



Business Math

Lending and Credit

- Basic Lending Concepts and Calculations
- Closed-End Loans
- Mortgage Loans
- Open-End Credit
- Loan Ratios
- Helping Members Compare Rates and Loans

Business Math: Lending and Credit



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Credit Union National Association



Introduction

Congratulations! You're participating in the **Business Math: Lending and Credit** course. This course can help you improve your math skills so you can better serve members and succeed in your career.

This workbook is designed to give you more practice to reinforce your learning. After completing the exercises in this workbook, your new skills will feel more comfortable and easier to use.

How to Use this Workbook

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ach section of this workbook corresponds with one of the courses in the Lending and Credit series. Some of the main concepts, formulas, and methods of calculation are repeated in the workbook. At times, we include basic refresher information on how to perform the calculations. For convenience, you may wish to print out the PDF file and work from a hard copy.



The calculator icon indicates practice exercises.

There are several ways to use the workbook:

1) During the completion of a course. You may want to keep this workbook at hand as you proceed through a course. Immediately after you learn a new calculation method, you can turn to the workbook to review key concepts and complete additional practice exercises. After you have thoroughly learned that calculation method, you can move on to the next topic in the course.

2) After the completion of a course. You may prefer to complete an entire course online and then work through the practice exercises for the whole course. This method helps you review an entire course at one time. If you have difficulties with any section, go back to the online course and review that section again.

3) As review for the series final exam. If you have completed the entire series of Lending and Credit courses, use this work-

book to help you review for the final exam. The calculation methods and concepts covered in the course pre/post tests and this workbook review all the topics tested in the final exam. If you successfully complete the tests and this workbook, you should be well prepared for the exam.

4) In combination with group learning. Your credit union may schedule group sessions to reinforce and expand on the methods learned in the course series. Your instructor may use the workbook during the sessions or as practice outside the sessions. In addition, your instructor may adapt these exercises to more closely reflect your credit union's loan calculation methods.

For best results, always complete the appropriate topic in a course before turning to these exercises. This workbook does not include all the teaching material in the course and you may not be able to complete the exercises accurately without the prior coursework.

Answers are found in a separate section toward the back of the workbook.

Now, warm up your calculator and turn to the section in the workbook where you plan to begin!

Basic Lending **Concepts** and **Calculations**

Learning Points

In this section, you learn these calculations:

- converting percentages to decimals (and the opposite)
- rounding numbers
- counting days when calculating loan interest

Converting Percentages to Decimals

Convert a percentage to a decimal number by moving the decimal point two places to the left and dropping the % sign or the word “percent.”

- At times, you will need to add zeroes as “place holders” or drop zeroes when they’re not needed.
- The decimal point may not always appear and you need to know where it is “understood.”



Convert the following percentages to decimals.

1. 25 percent =
2. 8% =
3. 23.4% =
4. 7.25% =
5. 0.035% =
6. 150% =

Converting Decimals to Percentages

To convert a decimal number to a percentage, move the decimal point two places to the right and add a % sign or the word “percent.”



Convert the following decimals to percentages.

1. $0.45 =$

2. $0.09 =$

3. $2.4 =$

4. $0.087 =$

5. $0.638 =$

6. $0.5 =$

Rounding Numbers

Fractions:

- If the fraction is less than $1/2$, the number is rounded down to the next lowest whole number.
- If the fraction is equal to $1/2$ or higher, the number is rounded up to the next highest number.

Decimals:

- Choose the desired number of decimal places. This is usually two (the nearest cent) if you are dealing with money.
- Find the digit that is in the third decimal place.
 - 1) If the digit in the third decimal place is 5 or higher, increase the digit in the second decimal place by one.OR
 - 2) If the digit in the third decimal place is 4 or lower, don't change the digit in the second decimal place.
- Drop the numbers in the excess decimal places.



Round the following fractions and decimals. Round decimals to two places.

1. $1 \frac{1}{2} =$

2. $3 \frac{3}{4} =$

3. $53 \frac{1}{3} =$

4. $1.03478 =$

5. $0.42879 =$

6. $23.642764 =$

7. $0.095112 =$

8. $0.85609 =$

9. $42.993987 =$

10. $3.997212 =$

Counting Days when Calculating Loan Interest

Ask yourself, “Who is holding the money at midnight on each day?”

- If the answer is “the member,” then the member pays interest for that day.
- If the answer is “the credit union,” then the member does not pay interest for that day.



1. If a member receives the money for a loan on September 9 and repays the whole balance on September 17, how many days of interest should the member pay?

2. If a member receives the money for a loan on January 18 and repays the whole balance on February 5, how many days of interest should the member pay?

3. If a member receives the money for a loan on June 25 and repays the whole balance on August 5, how many days of interest should the member pay?

