



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.

Objectives:

- Determine the values and new basis for each year when an asset is depreciated.
- Explore different methods of depreciation.

Straight Line Depreciation

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 an item is:

TD = B - S

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

TD = 1000 - 0 or 1000

N = 5

Periodic (annual depreciation) = 1000/5

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

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

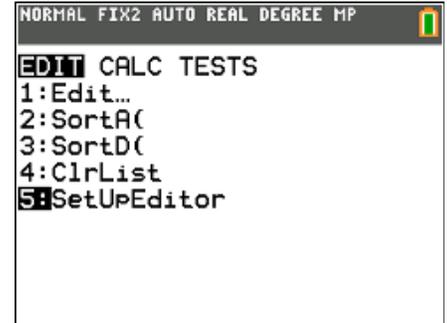
Straight line depreciation assigns 1/5 of the basis value to each of the 5 years.

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

Note: The mode DECIMAL SETTING was changed to **FIX2** to round computations to two decimal places.

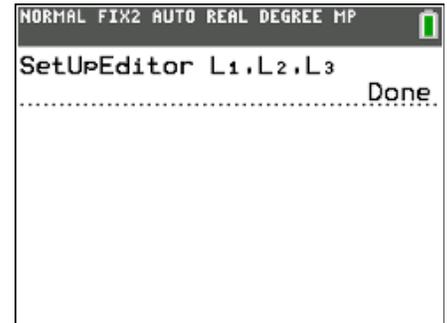
1. Press the `stat` key, and choose **SetUpEditor** from the EDIT menu.

This will paste SetUpEditor on the home screen.



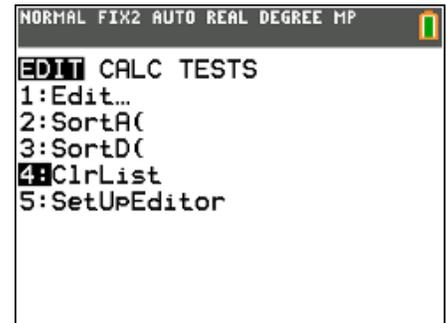
2. Enter `2nd` `[L1]` `,` `2nd` `[L2]` `,` `2nd` `[L3]` `enter`.

The calculator will respond **Done**.



3. Press the `stat` key, and choose **ClrList** from the EDIT menu.

This will paste the **ClrList** command on the home screen



4. Enter `2nd` `[L1]` `,` `2nd` `[L2]` `,` `2nd` `[L3]` `enter`.

The calculator will respond **Done**.



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**(L1,L2) would produce $\{1,2,3,4,5\}$.

1. Press **2nd** [**quit**] to return to the home screen.
2. Type **2nd** [**{**] 1 **,** 2 **,** 3 **2nd** [**}**] **sto→** **2nd** [**L1**] **enter** to store {1,2,3} in L1.
3. Type **2nd** [**{**] 4 **,** 5 **2nd** [**}**] **sto→** **2nd** [**L2**] **enter** to store {4,5} in L2.

```
NORMAL FIX2 AUTO REAL DEGREE MP
{1,2,3}→L1      {1.00 2.00 3.00}
{4,5}→L2        {4.00 5.00}
```

4. Press **2nd** [**list**] and choose **augment**(from the OPS menu to paste the function on the home screen.

```
NORMAL FIX2 AUTO REAL DEGREE MP
NAMES OPS MATH
1:SortA(
2:SortD(
3:dim(
4:Fill(
5:seq(
6:cumSum(
7:ΔList(
8:Select(
9:augment(
```

5. Type **2nd** [**L1**] **,** **2nd** [**L2**] **)** **enter**. The result is a list containing {1,2,3,4,5}.

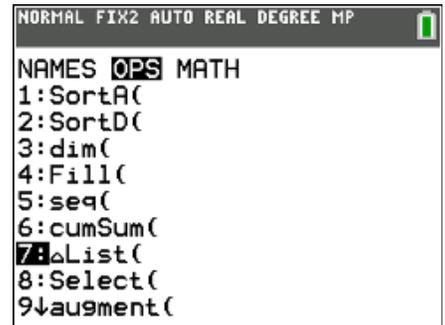
```
NORMAL FIX2 AUTO REAL DEGREE MP
{1,2,3}→L1      {1.00 2.00 3.00}
{4,5}→L2        {4.00 5.00}
augment(L1,L2)
{1.00 2.00 3.00 4.00 5.00}
```

Another interesting operation on the OPS menu is the $\Delta\text{List}(\text{listname})$ command. This operation creates a new list in which each element is the difference of successive elements of listname.

