

## LeaseMaker® Supplement for Lenders & Lessors

LeaseMaker® Supplement for Lenders & Lessors	1
APRChecker™ Routine	1
Computing Balloon-Loan Payment Factors	6
LeaseChecker™ Routine	7
Sample Lease with Dealer Reserve	8
Calculating Early Lease Terminations	9
Lease Payoff Routine	9
Elapsed Term	10
Net Yield Calculations	10
Total Yield Calculations	11
Bank (Acquisition) Fee	11
Early Termination Fees	11
Actuarial/Level Yield Implicit Rate (Code 401)	12
Rule of 78's (Sum of the Digits) Method (Code 402)	13
Rule of Anticipation Method (Code 403)	14
Constant Yield (Equivalent Rate) Method (Code 404)	15
History and Derivation of the Lease Factor	16

### **APRChecker™ Routine**

The LeaseMaker can be used to check the Annual Percentage Rate and Federal Box Disclosure of retail contracts, and to compute the dealer reserve or interest-rate buydown by three different methods. A minimum dealer reserve can be specified, and a percentage paid value can be specified. 0% loans can be checked and discounted.

The various disclosure items are entered: APR, Finance Charge, Amount Financed, Total of Payments, Payment Schedule, etc. These numbers are checked for mathematical accuracy. If any error or deviation is detected, it is reported. The entered data and results can be printed with the optional LeaseMaker Printer Kit.

(The APRChecker™ product is also available as a PC product. Visit us at [www.promsoft.com](http://www.promsoft.com) for more information and a downloadable demonstration copy.)

#### **Description of Dealer Reserve Methods**

For each dealer reserve method, there are two code numbers. Use the first number to start the routine if you do not want to print the results. If you want a printed record, and have the optional printer kit, use the second code number to start the routine. To start any of the APRChecker routines, push the [Setup] key, enter the appropriate code number in response to the "CODE?\_" prompt, and push [Enter].

**Difference in Finance Charges (Code 581 & 681)** - The entered simple buy rate is applied to the note amount over the term of the loan to find a finance charge at the buy rate. This amount is subtracted from the contract finance charge to compute the dealer reserve.<sup>1</sup>

This method is basically just calculating the loan twice, once at the rate the borrower is to pay, and again at the lender's buy rate (the rate at which he is willing to buy the contract from the dealer).<sup>2</sup>

**Present Value Reserve (Code 584 & 684)** - This method discounts the stream of payments at the simple buy rate (using the actuarial method of compounding interest) to find the present value. The note amount is subtracted from this present value to find the dealer reserve. This method can also be used to allow the dealer to "buy down" the rate, i.e., the dealer can advertise a lower interest rate than the bank is willing to accept. In this case, the reserve appears as a Buy Down amount and is the additional amount the dealer must give to the lender in order for the lender to realize the buy rate.

**Prorate Reserve (Code 585 & 685)** - This method prorates the total finance charge between the dealer and the lender based on the ratio of the buy rate to the contract rate. E.g., if the contract is computed at 10.0% and the buy rate is 8.0%, the dealer would received 2/10<sup>ths</sup> of the finance charge<sup>3</sup>.

A minimum dealer reserve amount can be specified.

#### **Early Terminations**

When the dealer reserve is paid up front, a problem for the lender arises if the borrower pays the loan off early. In this case, the lender has advanced an amount to the dealer that is based on the loan running to maturity. If the loan does not run to maturity, the lender will not realize the interest income that was expected.

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<sup>1</sup> This method is the most common (it is used by virtually all captive-finance companies). The lender's yield on the loan is slightly below the entered Buy Rate because the lender advances the dealer reserve amount at the start of the loan and yet must wait for the stream of payments to be repaid. Thus the dealer reserve amount becomes a no-interest loan that reduces the lender's overall yield on the loan slightly. The present value method takes this timing into account and computes a slightly smaller dealer-reserve amount that maintains the lender's yield.

For interest-rate buy downs, the reverse error occurs and the buy-down amount is too high when the difference-in-charges method is used. Again, the present value method will produce the accurate amount.

<sup>2</sup> In the second calculation, the finance charge is determined without adjusting the payment to a whole cent.

<sup>3</sup> Exclusive of any prepaid charge which is passed through to the lender in it's entirety.

Some lenders charge the dealer back for unearned portions of the dealer reserve due to early terminations. The dealer may be required to leave a portion of the accumulated dealer reserve amounts on deposit with the lender as security against future charge-backs.

Another common method is to only advance the dealer a percentage of the calculated reserve amount (typically 65%-75%) and then not bother to charge the dealer back for early terminations. This percentage paid can be entered in the PCT PD % field.

### **Buying Down the Interest Rate**

A common method of promoting automobile and other product sales is to offer the buyers very low interest rates. These rates are usually well below the true cost of money. To induce a lender to accept the loans, the dealer "buys down" the interest rate by making an additional payment to the lender.

