

Chapter 24

Real Estate Math

(The missing chapter)

Math plays an important role in the real estate business and is used in every real estate transaction. Realizing this, state licensing officials include math questions in the state licensing examinations. To be a real estate professional and pass the licensing examinations, applicants must be familiar with simple mathematical concepts and formulas. The thought of having to solve math problems on a licensing test creates apprehension for many people studying real estate, but this should not be the case because the math involved usually consists of simple arithmetic. To solve real estate math problems, all that is required is the ability to read and analyze the facts carefully, identify the correct formula or process, and solve using addition, subtraction, multiplication and division.

This review explains some of the basic mathematical concepts used most frequently in real estate transaction and licensing examinations. These include measurements, area and volume, fractions and percentages, and decimals. There are also practical examples of applying mathematics to real estate situations.

HINTS FOR SOLVING MATH PROBLEMS

- Read the question carefully to determine what information is being asked for.
- Take note of the measurements or units given in the problem and the measurements asked for in the answer (e.g., annual, semiannual or monthly amounts).
- If using a calculator, be careful to place the decimal in the property position when entering numbers.
- Make certain that your calculator rounds to at least the fourth decimal place.
- Do not use a solar power calculator unless it has a battery back up.
- Try working math problems backwards; using the various answers to determine which one matches the information given in the problem.

KEY TERMS

Annual – Yearly

Area - The number of square units (square feet, square yards, etc.) in a two dimensional (length, width) space.

Banker's Month – 30 days (also called a statutory month)

Banker's Year – 360 days (also called a statutory year)

Capitalization – (*Cap*) *Rate* – The rate of return for like kind business.

Front Feet – A measurement of the width (in feet) of a property's side that faces the frontage (the main street).

Mill – Equal to 1/10 of a cent or \$.001. Used to express a tax rate.

Percent – Means “per hundred” and represents a portion of a whole expressed as 100. Percentages can be less or than or greater than 100.

Perimeter – Total length of the boundary of a two-dimensional figure (square, rectangle, etc.).

Principal – The amount of money borrowed.

Quarterly – Four times per year.

Volume – The number of cubic units (cubic feet, cubic yards, etc.) contained in a three-dimensional (height, length and width) space.

MEASUREMENTS

Measurements are used in calculation to find perimeter, area and volume. Linear measurements measure the distance from one point to another. Some measurements commonly used in real estate are as follows:

Linear Measurements

1 Foot = 12 Inches

1 Yard = 3 Feet

1 Rod = 16 ½ Feet

100 links = 1 chain

***1 Chain = 66 Feet (4 rods)**

***1 Mile = 5,280 Feet**

Square Measurements

1 Sq. Foot = 144 Sq. Inches

1 Sq. Yard = 9 Sq. Feet

1 Acre = 160 Sq. Rod

***1 Acre = 43,560 Sq. Feet**

***1 Sq. Mile = 640 Acres**

***1 Section = 1 Sq. Mile**

***1 Township = 36 Section**

Cubic Measurements

1 Cu. Foot = 1,728 Cu. Inches

1 Cu. Yard = 27 Cu. Feet

Circular Measurements

Circle = 360 Degrees

1 Degree = 60 Minutes

1 Minute = 60 Seconds

Formulas

Area of Square = 1 Side x 1 Side

Area of Rectangle = Width x Length

Area of Triangle = ½ Base x Height

Volume of Cube = Length x Width x Height

* Indicates importance

CONVERTING UNITS OF MEASUREMENTS

a. Convert square feet to square inches = No. of square feet x 144.

Example: How many square inches does three square feet equal? ($3 \times 144 = 432$ sq. in.).

b. Convert square inches to square feet = no. of square inches \div 144.

Example: How many square feet does 432 square inches equal? ($432 \div 144 = 3$ sq. ft.).

c. Convert square yards to square feet = No. of square yards x 9.

Example: How many square feet does three square yards equal? ($3 \times 9 = 27$ sq. ft.).

d. Convert square feet to square yards = No. of square feet \div 9

Example: How many square yards does 27 square feet equal? ($27 \div 9 = 3$ sq. yds.).

e. Convert square yards to square inches = No. of square yards x 1,296.

Example: How many square inches does three square yards equal? ($3 \times 1,296 = 3,888$ sq. in.).

f. Convert square inches to square yards = No. of square inches \div 1,296.

Example: How many square yards does 3,888 square inches equal? ($3,888 \div 1,296 = 3$ sq. yds.).

g. Convert cubic feet to cubic yards = no. of cubic feet \div 27.

Example: How many cubic yards does 381 cubic feet equal? ($381 \div 27 = 3$ cu. yds.).

h. Convert square feet to acres = No. of square feet \div 43,560.

Example: How many acres does 130,680 square feet equal? ($130,680 \div 43,560 = 3$ acres).

FRACTIONS

A fraction has a numerator (the top number) and a denominator (the bottom number) divided by a bar.

Types of Fractions

a. Proper fractions (as called simple fractions): The numerator is smaller than the denominator (i.e., expresses a value less than 1).

Example: $\frac{1}{4}$, $\frac{1}{2}$, $\frac{3}{4}$, $\frac{15}{16}$

b. Improper fractions: The numerator is larger than the denominator (i.e., expresses a value greater than 1).

