# Depreciation

- Asset Depreciation

- Factors Inherent to Asset Depreciation

- Book Depreciation

# Depreciation

- Definition:  Loss of value for a fixed asset
- Example: You purchased a car worth $15,000 at the beginning of year 2000.

| End of Year | Market Value | Loss of Value |
|---|---|---|
| 0 | $15,000 | |
| 1 | 10,000 | $5,000 |
| 2 | 8,000 | 2,000 |
| 3 | 6,000 | 2,000 |
| 4 | 5,000 | 1,000 |
| 5 | 4,000 | 1,000 |

# Why Do We Need to Consider Depreciation?

**Business Expense:** Depreciation is viewed as part of business expenses that reduce taxable income.

Gross Income -Expenses:
            (Cost of goods sold)
            (Depreciation)
            (operating expenses)
            _____

Taxable Income

- Income taxes
            _____

Net income (profit)

# Causes of Depreciation

Physical depreciation:

This happens due to regular wear and tear of operation of an asset.

Functional depreciation:

- This happens due to increased or decreased demand.
- If the demand for the product increases, the existing asset cannot meet that capacity to produce.

Technological depreciation:

This happens due to improved technology available in the market .

**Sudden failure:**

- This happens due sudden or catastrophic loss in value due to technological characteristics inherent in the asset.

- It also includes loss due to accident or misuse.

**Depletion:**

- This happens due to consumption of exhaustible natural resources to produce products or services.

- For example, oil, rock, minerals, timber etc. from a site decrease the value of holding.

# Factors to Consider in Asset Depreciation

- Depreciable life (how long?)

- Salvage value (disposal value)

- Cost basis (depreciation basis)

- Method of depreciation (how?)

# Book Depreciation Methods

- Purpose: Used to report net income to stockholders/investors

- Types of Depreciation Methods:
  – Straight-Line Method
  – Declining Balance Method
  – Double Declining Balance Method
  – Service Output Method
  – Sinking Fund Method
  – Sum of the Years' Digits Method

# Straight – Line (SL) Method

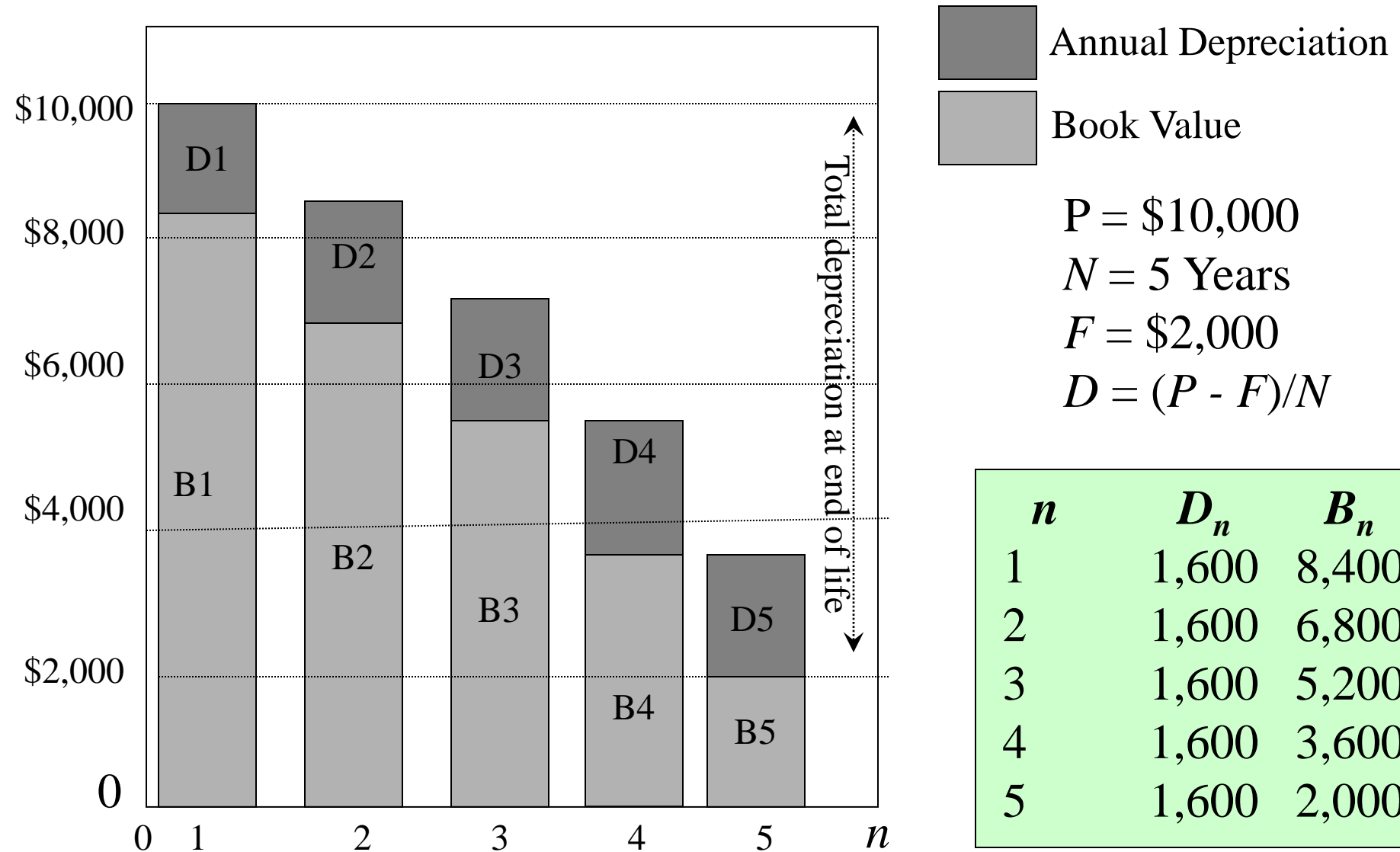Thus, depreciation for any year in straight line method is,

