

# Real Estate



MAATH





## STUDENT LEARNING OUTCOMES (SLOs):

1. Solve investment problems
2. Discounted problems
3. Appraisal problems
4. Commission problems
5. Interest and loan problems
6. Square footage and area calculations
7. Cost and seller price problems
8. Proration problems
9. Documentary transfer tax problems
10. Use of amortization problems
11. Use the gross rent multiplier (GRM)

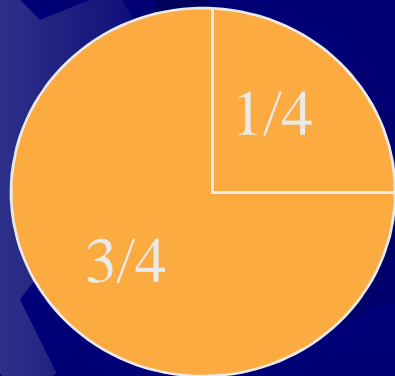


# SOLVING MATH PROBLEMS

- ✦ Read The Question
- ✦ Write Down the Formula
- ✦ Substitute
- ✦ Calculate

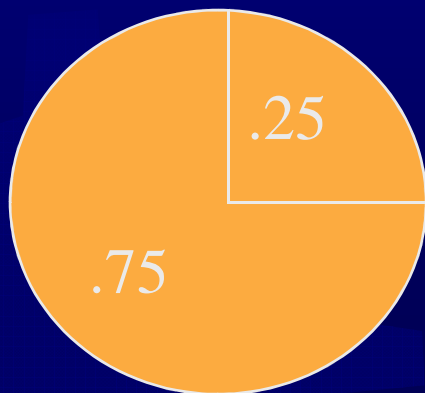
# CONVERTING FRACTIONS INTO DECIMALS

Divide the Bottom number (Denominator)  
into the Top number (Numerator)



$$\frac{1}{4} = \begin{array}{r} \phantom{0} \\ 4 \overline{) 1} \end{array}$$

$$1 \div 4 = .25$$



$$\begin{array}{r} \phantom{0} \\ 4 \overline{) 3} \end{array}$$

$$3 \div 4 = .75$$

$$I = R \times V$$

I like an RV

I like a Recreational Vehicle

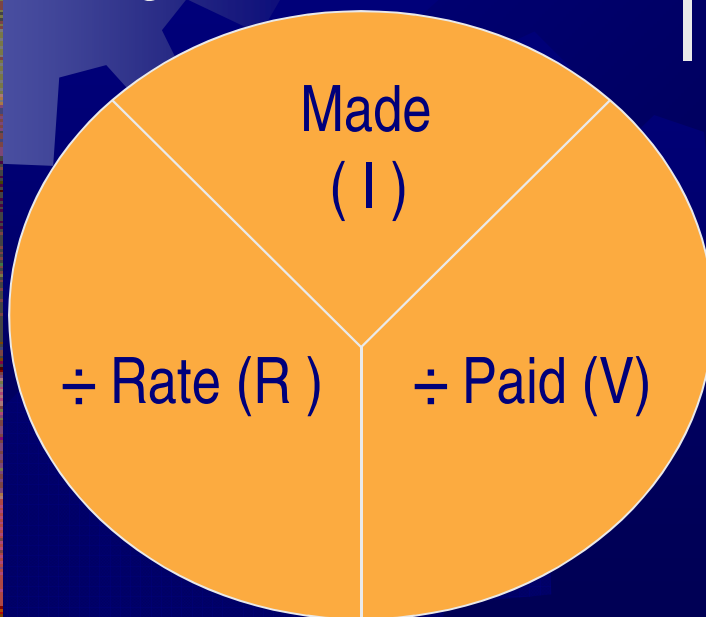
Pg 5-1

$$I (\text{Made}) = R (\%) \times V (\text{Paid})$$

$$I (\text{Made}) \div V (\text{Paid}) = R (\%)$$

$$I (\text{Made}) \div R (\%) = V (\text{Paid})$$

Figure 5-a.