Example: $\frac{3}{2}$, $\frac{4}{3}$, $\frac{6}{5}$, $\frac{12}{11}$

c. Mixed number: A whole plus a fraction.

Example: $1\frac{1}{2}$, $2\frac{3}{4}$, $5\frac{3}{8}$

Simplifying Fractions

Fractions should always be simplified (reduced to their lowest terms). This is done by finding the highest number by which both the numerator and the denominator can be divided evenly.

Example: $\frac{4}{6} = \frac{2}{3}$, $\frac{3}{6} = \frac{1}{2}$, $\frac{8}{16} = \frac{1}{2}$

Multiplying Fractions

1. Multiply the numerators.
2. Multiply the denominators
3. Reduce to lowest Terms.

Example: $\frac{2}{4} \times \frac{8}{12} = \frac{16}{48} = \frac{1}{3}$

Dividing Fractions

Invert the divisor (the fraction you are dividing by), and then solve the same as multiplication.

Example: $\frac{3}{4} \div \frac{2}{3} = \frac{3}{4} \times \frac{3}{2} = \frac{9}{8} = 1\frac{1}{8}$

PERCENTAGES AND DECIMALS

Percentages

Percent (%) means “per hundred” or per hundred parts.

Example: $50\% = 50$ parts of 100 (or $\frac{1}{2}$)

Converting a Percent to a Decimal

To use a percent in a mathematical calculation, it must be converted to a decimal. Drop the percent sign (%) and move the decimal two places to the left (i.e., divide the percentage by 100).

Example: 1% = .01, 10% = .10, 20% = .20, 150% = 1.50 or 1.5

Converting Decimals and Fractions to a Percent

To convert a decimal, move the decimal point two places to the right and add the percent sign (i.e., multiply by 100). To convert a fraction to a percent divide the numerator by the denominator and convert the resulting decimal number to a percent.

Example: .01 = 1%, .10 = 10%, .75 = 75%, 1.2 = 120%
 $\frac{1}{2} = 1 \div 2 = .5 = 50\%$, $\frac{3}{4} = 3 \div 4 = .75 = 75\%$

Converting a Percent to a Simple Fraction

Drop the percent sign (%), place the percentage over 100, then reduce to a simple fraction.

Example: 1% = $\frac{1}{100}$, 10% = $\frac{10}{100} = \frac{1}{10}$, 20% = $\frac{20}{100} = \frac{1}{5}$, 150% = $\frac{150}{100} = 1 \frac{1}{2}$

Adding and Subtracting Decimals

To add or subtract decimals, place the decimal point directly over one another and then add or subtract.

Example:

	234.56	653.78
	<u>+ 562.23</u>	<u>+ 432.65</u>
	796.79	221.13

Multiplying and Dividing Decimals

When multiplying, count the number of decimal places in the numbers being multiplied, then move the decimal in the answer to the left the same number of places. When dividing, move the decimal in the dividing number (the divisor) to the right to make it a whole number. Then move the decimal the same number of spaces to the right in the number being divided (the dividend).

Example:

6.11	$80.5 \div .25 = 8050 \div 25 = 322$
<u>x4.23</u>	or
25.8453	$.25 \overline{) 80.5} = 25 \overline{) 8050} = 322$

PERIMETER, AREA AND VOLUME

Performing calculations to find the perimeter, area and volume of land, buildings and other objects is done frequently in the real estate business. When computing the area and volume, the symbols and abbreviations below are often used.

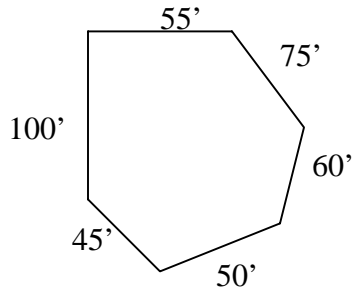
Common Symbols Used

a = area	cu. cubic	x = multiply
b = base	ft. = feet	÷ or / = divide
d = depth	in. = inches	
h = height	sq. = square	
l = length	' = feet	
v = volume	" = inches	
w = width		
d and h are interchangeable		

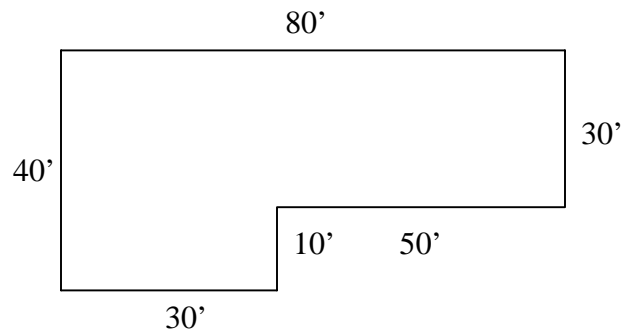
Perimeter

To Find the perimeter add all of the exterior dimensions.

a. The perimeter of the tract of land shown below is $100' + 55' + 75' + 60' + 50' + 45' = 385'$



b. The perimeter of the building shown below is $80' + 30' + 50' + 10' + 30' + 40' = 240'$

