

Chapter 15

REAL ESTATE MATH



I. AREA MEASUREMENT

Land Area

- Is the square measure of a lot
- Dimensions are normally given in square feet

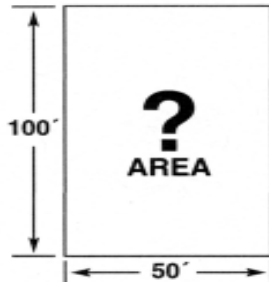
A. Area of a Rectangular Lot

- A four-sided parcel with corners that all form right angles
- The most common type of lot
 - Area of a rectangular lot is determined by multiplying the length by the width.
 - $A = L \times W$ (AREA = LENGTH X WIDTH)

Examples

VA 97

AREA OF A RECTANGULAR LOT



$$A = L \times W$$

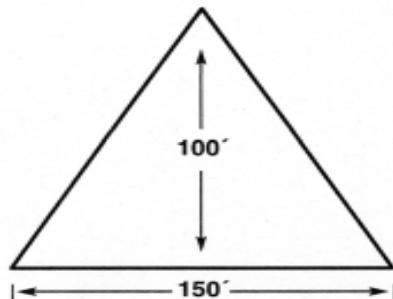
$$\text{AREA} = \text{LENGTH} \times \text{WIDTH}$$

$$\text{AREA} = 100 \text{ FEET} \times 50 \text{ FEET}$$

$$A = 100 \times 50$$

$$A = 5,000 \text{ SQUARE FEET}$$

AREA OF A TRIANGULAR LOT



$$A = \frac{B \times H}{2}$$

$$\text{AREA} = \frac{\text{BASE} \times \text{HEIGHT}}{2}$$

$$\text{AREA} = \frac{150 \text{ FEET} \times 100 \text{ FEET}}{2}$$

$$A = \frac{150 \times 100}{2}$$

$$A = \frac{15,000}{2}$$

$$A = 7,500 \text{ SQUARE FEET}$$

B. Area of a Triangular Lot (a three-sided parcel)

- Base of a Triangular Lot - the side that is represented as being horizontal.
- Height of a Triangular Lot - is the perpendicular distance from the base to the highest point
- The area of a triangular parcel is determined by multiplying the base by the height then dividing by two

Triangular Lot Formula:

- $A = B \times H / 2$

AREA = BASE X HEIGHT DIVIDED BY 2

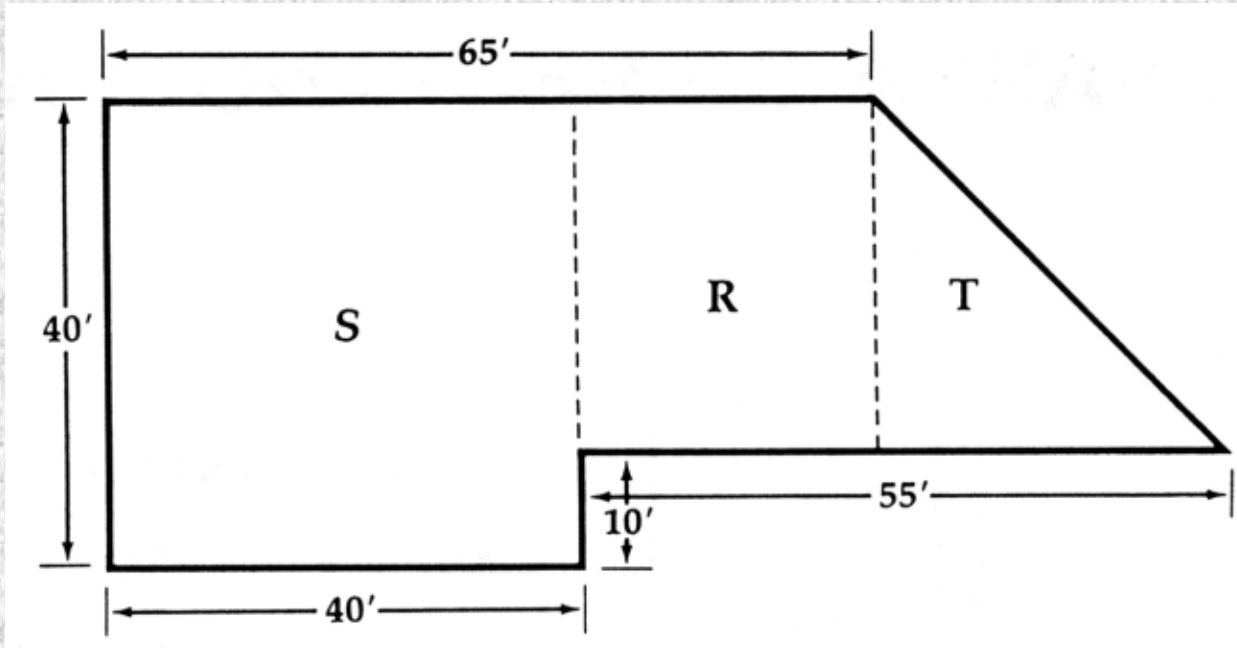
C. Area of an Irregular Lot

- Irregular Lot - a parcel that does not consist of a single known shape

1. The area of an irregular lot

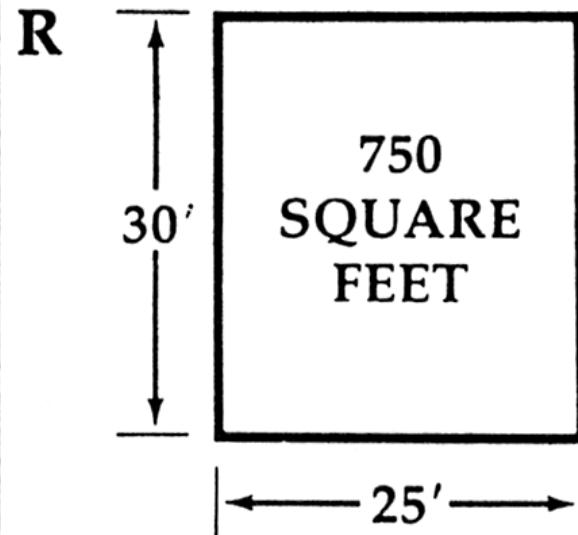
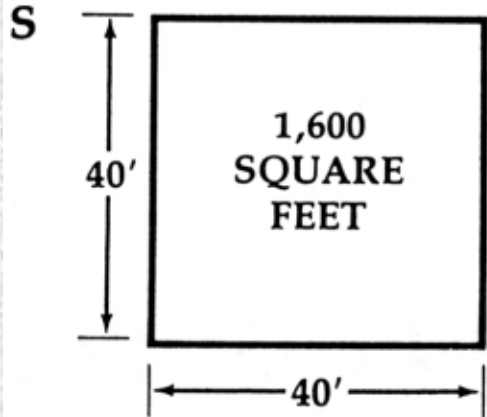
- Is determined by breaking the lot up into the various rectangles and triangles which comprise it and totaling their areas

Example:



- Answer: The irregular lot is broken up into a square, a rectangle, and a triangle. The area of the parcel is the total of the areas of each of these

Calculating area of an irregular lot



Answer:

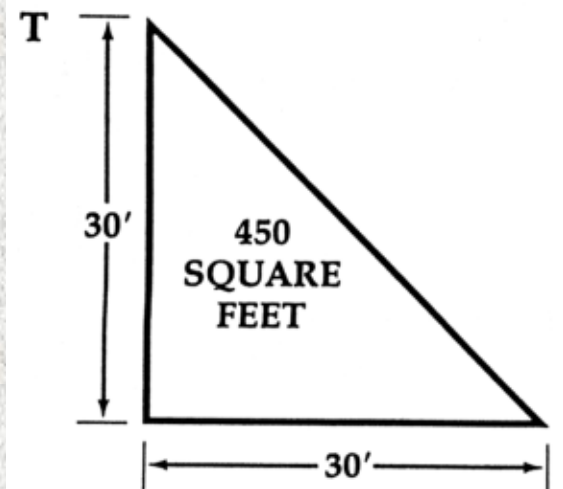
Area (S) = 1,600 sq ft

Area (R) = 750 sq ft

Area (T) = 450 sq ft

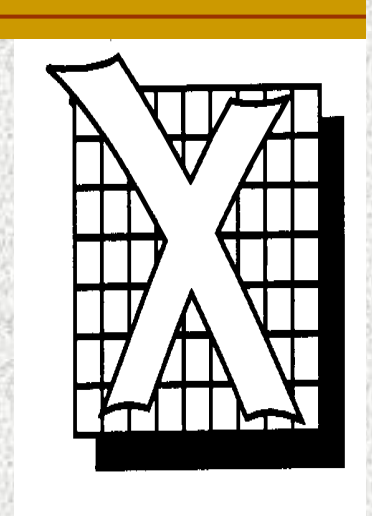
Total Area = S + R + T

Total Area = 2,800 sq ft.



Conversion: Square Feet to Square Yards

- Many questions on area will ask that you to present the answer in square yards or square feet
- Converting back and forth is a simple matter
- 1 SQUARE YARD = 9 SQUARE FEET
- SQUARE FEET = SQUARE YARDS x 9



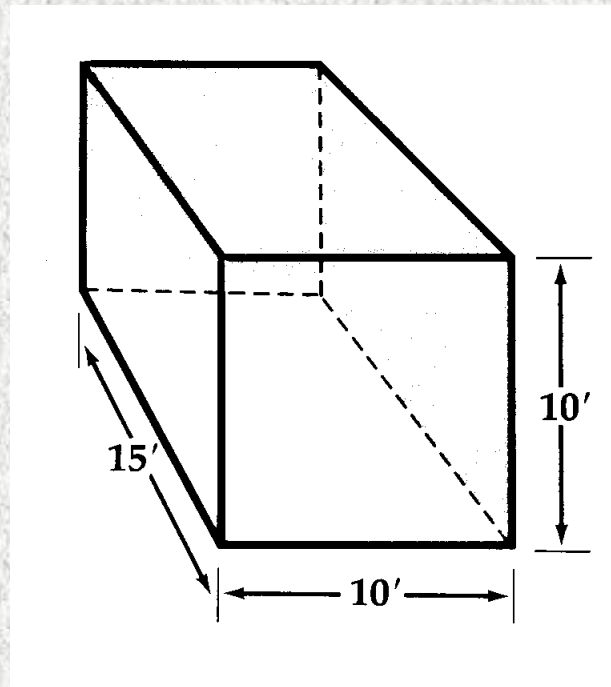
D. Volume of a Structure

- Structural Volume - the square or cubic measure of the space within a structure
- Square Measure - determined through the use of the same techniques that apply to finding the square footage of a lot
- Cubic Measure - area volume or total air space
- Cubic Volume - is determined by multiplying the interior length by the width by the height

Example

■ $V = L \times W \times H$

■ VOLUME = LENGTH x WIDTH x HEIGHT



Answer:

$$V = L \times W \times H$$

$$V = 15 \text{ ft} \times 10 \text{ ft} \times 10 \text{ ft}$$

$$V = 150 \times 10$$

$$V = 1,500 \text{ Cubic Feet}$$



II. PERCENTAGE PROBLEMS

3 Factor's in Percentage Problems

- The majority of math problems that you will encounter in real estate involve the use of percents
- There are 3 factors in any percentage problem:
 - PAID/PRINCIPAL (P) - the amount invested
 - PERCENTAGE/RATE (%) - the percentage
 - MADE (M) - the amount earned

Three rules for finding the missing factor:

1. To find the amount PAID (P), divide MADE (M) by the RATE (%)
2. To find the amount MADE (M), multiply PAID (P) by RATE (%)
3. To find the RATE (%), divide MADE (M) by (PAID (P))