Pg 5-2

$$I = R \times V$$

I (Amount Made) = R (%) x V (Amount Paid)

1. Amount earned /year	% return	Amount of the investment
2. Commission in dollars	% Rate of commission	Selling price or Loan Amount
3. Net operating income (NOI)	% Capitalization rate	Property value cost
4. Interest or Dividend earned	% Interest Rate x Time	Unpaid Loan Principal
5. Interest Dividend	% Rate of Return	Value of the property
6. Return on Investment (ROI)	% Rate of profit	Future Value
7. Area of property	Width	Length

# I. Solving Investment Problems

Sample: Return on investment

$$I = R \times V$$

To make \$6,000 a year when the interest rate (rate of return) is 5%, how much do you have to invest?

$$\begin{array}{l} \$6,000 \text{ (I)} \div 5\% \text{ (R)} = V \\ \$120,000 \text{ (V)} \end{array}$$

How much income would be earned if you invested \$45,000 at 5%?

$$\begin{array}{l} \$45,000 \text{ (V)} \times 5\% \text{ (R)} = \text{(I)} \\ \$2,250 \text{ (I)} \end{array}$$

## II. Discounted Notes

$$I = R \times V$$

What is the rate of return on a \$10,000 note plus 9% interest, due in 12 months, when the investor purchases it today at a 10% discount?

**Solution:** \$10,000 (V) x (R) .09 (or 9%) = (I) \$900 interest paid on loan Lender's return = \$10,900 (\$900 interest + \$10,000 return of loan amount)

Investor paid = \$10,000 less 10% or (\$10,000 x 90%) = \$9,000

Profit made by investor: \$10,900 less the investment of \$9000  
= \$1,900 \$1,900 (I) ÷ \$9,000 (V) = 21.1% (R)

### III. Appraisal Problems

$$I = R \times V$$

A duplex nets an income of \$600 per month per unit. An investor wants to purchase the property, and has set the Cap Rate at 8%. What is the maximum the investor should pay for the duplex?

**Solution:**

\$600 per unit x 2 units = \$1,200 net income/month

\$1,200 x 12 months = \$14,400

\$14,400 (I) ÷ .08 *or* 8% (R) = \$180,000 (V)

## IV. Commission:



$$(I) = \% (R) \times (V)$$

- A. You list a house for \$350,000 with a 6% commission, how much is the total commission?

$$\$350,000 (V) \times 6\% (R) = (I) \quad \$21,000 (I)$$

If a different office sells your listing on a 50-50 split, how much commission does your office earn?

$$\$350,000 (V) \times 3\% (R) [1/2 \text{ of } 6\%] = (I) \quad \$10,500 (I)$$

How much is your check if your commission split with your employing broker is 55%?

$$\$10,500 (V) \times 55\% (R) = (I) \quad \$5,775 (I)$$

## IV. Commission:

**B.** If an agent's listing sells for \$500,000 at 3% commission and has a 65% split with the employing broker, how much is the check?

$$\$500,000 (V) \times .03 \text{ or } 3\% (R) = \underline{\$15,000} (I)$$

$$\$15,000 (V) \times .65 \text{ or } 65\% (R) = \underline{\$9,750} (I)$$

**C.** If the agent's commission is 60%, what is the commission on a property that sells for \$3,000,500 where the seller pays 5% of the first \$1 million, 4% of the second \$1 million, 3% of the third \$1 million, and 10% for anything above \$3 million?

$$\$1,000,000 \times 5\% = \underline{\$50,000}$$

$$\$1,000,000 \times 4\% = \underline{\$40,000}$$

$$\$1,000,000 \times 3\% = \underline{\$30,000}$$

$$\$500 \times 10\% = \underline{\$50}$$

$$\$120,050 (V) \times 60\% (R) = (V)$$

$$\underline{\$72,030} = (V)$$

Total Commission **\$120,050**

## V. Interest on a Loan

A. 1       $I = R \times V$

How much interest will be paid  
on \$150,000 loaned for two  
years at 8%?

