Arti Academics Math Study Guide

Introduction

A Real Estate Agent needs to have strong math skills to be successful. They need to be able to calculate commissions, estimate property taxes, and keep track of their finances. They also need to be able to negotiate with buyers and sellers and understand the market.

Key Terms and Formulas

Loan to Value -

Definition
Loan to value ratio (LTV) is a financial term used to express the ratio of the amount borrowed to the value of a real estate asset. The property value is usually determined by an appraisal.

Calculating Loan to Value
LTV = Mortgage Amount / Property Value

Example Problem
If you have a mortgage amount of $500,000 and the appraised property value is 525,000 then your LTV would be: 500,000/525,000 or .95%

Mortgages & Basic Interest -

Definition
Basic Interest is the cost of borrowing money and is typically expressed as a percentage of the principal loan amount.

Calculating Basic Interest
A = P(1 + rt) A is the final amount, P is the initial balance, r is the rate and t is the time in years.

Example Problem
If you borrowed 500,000 at 6% for 15 years your final amount would be A = $500,000(1+.06*15) or $950,000

Now we find the Interest and the Principal in the payment. Take the loan amount at 500,000 and multiple by interest of .06 = 30,000 / 12 months = $2,500 - $2,997.75 = $497.75 This shows that month one interest is $2,500 and principal is $497.75

PITI
A mortgage will typically include Principal, interest, taxes, and Insurance.

Amortization
Mortgage Amortization is the process of spreading out the cost of a property over its useful life. This is usually done through periodic payments, such as monthly or yearly payments.

Per Annum
Per Annum means once per year

Example - A 5% per annum interest rate on a $500,000 dollar loan would cost $25,000 per year. (500000*.05).

Settlement & Closing Cost -

Definition
Fees that the buyer and/or seller pay to complete the sale of a property.

Closing cost are typically between 2%-5%

Prorations -

Definition
A proration is when a seller and buyer of a property agree to split the cost of something based on the time each owned the property.

Calculating Prorations
Property Taxes for a property are $1,000 for the year and the seller owned the property for six months and the buyer owned it for six months, the seller would pay $500 of the taxes and the buyer would pay $500.

Example Problem
Harold is selling a house and John is purchasing it. For the year, property taxes of $2,500 were already paid by Harold. Harold has owned the home for 120 days this year. John will own the home for 245 days. How much should money Harold get back at closing? Harold will receive $1678.08 at closing. Step one 245/365 = .67 Step 2 .67*2500=1678.08

Transfer Tax -

Definition
This is a tax by local or state government to complete a sale of property from one owner to another. Depending on the state or jurisdiction, the transfer tax fees can vary but are typically a percentage of the sales price.

Calculation
It is calculated as a percentage of the sale price or appraised value of the property being sold. It depends on the state, city, and county of the property is being sold in.

Pre-Payment-Penalty -

Definition
A fee that is charged by some lenders for if you pay the loan off before the term of the loan has expired. This is typically used to pay the lender additional money if the property is sold within the first few years. Most often these are applicable to commercial or investment loans. They are not as common on residential loans.

Calculating Pre Payment-Penalty
A typical Pre-payment structure is a 5-4-3-2-1 meaning if the loan is paid off in the first year the penalty is 5% of the loan value. If it is paid off in the second year the penalty is 4% of the loan value and so on. In this example, in year 5, there is no prepayment penalty.

Example Problem
You took out a loan for $500,000 dollars and you wish to pay it off in year 3 and you have paid down the loan $150,000 dollars how much is the Pre-payment Penalty? $500,000 - $150,000 = $350,000 *.03 = $10,500 of prepayment penalty for a total of $360,500 to pay off the loan

Discount Points on Loan -

Definition
Discount points are a fee paid by the borrower to the lender at closing to lower the interest rate on the loan. Generally, one point lowers your rate .0125-.025 or 1/8-1/4 of a percent.