To calculate<sup>4</sup> this buy-down amount, check the loan and compute the dealer reserve using the Present Value method. Enter the lender's required rate as the Buy Rate. The buy down amount will be calculated, which is the amount the dealer must advance to the bank.

In practice, the lender simply reduces the advance to the dealer by the buy-down amount, e.g., if the amount financed on the contract is \$14,300 and the buy-down amount is \$350, the lender would advance \$13,950 to the dealer.

### **Credit Insurance**

Loans with single-premium credit insurance can be checked with this routine. The premiums are included in the Note Amount and Amount Financed and are not considered part of the Finance Charge provided that the purchase of credit insurance is optional and not a condition of providing credit. Loans with monthly-outstanding-balance credit insurance (premiums collected monthly over the life of the loan) cannot be checked with this routine.

<sup>4</sup> The calculation is much like pricing a bond. The loan as cast by the dealer represents a stream of payments to be made to the lender. This stream of payments is discounted at the lender's required rate (Buy Rate) to find the present value. This present value (which is less than the note amount because of the discounted loan interest rate) is subtracted from the note amount to find the additional amount the dealer must advance to the lender in order for the lender to realize the required rate.

As an example, consider a \$15,000, 36-month loan at 3.9%. Loan is made on 5/1/99 with the first payment due 6/1/99 (31 days later using an Actual calendar to the first payment). The monthly payment is \$442.22. The lender will accept the loan at 8%, and using a rate of 8%, the present-value buy-down amount is calculated at \$889.75. Thus, the stream of 36 payments discounted at 8% has a present value of \$14,110.25 to the lender, some \$889.75 less than the amount financed of \$15,000.

### **APRChecker™ Routine**

#### **Prompt**

CODE = 581/681  
584/684  
585/685

APR % xx.xx?\_

CHG xxxxx.xx?\_

AMTF xxxxx.xx?\_

TPMTS xxxxx.xx?\_

*(If the Amount Financed plus the Finance Charge do not equal the Total of Payments, an error will be reported.)*

TERM xx?\_

PMT xxxx.xx?\_

*(If the number of payments times the payment amount does not equal the Total of Payments, an error will be reported. See footnote 5 for 0% loans.)*

DAYS TO #1 xx?\_  
DAYS TO 1ST XX?\_

#### **User Response**

Push the [Setup] Key and enter the desired code in response to the "CODE" prompt. After entering the code to run this routine once, you can push the Star [\*] function key to run it again.

Enter the disclosed APR as a percentage.<sup>5</sup>

Enter the disclosed Finance Charge.

Enter the disclosed Amount Financed.

Enter the disclosed Total of Payments.

Enter the term in months.

Enter the payment amount.

If using a Federal or 360-day calendar the DAYS TO #1 prompt will appear. If using an Actual calendar, the DAYS TO 1ST prompt will appear.

In either case, enter the total number of days to the first payment, thus if there are 45 days to the first payment, enter "45".

See the Setup Routine to select the calendar.<sup>6</sup>

<sup>5</sup> You can check and discount 0% loans. Enter a 0 for both the A.P.R. and Finance Charge, and make sure the Amount Financed and Total of Payments are the same. Enter the regular monthly payment at the payment prompt—the program will automatically calculated an adjusted final payment if it is necessary (the last payment will not be adjusted by more than  $n + 10$  cents, where 'n' is the number of payments, e.g., on a 36-month loan, the maximum adjustment is 0.46).

<sup>6</sup> If a loan is checked with a calendar different than the one used to compute it, you will see small variations in the computed APR and loan rate. The APR is, of course, based on both the amount of the finance charge and the length of time the borrower has use of the amount borrowed. The small differences in the way the length of the first period is measured from one calendar system to another

PPD CHG xx. xx?\_

Enter the prepaid charge.

APR COMP	xx. xx%
* APR WARNI NG *	
APR DI FF	xx. xx%
LOAN RATE	xx. xx%
[Reserve Method]	

Computed APR percentage.<sup>7</sup>  
If the computed APR deviates by more than 0.05%, this warning message appears.

Difference between disclosed and computed APRs.

If there is a prepaid charge, the loan rate is calculated and disclosed here.<sup>8</sup>

The dealer reserve method appears here.

BUY RATE xx. xx?\_

Enter the lender's buy rate.<sup>9</sup>

MI N RES xx. xx?\_

Enter the minimum dealer reserve amount the lender will pay.<sup>10</sup>

PCT PD % xx?\_

Enter the percentage of the dealer reserve amount that is paid to the dealer.<sup>11</sup>

RESERVE	xxxx. xx
BUY DOWN	xxxx. xx

The computed dealer reserve or interest rate buy down amount will appear.

will have a small effect on the APR. Typically, most indirect loans are computed with the Federal or 360-day calendar, and should be checked using that calendar. If the loan is computed on a Actual-to-first, or Actual/365 basis, then use the Actual calendar to check the loan.