$$I = \$150,000 (V) \times 8\% (R)$$

$$\$6,000/1 \text{ year} = \$1,200 (I)$$

$$\$1,200/1 \text{ year} \times 2 \text{ years} = \\ \$2,400 (I)$$



## V. Interest on a Loan

A. 2. What is the interest on a loan of \$2,000,000 for (5) five years at 10% ?

$$\text{Interest (I)} = \frac{\$2,000,000 \text{ (V)} \times 0.10}{10\% \text{ (R)}} = \$200,000/\text{year}$$

$$\text{(I)nterest} = \frac{\$200,000 \times 5 \text{ years}}$$

$$\text{(I)nterest} = \frac{\$1,000,000}$$

## V. Interest Rate on a Loan

**B. 1.** If the amount of the loan is \$150,000 the term is for two (2) years, and the total interest paid is \$24,000.

What is the interest rate?

$$\text{Rate} = \$24,000 \div (\$150,000 \times 2 \text{ years})$$

$$\text{Rate} = \$24,000 (I) \div \$300,000 (V) = .08$$

*(or eight 8 percent) (R )*

## V. Interest Rate on a Loan

**B. 2.** If the amount of the loan is \$250,000, the term is for five (5) years, and the total interest paid is \$125,000.

What is the interest rate?

$$\text{Rate} = \frac{\$125,000 (I)}{(\$250,000 (V) \times 5 \text{ years})}$$

$$\text{Rate} = \frac{\$125,000 (I)}{(\$1,250,000)(V)}$$

$$\text{Rate} = \underline{\$ .10 \text{ or } 10\% (R)}$$

## V. Principal on a loan

C. 1. If the total interest paid is \$85,312.50, the term is for five (5) years, and the interest is 9.75% per year. What is the principal?

$$\text{Principal (V)} = \$85,312.50 \text{ (I)} \div 5 \text{ years} = \\ \$17062.50 \text{ (I)nterest per year}$$

$$\$17062.50 \text{ (I)nterest per year} \div 9.75\% \text{ (R)} = \text{(V)}$$

$$\text{Principal} = \$175,000 \text{ (V)}$$

or

$$\text{Principal (V)} = \$85,312.50 \text{ (I)} \div (.0975 \times 5) \text{ (R)}$$

$$\text{Principal} = \$85,312.50 \div .4875 \text{ or } 48.75\%$$

$$\text{Principal} = \$175,000 \text{ (V)}$$

## V. Principal on a loan

C. 2. If the total interest paid is \$208,125, the term is for ten (10) years at 10% interest per year. What is the principal?

$$\text{Principal (V)} = \frac{\$208,125 \text{ (I)} \div 10\% \text{ (R)}}{10 \text{ years}} = \text{(V)}$$

$$\$20,812.50 \text{ per year} \times 10 \text{ years} =$$

$$\text{Principal} = \underline{\$208,125}$$

Or

$$\text{Principal (V)} = \frac{\$208,125 \text{ (I)} \div (0.10 \text{ or } 10\% \text{ (R)})}{10 \text{ years}}$$

$$\text{Principal} = \underline{\$208,125 \div 1.00 \text{ or } 100\%}$$

$$\text{Principal} = \underline{\$208,125}$$

## V. Loan Term

1. If the loan amount is \$250,000, the total interest paid is \$318,750 at 8 ½% per year. What is time (term)?

$$\text{Time} = \$318,750 (I) \div$$
$$[\$250,000 (V) \times .085 \text{ or } 8.5 \% (R )]$$