Calculating Discount Points
Discount points are calculated as a percentage of the loan amount. Each point is one percent of the total amount borrowed. On a 500,000 dollar loan if you wanted to buy down one point it would be $500,000 * .01 or 1% which is $5000. So, for every point buy down it would cost $5000 dollars.

Example Problem
A borrower is considering taking out a 500,000-dollar loan. The lender is offering the borrower the option to purchase discount points to reduce the interest rate on the loan. How many discount points must the borrower purchase to reduce the interest rate by 1%, If we assume each point buys down .025%? $500,000 *.01 = $5000 so each .25% rate reduction will cost $5,000 and we need 1%. 1/.25 = 4 so we need $5,000 * 4 = $20,000 to get 1% lower interest rate.

Loss or Gain on Property -

Definition
Loss or gain is the amount of money you made or lost at the time of selling the property.

Calculating Loss or Gain on Property
Start with the purchase price of the asset - the depreciation + improvements then subtract that from the purchase price if it is positive, you have gain if it is negative, you have loss.

Example Problem
You bought a home for $500,000 and in 15 years you sold it for $750,000, over those 15 years you put $35,0000 in to fix it up and it has depreciated about $30,000. So, the total purchase price becomes $500,000 - $30,000 + $20,000 = $750,000 - $490,000 = $260,000 in profit.

Gross Leasable Area -

Definition
Gross leasable area (GLA) is the amount of space in a commercial building that is available for lease to tenants. This includes both the usable square footage of the space, as well as common areas such as hallways and restrooms. The amount of GLA will vary significantly from one building to another and is typically larger in office buildings than in retail establishments.

Calculation
Simply add the total square feet available for lease.

Example Problem
Jon and Barry have two commercial suites for rent. Suite 1 is 3,900 square feet and Suite 2 is 12,000 square feet. What is the gross leasable area? Answer: The gross leasable area is 15,900 square feet. (3900 + 12000 = 15,900).

For more information refer to the commercial real estate leasing course at ARTI(r) Academics.

Net Operating Income -

Definition
After subtracting necessary operating expenses, the net operating income is used to determine the revenue and profitability of an investment.

Calculating Net Operation Income
All revenue – all operating expenses as necessary

Example Problem
If your investment had a revenue of $5,000 a month and the expenses were $1,800 a month what is your NOI over the year? $5,000 * 12 = $60,000 - $1,800 * 12 = $21,600 so our NOI is $60,000 - $21,600 = $39,400

Capitalization Rate -

Definition
Used in commercial real estate to indicate the rate of return that would be expected or generated on a real estate investment property. It gauges the risk and potential return on the property. Cap rates can vary from less than 4% to greater than 10% depending on the current real estate market dynamics.

Calculating Capitalization Rate
Start with finding the net income which is Gross Revenue – Total Expenses. Then divide the net income by the purchase price. Then multiply by 100 to get the percentage.

Example Problem
You bought a piece of property for $1,000,000 and the estimated gross income is $75,000 and expenses of $10,000. The net income becomes $75,000 - $10,000 = $65,000 now divide $65,000/$1,000,000 = .065 * 100 = 6.5% capitalization rate.

Depreciation -

Definition
Depreciation is an accounting method that allows a company to spread the cost of a purchase over the useful life of the asset. This method is often used for large purchases, such as buildings or equipment, that will be used for several years.

Calculating Depreciation
Divide the property value by the life of the property or useful life. For commercial real estate the useful life is 39 years. For residential real estate the useful life is 27.5 years.

Example Problem
We purchase a home that we rent for $500,000 with a useful life of 39 years. We would take $500,000 / 39 = $12,820.51 depreciation each year.

Capitalization Rate -

Definition
Generally, real estate agents receive a commission from the seller, which is often a percentage of the final sale price of the home.

Calculating Capitalization Rate
Take the total sales price of the property and divide it by the commission amount.

