EXPLORATIONS

CHAPTER 11

When using the TI-83 Plus or TI-84 Plus calculators you access ***Finance*** by pressing the APPS key.

Depreciation

Depreciation of an asset allows periodic allocation of the cost of the asset. Tax law and accounting students use many methods for assigning the cost of an asset to the period during which it is used.

Straight Line Depreciation

Straight line depreciation is the simplest method and uses the basis of an asset and the useful life of the asset to assign equal depreciation to each period.

Example 1:
XYZ corporation wishes to depreciate a $1,000 printer over its 5-year life using straight line depreciation. Calculate the values and the new basis for each year.

Let N = Useful life of asset in years

B = Basis of the asset

S = Salvage value

TD = Total depreciation allowed

Total depreciation allowed on a item is

TD = B - S

In these examples, salvage is assumed to be zero. For straight line depreciation

TD = 1000 - 0 = 1000

N = 5

Periodic (annual depreciation) = 1000/5

The adjusted basis B(Y) at the end of the year Y is

B(Y) = 1000 (1-Y*(1/N))

Straight line depreciation assigns 1/5 of the basis value to each of the 5 years.

In this example, the list feature of the calculator will be used to construct a depreciation table.

1. Press the [STAT] key *(3C)*† and choose **5:SetUpEditor** from the EDIT menu. This will paste **SetUpEditor** on the Home Screen. (Figure 1)

(Figure 1)

2. Type [2nd] [L_1] *(9B)* [,] [2nd] [L_2] *(9C)* [,] [2nd] [L_3] *(9D)* [ENTER]. The calculator will respond **Done**. (Figure 2)

(Figure 2)

3. Press the [STAT] key *(3C)* and choose **4:ClrList** from the EDIT menu to paste **ClrList** on the Home Screen. (Figure 3)

(Figure 3)

4. Type [2nd] [L_1] *(9B)* [,] [2nd] [L_2] *(9C)* [,] [2nd] [L_3] *(9D)* [ENTER]. The calculator will respond **Done**. (Figure 4)

(Figure 4)

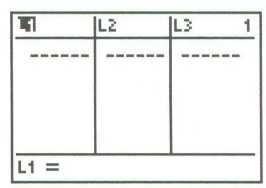
L_1 will store the numbers for the years.

5. Press the [STAT] key *(3C)* and choose **1:Edit** from the EDIT menu. (Figure 5)

(Figure 5)

6. When the lists appear, move the cursor to the top of the column so that L_1 is highlighted and press [ENTER]. (Figure 6)

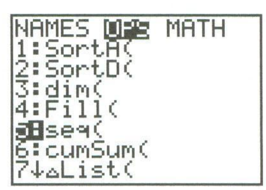
(Figure 6)



7. Press the quotes key, [ALPHA] ["] *(9E)*. Using quotes will cause the list to act like a spreadsheet.

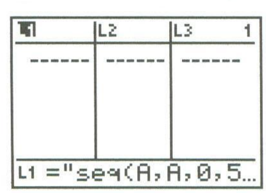
8. Press [2nd] [LIST] *(3C)* and choose **5:seq(** from the OPS menu. (Figure 7)
   The syntax for a sequence is **seq**(expression,variable,begin,end).

(Figure 7)



9. Complete the expression so that L_1 contains **"seq(A,A,0,5)"**. (Figure 8)

(Figure 8)

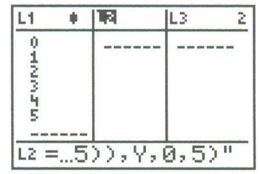


† **Refer to the section on Key Arrangement in Chapter 1 for an explanation of the key locator codes used in this manual.**

The second column of the table will be the annual adjusted bases.

10. In L_2 enter **"seq(1000(1-Y*(1/5)),Y,0,5)"**. (Figure 9)

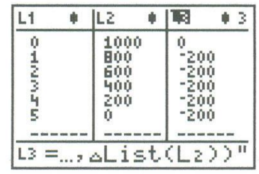
(Figure 9)



The last column, L_3, will display the annual depreciation, which is the difference between the adjusted bases for consecutive years. Note that no depreciation is allowed for year 0. An easy way to set up L_3 is to use the **augment** and **ΔList** functions. For an explanation of these functions, see the Calculator Housekeeping Detail section that follows this example.

11. Enter **"augment({0}, ΔList(L_2))"** for L_3. (Figure 10)
    The **augment** function is accessed by pressing [2nd] [LIST] *(3C)* and choosing **9:augment(** from the OPS menu. **ΔList** is also found in the OPS menu.