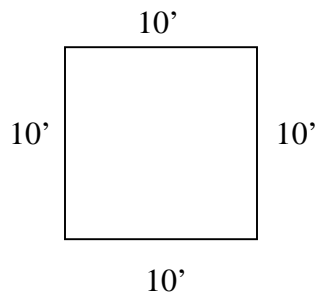


Area of a Square

A square has four sides of the same length. To calculate the area of a square, multiply one side by another. This is the same as finding the square of one of the sides.

$$\text{Area} = 1 \text{ Side} \times 1 \text{ Side}$$

Example: The area of the square below is $10' \times 10' = 100'$

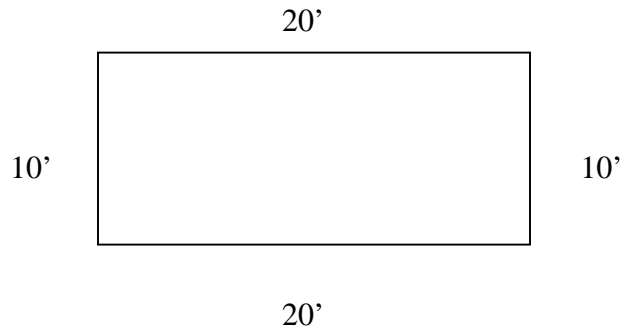


Area of a Rectangle

Any surface with four straight sides is called a quadrilateral. A rectangle is a quadrilateral in which the sides are joined at right angles and the opposite sides are the same length and are parallel to each other. To find the area, multiply the length by the width.

$$\text{Area} = \text{Width} \times \text{Length} \text{ or } a = w \times l$$

Example: The area of the rectangle below is $10' \times 20' = 200$ sq. ft.

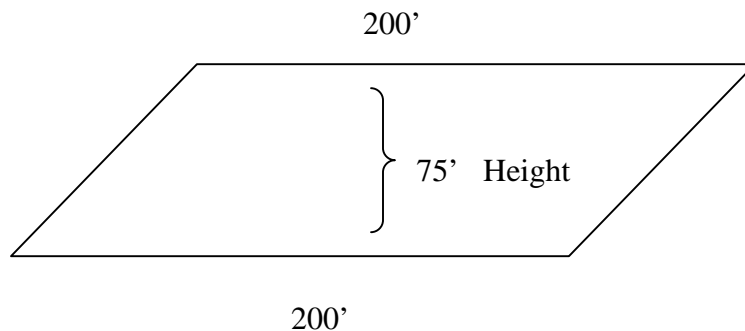


Area of a Parallelogram

A parallelogram is a quadrilateral with two sets of parallel sides. To find the area, the height is multiplied by the base. The height is the perpendicular distance between the parallel sides.

$$\text{Area} = \text{Height} \times \text{Base} \text{ or } a = h \times b$$

Example: The area of the parallelogram below is $200' \times 75' = 15,000$ sq. ft.



Area of a Trapezoid

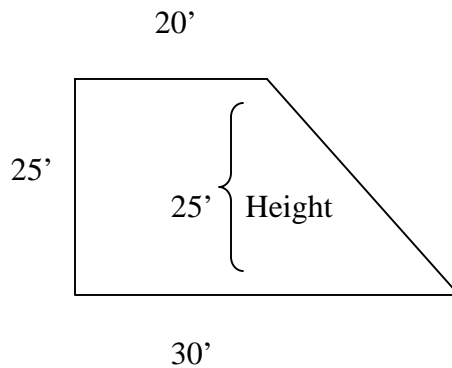
A trapezoid is a quadrilateral with only one pair of parallel sides. The parallel sides are called *bases* and the nonparallel sides are called *legs*. To find the area the height is multiplied by one half of the sum of the parallel sides (the bases). The height is the perpendicular distance between the parallel sides.

$$\text{Area} = \text{Height} \times \frac{1}{2} (\text{Base 1} + \text{Base 2}) \text{ or } a = \frac{1}{2} (b_1 + b_2)$$

Example: The area of the trapezoid below is

$$25' \times .5 (20' + 30')$$

$$25' \times 25' = 625 \text{ sq. ft.}$$



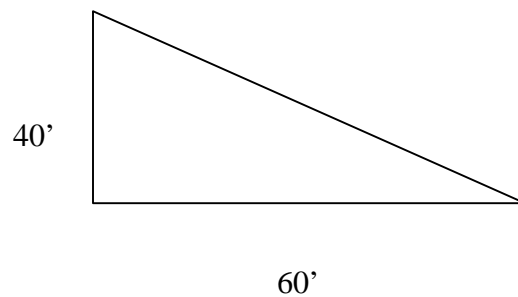
Area of a Triangle

A triangle is a three-sided figure. To find the area, multiply the base times the height and divide by 2.

$$\text{Area} = (\text{Base} \times \text{Height}) \div 2 \text{ or } a = (b \times h) \div 2$$

Example: The area of the triangle below is

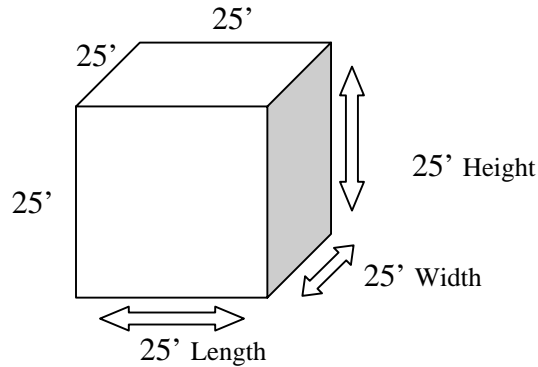
$$(60' \times 40') \div 2 = 1,200 \text{ sq. ft.}$$



Computing the Volume of a Cube

To calculate the volume of a cube multiply Length x Width x Height (l x w x h).