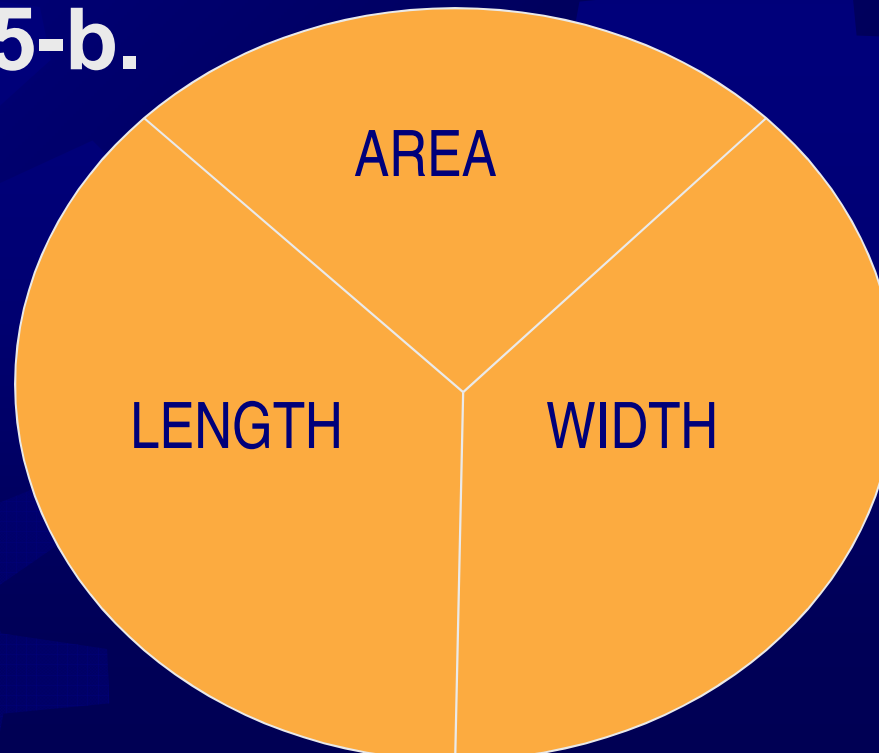
$$\text{Time} = \$318,750 \div \$21,250$$