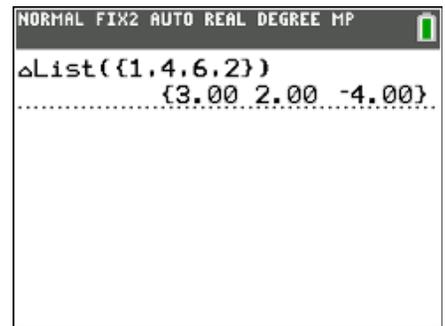
$$\Delta\text{List}(L1) = \{L1(2) - L1(1), L1(3) - L1(2), \text{etc.}\}$$

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

1. Press $\boxed{2\text{nd}} \boxed{[list]}$ and choose $\Delta\text{List}(\text{)}$ from the OPS menu.



2. Complete the command by typing $\boxed{2\text{nd}} \boxed{[{}]} \boxed{1} \boxed{,} \boxed{4} \boxed{,} \boxed{6} \boxed{,} \boxed{2} \boxed{2\text{nd}} \boxed{[{}]} \boxed{)} \boxed{enter}$.



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. L3 was generated by the expression “ $\text{augment}(\{0\}, \Delta\text{List}(L2))$ ”.

Observe that L3 is a list of the differences in the annual adjusted bases except for the first element 0, which is the depreciation for year 0.

$L2(2) - L2(1)$ is the depreciation allowed in year 1. $L2(3) - L2(2)$ is the depreciation allowed in year 2, etc. $\Delta\text{List}(L2)$ does this calculation automatically and was used to calculate the depreciation for years 1 through 5. The depreciation for year 0 is 0.

L1	L2	L3			
0.00	1000.0	0.00			
1.00	800.00	-200.0			
2.00	600.00	-200.0			
3.00	400.00	-200.0			
4.00	200.00	-200.0			
5.00	0.00	-200.0			

L3 = "augment({0}, ΔList(L2))"					

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. L1 is the year.

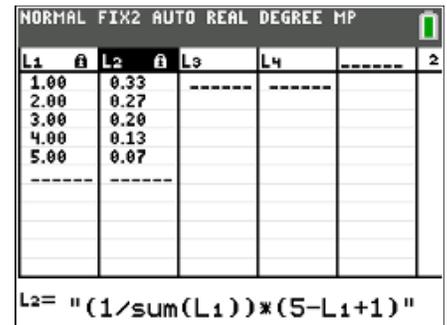
Note: Use the **SetUpEditor** to display L1, L2, L3, and L4. Use the **ClrList** command to clear the lists.

1. Arrow to the top of L1 and press **enter**. Enter “**seq(Y,Y,1,5)**” for L1.

L2 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. Arrow to the top of L2 and press **enter**. Enter “**(1/sum(L1))*(5-L1+1)**” for L2.

The **sum** function is accessed by pressing **2nd** **[list]** and choosing **sum** from the MATH menu.

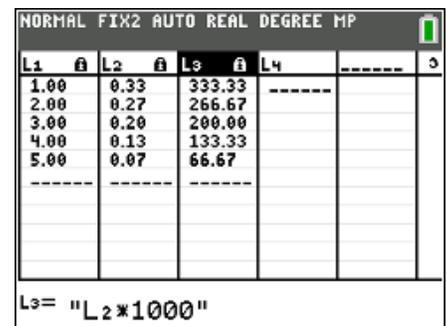


L1	L2	L3	L4	-----	2
1.00	0.33	-----	-----		
2.00	0.27	-----	-----		
3.00	0.20	-----	-----		
4.00	0.13	-----	-----		
5.00	0.07	-----	-----		

L2 = "(1/sum(L1))*(5-L1+1)"

L3 is the depreciation, the original basis multiplied by the factor in L2.