<sup>7</sup> APR is calculated by Federal Truth-in-Lending Regulation Z, §226.14 and Appendix J method using the calendar method selected to measure the length of the first period.

<sup>8</sup> If there is a prepaid charge, the loan interest rate will be lower than the APR. If there is no prepaid charge, the loan interest rate will be the same (or very nearly the same).

<sup>9</sup> If the buy rate is equal to or less than the loan interest rate, the dealer reserve will be calculated. If the buy rate is greater than the loan interest rate, the interest rate buy down will be calculated.

<sup>10</sup> Even if the buy rate is the same as the loan interest rate, the minimum applies. For interest rate buy down calculations, this prompt does not appear and the minimum is not applied.

<sup>11</sup> To compensate the lender for early terminations, only a portion of the computed dealer reserve is actually paid to the dealer. You should enter that percentage here. For interest rate buy down calculations, this prompt does not appear and the percentage is not applied.

### Computing Balloon-Loan Payment Factors

This routine computes two factors that are used to compute the monthly payment for a balloon loan. Balloon loans must be enabled before this routine can be used. The factors calculated by this routine are appropriate for the type of balloon loan specified in the setup routine.

Code = 199

Push the [Setup] key and enter this code to calculate balloon-loan payment factors.

BAL TYPE 1/2?\_  
CONV BALLOON  
N-PMT BALLOON

(BAL TYPE 1/2? appears only if the ASK option is selected in the Setting the Balloon Payment Method menu.) Enter "1" for a conventional balloon loan, or "2" for an N-payment balloon loan.

TERM?\_

Enter the loan term in months (3 or more).

DAYS TO #1 xx?\_  
DAYS TO 1ST xx?\_

If using a Federal or 360-day calendar the first prompt will appear. If using an Actual calendar, the second prompt will appear.

In either case, enter the total number of days to the first payment, thus if there are 45 days to the first payment, enter "45".

RATE xx. xx?\_

Enter the interest rate as a percentage.

UNPD BF	. xxxxxxx
FI X VF	. xxxxxxx

Unpaid balance (pmt) factor  
Balloon factor

The calculation is done in two steps. First, multiply the unpaid balance factor by the unpaid balance of the loan to generate a monthly payment without any credit for the balloon. Second, multiply the balloon factor by the balloon payment amount to generate a monthly credit which is deducted from the payment calculated in the first step.

For a conventional balloon, the factors for a 48-month, 10% balloon loan are 0.0258020 and 0.0173243. For a \$20,000 loan with an \$8,500 balloon, the payment is \$368.78 (20,000 x .0258020 - 8,500 x .0173243 = 368.783). There will be 47 payments at \$368.78 and 1 final payment of \$8500.00 due one month after the last regular monthly payment.

For an N-payment balloon, the factors are 0.0253626 and 0.0170293 resulting in a payment of \$362.50 (of which 48 are made).

## LeaseChecker™ Routine

This routine will compute the lease factor of a lease<sup>12</sup>, and will then compute the dealer reserve using a "buy" factor. Yields to the lessor are calculated.

### Prompt

Code = 481

CAP?\_

RESID?\_

TERM?\_

B PMT?\_

### User Response

Enter this code and push [ENTER] to calculate the lease dealer reserve by the difference in charges method. After entering the code to run this routine once, you can push the [\*] function key to run it again.

Enter the adjusted lease cap.

Enter the residual value used to compute the lease.

Enter the term of the lease.

Enter the base payment (excluding monthly taxes or non-financed charges).

FACTOR            xxxxxx    Computed lease factor.<sup>13</sup>

BUY xxxxxx?\_    Enter the "buy" factor.

CHG DIF        xxxxx. xx    Computed difference in charges reserve.

BANK FEE    xxx. xx?\_    Enter the bank fee.

YI ELD1        xxx. xxx%    Yield without dealer reserve.<sup>14</sup>  
YI ELD2        xxx. xxx%    Yield after dealer reserve paid.<sup>15</sup>

<sup>12</sup> This routine will extract the lease factor for any lease, not just those computed with a lease factor. It can be used to determine the equivalent factor for a simple-interest lease.

<sup>13</sup> The formula to find the factor is:  $(N \times P + R - C) / (N \times (C + R))$  where N is the term, P the payment, R the residual, and C the lease cap.

<sup>14</sup> Both yields include the impact of the bank fee and the advance first payment.

<sup>15</sup> The dealer reserve is considered to be advanced to the dealer at lease signing. Often, all or a portion of the dealer reserve is held back and advanced to the dealer at a later time. Any delay in payment of the reserve to the dealer will increase Yield2.

## Sample Lease with Dealer Reserve

Assume an adjusted cap of \$25,000, residual of \$12,000, term of 36 months, and a factor of 0.00440.

The monthly payment calculates to be \$523.91.

The bank fee of \$495 was paid at signing and is not capitalized.

First we check this lease by entering the adjusted cap of \$25,000, the residual of \$12,000, the term of 36, and the payment of \$523.91. The lease factor is calculated as 0.00440, which is what was used to calculate the payment.