Example: The volume of the cube below is
 $25' \times 25' \times 25' = 15,625$ cubic feet



COMMISSION CALCULATIONS

- a. Calculate the total commission owed on the sale of a property. The commission rate is 6 percent and the sales price is \$150,000.

$$\begin{aligned} \text{Sales price} \times \text{Rate of commission} &= \text{Commission amount} \\ \$150,000 \times .06 &= \$9,000 \end{aligned}$$

- b. Calculate the total commission owed on the sales of the property. The commission rate is 6 percent on the first \$50,000 of the sales price and 5 percent on the remainder of the sales price. The property sold for \$150,000.

$$\begin{aligned} \text{Sales price} \times \text{Rate of commission} &= \text{Commission amount} \\ (.06 \times \$50,000 = \$3,000) + (.05 \times \$100,000 = \$5,000) & \\ \$3,000 + \$5,000 &= \$8,000 \end{aligned}$$

- c. Calculate a commission split. The commission rate charged by a real estate company is 6 percent of the selling price and the company's salespersons receives 60 percent of the commission. The property sold for \$110,000. How much commission was received by the company and how much by the salesperson?

$$\begin{aligned} \text{Sales price} \times \text{Rate of commission} &= \text{Commission amount} \\ \text{Commission amount} \times \% \text{ received} &= \text{Commission split} \\ \$110,000 \times .06 &= \$6,600 \text{ Commission split} \\ \$6,600 \times .6 &= \$3,960 \text{ (salesperson) and } \$6,600 \times .4 = \$2,640 \text{ (company)} \end{aligned}$$

- d. Calculate the rate of commission. The commission amount was \$6,000 and the sales price was \$120,000.

$$\begin{aligned} \text{Amount of commission} \div \text{Sales price} &= \text{Commission rate} \\ \$6,000 \div \$120,000 &= .05, \text{ or } 5\% \end{aligned}$$

- e. Calculate the sales price of a property. The commission rate was 6 percent and the amount of commission was \$6,000.

$$\begin{aligned}\text{Amount of commission} \div \text{Commission rate} &= \text{Sales price} \\ \$6,000 \div .06 &= \$100,000\end{aligned}$$

LISTING CALCULATIONS

- a. Calculate the listing price on a property. The selling price was \$135,000, which was 90 percent of the listing price.

$$\begin{aligned}\text{Selling price} \div \text{Percentage of listing price} &= \text{Listing price} \\ \$135,000 \div .9 &= \$150,000\end{aligned}$$

- b. Calculate the percentage of the listing price the seller accepted. The listing price on the property was \$160,000 and its selling price was \$140,000.

$$\begin{aligned}\text{Selling price} \div \text{Listing price} &= \text{Percentage of listing price} \\ \$140,000 \div \$160,000 &= 87.5\%\end{aligned}$$

- c. Calculate the selling price on the net listing. The Seller expects to net \$90,000 and the broker expects to make 6 percent commission on the sale.

$$\begin{aligned}\text{Selling price} &= \text{Net to seller} \div (100\% - \text{Commission rate}) \\ \$90,000 \div (100\% - 6\%) &= \$90,000 \div .94 = \$95,745\end{aligned}$$

INSURANCE CALCULATIONS – PROPERTY INSURANCE

- a. Calculate the annual homeowner's premium if the policy has a face value of \$220,00 and the premium rate is \$4.75 per \$1,000.

$$\begin{aligned}(\text{Policy value} \div \$1,000) \times \text{Rate} &= \text{Annual premium} \\ (\$220,000 \div \$1,000) \times \$4.75 &= \$1,045\end{aligned}$$

- b. Calculate the face value of a homeowner's insurance policy. The annual premium rate is \$4.25 per \$1,000 of the face value and the annual premium is \$892.50

$$\begin{aligned}(\text{Annual premium} \div \text{Premium rate}) \times \$1,000 &= \text{Policy value} \\ (\$892.5 \div \$4.25) \times \$1,000 &= \$210,000\end{aligned}$$

INSURANCE CALCULATIONS – TITLE INSURANCE

Calculate the total premium of a title insurance policy that covers both the owner (mortgagor) and the lender (mortgagee). The property sold for \$180,000 and the owner financed the purchase with \$140,000 mortgage. The premium for the owner's coverage is \$4.25 per \$1,000 of face value and the premium for the lender's coverage is \$3.50 per \$1,000 of face value.

$$\begin{aligned} &(\text{Value of property} \div \$1,000) \times \text{Premium rate} = \text{Owner's policy premium} \\ &(\$180,000 \div \$1,000) \times \$4.25 = \$765 \end{aligned}$$

$$\begin{aligned} &(\text{Amount of the loan} \div \$1,000) \times \text{Premium rate} = \text{Lender's policy premium} \\ &(\$140,000 \div \$1,000) \times 3.50 = \$490 \end{aligned}$$

$$\begin{aligned} &\text{Owner's policy premium} \div \text{Lender's policy premium} = \text{Total premium} \\ &\$765 \div \$490 = \$1,255 \end{aligned}$$