Closed-End Loans

Learning Points

In this section, you learn the following calculations:

- calculating a simple interest payment for a closed-end loan
- determining the finance charge for the calculation of the loan's APR
- calculating interest for a loan payoff

Calculating Simple Interest for a Closed-End Loan

The formula for calculating simple interest is:

$$\text{principal} \times \text{rate} \times \text{time} = \text{interest}$$

or

$$P \times R \times T = \text{interest}$$

Remember that R is an annual interest rate and T is expressed in years or a portion of a year.

Here's how to calculate two years interest on a \$5,000 principal balance at a rate of 8%:

$$\$5,000 \times 0.08 \times 2 = \$800$$

Here's how to calculate 10 days interest on a \$5,000 balance at a rate of 8%:

$$\$5,000 \times 0.08 \times \frac{10}{365} = \$10.96$$



1. Marilyn is borrowing \$500 at 11 percent interest. She will receive the funds on April 1 and repay the full amount on June 1. How much interest will Marilyn pay based on simple interest for the exact number of days?

April = ___ days

Total = ___ days

May = ___ days

June = ___ days

$$\$ \underline{\quad} \times 0. \underline{\quad} \times \frac{\underline{\quad}}{365} = \$ \underline{\quad}$$

2. On September 1, Robert borrowed \$4,500 at an interest rate of 9% and for a term of 10 years. How much interest will he pay on his first monthly payment on October 1?

3. On March 1, Marilyn borrowed \$2,894 at an interest rate of 7.6% and for a term of 15 years. How much interest will he pay on his first monthly payment on April 1?

Calculating the Finance Charge on a Closed-End Loan

To calculate the finance charge:

1. Determine the payment schedule and total payments.
2. Calculate the amount financed. First, total the appropriate charges (fees, etc.) the member will pay. Then, subtract this amount from the principal balance of the loan to obtain the amount financed:
3. Calculate the finance charge. Subtract the amount financed from the total of payments to obtain the finance charge.

The reason for calculating this finance charge is so that you can calculate the annual percentage rate (APR). Therefore, check that you are including only the applicable fees in this calculation.



1. Eric is obtaining a loan that has a principal amount of \$28,000, total payments of \$34,894.23 and fees of \$125. What is the finance charge used to calculate APR?

2. David is obtaining a loan that has a principal amount of \$16,000, total payments of \$21,384.45 and fees of \$100. What is the finance charge used to calculate APR?

Calculating Interest for a Loan Payoff

For early payoffs of loans, interest is usually calculated for the number of days since the last payment and uses the standard simple interest formula:

$$\text{principal} \times \text{rate} \times \text{time} = \text{interest}$$

To calculate the total payoff amount, add the interest to the outstanding principal.



1. Julia has a \$1,000 outstanding balance on a 6 percent loan on which she made the regular monthly payment last week. Today, she comes in to the credit union and wants to pay off the loan. Her last payment was made on February 5 and today's date is February 11. How much interest will she pay? How much is her payoff amount?

2. Assume Ned has \$1,000 outstanding on a 9.3 percent loan on which he made the regular monthly payment two weeks ago. Today, he wants to pay off the loan. His last payment was made on August 3 and today's date is August 17. How much interest will he pay? How much is his payoff amount?

Mortgage Loans

Learning Points

In this section, you learn the following calculations:

- calculating monthly interest on a mortgage loan using a 30-day month and 360-day year
- calculating the payment for an early payoff on a mortgage loan

Calculating Monthly Interest on a Mortgage Loan

The formula for calculating the monthly interest on a typical mortgage loan is:

$$\text{principal} \times \text{rate} \times \frac{30}{360} = \text{one month's interest}$$

The calculations in this course use a 30 day month and 360 day year to calculate monthly interest. Although this is the typical method for most mortgage lenders, not all credit unions use this method. Some credit unions calculate the interest by using the exact days in the month and 365 days in the year. If your credit union makes mortgage loans, find out which method it uses.



1. Karen has a \$300,000 mortgage at 6 percent annual interest. What is one-month's interest payment on this amount?

2. Sam has a \$250,000 mortgage at 6.75 percent annual interest. What is one-month's interest payment on this amount?

3. Seth has made 359 monthly payments on a 30-year mortgage at 7.15 percent, leaving a balance of \$511.78.

a. What will he owe in interest on his final payment?

b. What will be the amount of the final payment?

Calculating an Early Payoff Amount for a Mortgage Loan

The usual formula for calculating the interest on an early mortgage loan payoff is:

$$\text{outstanding balance} \times \text{rate} \times \frac{\text{exact days since last payment}}{365} = \text{payoff interest}$$

The interest is then added to the outstanding balance to determine the payoff amount.