Then we enter a "buy" factor of 0.00420, giving the dealer a .00020 spread. The dealer reserve computes at \$266.36.<sup>16</sup>

Next, enter the bank fee of \$495 and push [Enter] to compute the yields.

Yield1 is the gross yield and computes at 11.601%. This is the yield of the lease to the lessor, including the advance first payment and bank fee but without the dealer reserve payment.<sup>17</sup>

Yield2 is the net yield and computes at 11.038%. This is the yield to the lessor after advancing the dealer reserve amount of \$266.36.<sup>18</sup>

<sup>16</sup> Original lease charge is \$5,860.76 (36 x 523.91 + 12,000.00 - 25,000.00). "Buy" lease charge is \$5,594.40.  $((25,000 + 12,000) \times 0.00420 \times 36 = 5,594.40)$ . Subtracting \$5,594.40 from \$5,860.76, we get a reserve amount of 266.36.

<sup>17</sup> Net advance is \$23,981.09 (25,000.00 - 495.00 - 523.91).

<sup>18</sup> Net advance is \$24,247.45 (25,000.00 - 495.00 - 523.91 + 266.36).

## Calculating Early Lease Terminations

The LeaseMaker can be used to compute early terminations of leases. The net payoff amount and lease charge refund are calculated by a variety of commonly used methods which are described in detail below.<sup>19</sup>

The net and total yields<sup>20</sup> to the lessor are calculated. They reflect the gain on early payoff based on the particular payoff method, as well as the impact of bank and early termination fees.

For all calculation methods, the first monthly payment is assumed to be paid in advance, followed by the remaining monthly payments in sequence. The residual value is assumed to be made one month after the last scheduled monthly payment is made.

The calculations assume the advance and all scheduled payments (except the one due at the end of the elapsed term) have been made.<sup>21</sup>

## Lease Payoff Routine

This routine calculates the lease payoff amount, lease charge refund, and various yields to the lessor.

Prompt	User Response
CODE = 401	Push the [Setup] Key and enter the desired code in response to the "CODE" prompt. See page 12 and following for a description of Early Termination Calculation Methods. After entering the code to run this routine once, you can push the [*] function key to run it again.
402	
403	
404	
ORI G TERM xx?	Enter the original term.
ELAP TERM xx?	Enter the elapsed term.

<sup>19</sup> The methods described herein are commonly used in the leasing industry, but are by no means the only methods in use. One should always contact the lessor to get an exact payoff quote for a particular lease.

<sup>20</sup> The yields and implicit rate calculated by the LeaseMaker use the U.S. convention where the monthly rate is multiplied by 12 to compute the annual rate, e.g., a monthly rate of 1% is an annual rate of 12%. In some countries, the monthly rate is compounded to obtain the annual rate, e.g., a 1% monthly rate would compute to an annual rate of 12.683%.

<sup>21</sup> See Elapsed Term on page 10.

See Elapsed Term below.

CAP xxxxx? Enter the adjusted lease cap.

RESID xxxxx? Enter the residual value.

B PMT xxx. xx? Enter the base payment (excluding taxes).

FACTOR	xxxxxx	Computed factor.
IRR	xxx. xx%	Computed Internal Rate of Return.
PMTS TO GO	xx	Number of remaining payments.
REFUND	xxxx. xx	Lease rent charge refund.
PAYOFF	xxxxx. xx	Payoff (excluding early termination fee).
N YIELD	xx. xxx%	Net yield if paid off. <sup>22</sup>

BANK FEE? Enter the bank fee.

TERM FEE? Enter the early termination fee to be added to the above computed payoff.

T POFF	xxxxx. xx	Payoff with early termination fee.
T YIELD	xx. xxx%	Total yield if paid off including fees. <sup>23</sup>

## Elapsed Term

The elapsed term is the number of months the lease is considered to run. Generally, lessors accrue the lease charge for the entire month at the beginning of the month. For example, assume a lease is written on January 1st. The lessee has just made the 11<sup>th</sup> sequential payment<sup>24</sup> on December 1st, and a few days later wants to pay the lease off. The elapsed term would be 12 months, and the lease charge will be earned through the 12<sup>th</sup> month.

## Net Yield Calculations

For all refund methods, the Net Yield (N YIELD) is calculated. This is the internal rate of return assuming the lease is paid off at the end of the elapsed term. This calculation takes into account any accelerated earnings because of the refund

<sup>22</sup> See Net Yield Calculations on page 10.

<sup>23</sup> See Total Yield Calculations on page 11.

<sup>24</sup> This can also be considered the 12<sup>th</sup> payment because one was made in advance in addition to the 11 sequential payments.

method. It does not take into account the effect of the bank fee or early termination fee.

**Total Yield Calculations**

For all refund methods, the Total Yield (T YIELD) is calculated. This takes into consideration the gain on payoff from accelerated earnings plus the impact of the bank fee and early termination fee.