3. Arrow to the top of L3 and press **enter**. Enter “**L2*1000**” for L3.



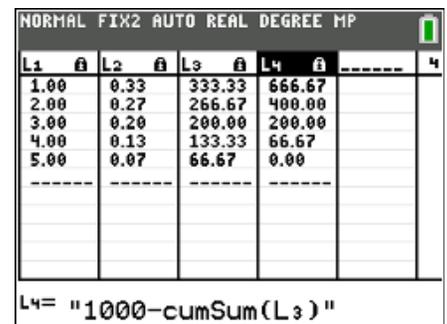
L1	L2	L3	L4	-----	3
1.00	0.33	333.33	-----		
2.00	0.27	266.67	-----		
3.00	0.20	200.00	-----		
4.00	0.13	133.33	-----		
5.00	0.07	66.67	-----		

L3 = "L2*1000"

L4 gives the basis at the end of each year and equals the original basis less the depreciation already taken.

4. Arrow to the top of L4 and press **enter**. Enter “**1000-cumSum(L3)**” for L4.

The **cumSum** command is accessed by pressing **2nd** **[list]** and choosing **cumSum** from the OPS menu.



L1	L2	L3	L4	-----	4
1.00	0.33	333.33	666.67		
2.00	0.27	266.67	400.00		
3.00	0.20	200.00	200.00		
4.00	0.13	133.33	66.67		
5.00	0.07	66.67	0.00		

L4 = "1000-cumSum(L3)"

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, and

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	$1000(1 - 0.4)$
2	$(1000(1 - 0.4))(1 - 0.4) = 1000(1 - 0.4)^2$
3	$(1000(1 - 0.4))(1 - 0.4)(1 - 0.4) = 1000(1 - 0.4)^3$

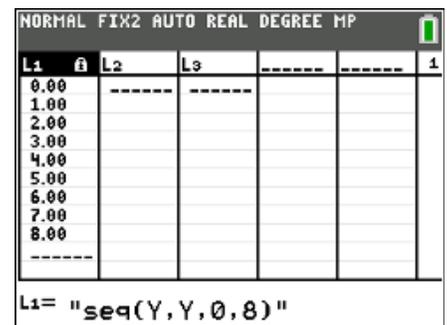
Note if the life had been 8 years, then straight line depreciation would allow only 12.5% of the original basis per year while the double declining balance would allow 25%.

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 L1.

Arrow to the top of L1 and press . Enter "**seq(Y,Y,0,8)**" for L1.



2. L2 is the declining balance.

Arrow to the top of L2 and press `enter`. Enter “ $1000(1-.25)^{L1}$ ” for L2.

NORMAL FIX2 AUTO REAL DEGREE MP							
L1	↕	L2	↕	L3	-----	-----	2
0.00		1000.0					
1.00		750.00					
2.00		562.50					
3.00		421.88					
4.00		316.41					
5.00		237.30					
6.00		177.98					
7.00		133.48					
8.00		100.11					
-----		-----					

L2= "1000(1-.25)^(L1)"

3. L3 is the depreciation allowed.

Arrow to the top of L3 and press `enter`. Enter “`augment({0}, ΔList(L2))`” for L3.

The `augment` function is accessed by pressing `2nd` `[list]` and choosing **augment** from the OPS menu. `ΔList` is also located in the OPS menu.

NORMAL FIX2 AUTO REAL DEGREE MP								
L1	↕	L2	↕	L3	↕	-----	-----	3
0.00		1000.0		0.00				
1.00		750.00		-250.0				
2.00		562.50		-187.5				
3.00		421.88		-140.6				
4.00		316.41		-105.5				
5.00		237.30		-79.10				
6.00		177.98		-59.33				
7.00		133.48		-44.49				
8.00		100.11		-33.37				
-----		-----		-----				

L3= "augment({0}, ΔList(L2))"