$$\text{Time} = \underline{15 \text{ years}}$$

## VI. Square Footage and Area Calculations:

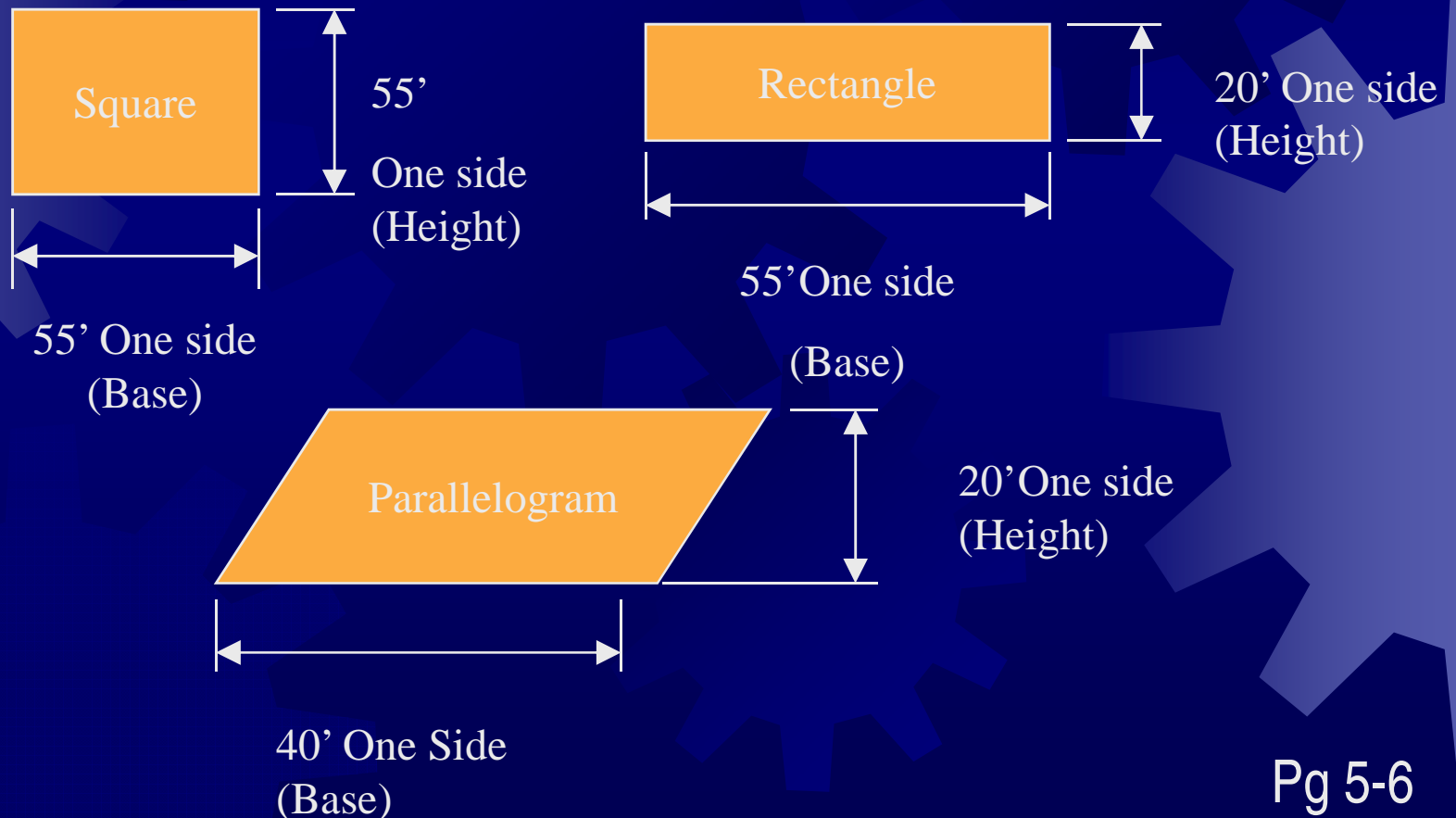
- ✦  $\text{Area} = \text{Length} \times \text{Width}$
- ✦  $\text{Length} = \text{Area} \div \text{Width}$
- ✦  $\text{Width} = \text{Area} \div \text{Length}$

### ✦ **Figure 5-b.**



# SQUARES, RECTANGLES AND PARALLELOGRAMS

- ☀ Area = One side x the other One Side
- ☀ Area = Base (Length) x Height (Width)