Example Problem
Larry is a Real Estate Agent representing Paul to sell his home. Paul agreed to pay Larry's Brokerage 6% of the sales price for the service. Another agent represented the Buyer and received 50% of the total commission. Larry sold Paul's home for $280,000. How much revenue does Larry's Brokerage earn on the transaction? Larry's Brokerage earns $8,400. (280,000 * (.06 - .03) = $8,400)

Decimals, Percentages, Fractions -

Definition
Decimal is a tenth part or power of tens.
Percentage is a rate or portion of 100.
Fractions represents a part or portion of a whole.

Examples
¼ = .25 = 25%
1/3 = .33 = 33.33%
½ = .50 = 50%
1/8 = .125 = 12.5%

Land Area Calculations

Calculate Square Feet -

Definition
Is a unit of area that is equal to 1 foot by 1 foot.

Calculating Square Footage
It is calculated by taking the Length and the width and multiplying them. L x W

Example Problems
If you have a room that is 14.7 ft by 25 ft what is the square footage? 14.7* 25 = 365.7 square feet

If you have a property that is 500ft by 357 ft what is the square footage? 500 * 357 = 178,500 square feet

Calculate Acreage –

Definition
An acre is a unit of measurement equaling 43,560 square feet. One acre is 208ft by 208ft square.

Calculating Acreage
This can be done multiple ways depending on what information you have. If you have the length (L) and width (W) of the property, you can multiple L X W then you would divide by 43560 Square feet.

Take the square feet and simply divide by 43560 to get the acreage.

Example Problems
If the length of the property is 750 and the width is 1000 what is the acreage? 750 * 1000 = 750,000 square feet. Divide 750,000 by 43560 = 17.22 acres

If the square footage is 7600 what is the acreage? 43560 / 7600 = .17 acres

Calculating a Section -

Definition
A section is a unit of measurement in the Public Land Surveying System commonly equaling 640 acres.

Calculating a section
Simply divide the number of acres using your calculator by the section size, typically 640 acres, to return the number of sections. Similarly, you can multiply the number of Sections by 640 to return the number of acres.

Example Problem
I own 2.5 sections of land. How many total acres do I have? = 640 + 640 + 320 or 1600 Acres. Calculated differently 2.5*640 = 1600 Acres

Practice Questions

1. What is the loan to value on a house that appraised for $475,000 and a loan amount of $300,000?

2. If someone has a loan for $750,000 at a 5% interest rate, how much will they pay in interest after one year?

3. A borrower is considering taking out a 500,000-dollar loan. The lender is offering the borrower the option to purchase discount points to reduce the interest rate on the loan. One discount point reduces the interest rate by .25%. How many discount points must the borrower purchase to reduce the interest rate by 1%?

4. A borrower bought down their rate 1.5% on their $500,000 dollar loan, at a rate of .025 percent per point how much did they spend on discount points?

5. The length of the property is 300ft and the width is 250 ft. How many acres is the property assume an acre is 43560 Square Feet?

6. What is the square footage if the length is 250 feet, and the width is 575 feet?

7. Jake owns 2.5 sections of land. How many acres does Jake have?

8. My property is 27,456 square feet what is the acreage?

9. I have 8.9 acres how large is my lot in square feet?

10. You bought a home for $500,000 and in 15 years you sold it for $750,000, over those 15 years you put $35,0000 in to fix it up and it has depreciated about $30,000. What is the loss or gain on the property?

11. You took out a loan for $750,000 over 5 years and you decide on year 2 to pay off the loan but it has a pre-payment penalty of 4%. What is the total you would owe for paying off early if your remaining balance is $600,000?

12. You have 3 rooms upstairs and need to find the square footage. Room 1: 15.7 X 18.5 Room 2: 12 X 12 and Room 3: 14 X 12.5 what is the total square footage?

13. A property is listed having 32,000 square footage what is the acreage?

14. You bought a home for $500,000 and in 10 years you sold it for $450,000, over those 10 years you put $25,000 in to fix it up and it has depreciated about $15,000. What is your loss or gain on the property?

15. If you invested $75,000 and the profit from your investment would be $115,000 what is your ROI?

16. Joe has two commercial suites for rent. Suite 1 is 7,700 square feet and Suite 2 is 9,600 square feet. What is the gross leasable area?