INSURANCE CALCULATIONS – MORTGAGE INSURANCE

Lenders, when making a mortgage with a very high loan-to-value ratio, require private mortgage insurance. Calculate the borrower's monthly mortgage insurance premium (P) if the mortgage (m) is for \$110,000 and the annual premium is $\frac{3}{4}$ percent (r) of the original loan amount paid in monthly installments.

$$\begin{aligned} &(\text{Loan amount} \times \text{Annual premium rate}) \div 12 \text{ months} = \text{Monthly insurance premium} \\ &(\$110,000 \times .0075) \div 12 = \$68.75 \end{aligned}$$

LOAN CALCULATIONS

- a.) Calculate the annual interest and monthly interest on a nonamortizing loan (straight or term loan). The loan balance is \$90,000 and the annual interest rate is 8 percent.

$$\begin{aligned} &\text{Loan balance} \times \text{Interest rate} = \text{Annual interest} \\ &\text{Yearly interest} \div 12 = \text{Monthly interest} \\ &\$90,000 \times .08 = \$7,200 \\ &7,200 \div 12 = \$600 \end{aligned}$$

- b.) Calculate the amount of a loan payment that is applied to the loan balance (principal). The beginning loan balance is \$75,000, the interest rate is 9 percent and the loan payment is \$600.

$$\begin{aligned} &\text{Loan payment} - (\text{Loan balance} \times \text{Interest rate} \div 12) = \text{Payment to principal} \\ &\$600 - \$562.50 = \$37.50 \end{aligned}$$

- c.) Calculate the total amount of interest paid on an amortized loan. The beginning loan balance is \$60,000, the interest rate is 9 percent, the loan term is 15 years and the monthly loan payment is \$609.

$$\begin{aligned} &\text{Total amount paid} - \text{Amount borrowed} = \text{Total interest} \\ &15 \text{ years} \times 12 \text{ months} = 180 \text{ months} \\ &180 \times \$609 = \$109,620 \text{ Total amount paid} \\ &\$109,620 - \$60,000 = \$49,620 \text{ Interest paid} \end{aligned}$$

- d.) Calculate the amount of interest paid in points. One point equals 1 percent of the loan amount. The loan amount is \$80,000, and the lender requires payment of 3½ points.

$$\begin{aligned} \text{Loan amount} \times \text{Number of points} &= \text{Dollars in points} \\ \$80,000 \times .035 &= \$2,800 \end{aligned}$$

- e.) Calculate the number of points paid. One point equals 1 percent of the loan amount. The loan amount is \$75,000, and the borrower paid \$2,250.

$$\begin{aligned} \text{Amount paid in points} \div \text{Loan amount} \times 100 &= \text{Number of points} \\ \$2,250 \div \$75,000 \times 100 &= 3 \text{ points} \end{aligned}$$

- f.) Calculate the loan-to-value ratio. The loan amount is \$70,000 and the property is worth \$87,500.

$$\begin{aligned} \text{Loan amount} \div \text{Property value} &= \text{Loan-to-value ratio} \\ \$70,000 \div \$87,500 &= .80 = 80\% \text{ loan-to-value ratio} \end{aligned}$$

CALCULATING POINTS CHARGED BY THE LENDER

One point equals one percent of the loan amount. Every point the borrower pays will either reduce his interest rate by 1/8 of one percent or increase the lenders yield by 1/8 of one percent.

- a. Calculate how many points a borrower will have to pay and how much it will cost to lower his interest rate from 8% to 7.5% on a \$100,000 loan.

$$\begin{aligned} 8\% &= .08 \quad 7.5\% = .075, \quad .08 - .075 = .005; \quad .005 = \frac{1}{2}\% = 4/8\% \\ \text{The borrower would have to pay} & \text{ 4 points.} \\ \text{It would cost the borrower} & \text{ \$4,000} \\ \$100,000 \times .04 &= \$4,000 \end{aligned}$$

- b. Calculate how many points would a lender have to charge if it wants to yield 10.5% and only charge the borrower 10.25%

$$\begin{aligned} 10.5\% &= .015 \quad 10.25\% = .0125, \quad .015 - .0125 = .0025 \text{ or } \frac{1}{4}\% = 2/8\% \\ \text{The lender would have to charge} & \text{ 2 points.} \end{aligned}$$

REAL ESTATE TAX CALCULATIONS

Market value (Sales Price) x Assessment rate x Equalization factor ÷ 100 (or per mill = 1000) x Tax rate = Annual taxes

- a. Calculate the tax rate. The assessed property in a taxing district is \$275,000,000 and income from taxes need to meet its budget is \$15,000,000.

$$\begin{aligned} \text{Tax income} \div \text{Assessed value} &= \text{Tax rate} \\ \$15,000,000 \div \$275,000,000 &= .0545 \end{aligned}$$

This rate also can be expressed as 5.45%, 54.5mills or \$5.45 per \$100 of assessed value.

