



Math Relating to Real Estate Financing

1. Determining Equity and Percent of Equity Increase

A. Parts of the problem: (1) Market Value (or price), (2) Amount of increase, (3) Percent of equity increase

B. Equity is the value or sales price of the property less the debt(s) owed on the property.

C. **Example:** A couple bought a home for \$90,000 and had a \$70,000 mortgage loan. Equity is determined as follows:

$$\$90,000.00 - \$70,000 = \$20,000 \text{ Original Equity}$$

Ten years later the value of the above property has increased to \$110,000 and the loan debt has been reduced to \$60,000. The equity is now:

$$\$110,000 - \$60,000 = \$50,000 \text{ New Equity}$$

Determine the percent of equity increase. **NOTE: In order to find the percent of equity increase, you MUST first determine the amount of increase.**

$$\$50,000 \text{ New Equity} - \$20,000 \text{ Original Equity} = \$30,000 \text{ Equity Increase}$$

Divide the Equity Increase by the Original Equity

$$\$30,000 \div \$20,000 = 1.5 = 150\% \text{ of Equity Increase}$$

2. Principal and Interest Math

A. Parts of the Problem: (1) Principal (2) Loan Amount/Loan Balance (3) Interest (4) Interest Rate (%)

B. Formulas:

1. $I = PR$ (Interest = Principal x Rate)

2. $P = I \div R$

3. $R = I \div P$

C. **Example:** The loan amount is \$85,000 and the interest rate is 6.5%. What is annual interest?

$$\$85,000 \times .065 = \$5,525 \text{ annual interest}$$

What is monthly interest?

$$\$5,525 \div 12 \text{ months} = \$460.42 \text{ monthly interest}$$

- D. **Example:** The loan amount is \$66,000 and the annual interest is \$5,200. What is the rate of interest?
 $\$5,200 \div \$66,000 = .078 = 7.8\%$
- E. **Example:** The annual interest is \$7,200 at a rate of 7.5%. What is the principal loan balance?
 $\$7,200 \div .075 = \$96,000$

3. Determining Monthly Principal and Interest Payments and Monthly PITI

- A. Parts of the Problem: (1) "Loan Factor" from a rate card, (2) Loan Amount Borrowed, (3) Annual Taxes, (4) Annual Insurance Premium
- B. **Example:** You bought a house with a loan of \$21,500 at 8% interest. The monthly principal and interest (PI) will be \$7.70 per \$1,000 of the loan amount. The annual property taxes are \$496.20, and the homeowner's insurance premium is \$240 per year. What is the total monthly PITI?

Step 1: Determine number of \$1,000's in loan amount
 $\$21,500 \div \$1,000 = 21.5$

Step 2: Determine monthly PI
 $\$7.70 \times 21.5 = \165.55 PI

Step 3: Determine monthly taxes
 $\$496.20 \div \text{by } 12 \text{ months} = \41.35

Step 4: Determine monthly insurance Premium
 $\$240 \div 12 \text{ months} = \20

Step 5: Determine monthly PITI
 $\$165.55 + \$41.35 + \$20 = \226.90 PITI

4. Determining Total Amount of Interest Paid Over the Life of a Loan

- A. Parts of the problem: (1) Loan Term, (2) Number of payments, (3) PI monthly payment (4) Original Loan Amount
- B. **Example:** Monthly payments are \$580 PI on an amount borrowed of \$60,000 for 25 years. What is the amount of interest paid over the entire term of the loan?

Step 1: Determine total PI paid over life of the loan
 $\$580 \text{ PI} \times 12 \text{ months} = \$6,960 \times 25 \text{ years} = \$174,000$ Total PI

Step 2: Determine Interest Paid over life of loan
 $\$174,000 \text{ PI} - \$60,000 \text{ P} = \$114,000$ Interest

5. Determining Loan Balance After One Month's Payment Has Been Made (Loan Reduction)

- A. Parts of the problem: (1) Loan Amount, (2) Monthly P/I payments, (3) Interest Rate
- B. **Example:** Loan balance is \$75,525 at 13% interest with the monthly payment being \$855 PI. What is loan balance remaining after one month's payment has been made?