$$D_t = (P-F)/n$$

Book Value, $B_t = P - t(P-F)/n$

| year, t | | year, t |
|---|---|---|
| 0 | ---- | P = 5000 |
| 1 | (P-F)/n → 800 | P- (P-F)/n = 4200 |
| 2 | 800 | P- 2(P-F)/n = 3400 |
| 3 | 800 | P- 3(P-F)/n = 2600 |
| 4 | 800 | 1800 |
| 5 | 800 | 1000 |

Thus, Depreciation rate = 1/n

# Example – Straight-Line Method



**Annual Depreciation**

**Book Value**

$P = \$10,000$
$N = 5$ Years
$F = \$2,000$
$D = (P - F)/N$

| $n$ | $D_n$ | $B_n$ |
|-----|-------|-------|
| 1 | 1,600 | 8,400 |
| 2 | 1,600 | 6,800 |
| 3 | 1,600 | 5,200 |
| 4 | 1,600 | 3,600 |
| 5 | 1,600 | 2,000 |

# Numerical

A lathe was purchased for 5 lakhs. It was estimated to have a useful life of 10 years and a salvage value of Rs. 50000. Due to unexpected development the lathe was sold in the open market for Rs. 90000 at the end of 8 years of its useful life. Determine how much 'sunk loss' or 'capital gain' has occurred if the asset is being depreciated according to Straight line method.

# Solution

Book value at the end of 8 years,

Book Value, $B_t = P - t (P-F)/n$

Given t= 8yrs P=5 lakhs F=50000

=500000- 8 (500000-50000) / 10

=Rs. 1,40,000

Book Value> Market price

Therefore Sunk Loss= 1,40,000- 90,000

=Rs. 50,000

# Declining Balance Method

1.  This method assumes that an asset decreases in value at a faster rate in the early portion of the service life than in the later portion of its life.

2.  By this method fixed percentage is multiplied times the book value of the asset.

3.  Hence book value of the asset decreases through time, so does the size of the depreciation charge.

| End of Year | Depreciation charge during year t | Book value at the end of year, t |
|---|---|---|
| 0 | ------ | $P = B_0$ |
| 1 | $R \times B_0 = R \times P$ | $B_0 - R \times B_0 = (1-R) B_0 = (1-R)P = B_1$ |
| 2 | $R \times B_1 = R(1-R)P$ | $(1-R) B_1 = (1-R)^2 P = B_2$ |
| 3 . . . | $R \times B_2 = R(1-R)^2 P$ | $(1-R) B_2 = (1-R)^3 P = B_3$ |
| t . . . | $R \times B_{t-1} = R(1-R)^{t-1} P$ | $(1-R) B_{t-1} = (1-R)^t P = B_t$ |
| n | $R \times B_{n-1} = R(1-R)^{n-1} P$ | $(1-R) B_{n-1} = (1-R)^n P = B_n$ |

Depreciation for previous year, $D_t = R \times B_{t-1}$ Where $D_t$ = depreciation charge for year t

$B_{t-1}$ = Book value for year (t-1)