Other fees may apply to the payoff so take these into consideration when determining the exact amount needed. Also, remember to ask for the exact date of the payoff and tell the member that if the payment is later, then the interest amount will be higher.



1. Jeannie wants to know the amount of money she needs to pay off her mortgage early. She has received a sudden inheritance and wants to use it for this purpose. Her loan has a balance of \$63,529.06, the interest rate is 8.2 percent, her last payment was July 5, and she wants to pay off the loan on August 1. What is the total amount of principal and interest she will need to pay off the loan?

2. Patrick asks you to tell him the amount of money he needs to pay off his mortgage early. His loan has a balance of \$142,605.96, the interest rate is 6.8 percent, his last payment was November 1, and he wants to pay off the loan on November 20. What is the total amount of principal and interest he will need to pay off the loan?

Open-End Credit

Learning Points

In this section, you learn the following calculations:

- calculating the average (mean) of a series of numbers
- calculating the average daily balance on an open-end credit account
- determining daily and monthly periodic rates from annual interest rates
- calculating the interest for a billing period using a daily or monthly periodic rate
- determining the amount of a minimum payment on an open-end credit account

Calculating an Average (Mean)

To calculate the average of a series of numbers, add up all the numbers and divide the answer by the total number of items.



Calculate the average (mean) for each series of numbers.

1. 23, 78, 299, 45, 92 average = _____

2. \$42.89, \$99.86, \$189.03, \$344.70 average = _____

3. \$1,238, \$3,905, \$2,833, \$1,866, \$6,948, \$7,501 average = _____

Calculating Daily and Monthly Periodic Rates from Annual Interest Rates

The formula for calculating the daily periodic rate is:

$$\frac{\text{annual interest rate}}{365} = \text{daily periodic rate}$$

The formula for calculating the monthly periodic rate is:

$$\frac{\text{annual interest rate}}{12} = \text{monthly periodic rate}$$

- The periodic rate may be expressed as a percent or decimal.
- When calculating the monthly periodic rate, the number of days in the month is not a factor.



Calculate the monthly and daily periodic rates (as a decimal number) for the following annual interest rates. (Rounding may affect your answers slightly.)

1. 8.9 percent

Daily =

Monthly =

2. 10.6 percent

Daily =

Monthly =

3. 12.25 percent

Daily =

Monthly =

4. 14.5 percent

Daily =

Monthly =

5. 16.9 percent

Daily =

Monthly =

Calculating the Interest for a Billing Period Using a Daily or Monthly Periodic Rate

The formula for using a daily periodic factor to calculate one billing period of interest on a credit card is:

average daily balance x number of days in the billing period x daily periodic rate = one billing period's interest

The formula for using a monthly periodic factor to calculate one billing period of interest on a credit card is:

average daily balance x monthly periodic rate = one billing period's interest



1. Derek's credit union uses a daily periodic factor to calculate one billing period of interest on a credit card. If Derek's average daily balance is \$2,500 and the annual interest rate is 8.7 percent, how much interest is charged for a billing period of June 1 through June 30?

Daily periodic factor =

Interest =

2. Donna's credit union uses a daily periodic factor to calculate one billing period of interest on a credit card. If Donna's average daily balance is \$900 and the annual interest rate is 10.9 percent, how much interest is charged for a billing period of March 1 through March 31?

Daily periodic factor =

Interest =

3. Mona's credit union uses a monthly periodic factor to calculate one billing period of interest on a credit card. If Mona's average daily balance is \$6,700 and the annual interest rate is 12.5 percent, how much interest is charged for a billing period of June 1 through June 30?

Monthly periodic factor =

Interest =

4. Marty's credit union uses a monthly periodic factor to calculate one billing period of interest on a credit card. If Marty's average daily balance is \$600 and the annual interest rate is 9.9 percent, how much interest is charged for a billing period of March 1 through March 31?

Monthly periodic factor =

Interest =

Calculating the Amount of a Minimum Payment on an Open-End Credit Account

Most credit unions determine the minimum payment as the greater of:

- a percentage of the balance, or
- a set minimum payment (or the full balance if it is less than the minimum).

Credit unions include the finance charge in the balance used to determine the minimum payment.



1. XYZ Credit Union requires a minimum payment of 2 percent of the balance or \$20, whichever is greater. If the balance on a member's credit card is \$1,100, what is the minimum payment?

2. ABC Credit Union requires a minimum payment of 1.5 percent of the balance or \$15, whichever is greater. If the balance on a member's credit card is \$600, what is the minimum payment?

Loan Ratios

Learning Points

In this section, you learn the following calculations:

- calculating debt-to-income ratios
- calculating monthly housing expense ratios
- calculating total-obligations-to-income ratios
- calculating loan-to-value ratios

Calculating Debt-to-Income Ratios

The formula for calculating a debt-to-income ratio is:

$$\frac{\text{monthly debt payments}}{\text{monthly income}} = \text{debt-to-income ratio}$$

Credit unions vary in terms of which debts and income are included in the calculation of the ratio. They also vary in terms of how to evaluate the ratio for loan consideration. Check with your credit union.