**Bank (Acquisition) Fee**

A Bank (some times called "origination" or "acquisition") fee is usually charged on a lease. If a lease is paid off early, the fee is typically kept in its entirety by the lessor. Much like an origination fee on a mortgage, the yield to the lessor improves if the lease is terminated early. The bank fee can be entered at the BANK FEE prompt. The total yield calculation includes the impact of a bank fee.

**Early Termination Fees**

Lessors often add an early termination fee to the calculated payoff amount. This has the effect of increasing the yield to the lessor if the lease is terminated early. An early termination fee can be entered at the TERM FEE prompt. The total yield calculation includes the impact of an early termination fee.

**Actuarial/Level Yield Implicit Rate (Code 401)**

The net investment in the lease is the lease cap less the advance payment. This method extracts the implicit internal rate of return in the lease<sup>25</sup>, and this rate is applied to the lease balance each month to accrue the lease charge. The bank fee, if any, is not taken into account when computing the implicit rate.

The implicit rate is divided by 12 to obtain a monthly rate. The initial lease balance is the net investment (lease cap less the first payment). Each month, the monthly implicit rate is multiplied by the previous month's lease balance to obtain the earned lease charge. The earned charge is subtracted from the monthly payment (except in the final month when the residual is due) to find the monthly depreciation. The monthly depreciation is deducted from the previous lease balance to find the current lease balance.

No matter when the lease is paid off, the lessor will realize the same yield that he would have if the lease ran to maturity.<sup>26</sup>

Sample payoff and yield calculations for a \$20,000 Lease, \$7,500 residual, 0.00700 factor, 36 month term, payment of \$539.72, bank fee of \$350, and early termination fee of \$500. Computed implicit internal rate of return is 16.622%.<sup>27</sup>

Elapsed Term	Refund	Payoff	Net Yield	Total Payoff	Total Yield
6	5,369.84	18,321.76	16.621%	18,821.76	25.675%
12	3,954.07	16,499.21	16.622%	16,999.21	21.324%
18	2,695.12	14,519.84	16.622%	15,019.84	19.896%
24	1,606.48	12,370.16	16.622%	12,870.16	19.201%
30	702.80	10,035.52	16.622%	10,535.52	18.800%

<sup>25</sup> The present value is the net investment (lease cap less the advance payment). A stream of n-1 payments (e.g., 35 on a 36-month lease) are assumed, followed by the residual value one month after the last regular payment. The annual implicit rate can be computed on an Excel spreadsheet by the formula "=RATE(N, -P, C, -R, 1) x 12", where N is the term, P the payment, C the cap, and R the residual. The rate is rounded to three decimal places.

<sup>26</sup> This does not take into account the effect of a bank fee or early termination fee. If there is a bank fee, the lessor will realize a greater yield the earlier the payoff occurs because no part of the bank fee is refunded. An early termination fee will also increase the yield, and the earlier the termination, the greater the increase.

<sup>27</sup> The unrounded computed rate is 16.621786%. This is rounded to three places (16.622%) for display and for calculating the refund and payoff amounts.

**Rule of 78's (Sum of the Digits) Method (Code 402)**

The net investment in the lease is the lease cap less the advance payment.

Each month, the earned charge is calculated by dividing the month number (starting with the highest number, e.g., 12 for a 12-month lease) by the sum of all the months' digits.<sup>28</sup> The earned lease charge is subtracted from the monthly payment (except in the final month when the residual is due) to find the monthly depreciation. The monthly depreciation is deducted from the previous lease balance to find the current lease balance.

This method accelerates the earning of the lease charge considerably compared to the Actuarial/Level Yield Method. The larger the residual value in proportion to the lease cap, the greater the acceleration.<sup>29</sup>

Sample payoff and yield calculations for a \$20,000 Lease, \$7,500 residual, 0.00700 factor, 36 month term, payment of \$539.72, bank fee of \$350, and early termination fee of \$500.

Elapsed Term	Refund factor	Refund	Payoff	Net Yield	Total Payoff	Total Yield
6	0.698198	4,838.46	18,853.14	22.024%	19,353.14	30.979%
12	0.450450	3,121.58	17,331.70	20.830%	17,831.70	25.435%
18	0.256757	1,779.31	15,435.65	19.716%	15,935.65	22.910%
24	0.117117	811.61	13,165.03	18.659%	13,665.03	21.179%
30	0.031532	218.51	10,519.81	17.636%	11,019.81	19.781%

<sup>28</sup> For a 12-month lease, 12/78<sup>ths</sup> of the charge is earned the first month, 11/78<sup>ths</sup> the second, 10/78<sup>ths</sup> the third, and so forth, with 1/78<sup>th</sup> being earned the last month. 78 is the sum of the digits from 1 through 12. A formula for computing the sum of the months' digits is:  $Sum = N \times (N + 1) / 2$ , where N is the month number, e.g., if N = 12, the sum is  $(12 \times 13) / 2$  or 78.