(Figure 10)

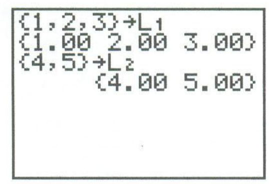


Calculator Housekeeping Detail

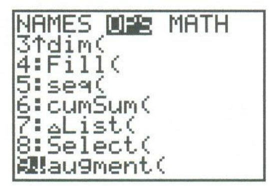
The **augment** (list1, list2) command concatenates list1 and list2, creating a new list with the elements of list1 followed by the elements in list2. For example, if L_1 = {1,2,3} and L_2 = {4,5} then **augment (L_1,L_2)** would produce {1,2,3,4,5}.

1. Press [2nd] [QUIT] *(2B)* to return to the Home Screen.
2. Type [2nd] [{] *(6C)* 1 [,] 2 [,] 3 [2nd] [}] *(6D)* [STO▶] *(9A)* [2nd] [L_1] *(9B)* [ENTER] to store {1,2,3,} in L_1.
3. Type [2nd] [{] *(6C)* 4 [,] 5 [2nd] [}] *(6D)* [STO▶] *(9A)* [2nd] [L_2] *(9C)* [ENTER] to store {4,5} in L_2. (Figure 11)
4. Press [2nd] [LIST] *(3C)* and choose **9:augment(** from the OPS menu to paste the function on the Home Screen. (Figure 12)
5. Type [2nd] [L_1] [,] [2nd] [L_2] [)] [ENTER]. The result is a list containing {1,2,3,4,5}. (Figures 13 and 14)

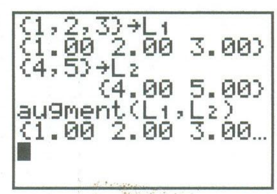
(Figure 11)



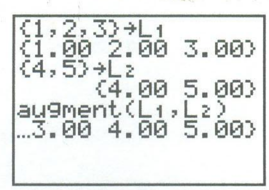
(Figure 12)



(Figure 13)



(Figure 14)



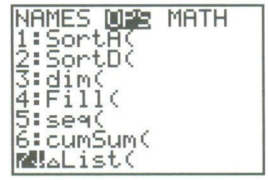
Another interesting operation on the **OPS** menu under the [2nd] [LIST] key is the **ΔList**(listname) command. This operation creates a new list in which each element is the difference of successive elements of listname.

ΔList(L_1) = {L_1(2) - L_1(1), L_1(3)-L_1(2), etc.}

ΔList({1,4,6,2}) yields the list {3,2,-4}. The new list will always have one less element in it than the original.

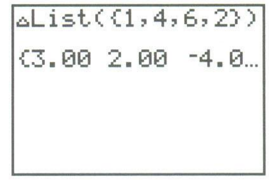
1. Press [2nd] [LIST] *(3C)* and choose **7:ΔList(** from the OPS menu. (Figure 15)

(Figure 15)

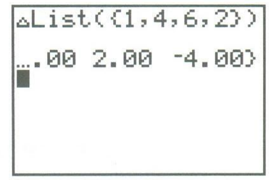


2. Complete the command by typing [2nd] [{] 1 [,] 4 [,] 6 [,] 2 [2nd] [}] [)] [ENTER]. (Figures 16 and 17)

(Figure 16)



(Figure 17)



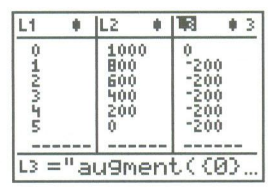
In the earlier straight line depreciation example, the third column of the depreciation table showed the annual depreciation for each of the years 0 to 5. L_3 was generated by the expression.

L_3 = **"augment ({0}, ΔList(L_2))"**.

Observe that L_3 is really a list of the differences of the bases in L_2 except for the first element, 0, which is the depreciation for year 0.

L_3 is a list of the differences in the annual bases. $L_2(2)$-$L_2(1)$ is the depreciation allowed in year 1. $L_2(3)$ - $L_2(2)$ is the depreciation allowed in year 2, etc. **ΔList(L_2)** does this calculation automatically and was used to calculate the depreciation for years 1 through 5. The depreciation for year 0 is 0. (Figure 18)

(Figure 18)



Sum of the Digits Method of Depreciation

A classic depreciation technique is called the sum of the digits method and computes a different fractional depreciation for each year. The denominator of each fraction is the sum of the digits from 1 to N where N is the number of years in the life of the asset. The numerator is N-Y+1 where Y is the period number.

Example 2:
Show a depreciation table for a sum of the digits method for 5 years on a $1,000 printer.

