets payment mode to BEGIN.
9 BEG		
1 CHS PMT	-1.0000	Payment amount of 1.
1.4 i	1.4000	Monthly interest rate.
60 n	60.0000	Number of months in the full life of asset.
PV	40.9777	Calculates the present value factor for maintenance.

Line 6 will be:

$$6. \text{ Maintenance } \$210 \times (1 - .46) \times 40.9777 = \$4,647$$

7. Excess use fees for using the equipment beyond a specified maximum are to be paid at the end of each year. These items must be discounted after-tax annually in arrears. Since it is an annual series of payments to be analyzed on a monthly basis, we must use the equivalent annual interest rate of 18.1559% (see page 104) to calculate the present value factor.

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers and sets payment mode to END.
9 END		

Keystrokes	Display	
1 CHS PMT	-1.0000	Annual payment of 1.
4 i	4.0000	Number of years in lease.
18.1559 i	18.1559	Annual interest rate.
PV	2.6819	Present value factor for the excess use fee.

With this present value factor, line 7 is:

$$7. \text{ Excess Use Fees } \$500 \times (1 - .46) \times 2.6819 = \$724$$

8. The miscellaneous cost line in the worksheet is used for other fees that frequently affect leasing such as contingent rentals, accounting costs, insurance, property taxes, etc. There are none in this example, so zero is entered onto line 8 of the Cost to Lease Worksheet:

8. Miscellaneous **\$0** = **\$0**

9. The present value of the purchase option plus sales tax must be calculated without adjustment for taxes since the purchase of equipment is not tax deductible. (However, the subsequent depreciation on the asset is tax deductible.) We can discount the purchase option plus sales tax for 48 months at the monthly rate of 1.4%, or for 4 years at the annual equivalent rate of 18.1559%. Either method results in the same answer. In the next keystroke series the 48-month period is used.

The purchase option plus sales tax is:

$$15,000 + (15,000 \times .05) = \$15,750$$

The present value factor is calculated as follows:

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
1 CHS FV	-1.0000	Future value of 1.
48 n	48.0000	Number of months.
1.4 i	1.4000	Monthly interest rate.
PV	0.5131	Present value factor for the purchase option plus sales tax.

Line 9 then takes the form:

$$9. \text{ Purchase Option } \$15,750 \times 1 \times 0.5131 = \$8,081$$

10. In the event that the purchase option is not exercised, the lessee would pay shipping and removal costs which must be tax adjusted by the factor $(1-t)$. The present value factor calculated in step 9 above is used and the result is entered onto line 10 of the Worksheet. The option is exercised in the example, therefore zero is entered:

$$10. \text{ Removal Costs } \$0 = \$0$$

11. Some leases (closed end) require the lessee to return the asset to the lessor and pay any deficiency below a stated minimum salvage value upon the subsequent salvaging of the equipment by the lessor. Such residual guaranteed deficiency must be tax adjusted by the factor $(1-t)$. The present value factor from step 9 is also used here. The example is not a closed end lease and a zero is entered onto line 11 of the Worksheet:

$$11. \text{ Residual Deficiency } \$0 = \$0$$

12. Since the lessor has elected to pass-through the investment tax credit to the lessee, the lessee will have the benefit of a tax saving. This amount is not tax adjusted since it can be offset dollar for dollar against a tax liability. Frequently however, the lessee must wait several months until his next quarterly tax deposit is due to actually receive the cash benefit. We must therefore calculate the present value factor of the *ITC* for the number of months the benefit is delayed.

Keystrokes

Display

1 **CLEAR** **[FIN]**
9 **[END]**

Clears the financial registers and sets payment mode to **END**.

1 **[FV]**
3 **[n]**
1.4 **[i]**
[PV]

1.0000
3.0000
1.4000
-0.9591

Future value of 1.
3 months.
Monthly interest rate.
Present value factor of *ITC*.

The amount calculated is a receipt to the lessee, thus a negative number in the Cost to Lease Worksheet:

12. *ITC* Pass-through $\$10,000 \times 1 \times -0.9591 = \$-9,591$

13. The refundable security deposit is usually returned to the lessee on the last day of the lease. This item requires no tax adjustment, but its present value must be calculated. The present value factor is the same as that calculated in step 9 (0.5131). The return of the security deposit is a cash receipt to the lessee, thus a negative number in the Cost to Lease Worksheet:

13. Sec. Deposit Return $\$2,500 \times 1 \times -0.5131 = \$-1,283$

14. Since the asset will be valued at zero at the end of the 5th year, a tax deduction equal to the purchase option price, plus sales tax, will be available to the lessee. This tax deduction will produce a tax benefit equal to the option price multiplied by the tax rate, t , not $(1-t)$. This calculation will be for the period of 60 months as a single payment.