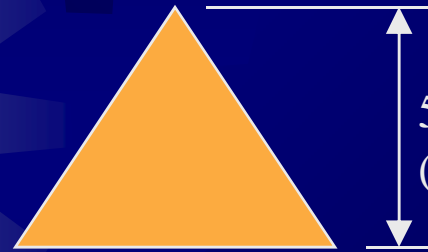


# TRIANGLES

☀ Area =  $\frac{1}{2}$  One side x the other One side

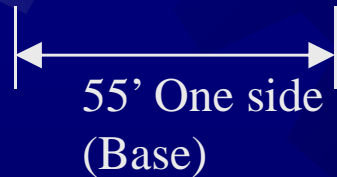
OR

☀ Area = One side x  $\frac{1}{2}$  the other One side



$$= \frac{1}{2} 55 \times 55$$

$$\text{Or } = 55 \times \frac{1}{2} 55$$



$$= \frac{1}{2} 55 \times 90$$

$$\text{Or } = \frac{1}{2} 90 \times 55$$

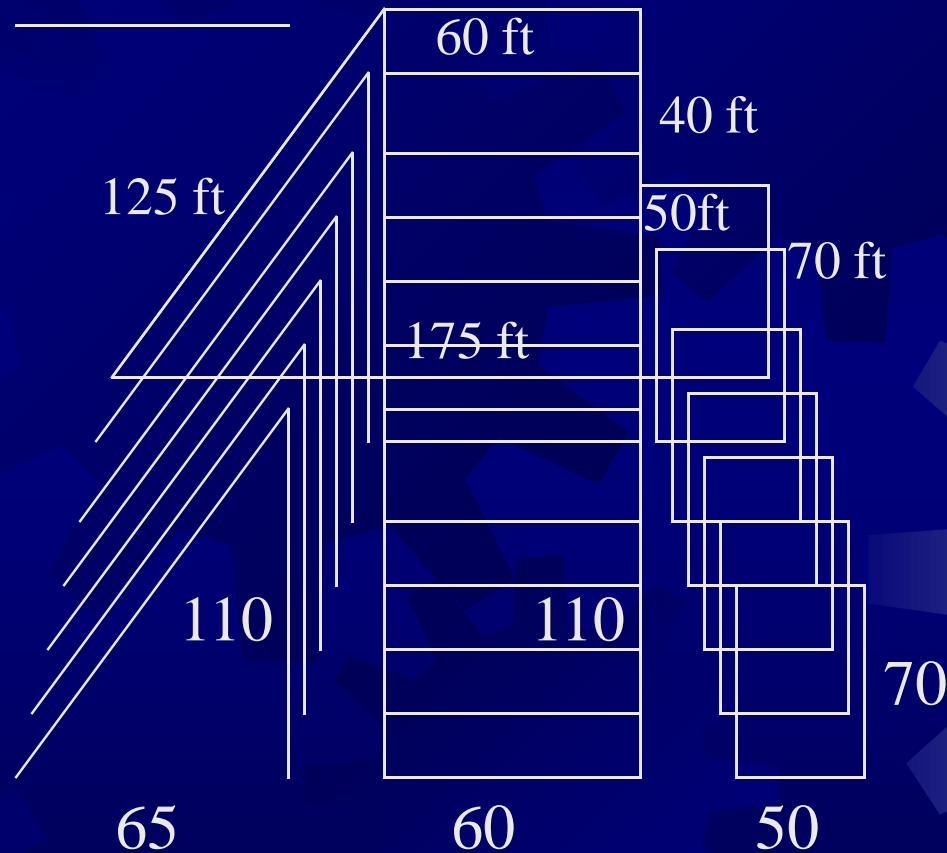


90' One side  
(Base)

## Sample Question: ODD SHAPES


What is the total square feet of this lot?

- ★ (Hint: Divide the shape into triangles, squares, and rectangles, and calculate their areas)



Note:  $40 + 70 = 110$

$175 - 50 - 60 = 65$



Add the areas together to get the area of the odd shaped whole.

1. Smallest box =  $50 \times 70 = 3500$
2. Larger box =  $60 \times 110 = 6600$
3. Triangle area =  $110 / 2 \times 65 = \underline{3575}$

13,675 square feet

## A. Area

- ★ What would be the approximate depth or length of a rectangular piece of property containing 4 acres with one side totaling 700 ft.?