- b. Calculate the assessed value of a property. The market value of the property is \$178,000, and the property is assessed at a rate of 20 percent of market value.

$$\begin{aligned} \text{Property's market value} \times \text{Assessed rate} &= \text{Assessed value} \\ \$178,000 \times .2 &= \$35,600 \end{aligned}$$

- c. Calculate the real estate tax on a property. The assessed value of the property is \$40,000, and the tax rate is \$3.75 per \$100 of assessed value.

$$\begin{aligned} (\text{Assessed value} \div 100) \times \text{Tax rate} &= \text{Real estate tax} \\ (\$40,000 \div \$100) \times 3.75 &= \$1,500 \end{aligned}$$

- d. Calculate the market value of a property. The property was assessed at 80 percent of market value, the tax rate is 5 percent and the amount of the tax is \$1,875.

$$\begin{aligned} (\text{Real estate tax} \div \text{Tax rate}) \div \text{Assessment rate} &= \text{Market value} \\ \$1,875 \div .05 &= \$37,500 \\ \$37,500 \div .8 &= \$46,875 \end{aligned}$$

TRANSFER TAX CALCULATIONS

Calculate the amount of the transfer tax. The state transfer tax is \$.50 for every increment of \$500 not including assumed mortgages. The county transfer tax is \$.25 for every increment of \$500 not including assumed mortgages. Transactions where the sales price is \$100 or less is exempt transfer tax.

A property sold for \$168,250. What is the total transfer tax?

$$\begin{aligned} \text{State: } \$168,250 + 250 \text{ [round up to the next } \$500 \text{ increment]} \div 500 \times .50 &= \$168.50 \\ \text{County: } \$168,250 + 250 \text{ [round up to the next } \$500 \text{ increment]} \div 500 \times .25 &= \$84.25 \end{aligned}$$

$$\text{Total } \$252.75$$

CAPITALIZATION CALCULATIONS

Capitalization calculations are used frequently by investors and in appraising properties that generate operating income. The capitalization rate is based on the amount invested and the annual net income from the property. Investors use it to calculate the rate of return they will receive on the money they invest and to determine the appropriate purchase price for a property based on its net income.

$$\text{Market Value (Sales Price)} \times \text{Capitalization rate} = \text{Annual net income}$$

- a. Calculate the capitalization rate. A property is worth \$635,000 and generates net income of \$50,800.

$$\begin{aligned} \text{Net operating income} \div \text{value of the property} &= \text{Capitalization rate} \\ \$50,800 \div \$635,000 &= .08 \text{ or } 8\% \end{aligned}$$

- b. Calculate the value of a property using the capitalization rate. A property generates net income of \$63,000, and the capitalization rate is 9 percent.

$$\begin{aligned} \text{Net operating income} \div \text{Capitalization rate} &= \text{Property value} \\ \$63,000 \div .09 &= \$700,000 \end{aligned}$$

- c. Calculate the net income of a property using the amount invested and the capitalization rate. An investor paid \$350,000 for a property that returns a capitalization rate of 9 percent to the investors.

$$\begin{aligned} \text{Property value} \times \text{Capitalization rate} &= \text{Net operating income} \\ \$350,000 \times .09 &= \$31,500 \end{aligned}$$

DEPRECIATION CALCULATIONS

- a. Calculate the amount of yearly and accumulated depreciation. A property was purchased four years ago for \$450,000. The value of the land was \$80,000 and the property was depreciated at 3 percent per year.

$$\begin{aligned} (\text{Original value} - \text{Land Value}) \times \text{Rate of depreciation} &= \text{Yearly depreciation} \\ (\text{Yearly depreciation} \times \text{Number of years depreciated}) &= \text{Accumulated depreciation} \\ (\$450,000 - \$80,000) \times .03 &= \$11,100 \\ \$11,100 \times 4 &= \$44,400 \end{aligned}$$

- b. Calculate the original value of a property. A property was purchased six years ago and has been depreciated at a rate of 3 percent per year. The remaining depreciable balance is \$360,800. The value of the land at the time purchased was \$40,000.

$$\begin{aligned} \text{Remaining balance} \div (\text{Years depreciated} \times \text{Rate of depreciation} - 100\%) + \text{Land value} &= \\ \text{Property's original value} & \\ \$360,000 \div (6 \times .03 - 1) = \$440,000 + \$40,000 &= \$480,000 \end{aligned}$$

LEASE CALCULATIONS

Calculate the annual rent on a percentage lease. The rent charged is \$500 a month plus 4 percent of gross sales, and the tenant had gross sales of \$230,000 in the year.

$$\begin{aligned} \text{Annual rent} &= (\text{Monthly rent} \times 12 \text{ months}) + (.04 \times \text{Gross sales}) \\ \$500 \times 12 &= \$6,000 \\ .04 \times \$230,000 &= \$9,200 \\ \$6,000 + \$9,200 &= \$15,200 \end{aligned}$$

GROSS RENT MULTIPLIER

Calculate the value of a property with a annual rent of \$12,000 and a Gross Rent Multiplier of 40.

$$\text{Monthly rent} \times \text{Gross rent multiplier} = \text{Value}$$

$$\$12,000 \div 12 = \$1,000 \text{ rent per month} \times 40 = \$40,000$$

GROSS INCOME MULTIPLIER

Calculate the value of a property with a quarterly income of \$25,000 and a Gross income Multiplier of 5.