Keystrokes

Display

1 **CLEAR** **[FIN]**

Clears the financial registers.

1 **[FV]**

1.0000

Future value of 1.

60 **[n]**

60.0000

Number of months.

1.4 **[i]**

1.4000

Monthly interest rate.

[PV]

-0.4342

Present value factor for the tax benefit.

The tax benefit is a receipt to the lessee, thus a negative number in the Cost to Lease Worksheet:

$$14. \text{ ACRS Tax Shield } \$15,750 \times .46 \times -0.4342 = \$-3,146$$

This completes the individual entries for the Cost to Lease Worksheet. The final step is to sum all of the values to calculate the present value cost to lease. This sum is shown on the filled out worksheet that follows.

Cost to Lease Worksheet

Applicable Leasing Costs	Amount	Tax Factor	PV Factor	Total Cost
1. Advance Payments	\$ 2,682	× .54	× 1	= \$ 1,448
2. Security Deposit	\$ 2,500	× 1	× 1	= \$ 2,500
3. Service Fees	\$ 200	× .54	× 1	= \$ 108
4. Remaining Payments	\$ 2,682	× .54	× 34.2675	= \$49,629
5. Sales or Use Tax	\$ 134	× .54	× 35.2625	= \$ 2,552
6. Maintenance	\$ 200	× .54	× 40.9777	= \$ 4,647
7. Excess Use Fees	\$ 500	× .54	× 2.6819	= \$ 724
8. Miscellaneous	\$ 0	× 1-t	× PVa	= \$ 0
9. Purchase Option	\$15,750	× 1	× 0.5131	= \$ 8,081
10. Removal Costs	\$ 0	× 1-t	× PV1	= \$ 0
11. Residual Deficiency	\$ 0	× 1-t	× PV1	= \$ 0
12. ITC Passthrough	\$10,000	× 1	× -0.9591	= \$-9,591
13. Secur. Dep. Return	\$ 2,500	× 1	× -0.5131	= \$-1,283
14. ACRS Tax Shield	\$15,750	× .46	× -0.4342	= \$-3,146
Total Present Value of the Cost to Lease				→ \$55,669

Completing the Cost to Buy Worksheet

1. Down payments are not tax deductible and require no present value adjustment. Should the equipment user desire to pay cash in lieu of a loan, then the total cash price would become the down payment with respect to the worksheet format. Line 1 is entered as follows:
 1. Down Payment $\$20,000 \times 1 \times 1 = \$20,000$
2. Compensating bank balances represent non-tax deductible funds required to be placed with a bank during the full term of an installment loan. No present value adjustment is required since the compensating balance is placed with the bank at the inception of the lease. Line 2 is entered as follows:
 2. Compensating Balance $\$3,000 \times 1 \times 1 = \$3,000$
3. Line 3 of the Cost to Buy Worksheet is treated the same as under a lease:

3. Service Fees $\$500 \times (1 - .46) \times 1 = \270
4. Sales or use tax is usually computed as a percentage of the equipment's cost, is paid at the inception of the lease, and is fully tax deductible.

The sales tax is calculated as follows:

$$\$100,000 \times .05 = \$5,000$$

The result is entered on line 4 of the worksheet as follows:

4. Sales Tax $\$5,000 \times (1 - .46) \times 1 = \$2,700$
5. The present value of the remaining installment payments of \$2,392 per month is calculated as an ordinary annuity without adjustment for taxes. The tax deductible interest component of each payment is treated as a deduction from purchasing costs in step 13 below.

Keystrokes	Display	
1 [CLEAR] [FIN] 9 [END]		Clears financial registers and sets payment mode to END.
1 [CHS] [PMT]	-1.0000	Payment amount of 1.
48 [n]	48.0000	Number of months.
1.4 [i]	1.4000	Monthly interest rate.
[PV]	34.7806	Present value factor for loan payments.

Line 5 will be:

5. Remaining payments $\$2,392 \times 1 \times 34.7806 = \$83,195$
6. Maintenance is treated the same as under the lease alternative, except that there would probably be no advance payments and consequently no maintenance would be paid in advance.