<sup>29</sup> The Rule of 78's reasonably tracks the amortization of a conventional installment loan with no balloon payment and gives an advantage to the lender in the case of early terminations. Because leases have a residual value, the advantage to the lessor becomes more significant, especially in the first half of the lease term. The larger the residual value is in comparison to the lease cap, the greater the advantage. For short leases with high residuals (70%+), the acceleration can more than double the yield of the lease if it is paid off early.

**Rule of Anticipation Method (Code 403)**

First the implicit ("lease" or "money") factor is extracted from the lease.<sup>30</sup>

Using the implicit factor, a hypothetical lease is then calculated "backwards" (solving for the lease cap) using the original payment and residual value, and remaining term of the lease.<sup>31</sup>

The lease charge on this hypothetical lease is the refund of the original lease charge.<sup>32</sup> This method could be considered a "true" no penalty payoff method for a factor lease.

Sample payoff and yield calculations for a \$20,000 Lease, \$7,500 residual, 0.00700 factor, 36 month term, payment of \$539.72, bank fee of \$350, and early termination fee of \$500. Computed lease factor is 0.00700.

Elapsed Term	Refund	Payoff	Net Yield	Total Payoff	Total Yield
6	5,413.37	18,278.23	16.173%	18,778.23	25.235%
12	4,020.64	16,432.64	16.278%	16,932.64	20.988%
18	2,765.59	14,449.37	16.377%	14,949.37	19.659%
24	1,664.22	12,312.42	16.470%	12,812.42	19.054%
30	735.13	10,003.19	16.553%	10,503.19	18.734%

<sup>30</sup> The lease factor can be extracted from any lease. The formula is:  $(N \times P + R - C) / (N \times (C + R))$ , where N is the lease term, P the payment, R the residual value, and C the lease cap.

<sup>31</sup> The formula to calculate the lease cap is:  $Cap = (K \times (P - R \times F) + R) / (1 + K \times F)$ , where K is the remaining term, P is the payment, R is the residual, and F is the factor.

<sup>32</sup> As an example, assume a lease cap of \$20,000, residual of \$7,500, term of 36 months, and factor of 0.00700. The payment calculates at \$539.72. If the lease is to be paid off after 12 months, we calculate a lease "backwards" using this payment, factor, residual value, and term of 24 months. We get a lease capitalization of \$16,432.60 and a lease charge of \$4,020.68. The payoff is \$16,432.60, and it includes a lease charge refund of \$4,020.68.

### Constant Yield (Equivalent Rate) Method (Code 404)

First the implicit ("lease" or "money") factor is extracted from the lease.<sup>30</sup>

The initial lease balance is the same as the net investment in the lease (the lease cap less the advance payment).

Each month, the implicit factor is applied to twice the lease balance to compute the earned lease charge.<sup>33</sup> The earned charge is subtracted from the monthly payment (except in the final month when the residual is due) to find the monthly depreciation. The monthly depreciation is deducted from the previous lease balance to find the current lease balance.

This method of converting the factor produces approximate results that are fairly accurate if the residual value is about 50% of the lease cap.<sup>34</sup>

Sample payoff and yield calculations for a \$20,000 Lease, \$7,500 residual, 0.00700 factor, 36 month term, payment of \$539.72, bank fee of \$350, and early termination fee of \$500. Computed lease factor is 0.00700 and an equivalent rate of 16.800%.

Elapsed Term	Refund	Payoff	Net Yield	Total Payoff	Total Yield
6	5,352.44	18,339.16	16.800%	18,839.16	25.851%
12	3,919.45	16,533.83	16.800%	17,033.83	21.498%
18	2,643.52	14,571.44	16.800%	15,071.44	20.070%
24	1,538.30	12,438.34	16.800%	12,938.34	19.374%
30	618.65	10,119.67	16.800%	10,619.67	18.973%

<sup>33</sup> The effect of doubling the lease balance is to double the factor. E.g., a factor of 0.00425 becomes a monthly lease charge of 0.00850. Multiplying this by 12 gives the annual lease charge rate of 0.1020 or 10.20%. The equivalent annual rate can be calculated directly by multiplying the factor by 2400.

<sup>34</sup> The implicit rate for a 36-month lease with a residual that is 50% of the lease cap and a factor of 0.00473 is 11.351% which is very close to the equivalent rate of 11.352%. With residual value percentages greater than 50%, the implicit rate is higher than the equivalent rate (thus a payoff calculated with the equivalent rate will be lower than one calculated with the implicit rate). With residual value percentages less than 50%, the implicit rate is lower than the equivalent rate. The implicit rate/equivalent rate relationship is also affected by the term of the lease. See also on page 16.

### History and Derivation of the Lease Factor

The lease or money factor has a bit of magic about it. It is widely used for calculating leases and yet often not understood. It is the first-generation descendant of the "add-on" interest rate (called the Flat rate in some countries) that was used widely in the 1950's through the 1970's to calculate loan payments for automobiles.

