

LeaseMaker® Supplement for Lessors

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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.¹

The net and total yields² 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.³

¹ 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.

² 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%.

Lease Payoff Routine

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

Prompt

User Response

CODE = 401
402
403
404

Push the [Setup] Key and enter the desired code in response to the "CODE" prompt. See page 4 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.

ORIG TERM xx?

Enter the original term.

ELAP TERM xx?

Enter the elapsed term.
See Elapsed Term on page 3.

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
IRR	xxx. xx%
PMTS TO GO	xx
REFUND	xxxx. xx
PAYOFF	xxxxx. xx
N YIELD	xx. xxx%

Computed factor.
Computed Internal Rate of Return.
Number of remaining payments.
Lease rent charge refund.
Payoff (excluding early termination fee).
Net yield if paid off.⁴

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
T YIELD	xx. xxx%

Payoff with early termination fee.
Total yield if paid off including fees.⁵

³ See Elapsed Term on page 3.

⁴ See Net Yield Calculations on page 3.

Elapsed Term

The elapsed term is the number of months the lease is considered to run. Generally, lessors accrue the lease charge 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 11th sequential payment⁶ 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 12th 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 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.

⁵ See Total Yield Calculations on page 3.

⁶ This can also be considered the 12th payment because one was made in advance in addition to the 11 sequential payments.

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 lease⁷, 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.⁸

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%.⁹

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%

⁷ 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.

⁸ 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.

⁹ 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.¹⁰ 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.¹¹

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%

¹⁰ For a 12-month lease, 12/78^{ths} of the charge is earned the first month, 11/78^{ths} the second, 10/78^{ths} the third, and so forth, with 1/78th 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.

¹¹ 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.¹²

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.¹³

The lease charge on this hypothetical lease is the refund of the original lease charge.¹⁴ 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%

¹² 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.

¹³ The formula to calculate the lease cap is: $\text{Cap} = (K \times (P - R \times F) + R) / (1 + K \times F)$, where K is the remaining term, P is the payment, R is the residual, and F is the factor.

¹⁴ 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.¹²

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.¹⁵ 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.¹⁶

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%

¹⁵ 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.

¹⁶ 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 History and Derivation of the Lease Factor on page 10.

Lease Check, Dealer Reserve & Yield Calculations

This routine will compute the lease factor of a lease¹⁷, and will then compute the dealer reserve using a “buy” factor. Yields to the lessor are calculated.

Prompt

User Response

Code = 481

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.

CAP?_

Enter the adjusted lease cap.

RESID?_

Enter the residual value used to compute the lease.

TERM?_

Enter the term of the lease.

B PMT?_

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

FACTOR	xxxxxx	Computed lease factor. ¹⁸
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BUY xxxxxx?_ Enter the “buy” factor.

CHG DIF	xxxxx.xx	Computed difference in charges reserve.
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BANK FEE xxx.xx?_ Enter the bank fee.

YIELD1	xxx.xxx%	Yield without dealer reserve. ¹⁹
YIELD2	xxx.xxx%	Yield after dealer reserve paid. ²⁰

¹⁷ 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.

¹⁸ 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.

¹⁹ Both yields include the impact of the bank fee and the advance first payment.

²⁰ 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 \$266.36.²¹

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.²²

Yield2 is the net yield and computes at 11.038%. This is the yield to the lessor after advancing the dealer reserve amount of \$266.36.²³

²¹ Original lease charge is \$5,860.76 ($36 \times 523.91 + 12,000.00 - 25,000.00$). "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.

²² Net advance is \$23,981.09 ($25,000.00 - 495.00 - 523.91$).

²³ Net advance is \$24,247.45 ($25,000.00 - 495.00 - 523.91 + 266.36$).

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 ($10,000 \times 0.00700 \times 12 = 840.00$) which is the same result we get by multiplying the \$10,000 by 8.4%.²⁴

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 component²⁵, 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.²⁶

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.

²⁴ 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.

²⁵ The depreciation is the difference between the lease cap and the residual. If they are the same, the depreciation is 0.

²⁶ Multiply the lease factor by 1200 to get the equivalent add-on rate, e.g., $0.00700 \times 1200 = 8.40\%$.

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.

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.²⁷

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.

²⁷ 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 $(C - R) \times F + R \times 2 \times F$, which simplifies to the commonly used $(C + R) \times F$.