1. Credit union XYZ calculates the debt-to-income ratio from net monthly income and debt payments but no housing expenses.

Paula wants a loan to pay for furnishing a new apartment. Her net monthly income is \$3,350 and she has current monthly debt payments of \$1,200. The loan payment will be \$200. What is her debt-to-income ratio?

2. Credit union BBB calculates the debt-to-income ratio from gross monthly income and debt payments including housing expenses.

Marcus wants a loan to pay for a used car. He has gross monthly income of \$3,000 and current monthly debt payments of \$350. His monthly housing expense is \$500. The loan payment will be \$200. What is his debt-to-income ratio?

3. Jessica and Jeremy are married and applying for a loan for vacation expenses. Jessica has net monthly income of \$4,000 and Jeremy has net monthly income of \$4,400. The couple has current debt payments of a total of \$2,000. The loan payment will be \$250. If Jessica and Jeremy will be jointly responsible for the loan, what would be the debt-to-income ratio?

Calculating Monthly Housing Expense Ratios

The formula for calculating monthly housing expense ratio for a mortgage loan is:

$$\frac{\text{monthly housing expense}}{\text{gross monthly income}} = \text{housing expense ratio}$$

Usually, the member's monthly housing expense is calculated as the total of the principal and interest payment for the mortgage and prorated monthly cost of insurance premiums, real estate taxes, and homeowners' association dues, if any.



1. Carmela's gross monthly income is \$3,000, and the monthly principal and interest payment on the proposed mortgage would be \$800 with total monthly escrow payments of \$120. What is the housing expense ratio?

2. Roger's gross monthly income is \$3,700, and the monthly principal and interest payment on the proposed mortgage would be \$790 with total monthly escrow payments of \$130. What is the housing expense ratio?

Calculating Total-Obligations-to-Income Ratios

The formula for the total-obligations-to-income ratio is:

$$\frac{\text{total obligations}}{\text{gross monthly income}} = \text{total-obligations-to-income ratio}$$



1. Let's look at Carmela's situation again. Remember that her gross monthly income is \$3,000, and the monthly principal and interest payment on the proposed mortgage would be \$800 with total monthly escrow payments of \$120. In addition, her debts and nonhousing obligations total \$150. What is the total-obligations-to-income ratio?

2. Now, let's look at Roger's situation again. Remember that his gross monthly income is \$3,700, and the monthly principal and interest payment on the proposed mortgage would be \$790 with total monthly escrow payments of \$130. In addition, his debts and nonhousing obligations total \$350. What is the total-obligations-to-income ratio?

Calculating Loan-to-Value Ratios

The formula for calculating loan-to-value ratio is:

$$\frac{\text{mortgage amount}}{\text{value (lower of the sales price or raise value)}} = \text{loan-to-value (LTV) ratio}$$



1. Laura and Lyle are applying for a mortgage to buy a home. The sales price of the home is \$150,000, the appraised value is \$155,000, and the mortgage is \$135,000. What is the loan-to-value ratio?

2. Brian has a sales contract for a home with a price of \$295,000. The home is appraised at \$290,000 and he is applying for a mortgage of \$275,500. What is the loan-to-value ratio?

Helping Members Compare Rates and Loans

Learning Points

In this section, you learn the following calculations:

- calculating add-on interest and loan payments
- converting a fee for a short-term payday loan to an annual rate of interest

Calculating Add-On Interest and Loan Payments

The formula for calculating add-on interest is:

$$\text{loan amount} \times \text{annual rate} \times \text{loan term in years} = \text{total loan interest}$$

The formula for calculating loan payments with add-on interest is:

$$\frac{\text{principal} + \text{total loan interest}}{\text{number of months in the loan}} = \text{monthly loan payment}$$

A credit union might be able to save the member money with a loan, even if the credit union rate is higher, because add-on interest loans are not amortized.



1. Mike is shopping for a new sofa and has found one he likes at a local furniture store. However, the price is more than he can pay upfront. The sofa costs \$1,500 and the store offers a financing plan. The salesperson explains that the interest rate on the plan is 7 percent and the plan term is 18 months.

- a. If the store charges add-on interest, how much interest would Mike pay under this plan?

- b. What would be the monthly payment?

2. Soo Lon is thinking about buying a flat-screen TV that her boyfriend has recommended. At a local store, the price of the system is \$2,000 and the store offers a financing plan. The salesperson tells Soo Lon that the interest rate on the plan is 6 percent and the plan term is 24 months.

- a. If the store charges add-on interest, how much interest would Soo Lon pay under this plan?