A. Other Factor Terms:

MADE

Return

Profit

Commission

Net Income

Interest

PAID

Investment

Cost

Price

Value

Principal

% RATE

Rate of return

Rate of profit

Rate of commission

Rate of capitalization

Rate of Interest

B. Huber's Pyramid

VA 100

- Consists of three sections, or chambers (which can be modified to four chambers for certain problems); the top chamber is the **MADE (M)** chamber – separated from the other two chambers by a division sign

FINDING MADE, PRINCIPAL/PAID, RATE(%)

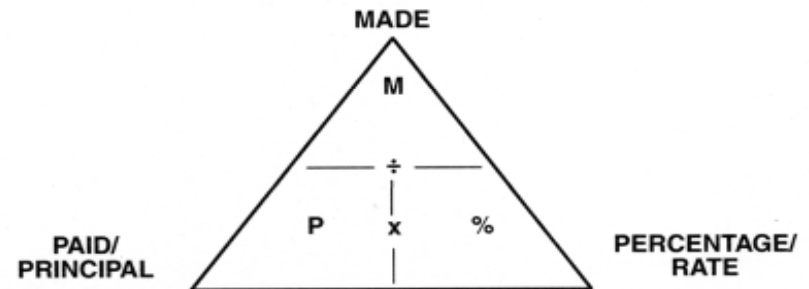
$$\text{PRINCIPAL/PAID (P)} = \text{MADE (M)} \div \text{RATE (\%)} \quad \text{P} = \frac{\text{M}}{\%}$$

$$\text{MADE (M)} = \text{PRINCIPAL/PAID (P)} \times \text{RATE (\%)} \quad \text{M} = \text{P} \times \%$$

$$\text{RATE (\%)} = \text{MADE (M)} \div \text{PRINCIPAL/PAID (P)} \quad \text{\%} = \frac{\text{M}}{\text{P}}$$

$$\begin{aligned} \text{P} &= \frac{\text{M}}{\%} \\ \text{M} &= \text{P} \times \% \\ \text{\%} &= \frac{\text{M}}{\text{P}} \end{aligned}$$