1 Acre = 43,560 Sq. ft.

4 acres x 43,560 = 174,240 Sq. ft. total

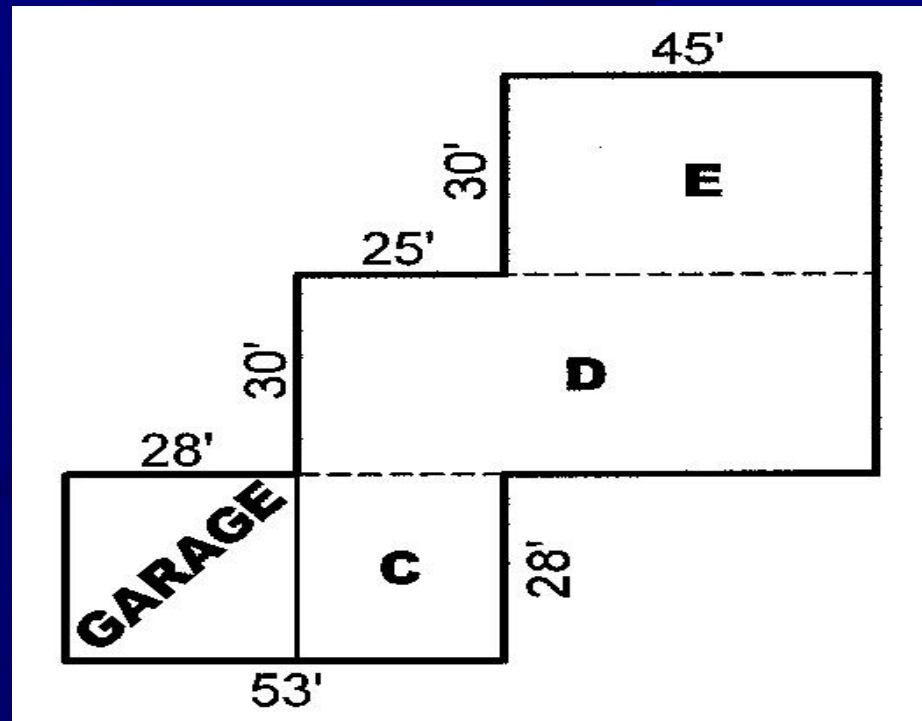
$174,240 \text{ Sq. ft.} \div 700 \text{ ft.} =$   
approximately 250 ft. (248.9)

Figure 5-f.

## D. Area, Square foot, Cost

Compute the construction cost of the house and the garage. Assume the contractor quotes \$40 per sq. foot for garage and \$85 per sq. foot for home.

Figure 5-f



## D. Solution for area cost

### Solution:

$$C = 28' \times 25' = 700 \text{ sq. ft.}$$

$$D = 70' \times 30' = 2,100 \text{ sq. ft.}$$

$$E = 30' \times 45' = \underline{1,350} \text{ sq. ft.}$$

$$\text{Total sq. ft. of home} = 4,150 \text{ sq. ft.}$$

$$4,150 \text{ sq. ft.} \times \$85 = \$352,750$$

$$\text{Garage } 28' \times 28' = 784 \text{ sq. ft.}$$

$$784 \text{ sq. ft.} \times \$40 = \underline{31,360}$$

$$\text{Total cost } \underline{\underline{\$384,110}}$$

1990

Okay, now listen up. Nobody gets in here without answering the following question: A train leaves Philadelphia at 1:00 p.m. It's traveling at 65 miles per hour. Another train leaves Denver at 4:00... Say, you need some paper?



Math phobic's nightmare

## VII. Cost & Selling Price

$$\% (R) \times VB (V) = VA (I)$$

- A. A house originally purchased for \$150,000 was sold at a 25% profit.

What was the sales price?

$$VA = (100\% + 25\%) \text{ of } VB$$

$$125\% \times \$150,000 = VA$$

$$1.25 (R) \times \$120,000 (V) = \$150,000 (I)$$



## VII. Cost & Selling Price

B. A seller offers to sell a lot for a certain amount. A real estate broker buys the property, gives a check to seller for \$94,000 after deducting the agreed 6% commission. Seller and the real estate broker buying the property had agreed on a 6% commission and the broker deducted the commission from the sales price.

What did the lot sell for?

### Solution:

Selling price = Net amount  $\div$  (100% - commission rate)

$$\$94,000 \div (100\% - 6\% = 94\%)$$

$$\$94,000 (V) \div 94\% (R) = \$100,000 (I)$$

# VIII. PRORATION

in advance or in arrears

- ★ A. There are four basic steps in proration.
  - ★ 1. Determine the number of days to be prorated.
  - ★ 2. Calculate the cost per day.
  - ★ 3. Multiply the number of days by the cost per day.
  - ★ 4. Determine whether the amount should be credit or a debit to the buyer or the seller.