Step 1: Determine Annual Interest
 $\$75,525 \times .13 = \$9,818.25$

Step 2: Determine Monthly Interest
 $\$9,818.25 \div 12 \text{ months} = \818.19 I

Step 3: Determine Monthly Principal
 $\$855 \text{ PI} - \$818.19 \text{ I} = \$36.81 \text{ P}$

Step 4: Determine Loan Balance Remaining
 $\$75,525 - \$36.81 = \$75,488.19$

6. Qualifying a Buyer on an FHA Loan

- A. In qualifying for an FHA loan, lenders will use the following ratios:
- I. Monthly housing expenses should not exceed 29% of the monthly gross income.
 - II. Monthly recurring obligations should not exceed 41% of the monthly gross income.
- B. Gross income is gross income of borrower and co-borrower expected to continue for the first five years of the mortgage loan.
- C. Housing expenses include:
- I. Monthly Loan principal and interest (PI) payment
 - II. 1/12 of annual real property taxes
 - III. 1/12 of annual homeowner's insurance premium
 - IV. The monthly FHA Mortgage Insurance Premium (MIP), if being financed along with the loan amount
 - V. Monthly Home Owner's Association Dues, if applicable
- D. Recurring obligations include all of the Housing Expenses (paragraph C above) plus all other fixed recurring payments (Debts) that have more than 6 payments left, such as automobile, personal loans, alimony and child support, credit cards and revolving charge accounts.

- E. **Example:** Bill and Betty have applied for a 30 year FHA loan in the amount of \$72,500 at 11% interest. Their combined monthly gross income is \$3,600. The estimated monthly loan payment including taxes and insurance and MIP is \$820.00. They have other recurring debts of \$600.00 per month.

Under which of the qualifying ratios will the lender find them to qualify?

- I. Housing expenses to income
- II. Recurring obligations to income

- (a) I Only (b) II Only (c) Both (d) Neither

Solution

Housing expenses:

$\$820 \text{ PITI/MIP} = \$820.00 \text{ divided by } \$3,600 \text{ effective income} = .227 = 22.7\%$. This does not exceed 29%. They will qualify under this ratio.

Recurring obligations:

$\$820 \text{ monthly housing expenses plus } \$600 \text{ other debts} = \$1,420 \text{ total monthly recurring obligations} \div \$3,600 \text{ effective income} = .394 = 39.4\%$, which does not exceed 41%. They will qualify under this ratio.

Answer to this problem is (c) Both.

7. Qualifying a Buyer on a Conventional Loan

- A. In qualifying for a conventional loan, lenders will use ratios based on the amount of down payments given by the buyer:

The making of a down payment of more than 10%, the monthly housing expenses cannot exceed 28% of monthly gross income, and recurring obligations cannot exceed 36% of monthly gross income.

NOTE: These qualifying ratios will be given in the problem to work.

- B. Qualifying for a conventional loan, lenders use gross monthly income

- C. Housing Expenses Include:

- Monthly loan P I Payment
- 1/12 of annual real property taxes
- 1/12 of annual insurance premium
- Monthly private mortgage insurance (PMI) if being financed with the loan amount
- Monthly Homeowner's Association Dues, if applicable

D. Recurring obligations include:

- Housing expenses (All of paragraph C above)
- Automobile payments
- Personal loan payments
- Other mortgage loan payments
- Credit cards/revolving charge accounts
- Alimony/child support payments
- Any other recurring debts (**NOTE: It does not matter that these debts may be paid off in the near future. Any recurring debts at time of loan application will be considered as a "long-term" recurring obligation.**)

E. Parts of the problem: (1) Loan amount (2) Housing expenses (3) Recurring Obligations (4) Qualifying ratios

F. **Example:** A husband and wife apply for a \$90,000 conventional mortgage loan with a sales price of \$110,000. The "housing expenses" are \$825 per month. The couple's "total monthly recurring obligations" are \$1,600, and their combined monthly gross income is \$3,600. Under which of the following ratios will the lender find them to be qualified? Use qualifying ratios of 28/36.