Huber's Pyramid

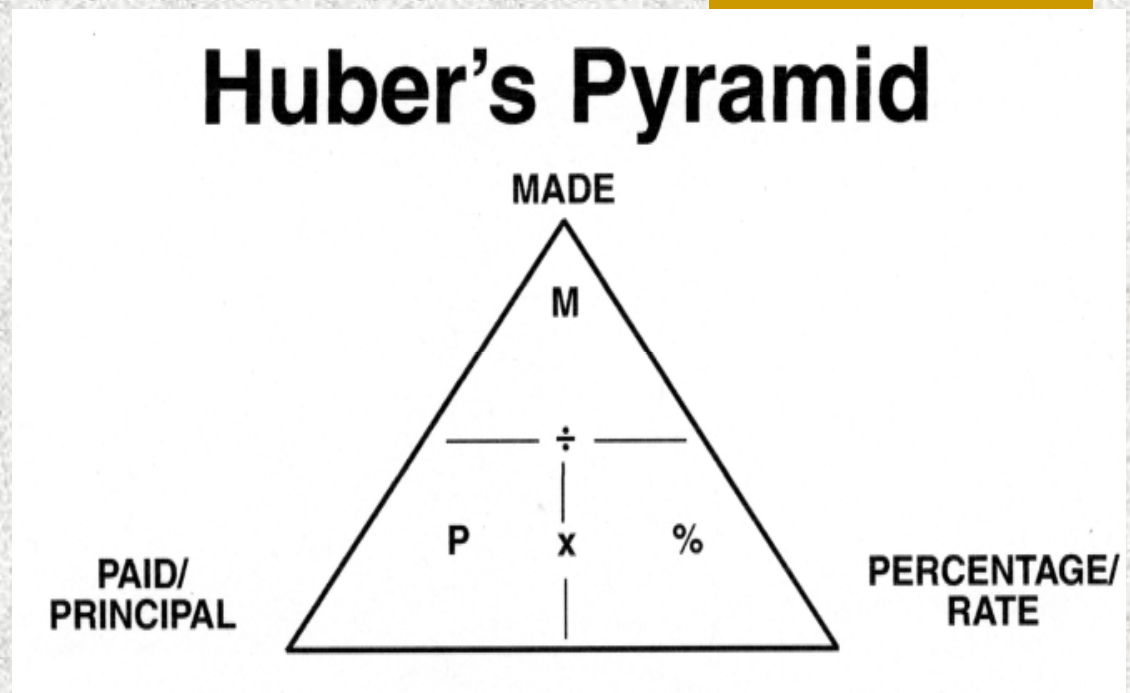


The Huber Pyramid consists of three sections, or chambers (which can be modified to four chambers for certain problems). The top chamber is the **MADE (M)** chamber. It is separated from the other two chambers by a division sign. The bottom left chamber is the **PAID** or **PRINCIPAL (P)** chamber. The bottom right chamber is the **RATE (%)** chamber. It is separated from the **PAID** chamber by a **multiplication sign**.

-
- The bottom left chamber is the PAID or PRINCIPAL (P) chamber
 - The bottom right chamber is the RATE (%) chamber
 - These two factors are separated from the PAID chamber by a multiplication sign

B. Huber's Pyramid

■ To use the pyramid, simply cover the chamber you are trying to find and then perform the required math



1. To find **M**, cover **M** and multiply **P** x **%**
2. To find **P**, cover **P** and divide **M** by **%**
3. To find **%**, cover **%** and divide **M** by **P**

Example 1

- What is the sales price (PRINCIPAL) if the commission amount (MADE) is \$27,000 and the commission percentage (RATE) is 6% ?
 - $\text{PRINCIPAL} = \text{MADE DIVIDED BY RATE}$
 - $? = \$27,000 \div .06$
 - $\$450,000 = \$27,000 \div .06$

Example 2

- What is the commission percentage (RATE) if the sales price (PRINCIPAL) is \$450,000 and the commission amount (MADE) is \$27,000 ?
 - $\text{RATE} = \text{MADE} \text{ DIVIDED BY } \text{PRINCIPAL}$
 - $? = \$27,000 \div \$450,000$
 - $.06 = 27,000 \div 450,000$

Example 3

- What is the commission amount (MADE) if the sales price (PRINCIPAL) is \$450,000 and the commission percentage (RATE) is 6% ?
 - $MADE = PRINCIPAL \times RATE$
 - $? = \$450,000 \times .06$
 - $\$27,000 = \$450,000 \times .06$

Converting Decimal to % and % to Decimal

- To convert a decimal number into a percentage, you simply move the decimal point two spaces to the right, add zeros if needed
- To reverse the process, move the decimal point two spaces to the left, and drop the percent sign

CONVERTING: DECIMAL AND PERCENTAGE

PERCENT TO DECIMAL

$$\underbrace{8.5\%}_{\text{move 2 places left}} = .085$$

$$\underbrace{50\%}_{\text{move 2 places left}} = .5$$

$$\underbrace{110\%}_{\text{move 2 places left}} = 1.1$$

DECIMAL TO PERCENT

$$\underbrace{.095}_{\text{move 2 places right}} = 9.5\%$$

$$\underbrace{1.2}_{\text{move 2 places right}} = 120\%$$

$$\underbrace{.009}_{\text{move 2 places right}} = .9\%$$

C. Determining Commissions and Selling Price

- Commission Rate - a percentage of the selling price of a property which an agent is paid for completing the sale
- Commission – is the dollar amount received by a real estate agent for completing a sale

Splitting Commissions

- Most often, your brokerage will not be entitled to the full commission

COMMISSION

EXAMPLE: You have completed the sale of a \$100,000 home. The rate of commission is 6%. How much money have you made?