17. Bill has an investment with a monthly revenue of $10,000 and monthly expenses of $2,700 what is the NOI over the year?

18. Jimmy bought a piece of property for $2,000,000 and has an estimate gross income of $200,000 and expenses of $50,000. What is the capitalization rate?

19. Brad buys a home that he wants to rent for $750,000 which has a useful life of 27.5 years, what is the depreciation?

20. Jimmy is a Real Estate Agent representing Paul to sell his home. Paul agreed to pay Larry's Brokerage 6% of the sales price for the service. Another agent represented the Buyer and received 50% of the total commission. Larry sold Paul's home for $520,000. How much revenue does Larry's Brokerage earn on the transaction?

21. What is your PITI if your principal payment is $1,745 interest payments is $1,256, taxes are $124, and insurance is $99?

22. What is .33 in fraction and decimal form?

23. What is 50% in decimal and fraction form?

24. What is ¼ in decimal and percentage form?

25. You took out $250,000 loan for 5 years with a prepayment penalty of 8%. You decide to pay off the loan at the end of year 1. What is the total you would owe for paying off early if your remaining balance is $200,000?

26. Larry purchases a home that he rents for $500,000 with a useful life of 27 years. Calculate the amount of depreciation each year.

27. Louise is purchasing a home for $500,000 and it is estimated that closing costs will be 3%. How much money should Louise plan on paying at closing?

28. Harold is selling a house and John is purchasing it. For the year, property taxes of $2,500 were already paid by Harold. Harold has owned the home for 120 days this year. John will own the home for 245 days. How much should money Harold get back at closing?

Answer Key

1. $300,000/$475,000 = .63%
2. A=$750,000(1+.05*1) A = $787,500 Total interest paid is $787,500-$750,000 =$37,500
3. Each point is .025% and 1% is the total buy down. 1/.025 = 4 so we need 4 discount points
4. 1.5% at .25% per buy down 1.5/.25 = 6. Buy down point cost 1% of the total loan $500,000 or $5,000 per buy down. 6 points at $5,000 per point = 6 * $5,000 = $30,000
5. 300ft * 250ft = 75,000 square feet 75,000/43560 = 1.7 acres
6. 250ft X 575ft = 143,750 square feet
7. 640 + 640 + 320 or 1600 Acres. Calculated differently 2.5*640 = 1,600 Acres
8. 27,456 / 43,560 = .63 acres
9. 8.9 * 43,560 = 387,654 square feet
10. Total purchase price = $500,000 - $30,000 + $20,000 = $750,000 - $490,000 = $260,000 in profit
11. $600,000 * .04 = $24,000 total payment is $600,000 + $24,000 = $624,000
12. 15.7ft X 18.5ftf + 1t2 X 12ft + 14ft X 12.5ft = 609.45 square feet
13. 32,000/43,560 = .73 acres
14. Total purchase price = $500,000 - $15,000 + $25,000 = $450,000 - $510,000 = $-60,000 or a loss
15. ($115,000-$75,000)/$75,000 * 100 = 60%
16. 7,700 + 9,600 = 17,300 square feet
17. $10,000 * 12 – $2,700 * 12 = $120,000 – $32,400 = $87,600 NOI
18. (($200,000 - $50,000)/$1,000,000) * 100 = 15%
19. 750,000/ 27.5 = 27272.73
20. (520,000 * (.06 - .03) = $15,600)
21. $1,745 + $1,256 + $124 + $99 = $3,224
22. 33% is the percentage form and 1/3 is the fraction form.
23. ½ is the fraction form and .5 is the decimal form.
24. 25% is the percentage form and .25 is the decimal form.
25. $16,000. $200,000 * .08 = 16,000 prepayment penalty.
26. $18,618.52. $500,000 / 39 = $18,618.52 depreciation each year.
27. $500,000 * .03 = $15,000 closing costs
28. 245/365 = .67 then .67*$2,500=$1,678.08