*30 days in a month and 360 days in a year*

- 1. Real property taxes
- 2. Interest on seller's loan
- 3. Interest on buyer's loan
- 4. Insurance policies
- 5. Prepaid rental income
- 6. Prepaid homeowner association dues

# Proration

- ★ Mr. Smith sells his house on Nov. 1, 2003. He has an existing loan of \$120,000 on the house with an interest at 8%. Mrs. Otto assumes Mr. Smith's loan with interest paid to Oct 15, 2003. Mrs. Otto assumes an existing hazard insurance policy for \$360 per year paid by Mrs. Smith until December 1, 2004. Mr. Smith failed to pay his property taxes of \$3,600 per year. What is the interest proration and who is credited or debited? What is the insurance proration and who is debited? What is the tax proration and who is credited or debited?

# Proration – Interest & Insurance

## Solution: Interest prorations

Step 1. Oct. 15 to Nov. 1 = 15 days

Step 2.  $\$120,000 \times 8\% \div 360 \text{ days} = \$26.67/\text{day}$

Step 3.  $15 \text{ days} \times \$26.67 \text{ per day} = \$400.00$

Step 4. Credit buyer and debit seller

## Solution: Insurance prorations

Step 1. Oct 15, 2003 through Dec. 1, 2004 = 405 days

Step 2.  $\$360 \div 360 \text{ days} = \$1.00 \text{ per day}$

Step 3.  $405 \text{ days} \times \$1.00 \text{ per day} = \$405.00$

Step 4. Credit the seller and debit the buyer

# Proration – Property taxes

## Solution: Tax prorations

Step 1. July 1 to Nov. 1 = 120 days

Step 2.  $\$3,600 \div 360 \text{ days} = \$10 \text{ per day}$

Step 3.  $120 \text{ days} \times \$10 \text{ per day} = \$1,200$

Step 4. Credit the buyer and debit the seller

# IX. DOCUMENTARY TRANSFER TAX

## A. Placed on the deed

1. Computed: \$.55 for every \$500 (or \$1.10/\$1,000) or fraction thereof

B. **Problem:** A home sold for \$200,500. The buyer puts some cash down and obtains new financing for the balance. What is the documentary transfer tax?

### Solution:

$$\$200,500 \div \$500 = 401 \times \$.55 = \$220.55$$

# XI. GROSS RENT MULTIPLIER (GRM):

## A. Problem:

Ms. Gonzalez wants to purchase a building that has a gross annual income of \$80,000.

1. \$80,000 annual income multiplied by GRM of 5 = \$400,000 would be the purchase price
2. \$80,000 annual income multiplied by GRM of 10 = \$800,000 would be the purchase price
3. \$80,000 annual income multiplied by GRM of 15 = \$1,200,000 would be the purchase price

GRM does not take into account any expenses.

## XII. CAPITALIZATION RATE

A four-unit apartment building rents for \$1,500 per unit per month. Vacancies and annual operating expenses come to 35% of the gross scheduled income. A prospective investor would like to purchase the property at a price that will generate a 10% capitalization rate (cap rate). What price should the investor pay?

### Solution:

$\$1,500 \times 4 \text{ units} \times 12 \text{ months} = \$72,000$  gross scheduled income

$\$72,000 \times 35\% = \$25,200$  for vacancies and expenses

$\$72,000$  minus  $\$25,200 = \$46,800$  Net Operating Income (I)

$\$46,800$  Net Operating Income (I) divided by 0.1 or 10%

Capitalization rate (R ) =  $\$468,000$  (V)

The price the investor should pay is  $\$468,000$ .

## XII. CAPITALIZATION RATE

$$I = R \times V$$

A property worth \$425,000 generates a net income of \$46,750.

What is the capitalization rate?

$$\$46,750 = R \times \$425,000$$

$$\$46,750 \div \$425,000 = .11$$

11% = Capitalization Rate

# Property TAXES

$$I = R \times V$$

How much will be owed on a home valued at \$374,000 if the annual property tax rate is 1.25%?

$$I = .0125 \times \$374,000$$

$$I = \$4,675$$

$$\$4,675 \div 12 \text{ mo/yr} = \$389.58/\text{month}$$



# LET'S FLY ON HOME