The add-on rate was a brilliant invention at the time. The auto industry was very interested in making financing readily available and the add-on rate was a perfect way to make it easy for nearly anyone to compute the payments for a loan. There were no financial calculators, and, before the add-on rate, people had to refer to large tables to compute the proper payment and finance charge for loans. The tables were unwieldy, had many, many pages, and only had loans for even amounts (such as \$10,000 or \$11,000 – no in between amounts), making them hard to use. The genius of the add-on rate was that you could calculate exact payments with simple multiplication and division – no higher math was required.

To illustrate, a \$10,000 loan with an 8% add-on rate for one year has an interest charge of \$800.00. The total of payments is \$10,800, and dividing that by 12, we get a payment of \$900.00. A two-year loan has an interest charge of \$1,600, a three-year loan, \$2,400, and so forth.

A side benefit of the add-on rate was that the rates seemed low – a 7% add-on rate sounded better than an A.P.R. or yield of 12.83%. On a 36-month loan, the two rates are equivalent and result in the same interest charge and payment. (With the arrival of the Federal Truth-in-Lending Regulation, the add-on rate has fallen into disuse.)

In a simple-interest loan, the interest charge is computed by applying a monthly rate to the series of decreasing balances. Each month, the balance is reduced because a payment has been made. The add-on rate was applied to the initial loan amount for the entire term of the loan. Because the initial loan amount is always greater than the average monthly balance by almost a factor of 2, the simple-interest rate is almost twice the add-on rate.

#### Factor vs. Rate

We speak of an add-on rate of x.xx percent per year. But we could divide this factor by 12 to get a monthly percentage, and then divide it by 100 to get a monthly factor. Thus, an 8.40% annual add-on rate can be converted to a equivalent monthly factor of 0.00700 ( $8.40 \div 12 \div 100 = 0.00700$ ).

This factor can be used to compute the add-on interest charge for a loan by multiplying the loan amount by the factor, and then the result by the number of payments. Thus for a \$10,000, 12-month loan, the result is \$840.00 ( $10,000 \times$



0.00700 x 12 = 840.00) which is the same result we get by multiplying the \$10,000 by 8.4%.<sup>35</sup>

This shows that we can express an add-on annual percentage rate as a monthly factor which is directly equivalent.

On leases, of course, we speak of lease charge or rent instead of interest charge, and of depreciation instead of principal reductions, however, the monthly calculation procedures are very similar to those of a loan. A portion of each lease payment is divided between rent or lease charge and depreciation.

### **Enter the Residual Value**

The type of loans originally written with an add-on rate were fully amortizing loans with no residual or balloon payment. Nearly all vehicle leases have a residual value, the effect of which is to significantly raise the average monthly balance. If we use the factor method described above, clearly the yield on the lease would decrease as the proportion of the residual value to the lease cap increases (causing the average balance to increase).

We noted above that if the residual value is equal to the lease cap, the simple-interest rate would be the same as the add-on rate. In this case, we essentially have a lease with no depreciation, just a residual value. The monthly payment has no depreciation component<sup>36</sup>, but just the lease charge applicable to the residual value.

The elegant solution to using a factor to calculate a lease while maintaining the desired yield regardless of the lease cap/residual proportion is to calculate the lease charge separately on the depreciation and residual portions of the lease.

We know that applying a lease factor to the depreciation amount results in a simple-interest equivalent of about twice the equivalent add-on rate.<sup>37</sup>

We also know if we have a residual that is equal to the lease cap (essentially a lease with no depreciation), we have to charge twice the factor on the residual value to obtain the desired equivalent simple rate.

By a stroke of the pencil on the lease worksheet, this is exactly what happens. It's just presented differently – partly to make calculation easier, and partly to obfuscate what is really happening.

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<sup>35</sup> For a two-year loan, we would multiply the \$10,000 by 0.00700 to get a monthly charge of \$70, and the \$70 by 24 to get a total interest charge of \$1,680.

<sup>36</sup> The depreciation is the difference between the lease cap and the residual. If they are the same, the depreciation is 0.

<sup>37</sup> Multiply the lease factor by 1200 to get the equivalent add-on rate, e.g., 0.00700 x 1200 = 8.40%.

The typical lease factor calculation requires one to add the residual to the lease cap, and then multiply this sum by the factor to get the monthly charge. The monthly charge is multiplied by the term of the lease to get the total charge. It appears that the charge is based on the lease cap plus the residual, but it is really based on the depreciation plus twice the residual value.<sup>38</sup>

Of course, we're not really doubling the residual value at all, but by applying the factor to double the residual value when computing the lease charge, we're really applying double the factor to the residual value.

Thus, the conventional factor worksheet is applying the factor to the depreciation (the declining portion), and double the factor to the residual (the level portion).

### **Effect of the Advance Payment**

As we noted above, the A.P.R. for an add-on rate loan is slightly less than twice the add-on rate, e.g., a 36-month 7% add-on loan has an A.P.R. of 12.83%.