- b. What would be the monthly payment?

Converting a Fee for a Short-Term Payday Loan to an Annual Rate of Interest

The formula for converting a fee on a payday loan to an annual rate of interest is:

$$\frac{\text{fee}}{\text{principal} \times \frac{\text{number of days}}{365}} = \text{annual interest rate}$$

The fee on a payday loan is not considered to be interest but by comparing it to an annual interest rate, you can show the high cost of these loans compared to credit union alternatives.



1. Jennifer went to a payday lender for a short-term loan and paid \$20 for a 14-day, \$200 loan. What is the annual interest rate this fee represents?

2. Victor paid \$20 for a 14-day, \$125 payday loan. What is the annual interest rate this fee represents?

Answers

Basic Lending Concepts and Calculations

(Page 4)

Converting Percentages to Decimals

1. 25 percent = 0.25
2. 8% = 0.08
3. 23.4% = 0.234
4. 7.25% = 0.0725
5. 0.035% = .00035
6. 150% = 1.50

Converting Decimals to Percentages

1. 0.45 = 45%
2. 0.09 = 9%
3. 2.4 = 240%
4. 0.087 = 8.7%
5. 0.638 = 63.8%
6. 0.5 = 50%

Rounding Numbers

1. $1 \frac{1}{2} = 2$
2. $3 \frac{3}{4} = 4$
3. $53 \frac{1}{3} = 53$
4. 1.03478 = 1.03
5. 0.42879 = 0.43
6. 23.642764 = 23.64
7. 0.095112 = 0.10
8. 0.85609 = 0.86
9. 42.993987 = 42.99
10. 3.997212 = 4

Counting Days when Calculating Loan Interest

1. If a member receives the money for a loan on September 9 and repays the whole balance on September 17, how many days of interest should the member pay?
8 days
2. If a member receives the money for a loan on January 18 and repays the whole balance on February 5, how many days of interest should the member pay?
18 days (14 days in January and 4 days in February)
3. If a member receives the money for a loan on June 25 and repays the whole balance on August 5, how many days of interest should the member pay?
41 days (6 days in June, 31 days in July, and 4 days in August)

Closed-End Loans

(Page 8)

Calculating Simple Interest for a Closed-End Loan

1. Marilyn is borrowing \$500 at 11 percent interest. She will receive the funds on April 1 and repay the full amount on June 1. How much interest will Marilyn pay based on simple interest for the exact number of days?

April = 30 days
May = 31 days
June = 0
Total = 61 days

$$\$500 \times 0.11 \times \frac{61}{365} = \$9.19$$

2. On September 1, Robert borrowed \$4,500 at an interest rate of 9% and for a term of 10 years. How much interest will he pay on his first monthly payment on October 1?

September 1 to October 1 = 30 days

$$\$4,500 \times 0.09 \times \frac{30}{365} = \$33.29$$

3. On March 1, Marilyn borrowed \$2,894 at an interest rate of 7.6% and for a term of 15 years. How much interest will he pay on his first monthly payment on April 1?

March 1 to April 1 = 31 days

$$\$2,894 \times 0.076 \times \frac{31}{365} = \$18.68$$

Calculating the Finance Charge on a Closed-End Loan

1. Eric is obtaining a loan that has a principal amount of \$28,000, total payments of \$34,894.23 and fees of \$125. What is the finance charge used to calculate APR?

$$\begin{array}{r} \$28,000 \text{ principal} \\ - 125 \text{ fees} \\ \hline \$27,875 \end{array}$$

$$\begin{array}{r} \$34,894.23 \text{ total payments} \\ -27,875.00 \\ \hline \$ 7,019.23 = \text{finance charge} \end{array}$$

1. David is obtaining a loan that has a principal amount of \$16,000, total payments of \$21,384.45 and fees of \$100. What is the finance charge used to calculate APR?

$$\begin{array}{r} \$16,000 \text{ principal} \\ - 100 \text{ fees} \\ \hline \$15,900 \end{array}$$

$$\begin{array}{r} \$21,384.45 \text{ total payments} \\ -15,900.00 \\ \hline \$ 5,484.45 = \text{finance charge} \end{array}$$

Calculating Interest for a Loan Payoff

1. Julia has a \$1,000 outstanding balance on a 6 percent loan on which she made the regular monthly payment last week. Today, she comes in to the credit union and wants to pay off the loan. Her last payment was made on February 5 and today's date is February 11. How much interest will she pay? How much is her payoff amount?

$$\$1,000 \times 0.06 \times \frac{6}{365} = \$0.99 \text{ interest}$$

$$\begin{array}{r} \$1,000.00 \\ + \quad .99 \\ \hline \$1,000.99 \text{ payoff amount} \end{array}$$