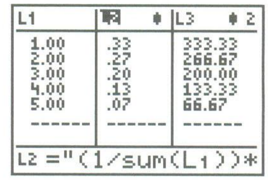
The depreciation table will consist of 4 columns. L_1 is the year.

1. Enter **"seq(Y,Y,1,5)"** for L_1.

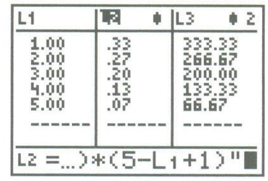
L_2 is the fraction of the basis taken as depreciation for each year. The numerator of the fraction is 5-Y+1 and the denominator is the sum of the digits 1 through 5.

2. Enter **"(1/sum(L_1))*(5-L_1+1)"** for L_2. The **sum** function is accessed by pressing [2nd] [LIST] *(3C)* and choosing **5:sum(** from the MATH menu. (Figures 19 and 20)

(Figure 19)



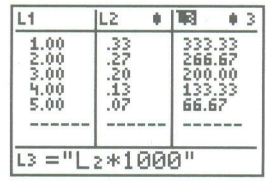
(Figure 20)



L_3 is the depreciation, the original basis multiplied by the factor in L_2.

3. Enter **"L_2*1000"** for L_3. (Figure 21)

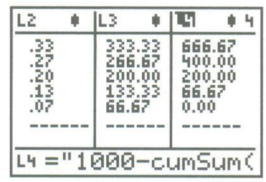
(Figure 21)



L_4 gives the basis at the end of each year and equals the original basis less the depreciation already taken.

4. Enter **"1000-cumSum(L_3)"** for L_4. The **cumSum** command can be entered by pressing [2nd] [LIST] *(3C)* and choosing **6:cumSum(** from the OPS menu. (Figure 22)

(Figure 22)



Double Declining Balance Depreciation

This depreciation method is allowed by the tax code and gives a larger depreciation in the early years of an asset. Unlike the straight line and the sum of the digits methods, both of which use the original basis to calculate the depreciation each year, the double declining balance uses a fixed percentage of the prior year's basis to calculate depreciation. The percentage rate is 2/N where N is the life of the asset. With this method, the basis never becomes zero. Consequently, it is standard practice to switch to another depreciation method as the basis decreases. Usually the taxpayer will convert to the straight line method when the annual depreciation from the declining balance becomes less than the straight line.

For example, if the life of an asset is 5 years, straight line depreciation allows 1/5 or 20% of the basis as depreciation each year. Thus, a $1,000 basis depreciates $200 per year. The double declining balance method allows 2/5 or 40%, double the straight line rate, of the current basis each year. In this example,

40% of $1000 = $400 in year 1

40% of $600 = $240 in year 2

40% of $360 = $144 in year 3

The double declining balance method relies on the new basis each year. This calculation is similar to finding compound interest.

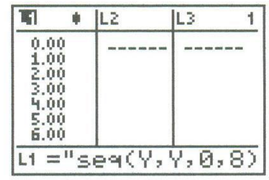
Year	Basis
0	1000
1	1000(1-.4)
2	(1000(1-.4))(1-.4)= $1000(1-.4)^2$
3	((1000(1-.4))(1-.4))(1-.4)= $1000(1-.4)^3$

Note if the life had been 8 years, then straight line depreciation would allow only 12.5% of the original basis per year while the double declining balance would allow 25%.

Example 3:
Calculate double declining balance depreciation for an item with useful life of 8 years and a basis of $1,000.

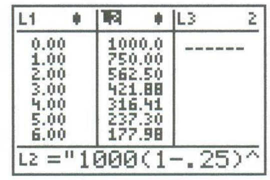
1. Store the years in L_1: L_1 = **"seq (Y,Y,0,8)"**. (Figure 23)

(Figure 23)

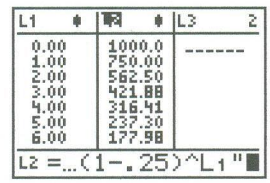


2. L_2 is the declining balance: L_2 = **"1000(1-.25)^L_1"**. (Figures 24 and 25)

(Figure 24)



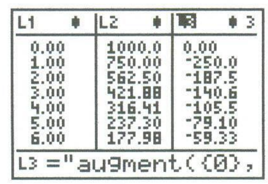
(Figure 25)



3. L_3 is the depreciation allowed: L_3 = **"augment ({0}, ΔList(L_2))"**. (Figures 26 and 27)

   The **augment** function can be found by pressing [2nd] [LIST] *(3C)* and choosing **9:augment(** from the OPS menu. **ΔList** is also located in the OPS menu.

(Figure 26)



(Figure 27)