You will note, however, that when computing yields on leases computed with a factor, the yield is very close to twice the underlying factor, e.g., a lease factor of 0.00700 (equivalent to an add-on rate of 8.40%) has a yield of almost exactly 16.80%.

At first glance, this is higher than we would expect, because an 36-month, 8.40% add-on loan has an A.P.R. of only 15.23%.

The increase in yield is primarily due to the fact that the first payment is collected in advance on a lease (whereas it is collected at the end of the first month on a loan). The advance payment decreases the lessor's net investment in the lease by one payment.

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<sup>38</sup> The depreciation is the cap less the residual, or C – R. However, the factor is applied to C + R, not C – R. "C + R" is the depreciation plus twice the residual (C – R + R + R = C + R). Stated another way, the monthly charge could be stated as (C – R) x F + R x 2 x F, which simplifies to the commonly used (C + R) x F.

**Table of sales tax methods by state for leases:**

State & number	Sales tax applied to	How tax is paid	Tax bank fee <sup>39</sup>	Tax trade (tax-the-payment-states only) <sup>40</sup>	Tax credit given for (tax-the-price-states only)
AK 1	no tax				
AL 2	payment	monthly	Y	N	
AR 3	price + other-1	at signing	N		trade (optional)
AZ 4	payment	monthly	Y	N	
CA 5	payment	monthly	Y	N	
CO 6	payment	monthly	Y	N	
CT 7	payment	monthly	Y	N	
DC 8	payment	monthly	Y	N	
DE 9	Price + other-1 (Tax 1) and payment (Tax 2) <sup>41</sup>	at signing (Tax 1) and monthly (Tax 2)	N	N (Tax 2)	trade (optional)
FL 10	payment	monthly	Y	N	
GA 11	payment	monthly	Y	N	
HI 12	payment	monthly	Y	N	
IA 13	payment	monthly	Y		
ID 14	payment	monthly	Y	N	
IL 15	price + other-1 (Tax 1) and payment (Tax 2) (Optional) <sup>41</sup>	at signing (Tax 1) and monthly (Tax 2)	N	N (Tax 2)	trade (Tax 1) (optional)
IN 16	payment	monthly	Y	N	
KS 17	payment	monthly	Y	N	

<sup>39</sup> This option can be changed by using Setup Code 26 (State Lease Tax Options).

<sup>40</sup> Some tax-the-payment states tax all or a portion of the value of a trade.

<sup>41</sup> State and local taxes are applied to both the price + other-1 and payment in these states.

State & number	Sales tax applied to	How tax is paid	Tax bank fee <sup>39</sup>	Tax trade (tax-the-payment-states only) <sup>40</sup>	Tax credit given for (tax-the-price-states only)
KY 18	payment	monthly	Y	Equity <sup>42</sup>	
LA 19	payment	monthly	Y	N	
MA 20	payment	monthly	Y	N	
MD 21	price + other-1	at signing	Y		
ME 22	payment <sup>43</sup>	at signing	Y	Equity <sup>42</sup>	
MI 23	payment	monthly	Y	N	
MN 24	payment	monthly	Y	N	
MO 25	payment	monthly	Y	N	
MS 26	payment	monthly	Y	N	
MT 27	payment	monthly	Y	N	
NC 28	payment <sup>44</sup> or price	monthly or at signing	N	N	trade (if price taxed)
ND 29	price + other-1	at signing	N		trade
NE 30	payment	monthly	Y	N	
NH 31	no tax				
NJ 32	price + other-1	at signing	Y		residual
NM 33	payment	monthly	Y	N	
NV 34	payment	monthly	Y	N	
NY 35	payment <sup>43</sup>	at signing	Y	N	
OH 36	payment	monthly	Y	N	
OK 37	price + other-1	at signing	N		trade
OR 38	no tax				
PA 39	payment	monthly	Y	N	

<sup>42</sup> The difference between the trade-in allowance and any money owed on the trade.

<sup>43</sup> These states use special methods that calculate the tax on the payment but collect it at signing.

<sup>44</sup> In NC, the maximum tax is \$1,500. Either the price or payment can be taxed.

State & number	Sales tax applied to	How tax is paid	Tax bank fee <sup>39</sup>	Tax trade (tax-the-payment-states only) <sup>40</sup>	Tax credit given for (tax-the-price-states only)
RI 40	payment	monthly	Y	N	
SC 41	price + other-1 <sup>45</sup>	at signing	N		
SD 42	price + other-1	at signing	N		
TN 43	payment	monthly	Y	N	
TX 44	price + other-1	at signing	N		trade or residual (optional)
UT 45	payment	monthly	Y	N	
VA 46	price + other-1	at signing	N		-
VT 47	price + other-1	at signing	N		residual
WA 48	payment	monthly	Y	N	
WI 49	payment	monthly	Y	N	
WV 50	payment	monthly	Y	N	
WY 51	payment	monthly	Y	N	

<sup>45</sup> In SC, the maximum tax is \$300.