2. Assume Ned has \$1,000 outstanding on a 9.3 percent loan on which he made the regular monthly payment two weeks ago. Today, he wants to pay off the loan. His last payment was made on August 3 and today's date is August 17. How much interest will he pay? How much is his payoff amount?

$$\$1,000 \times 0.093 \times \frac{14}{365} = \$3.57 \text{ interest}$$

$$\begin{array}{r} \$1,000.00 \\ + \quad 3.57 \\ \hline \$1,003.57 \text{ payoff amount} \end{array}$$

Mortgage Loans

(Page 11)

Calculating Monthly Interest on a Mortgage Loan

1. Karen has a \$300,000 mortgage at 6 percent annual interest. What is a 30-day interest payment on this amount?

$$\$300,000 \times 0.06 \times \frac{30}{360} = \$1,500$$

2. Sam has a \$250,000 mortgage at 6.75 percent annual interest. What is one-month's interest payment on this amount?

$$\$250,000 \times 0.0675 \times \frac{30}{360} = \$1,406.25$$

3. Seth has made 359 monthly payments on a 30-year mortgage at 7.15 percent, leaving a balance of \$511.78.

a. What will he owe in interest on his final payment?

$$\$511.78 \times 0.0715 \times \frac{30}{360} = \$3.05$$

b. What will be the amount of the final payment?

$$\$511.78 + \$3.05 = \$514.83$$

Calculating an Early Payoff Amount for a Mortgage Loan

1. Jeannie wants to know the amount of money she needs to pay off her mortgage early. She has received a sudden inheritance and wants to use it for this purpose. Her loan has a balance of \$63,529.06, the interest rate is 8.2 percent, her last payment was July 5, and she wants to pay off the loan on August 1. What is the total amount of principal and interest that she will need to pay off the loan?

$$\$63,529.06 \times 0.082 \times \frac{27}{365} = \$385.35 \text{ interest}$$

$$\$63,529.06 + \$385.35 = \$63,914.41 \text{ principal and interest payoff amount}$$

2. Patrick asks you to tell him the amount of money he needs to pay off his mortgage early. His loan has a balance of \$142,605.96, the interest rate is 6.8 percent, his last payment was November 1, and he wants to pay off the loan on November 20. What is the total amount of principal and interest that he will need to pay off the loan?

$$\$142,605.96 \times 0.068 \times \frac{19}{365} = \$504.79 \text{ interest}$$

$$\$142,605.96 + \$504.79 = \$143,110.75 \text{ principal and interest payoff amount}$$

Open-End Credit**(Page 13)****Calculating an Average (Mean)**

Calculate the average (mean) for each series of numbers.

1. 23, 78, 299, 45, 92

$$23 + 78 + 299 + 45 + 92 = 537$$

$$537 \div 5 = 107.4$$

2. \$42.89, \$99.86, \$189.03, \$344.70

$$\$42.89 + \$99.86 + \$189.03 + \$344.70 = \$676.48$$

$$\$676.48 \div 4 = \$169.12$$

3. \$1,238, \$3,905, \$2,833, \$1,866, \$6,948, \$7,501

$$\$1,238 + \$3,905 + \$2,833 + \$1,866 + \$6,948 + \$7,501 = \$24,291$$

$$\$24,291 \div 6 = \$4,048.50$$

Calculating the Average Daily Balance on an Open-End Credit Account

1. Barbara starts out the billing period with a balance of \$300. On the 8th day in the billing period, her balance changes to \$500. Then, on the 15th day, her balance changes to \$900 and remains the same through the end of the billing period. What is the average daily balance of her account for the 30-day billing period?

$$\$300 \times 7 \text{ days} = \$ 2,100$$

$$\$500 \times 7 \text{ days} = \$ 3,500$$

$$\$900 \times 16 \text{ days} = \$14,400$$

$$\text{Total } 30 \text{ days } \$20,000$$

$$\$20,000 \div 30 \text{ days} = \$666.67 \text{ average daily balance}$$

2. Gary starts out on March 1 with a balance of \$800. On March 15th, his balance changes to \$1,000. Then, on March 20th, his balance changes to \$800 and remains the same through the end of the billing period. What is the average daily balance of his account for the month of March?

$$\$800 \times 14 \text{ days} = \$11,200$$

$$\$1,000 \times 5 \text{ days} = \$ 5,000$$

$$\$800 \times 12 \text{ days} = \$ 9,600$$

$$\text{Total } 31 \text{ days } \$25,800$$

$$\$25,800 \div 31 = \$832.26$$

Calculating Daily and Monthly Periodic Rates from Annual Interest Rates

Calculate the monthly and daily periodic rates (as a decimal number) for the following annual interest rates. (Rounding may affect your answers slightly.)