$$R = P \times \%$$

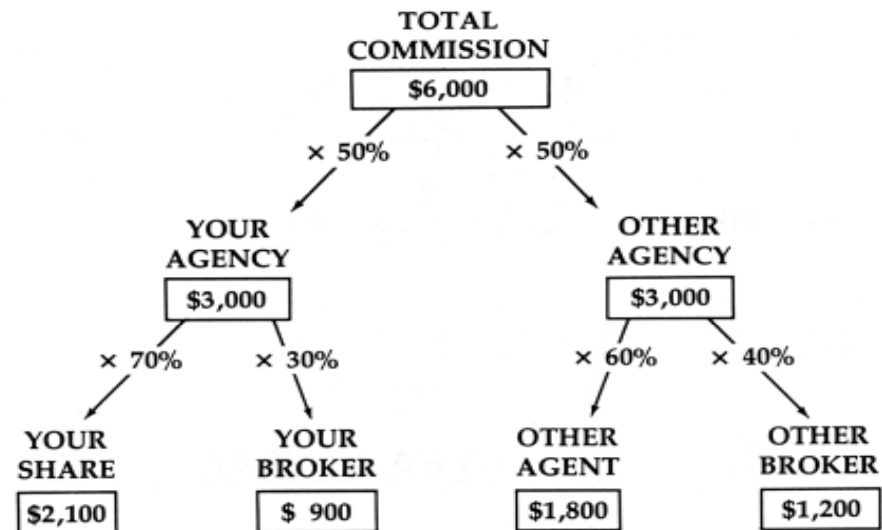
$$\text{RESULT} = \text{PRINCIPAL} \times \text{RATE}$$

$$\text{RESULT} = \$100,000 \times 6\% \\ (06\%)$$

$$\text{RESULT} = 100,000 \times .06$$

$$\text{RESULT} = \$6,000$$

ANSWER: Your commission is \$6,000.



$$\$2,100 + \$900 + \$1,800 + \$1,200 = \$6,000$$

D. Profit and Loss

Key terms when working profit and loss problems:

- **SELLING PRICE** - the dollar value after the profit or loss has been added or subtracted from the original cost
- **COST** - the dollar value before the profit or loss has been added or subtracted; cost is often stated as purchase price or original price

1 plus % PROFIT

- In a profit problem, the percent used in the formula will always be greater than 100%
- In other words, the original cost (100%) plus the percent of profit
- If you sold your property for 40% more than you paid for it, your selling price ($100\% + 40\% = 140\%$) would be the cost \times 140 % (1.40)
- To find the amount of profit (+40%), you would subtract the cost from the selling price

1 minus % LOSS

- For a loss problem, the percent used will always be less than 100%
- In other words, the original cost (100%) minus the percent of loss
- If you sold your property for 25% less than what you paid for it, your selling price ($100\% - 25\% = 75\%$) would be the cost \times 75% (.75)
- To find the amount of loss (-25%), you would subtract the selling price from the cost

E. Principal and Interest Calculations

- Interest - a fee paid for the use of other people's money, stated in dollars and cents
- Use a 30-day month in calculating interest payments; 1 year = 360 days
 - $MADE = PRINCIPAL \times RATE \times TIME$
 - $M = P \times R \times T$

Here is a sample exercise for you to try:

- What would be the interest due on a loan of \$10,000, borrowed at 9%, for a period of 2 years?
 - $MADE = P \times \% \times T$
 - $MADE = \text{PRINCIPAL} \times \text{RATE} \times \text{TIME}$
 - $MADE = \$10,000 \times 9\% \times 2 \text{ YEARS}$
 - $MADE = 10,000 \times .09 \times 2$
 - $MADE = 900 \times 2$
 - $MADE = \$1,800$
 - ANSWER: The interest would be \$1,800

F. Discount Points ("Points")

- Are charges made by a lender to increase the yield on a loan
- One point equals 1% of the loan