- I. Housing expenses to gross income
- II. Recurring obligations to gross income

- (a) I Only (b) II Only (c) Both (4) Neither

Solution:

Housing expenses = $\$825 \div \$3,600 = .23 = 23\%$. Does not exceed 28%: Okay
Recurring obligations = $\$1,600 \div \$3,600 = .444 = 44.4\%$. Exceeds 36%: Do not qualify.

Answer is (a) I Only.

G. **Example:** A husband and wife apply for a conventional loan of \$85,000. The lender estimates housing expenses to be \$995 per month. Their recurring obligations (excluding housing expenses) are \$525. Their combined annual gross income is \$43,200. Using ratios of 28/36, under which of the following will the lender find them to qualify?

- I. Housing Expenses to Gross Income
- II. Recurring Obligations to Gross Income

- (a) I Only (b) II Only (c) Both (d) Neither

Solution:

$\$43,200 \div 12 \text{ months} = \$3,600$ monthly income
Housing expenses = $\$995$ divided by $\$3,600 = .276 = 27.6\%$.
Does not exceed 28%, will qualify under this ratio.

Recurring Obligations = $\$995 + \$525 = \$1,520 \div \$3,600 = .422 = 42.2\%$
exceeds 36%, will not qualify.

Answer is (a) I Only.

8. Property Analysis

The appraised value must be high enough to justify the loan in accordance with the lender's established policies on loan-to-value ratios. The lender would prefer the appraised value to equal or be above the sales price.

A. Parts of the problem: (1) Requested loan amount, (2) Loan to Value Ratio, (3) Appraised Value

B. **Example:** If the requested loan amount is \$76,500, and the maximum permissible loan to value ratio is 90%, what must be the appraised value?

Solution: Determine the appraised value by dividing the requested loan amount by the loan to value ratio.

$\$76,500 \div .90 = \$85,000$ Appraised Value

9. Loan Analysis

The lender will insure the loan is a sound investment by evaluating the characteristics of the loan itself. The yield must be adequate, discount points will be charged if the rate is below market rates, and if the down payment is less than 20%, the lender will require private mortgage insurance (PMI).

Example: A buyer wants an \$80,000 loan to purchase a \$100,000 house. Current market rates are 10% but the buyer wants a 9.5% loan. Lender will charge a 1% origination fee, plus appropriate discount points. How much cash money will the buyer need to close the loan?

Solution:

Down payment: \$20,000

Origination Fee: + \$800 ($80,000 \times .01$)

Discount Points: + \$3,200 ($10.00\% - 9.50\% = .50 \times 8 = 4 = .04 \times 80,000 = \$3,200$)

Cash Required: \$24,000 ($20,000 + 800 + 3,200$)

10. Discount Points and Yield

If a lender charges an interest rate lower than market rates, they will charge discount points to increase their yield.

- A. To determine the number of discount points that will be charged to increase the yield, lenders apply the following:
“One (1) discount point adjusts the effective interest rate by one-eighth of one percent.” (Or put another way, "there is one discount point charged for each $\frac{1}{8}\%$ difference in the two interest rates.)
- B. Convert the fractions in the rates to an equivalent decimal percentage, subtract the loan rate from the market rate and multiply the difference by 8: the result being the number of discount points to be charged.