Keystrokes	Display	
1 [CLEAR] [FIN] 1 [CHS] [PMT]	-1.0000	Clears financial registers. Payment amount of 1.

Keystrokes	Display	
60 n	60.0000	Number of months.
1.4 i	1.4000	Monthly interest rate.
PV	40.4119	Present value factor for maintenance costs.

Line 6 is then entered as follows:

$$6. \text{ Maintenance } \$250 \times (1 - .46) \times 40.4119 = \$5,456$$

7. Miscellaneous costs are treated in the same manner as in a lease:

$$7. \text{ Miscellaneous } \$0 = \$0$$

8. When an equipment owner must provide his own maintenance, as contrasted with a full service lease where maintenance is included, he usually incurs additional costs for spare parts and additional facilities. These costs must be tax adjusted and the present value of the series of costs must be calculated as an ordinary annuity. The calculation in this example will be on an annual basis using the equivalent annual interest rate of 18.1559%.

Keystrokes	Display	
1 CLEAR FIN		Clears the financial registers.
1 CHS PMT	-1.0000	Payment amount of 1.
5 n	5.0000	Number of years.
18.1559 i	18.1559	Equivalent annual interest rate.
PV	3.1162	Present value factor for spare parts cost.

Line 8 will be:

$$8. \text{ Spare parts } \$1,000 \times (1 - .46) \times 3.1162 = \$1,683$$

9. The Investment Tax Credit is treated the same as under the leasing alternative. The present value factor for the ITC is -0.9591:

$$9. \text{ ITC } \$10,000 \times 1 \times -0.9591 = \$-9,591$$

10. Return of the compensating balance is treated the same as the return of a security deposit under the leasing option (no tax adjustment is required). The calculation is on an annual basis using the 48 month period in a monthly analysis. The procedure for calculating the present value factor is detailed in step 9 of the Cost to Lease Worksheet (page 107).

Keystrokes	Display	
1 CLEAR FIN		Clears the financial registers.
1 FV	1.0000	Future value of \$1.
48 n	48.0000	Number of periods.
1.4 i	1.4000	Monthly interest rate.
PV	-0.5131	Present value factor for the compensating balance.

The return of the compensating balance is a receipt, which will be a negative number on the Cost to Buy Worksheet. The information is entered in the worksheet as follows:

10. Return of Compensating Bal. $\$3,000 \times 1 \times -0.5131 = \$-1,539$

11. The depreciation tax shield is calculated by multiplying the equipment purchaser's tax rate by the applicable quarterly ACRS tax deduction percentage as in the following table. The present value of these benefits are then calculated using a quarterly equivalent discount rate of 4.2591% (calculated on page 103).

Year	Annual %*	Quarterly %	Deduction
1	15%	3.75%	3,750
2	22%	5.50%	5,500
3	21%	5.25%	5,250
4	21%	5.25%	5,250
5	21%	5.25%	5,250

* These ACRS percentages are subject to change in 1985 and 1986 and thereafter. Also, the quarterly percentages available during the first year might be higher, depending upon which quarter the asset was acquired.

Keystrokes	Display	
1 CLEAR FIN		Clears financial registers.
1 2		Sets display to 2 decimals.
4.2591 i	4.28	Equivalent quarterly interest rate.
0 g CF0	0.00	Zero as the initial cash flow.
3750 g CF1	3,750.00	First year quarterly deduction.
4 g N1	4.00	Number of quarters.
5500 g CF2	5,500.00	Second year quarterly deduction.
4 g N1	4.00	Number of quarters.
5250 g CF3	5,250.00	Quarterly deduction amount for the third, fourth and fifth years.
12 g N1	12.00	Number of quarters in the last three years.
1 NPV	65,091.42	Calculates the present value of the ACRS tax deductions.
46 % CMS	-29,942.05	Calculates the present value of the ACRS tax benefits.

The ACRS tax benefits are receipts, which will appear as negative numbers on the Cost to Buy Worksheet. Enter \$-29,942 onto line 11 of the Cost to Buy Worksheet.

12. The interest tax shield benefits of the interest included in each loan installment payment is determined first by calculating the amount of interest paid each quarter on the loan. Refer to page 14 for an explanation of loan amortization in order to determine the quarterly interest deductions. Once these have been calculated, then their present value must be determined using the equivalent quarterly discount rate. The table below summarizes the interest amounts calculated from the following amortization procedure.