Annual income x Gross income multiplier = Value

$$\$25,000 \times 4 = \$100,000 \text{ Annual income} \times 5 = \$500,000$$

CO-INSURANCE CLAUSE CALCULATIONS

Calculate what the insurance company will pay the homeowner if the property is valued at \$100,000 and the homeowners purchase \$20,000 of insurance and they suffer an insurable loss in the amount of \$80,000.

The co-insurance clause says that if the homeowner does not maintain insurance of at least 80% of the property's value then the insurance company will only pay the homeowner the insured amount divided by 80% of the property's value times the loss. An insurance company will never pay out more than the amount of the policy.

(Insured amount \div 80% x Value) x Loss = Amount paid by insurance company

$$\$20,000 \div \$80,000 = 25\% \times \$80,000 = \$20,000$$

THE FORMULA FOR THE AMOUNT OF EACH PAYMENT ON A FULLY AMORTIZED LOAN:

p = payment amount

n = # of payments per year

t = # of years

N = n * t = total # of payments

r = annual interest rate

R = r/n = periodic interest rate

P = original principal

The formula for the amount of each payment on the loan is:

$$P = \frac{P * R * (1 + R)^N}{(1 + R)^N - 1} = \frac{P * r/n * (1 + r/n)^{n * t}}{(1 + r/n)^{n * t} - 1}$$

In the vast majority of home mortgages, payments are made on a monthly basis. For such loans the number of payments per year is $n = 12$, while the periodic interest rate is the annual interest rate divided by 12, or $R = r/12$. The formula for the monthly payment then becomes:

$$P = \frac{P * r/12 * (1 + r/12)^{12 * t}}{(1 + r/12)^{12 * t} - 1}$$

PRACTICE EXERCISES

1. If a real estate broker earned a commission of \$7,500 at a rate of 6 percent, the selling price of a property was:

a. \$75,000.	c. \$120,000.
b. \$79,787.	d. \$125,000.

2. If a property sold for the amount of its assessed value, the annual tax on the property is \$1,200 and the tax rate is \$1.50 per \$100 of assessed value, the selling price of the property was:

a. \$1,200.	c. \$8,000.
b. \$1,800.	d. \$80,000.

3. The annual rent in a lease agreement is to be 3.5 percent of the tenant's gross sales with a minimum annual rent of \$6,800. What will be the amount of the rent if the sales are \$236,000?

a. \$6,800	c. \$15,060
b. \$8,260	d. \$82,600

4. How many acres does a rectangular parcel of land contain if it is 120 feet deep and 20 yards wide?

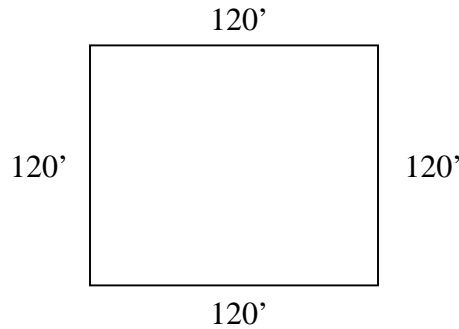
a. .06 acre	c. 6 acres
b. .165 acre	d. 17 acres

5. A salesperson earned \$60,000 in commissions, which was 30 percent of the commissions earned by the office last year. The total amount of commissions earned by the office last year was:
- a. \$78,000.
 - b. \$180,000.
 - c. \$200,000.
 - d. \$20,000,000.
6. What is the market value of a commercial building if its gross income is \$82,000, its operating expenses are \$10,000 and an investor expects a capitalization rate of 9 percent?
- a. \$80,000
 - b. \$800,000
 - c. \$920,00
 - d. \$911,111
7. A building with an economic life of 25 years is four years old and its current value is \$218,400. The original value of the building was:
- a. \$225,000.
 - b. \$252,944.
 - c. \$260,000.
 - d. \$273,000.
8. An investor bought a condominium for \$48,000. A year later the investor sold it for \$52,000. What rate of return did the investor receive on the property?
- a. .083%
 - b. 7.7%
 - c. 8.3%
 - d. 83%
9. The dimensions of a rectangular house are 68 feet by 87 feet. The square footage of the house is:
- a. 155 sq. ft.
 - b. 174 sq. ft.
 - c. 5,916 sq. ft.
 - d. 24,025 sq. ft.
10. A property sold for \$262,500 and the broker earned a 6 percent commission on the sale. The broker earned:
- a. \$1,575.
 - b. \$4,375.
 - c. \$5,750.
 - d. \$15,750.
11. The real estate tax rate in mills for a taxing body that includes properties totaling \$42,000,000 is assessed value and a budget of \$1,890,000 is:

17. A property has a loan of \$77,000 with an annual interest rate of 9.25%. The amount of the monthly interest payment is:

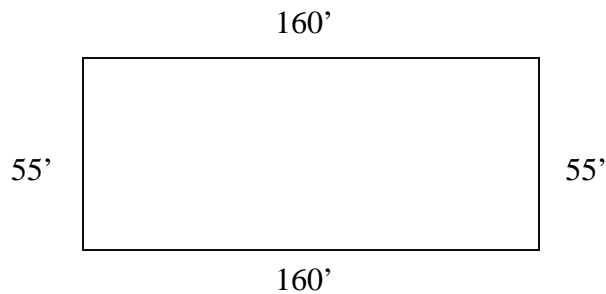
- a. \$594.
- b. 712.
- c. \$5,935.
- d. \$7,123.