Example: Market rate of $10\frac{3}{4}\%$ and loan rate at $9\frac{1}{2}\%$

$$10\frac{3}{4}\% = 10.75\%$$

$$9\frac{1}{2}\% = 9.50\%$$

$$10.75 - 9.50 = 1.25 \times 8 = 10 \text{ Discount Points}$$

- C. To determine the amount of money required to pay the discount points, simply convert the amount of discount points to a decimal and multiply by the loan amount:

Example: Loan amount is \$60,000 at 2 discount points.

$$\$60,000 \times .02 = \$1,200$$

11. Practice Problems: Finance Math

- A. A couple purchased a home for \$90,000 with a \$20,000 down payment. Ten years later the house sold for \$150,000 with the loan being reduced to \$65,000. What was the percent of equity increase?
- (a) 200% (b) 425% (c) 325% (d) 166%
- B. Original equity in a property was \$7,500 and in two years the equity increased by \$3,750. What is the percent of equity increase?
- (a) 200% (b) 50% (c) 25% (d) 33%
- C. You have a mortgage loan at 7.5% interest. The annual interest is \$6,520. What is the principal balance?
- (a) \$86,733.33 (b) \$85,310.28 (c) \$93,142.85 (d) \$86,933.33
- D. You are paying a 10.5% rate of interest on a loan of \$72,250. What is the monthly interest?
- (a) \$7,586.25 (b) \$632.19 (c) \$602.08 (d) \$7,225

E. Smith bought a home with a mortgage loan of \$92,500. The monthly payment will be \$9.15 per \$1,000 of the loan amount. The annual property taxes are \$1,496 and the homeowner's insurance policy is \$340 per year. What is the monthly PITI?

- (a) \$846.38 (b) \$847.71 (c) \$999.38 (d) \$971.05

F. Loan balance is \$55,500 at 10% interest. The monthly payment is \$8.78 per \$1,000. What is the loan balance after one month's payment?

- (a) \$55,421.13 (b) \$55,475.21 (c) \$56,475.21 (d) \$55,381.14

G. You borrowed \$73,000 at 12% interest. Monthly payments are \$745 PI for a term of 30 years. What is the total amount of interest paid over the life of the loan?

- (a) \$268,200 (b) \$195,200 (c) \$262,000 (d) \$189,800

H. A couple wants to buy a home with an \$80,000 first mortgage loan at 10.5%. Their combined gross annual income is \$40,800. Estimated monthly housing expenses are \$875. Their total monthly recurring obligations are \$1,670, which includes housing expenses. Using ratios of 28/36, under which of the following ratios will the lender find them to qualify?

- I. Housing expenses to gross income
II. Recurring obligations to gross income

- a) I Only (b) II Only (c) Both (d) Neither

I. A conventional loan interest rate is 10% and VA loan rates are 9¼%. How many discount points would be charged by the lender in order to set the VA rate?

- (a) 6 (b) 7 (c) 5 (d) 8

J. Current market rates are 11½%. Loan is to be given at 10¼%. How many discount points would be charged?

- (a) 9 (b) 10 (c) 8 (d) 7

K. Lender is giving a buyer a loan at 9½% and needs to increase the yield up to 10¾%. The loan amount is \$50,000. How much money would the buyer have to pay in discount points?

- (a) \$5,100 (b) \$5,250 (c) \$4,000 (d) \$5,000

L. Bill and Betty received \$19,000 from the sale of their house to apply toward the purchase of a new home costing \$90,000. They assumed an existing mortgage of \$49,500 and borrowed \$24,000 at 12% to be secured by a second mortgage. The lender charged them a 0.5% assumption fee; a 2% origination fee on the second, at 5 ½ points on the new loan. How much was the lender paid in fees?

- (a) \$2,226 (b) \$3,092 (c) \$2,047.50 (d) \$2,470

M. Bob and Mary got a VA Loan for \$80,000. The lender charged them a 1% origination fee and 4 discount points. Other closing costs included \$500 for attorney fees, \$35 survey fees, and \$15 recording fee. How much cash did Bob and Mary have to bring to the closing?

- (a) \$4,550 (b) \$3,750 (c) \$1,350 (d) None, VA's require no down payment.