Amortization Schedule

Year	Quarter	Interest Amount
1	1	3,746.27
	2	3,580.75
	3	3,407.27
	4	3,225.40
2	5	3,034.77
	6	2,834.92
	7	2,625.44
	8	2,405.85
3	9	2,175.66
	10	1,934.36
	11	1,681.42
	12	1,416.27
4	13	1,138.34
	14	846.98
	15	541.56
	16	221.41

Calculate the NPV of this series:

Keystrokes	Display	
4.2591 i	4.28	Quarterly interest rate.
0 g CF0	0.00	Zero as the initial cash flow.

Keystrokes	Display	
3746 [g] [CF]	3,746.00	First quarterly interest.
3581 [g] [CF]	3,581.00	Second quarterly interest.
3407 [g] [CF]	3,407.00	And so forth . . .
3225 [g] [CF]	3,225.00	
3035 [g] [CF]	3,035.00	
2835 [g] [CF]	2,835.00	
2625 [g] [CF]	2,625.00	
2406 [g] [CF]	2,406.00	
2176 [g] [CF]	2,176.00	
1934 [g] [CF]	1,934.00	
1681 [g] [CF]	1,681.00	
1416 [g] [CF]	1,416.00	
1138 [g] [CF]	1,138.00	
847 [g] [CF]	847.00	
542 [g] [CF]	542.00	
221 [g] [CF]	221.00	
[I] [NPV]	27,205.55	Present value of the interest payments.
46 [%] [CHS]	-12,514.55	Present value of the tax benefit from the interest payments.

The tax benefits from the interest payments are receipts, thus the present value of the tax benefit is entered as a negative number on the Cost to Buy Worksheet. Recall that the present value of the entire payment series on the loan was calculated and entered on line 5 of the worksheet. Enter $-\$12,515$ onto line 12 of the Cost to Buy Worksheet.

13. In the event the lease is a closed-end lease (no purchase option available), then it must be assumed that the equipment is sold under the purchase alternative on the same day the lease ends; otherwise, a valid comparison cannot be made. Basically, the salvage value would be the anticipated residual proceeds of the asset, less any taxes due on the sale, less any ITC recapture. If the proceeds are less than the remaining book value, then a tax benefit would be created which must be added to the salvage

proceeds. The tax adjusted salvage value should be discounted for the number of months in the lease term using the monthly rate of interest.

For the example, the lease is not a closed-end lease. Therefore, enter zero on line 13 of the Cost to Buy Worksheet.

All of the calculations for the individual entries on the Cost to Buy Worksheet are now complete and can be summed. The final answer for the cost to buy is given on the completed worksheet below:

Cost to Buy Worksheet

Applicable Buying Costs	Amount	Tax Factor	PV Factor	Total Cost
1. Down Payment	$\$20,000 \times 1 \times 1 = \$ 20,000$			
2. Compensating Bal.	$\$ 3,000 \times 1 \times 1 = \$ 3,000$			
3. Service Fees	$\$ 500 \times .54 \times 1 = \$ 270$			
4. Sales or Use Tax	$\$ 5,000 \times .54 \times 1 = \$ 2,700$			
5. Remaining Payments	$\$ 2,392 \times 1 \times 34.7806 = \$ 83,195$			
6. Maintenance	$\$ 250 \times .54 \times 40.4119 = \$ 5,456$			
7. Miscellaneous	$\$ 0 \times 1-t \times PVa = \$ 0$			
8. Spare Parts	$\$ 1,000 \times .54 \times 3.1162 = \$ 1,683$			
9. ITC	$\$10,000 \times 1 \times -0.9591 = \$ -9,591$			
10. Return of Compensating Bal.	$\$ 3,000 \times 1 \times -0.5131 = \$ -1,539$			
11. Depreciation Tax Shield	FORMULA			$= \$ -29,942$
12. Interest Tax Shield	FORMULA			$= \$ -12,515$
13. Tax Adjusted Salvage Value	FORMULA			$= \$ 0$
Total Present Value of the Cost to Buy				$\$ 62,717$

Conclusion

The analysis we have just completed shows that the present value cost of leasing is $\$55,669$ and the comparable cost of buying is $\$62,717$. Thus, we conclude that buying would cost $\$7,048$ more than leasing, that is $\$62,717 - \$55,669$. Based on this analysis then, leasing is the more attractive alternative.

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