1. 8.9 percent

$$\text{Daily} = \frac{0.089}{365} = 0.0002438$$

$$\text{Monthly} = \frac{0.089}{12} = 0.0074166$$

2. 10.6 percent

$$\text{Daily} = \frac{0.106}{365} = 0.0002904$$

$$\text{Monthly} = \frac{0.106}{12} = .0088333$$

3. 12.25 percent

$$\text{Daily} = \frac{0.1225}{365} = .0003356$$

$$\text{Monthly} = \frac{0.1225}{12} = 0.0102083$$

4. 14.5 percent

$$\text{Daily} = \frac{0.145}{365} = 0.0003972$$

$$\text{Monthly} = \frac{0.145}{12} = 0.0120833$$

5. 16.9 percent

$$\text{Daily} = \frac{0.169}{365} = 0.000463$$

$$\text{Monthly} = \frac{0.169}{12} = 0.0140833$$

Calculating the Interest for a Billing Period Using a Daily or Monthly Periodic Rate

1. Derek's credit union uses a daily periodic factor to calculate one billing period of interest on a credit card. If Derek's average daily balance is \$2,500 and the annual interest rate is 8.7 percent, how much interest is charged for a billing period of June 1 through June 30?

$$\text{Daily periodic factor} = \frac{0.087}{365} = 0.0002383$$

$$\text{Interest} = \$2,500 \times 30 \times 0.0002383 = \$17.87$$

2. Donna's credit union uses a daily periodic factor to calculate one billing period of interest on a credit card. If Donna's average daily balance is \$900 and the annual interest rate is 10.9 percent, how much interest is charged for a billing period of March 1 through March 31?

$$\text{Daily periodic factor} = \frac{0.109}{365} = 0.0002986$$

$$\text{Interest} = \$900 \times 31 \times 0.0002986 = \$8.33$$

3. Mona's credit union uses a monthly periodic factor to calculate one billing period of interest on a credit card. If Mona's average daily balance is \$6,700 and the annual interest rate is 12.5 percent, how much interest is charged for a billing period of June 1 through June 30?

$$\text{Monthly periodic factor} = \frac{0.125}{12} = 0.0104166$$

$$\text{Interest} = \$6,700 \times 0.0104166 = \$69.79$$

4. Marty's credit union uses a monthly periodic factor to calculate one billing period of interest on a credit card. If Marty's average daily balance is \$600 and the annual interest rate is 9.9 percent, how much interest is charged for a billing period of March 1 through March 31?

$$\text{Monthly periodic factor} = \frac{0.099}{12} = 0.00825$$

$$\text{Interest} = \$600 \times 0.00825 = \$4.95$$

Calculating the Amount of a Minimum Payment on an Open-End Credit Account

1. XYZ Credit Union requires a minimum payment of 2 percent of the balance or \$20, whichever is greater. If the balance on a member's credit card is \$1,100, what is the minimum payment?

The required minimum payment is \$22:
 $\$1,100 \times 0.02 = \22

2. ABC Credit Union requires a minimum payment of 1.5 percent of the balance or \$15, whichever is greater. If the balance on a member's credit card is \$600, what is the minimum payment?

The required minimum payment is \$15
 $\$600 \times 0.015 = \9

Loan Ratios

(Page 19)

Calculating Debt-to-Income Ratios

1. Credit union XYZ calculates the debt-to-income ratio from net monthly income and debt payments but no housing expenses.

Paula wants a loan to pay for furnishing a new apartment. Her net monthly income is \$3,350 and she has current monthly debt payments of \$1,200. The loan payment will be \$200. What is her debt-to-income ratio?

$$\frac{\text{monthly debt payments}}{\text{monthly income}} = \frac{\$1,200 + 200}{\$3,350} = 0.4179, \text{ or } 42 \text{ percent}$$

2. Credit union BBB calculates the debt-to-income ratio from gross monthly income and debt payments including housing expenses.

Marcus wants a loan to pay for a used car. He has gross monthly income of \$3,000 and current monthly debt payments of \$350. His monthly housing expense is \$500. The loan payment will be \$200. What is his debt-to-income ratio?

$$\frac{\text{monthly debt payments}}{\text{monthly income}} = \frac{\$350 + 500 + 200}{\$3,000} = \frac{\$1,050}{\$3,000} = 0.35, \text{ or } 35 \text{ percent}$$

3. Jessica and Jeremy are married and applying for a loan for vacation expenses. Jessica has net monthly income of \$4,000 and Jeremy has net monthly income of \$4,400. The couple has current debt payments of a total of \$2,000. The loan payment will be \$250. If Jessica and Jeremy will be jointly responsible for the loan, what would the debt-to-income ratio be?

$$\frac{\text{monthly debt payments}}{\text{monthly income}} = \frac{\$2,000 + 250}{\$8,400} = 0.2679, \text{ or } 27 \text{ percent}$$