N. What is the interest due from May 1 through May 15th (day of closing) on a \$80,000 loan at 9½% interest?

- (a) \$316.65 (b) \$337.76 (c) \$295.54 (d) \$300

Solutions to finance math practice problems:

A. \$20,000 is original equity

$$\$150,000 - \$65,000 = \$85,000 \text{ New Equity}$$

$$\$85,000 \text{ New Equity} - \$20,000 \text{ Original Equity} = \$65,000 \text{ Equity Increase}$$

$$\$65,000 \div \$20,000 = 3.25 = 325\% \text{ (c)}$$

B. \$3,750 is equity increase \div \$7,500 original equity = .50 = 50% (b)

C. $\$6,520 \div .075 = \$86,933.33$ (d)

D. $\$72,250 \text{ loan balance} \times .105 = \$7,586.25 \text{ annual interest} \div 12 \text{ months} = \632.19 (b)

E. $\$92,500 \text{ loan amount} \div 1000 = 92.5 \times \$9.15 = \$846.38 \text{ PI}$

$$\$1,496 \text{ annual taxes} \div 12 \text{ months} = \$124.67 \text{ Taxes}$$

$$\$340 \text{ annual insurance premium} \div 12 \text{ months} = \$28.33 \text{ Insurance}$$

$$\$846.38 + \$124.67 + \$28.33 = \$999.38 \text{ PITI (c)}$$

F. $\$55,500 \div \text{by } 1000 = 55.5 \times 8.78 = \487.29 PI

$$\$55,500 \times .10 = \$5,550 \text{ divided by } 12 \text{ months} = 462.50 \text{ I}$$

$$\$487.29 \text{ PI} - \$462.50 \text{ I} = \$24.79 \text{ P}$$

$$\$55,500 - \$24.79 = \$55,475.21 \text{ (b)}$$

G. $30 \text{ years} \times 12 \text{ months} = 360 \text{ monthly payments} \times \$745 \text{ PI} = \$268,200 \text{ PI} - \$73,000 \text{ P} = \$195,200 \text{ (b)}$

H. $\$40,800$ annual gross income \div 12 months = $\$3,400$ monthly gross income
Housing Expenses = $\$875 \div \$3,400 = .257 = 25.7\%$, yes will qualify under this ratio.
Recurring Obligations = $\$1,670 \div \$3,400 = .49 = 49\%$, no will not qualify under this ratio. (a)

I. $10\% = 10.00$
 $9\frac{1}{4}\% = 9.25$
 $10.00 - 9.25 = .75 \times 8 = 6$ discount points (a)

J. $11\frac{1}{2}\% = 11.50$
 $10\frac{1}{4}\% = 10.25$
 $11.50 - 10.25 = 1.25 \times 8 = 10$ discount points (b)

K. $10\frac{3}{4}\% = 10.75$
 $9\frac{1}{2}\% = 9.50$
 $10.75 - 9.50 = 1.25 \times 8 = 10$ discount points = $.10 \times \$50,000 = \$5,000$ (d)

L. $\$49,500$ loan assumption $\times .005 = \$247.50$ Assumption Fee
 $\$24,000$ second at $2\% = \$24,000 \times .02 = \480 Origination Fee
 $\$24,000$ at $5\frac{1}{2}$ points = $\$24,000 \times .055 = \$1,320$ Discount Points
 $\$247.50 + \$480 + \$1,320 = \$2,047.50$ Total Fees paid to the lender (c)

M. $\$80,000 \times .01$ origination fee = $\$800$
 $\$800 + \$3,200$ points + $\$500$ attorney fee + $\$35$ survey fee + $\$15$ recording fee = $\$4,550$ cash needed to close (a)

Caution: You may have a similar question, but it may ask, "How much will the lender receive in fees?"

$\$800.00$ origination fees + $\$3,200$ discount points = $\$4,000$ lender will receive

N. $\$80,000 \times .095 = \$7,600 \div 12$ months = $\$633.33 \div 30$ days = $\$21.11$ daily interest
 15 days $\times \$21.11 = \316.65 (a)