Example

- Mr. and Mrs. Majors are purchasing a house for \$155,000. They will put \$30,000 down and borrow the rest, which will include a 4 point charge by the savings bank. How much will the points cost them?
 - Solution: First we must determine the amount being borrowed:
 - $\$155,000 - \$30,000 = \$125,000$
 - Next compute the discount rate:
 - 1 point = 1% of loan amount = $.01 \times \$125,000 = \$1,250$
 - Finally, calculate the amount of discount:
 - $4 \times \$1,250 = \$5,000$
 - Answer: The Majors will pay \$5,000 for the discount points from the borrowed \$125,000



III. DETERMINING PRORATIONS

Proration

- The process of proportionately dividing expenses or income to the precise date that escrow closes, or any other date previously agreed upon
- The items that are normally prorated include:
 - mortgage interest
 - taxes
 - fire Insurance premiums
 - rent
 - assessments

A. Rents (Income)

- All escrow companies use a 30-day base month to determine proration of rents

Example:

- If the escrow closes on the 21st day of a month, how would you divide a prepaid rent of \$1,500 between the seller and the buyer?
 - ANSWER: The seller's share would be 20/30 of the whole, because he holds ownership through the 20th day. The share for the other 10 days(10/30) would go to the buyer.
 - SELLER'S SHARE BUYER'S SHARE
 - $20 \times 1,500 = \$1,000$ $10 \times 1,500 = \$500$
 - So, the seller would receive \$1,000 of the rent money, while the buyer would be prorated \$500

B. Property Taxes (Expenses)

- Property taxes are prorated either from July 1 (beginning of the fiscal year) or January 1 (middle of the fiscal year)

Try this problem:

- The second installment of property tax on a home is \$500. The seller has paid this tax which covers a 6-month period ending June 30. If he sells this property and escrow closes on April 1, how much of the \$500 is his share in the expense? How much would the buyer reimburse?
 - ANSWER: The seller's share would be $\frac{3}{6}$ of the tax bill, while the buyer would also be responsible for $\frac{3}{6}$. This is because both the seller and the buyer owned the property for 3 months during the six month period.

SELLER'S SHARE	BUYER'S SHARE
$\frac{3}{6} \times 500 = \250	$\frac{3}{6} \times 500 = \250
 - Each would be responsible for \$250 of the tax, the buyer having to reimburse the seller, who already paid the entire tax bill.



IV. DEPRECIATION

Depreciation

- For income taxes, depreciation is a diminishing (loss) in the value of buildings and other improvements
- All new depreciation schedules for normal income tax purposes involving real property must be straight-line

A. Straight-Line Depreciation

- A method of computing depreciation on assets other than land for income tax purposes in which the difference between the original cost and salvage value is deducted in installments evenly over the life of the asset
- When doing depreciation problems, it is important to remember that land does NOT depreciate
- Annual Depreciation (A) = Value (Cost) of Improvement (V) divided by Economic Life (E)
 - $A = V / E$

Problem:

- Land \$400,000
- Building (Commercial) \$975,000
- Total Purchase Price \$1,375,000

- Depreciation = Building Cost / Years

- Depreciation = \$975,000 / 39 Years
 - If residential, 27.5 years is economic life

- Depreciation = \$25,000 Each Year



V. HOW TO FIND THE VALUE OF A PARCEL

Problem:

- The NW $\frac{1}{4}$ of the SW $\frac{1}{4}$ of Section 7 is valued at \$800 per acre. The N $\frac{1}{2}$ of the NE $\frac{1}{4}$ of Section 4 is valued at \$500 per acre. What is the difference in value between the two parcels?

Solution:

- 1 section = 640 acres
- $\frac{1}{4}$ section = 160 acres
- $\frac{1}{4}$ of $\frac{1}{2}$ section = 80 acres
 - 40 acres x \$800 per acre = \$32,000
- $\frac{1}{2}$ of $\frac{1}{4}$ section = 80 acres
 - 80 acres x \$500 per acre = \$40,000
- \$40,000 - \$32,000 = \$8,000

HOMework

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