Calculating Monthly Housing Expense Ratios

1. Carmela's gross monthly income is \$3,000, and the monthly principal and interest payment on the proposed mortgage would be \$800 with total monthly escrow payments of \$120. What is the housing expense ratio?

$$\frac{\text{monthly housing expense}}{\text{gross monthly income}} = \frac{\$800 + \$120}{\$3,000} = 0.3067 \text{ or } 31 \text{ percent}$$

2. Roger's gross monthly income is \$3,700, and the monthly principal and interest payment on the proposed mortgage would be \$790 with total monthly escrow payments of \$130. What is the housing expense ratio?

$$\frac{\text{monthly housing expense}}{\text{gross monthly income}} = \frac{\$790 + \$130}{\$3,700} = 0.2486 \text{ or } 25 \text{ percent}$$

Calculating Total-Obligations-to-Income Ratios

1. Let's look at Carmela's situation again. Remember that her gross monthly income is \$3,000, and the monthly principal and interest payment on the proposed mortgage would be \$800 with total monthly escrow payments of \$120. In addition, her debts and nonhousing obligations total \$150. What is the total-obligations-to-income ratio?

$$\frac{\text{total obligations}}{\text{gross monthly income}} = \frac{\$800 + \$120 + \$150}{\$3,000} = 0.3567 \text{ or } 36 \text{ percent}$$

2. Now, let's look at Roger's situation again. Remember that his gross monthly income is \$3,700, and the monthly principal and interest payment on the proposed mortgage would be \$790 with total monthly escrow payments of \$130. In addition, his debts and nonhousing obligations total \$350. What is the total-obligations-to-income ratio?

$$\frac{\text{total obligations}}{\text{gross monthly income}} = \frac{\$790 + \$130 + \$350}{\$3,700} = 0.3432 \text{ or } 34 \text{ percent}$$

Calculating Loan-to-Value Ratios

1. Laura and Lyle are applying for a mortgage to buy a home. The sales price of the home is \$150,000, the appraised value is \$155,000, and the mortgage is \$135,000. What is the loan-to-value ratio?

$$\text{LTV} = \frac{\text{mortgage amount}}{\text{value (lower of the sales price or appraised value)}} = \frac{\$135,000}{\$150,000} = 0.9, \text{ or } 90 \text{ percent}$$

2. Brian has a sales contract for a home with a price of \$295,000. The home is appraised at \$290,000 and he is applying for a mortgage of \$275,500. What is the loan-to-value ratio?

$$\text{LTV} = \frac{\text{mortgage amount}}{\text{value (lower of the sales price or appraised value)}} = \frac{\$275,500}{\$290,000} = 0.95, \text{ or } 95 \text{ percent}$$

Helping Members Compare Rates and Loans (Page 23)

Calculating Add-on Interest and Loan Payments

1. Mike is shopping for a new sofa and has found one he likes at a local furniture store. However, the price is more than he can pay upfront. The sofa costs \$1,500 and the store offers a financing plan. The salesperson explains that the interest rate on the plan is 7 percent and the plan term is 18 months.

a. If the store charges add-on interest, how much interest would Mike pay under this plan?

$$\$1,500 \times 0.07 \times 1.5 = \$157.50$$

b. What would be the monthly payment?

$$(\$1,500 + \$157.50) \div 18 = \$92.08$$

2. Soo Lon is thinking about buying a flat-screen TV that her boyfriend has recommended. At a local store, the price of the system is \$2,000 and the store offers a financing plan. The salesperson tells Soo Lon that the interest rate on the plan is 6 percent and the plan term is 24 months.

a. If the store charges add-on interest, how much interest would Soo Lon pay under this plan?

$$\$2,000 \times 0.06 \times 2 = \$240$$

b. What would be the monthly payment?

$$(\$2,000 + \$240) \div 24 = \$93.33$$

Converting a Fee for a Short-Term Payday Loan to an Annual Rate of Interest

1. Jennifer went to a payday lender for a short-term loan and paid \$20 for a 14-day, \$200 loan. What is the annual interest rate this fee represents?

$$\frac{20}{200 \times \frac{14}{365}} = \text{annual interest rate}$$

$$\frac{20}{200 \times 0.0383561} = \text{annual interest rate}$$

$$\frac{20}{7.67122} = 2.61, \text{ or } 261 \text{ percent}$$

2. Victor paid \$20 for a 14-day, \$125 payday loan. What is the annual interest rate this fee represents?

$$\frac{20}{125 \times \frac{14}{365}} = \text{annual interest rate}$$

$$\frac{20}{125 \times 0.0383561} = \text{annual interest rate}$$

$$\frac{20}{4.79451} = 4.17, \text{ or } 417 \text{ percent}$$



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