18. An owner wishes to have a landscaping company spray her lot with weed killer. The landscaping company charges \$.50 per 100 square feet. How much will it cost for the lot to be spayed?



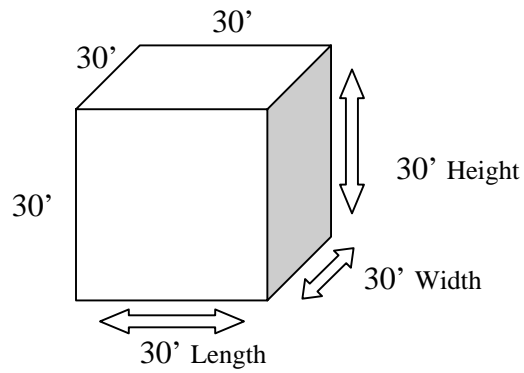
- a. \$7.20
- b. \$72
- c. \$720
- d. \$7,200

19. What is the area of the parcel of land shown here?



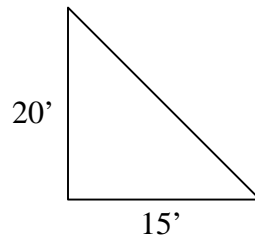
- a. 430 sq. ft.
- b. 8,800 sq. ft.
- c. 3,025 sq. ft.
- d. 25,600 sq. ft.

20. What is the volume of the cube illustrated?



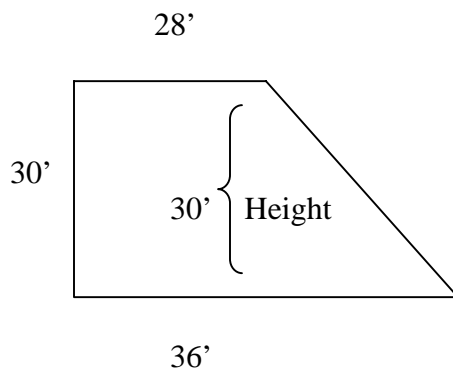
- a. 90 cu. ft.
- b. 900 cu. ft.
- c. 2,700 cu. ft.
- d. 27,000 cu. ft.

21. What is the area of the triangle?



- a. 75 sq. ft.
- b. 150 sq. ft.
- c. 300 sq. ft.
- d. 3,000 sq. ft.

22. What is the area of the parcel of land shown?



5. **c** $\$60,000 \div .3 = \$200,000$
6. **b** $\text{Gross income} - \text{Operating expenses} \div \text{Capitalization rate} = \text{Value}$
 $\$82,000 - \$10,000 \div .09 = \$800,000$
7. **c** $100\% \div 25 = 4\%$ depreciation each year
 $4\text{yr.} \times 4\% = 16\%$ depreciated ($100\% - 16\% = 84\%$ left)
 $\$218,400 \div .84 = \$260,000$
8. **c** $\$52,000 - \$48,000 = \text{profit}$
 $\$4,000 \div \$48,000 = 8.3\%$
9. **c** $68 \text{ ft.} \times 87 \text{ ft.} = 5,916 \text{ sq. ft.}$
10. **d** $\$262,500 \times .06 = \$15,750$
11. **c** $\$1,890,000 \div \$42,000,000 = .045 = 45 \text{ mills}$
12. **a** $\$148,000 \times .005 = \740
 $\$740 \div 12 = \61.67
13. **c** $\$86,000 \times .085 = \$7,310$
14. **c** $\$152,000 \div .85 = \$178,824$
15. **c** $\$94,500 \times .03 = \$2,835$
16. **c** $66 + 30 + 30 + 12 + 8 + 8 + 28 + 26 = 208 \text{ ft.}$
17. **a** $\$77,000 \times .0925 \div 12 = \$593.54 = \$594$
18. **b** $120 \times 120 = 14,400 \text{ sq. ft.} \div 100 = 144 \times \$.50 = \$72$
19. **b** $160 \times 55 = 8,800 \text{ sq. ft.}$
20. **d** $\text{Volume} = \text{height} \times \text{width} \times \text{length}$
 $30 \times 30 \times 30 = 27,000 \text{ cu. ft.}$
21. **b** $\text{Area} = \frac{1}{2} (\text{base} \times \text{height})$
 $20 \times 15 \div 2 = 150 \text{ sq. ft.}$
22. **b** $\text{Area} = \frac{1}{2} \text{height} \times (\text{base 1} + \text{base 2})$
 $.5 \times 30 \times (36 + 28)$
 $15 \times 64 = 960 \text{ sq. ft.}$
23. **a** $\$195,300 + 200$ (rounded up to the next \$500 increment)
 $\div 500 \times .25 = \$97.75$

24. **c** $\$350,600 \div (\$35,000 \div 12) = 120$

25. **d** $\$30,000 \div (80\% \times \$150,000) \times \$40,000 = \$10,000$