Book value for the year t,

$$B_t = B_{t-1} - D_t$$

Therefore, $B_t = B_{t-1} - R B_{t-1}$

$$B_t = B_{t-1} (1-R)$$

Depreciation at any time t,

$$D_t = R (1-R)^{t-1} P$$

Book value at any time t,

$$B_t = (1-R)^t P$$

Depreciation for previous year, $D_t = R \times B_{t-1}$

Where $D_t$ = depreciation charge for year t

$B_{t-1}$ = Book value for year (t-1)

Expression to determine book value for the year t, $B_t = B_{t-1} - D_t$

Therefore, $B_t = B_{t-1} - R\, B_{t-1}$

$$B_t = B_{t-1}\,(1-R)$$

Using this expression it is possible to determine the general expression,

Depreciation at any time t,

$$D_t = R\,(1-R)^{t-1}\,P$$

Book value at any time t,

$$B_t = (1-R)^t\,P$$

$$\text{Therefore,}\ 1-R = \sqrt[t]{B_t/P}$$

# Numerical

1.  An asset costs Rs.5000 now and its salvage value is Rs.1000 estimated and an estimated service life of 5 years and a depreciation rate of 30% per year. Determine the depreciation charges and book values for all the five years.

| End of Year | Depreciation charge during year t | Book value at the end of year, t |
|---|---|---|
| 0 | 0 | 5000 |
| 1 | R* P= 5000*0.3= 1500 | (1-R)P=5000-1500 = 3500 |
| 2 | R (1-R)P= 3500*0.3= 1050 | 3500-1050= 2450 |
| 3 | 2450*0.3=735 | 2450-735= 1715 |
| 4 | 1715*0.3= 515 | 1715-515= 1200 |
| 5 | 1200*0.3= 360 | 1200-360= 840 |

- An asset was purchased for Rs. 2,50,000 It has an expected life of 10 years and a salvage value of Rs.50000 at the end of $10^{th}$ year. What will be the undepreciated amount of capital remaining in the asset at the end of $6^{th}$ year, if the asset is being depreciated according to the declining balance method. Also calculate the depreciation charge for the $8^{th}$ year.

$$R = 1 - (B_t /P)^{1/t}$$

1- $(50000/2,50,000)$ ^ $(1/10)$

= 0.1487 = 14.87%

Depreciate charge during year 8,
$D_8 = R (1-R)^{t-1} * P$
= $0.1487(1-0.1487)^{(8-1)} * 250000$

Undepreciated amount at the end of $6^{th}$ year,

$B_t = (1-R)^t P = (1-0.1487)^6 \times 250000$

= 95156

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# Double Declining Balance Method

- In this method the depreciation rate is given as the double the straight line rate that would be allowed for a particular asset being depreciated.

- Depreciation rate= 2 x 1/n =  2/n

- Remaining terms are same as Declining Balance method.

# Numerical 1

- An asset was purchased 10 years ago for Rs. 5,00,000. it is depreciated according to DDB method for an estimated life of 20 years and a salvage value of Rs. 50,000. calculate its current book value.

# Numerical 2

- An asset has a first cost of Rs. 48,000 with an estimated life of 20 years. What is the total accumulated depreciation charge during the first 5 years of the asset life if it is depreciated according to DDB Method?

Upjohn Company purchased new packaging equipment with an estimated useful life of five years. The cost of the equipment was $35,000, and the salvage value was estimated to be $5,000 at the end of year 5. Compute the annual depreciation expenses over the five-year life of the equipment under each of the following methods of book depreciation:

(a) Straight-line method.

(b) Double-declining-balance method. (Limit the depreciation expense in the fifth year to an amount that will cause the book value of the equipment at year-end to equal the $5,000 estimated salvage value.)

A cooling-water pumping station at the LCRA plant costs $600,000 to construct, and it is projected to have a 25-year life with an estimated salvage value of 15% of the construction cost. However, the station will be book-depreciated to zero over a recovery period of 30 years. Calculate the annual depreciation charge for years 4, 10, and 25, using (a) straight line depreciation and (b) DDB depreciation.

Q. A laser surgical tool has a cost basis of $200,000 and a five-year depreciable life. The estimated SV of the laser is $20,000 at the end of five years. Determine the annual depreciation amounts using the Straight Line method. Tabulate the annual depreciation amounts and the book value of the laser at the end of each year.

Q. A new electric saw for cutting small pieces of lumber in a furniture manufacturing plant has a cost basis of $4,000 and a 10-year depreciable life. The estimated SV of the saw is zero at the end of 10 years. Use the DB method to calculate the annual depreciation amounts Tabulate the annual depreciation amount and BV for each year.