

# 3-2 Loan Calculations and Regression

Advanced Financial Algebra

# How can you calculate and model loan computations?

- Before taking out a loan, you need a complete picture of what your payment responsibilities will be over the life of the loan.
- Check for balloon payments and pre-payment penalties.
- Your monthly payments will cover some of the principal and some interest.
- You can either use the monthly payment formula or the loan summary statement provided by your lender.

# Sample summary statement from lender

- This tells you a lot of information you should know about your loan payments.
- It includes:
  - Monthly payment
  - Total interest you will pay
  - Loan amount
  - Interest rate
  - Term of the loan
  - Etc.

LOAN AMOUNT	INTEREST RATE	TERM	START DATE
\$100,000	5.50%	5 Years	Jan-17

<b>MONTHLY PAYMENT</b>	<b>PAYMENTS and INTEREST</b>
	\$ 1,910.12
<b>TOTAL INTEREST PAID (LIFE OF LOAN)</b>	<b>\$ 14,606.97</b>

DATE	PRINCIPAL	INTEREST	BALANCE
Jan. 2017	\$1,451.78	\$458.33	\$98,548.22
Feb. 2017	\$1,458.44	\$451.68	\$97,089.78
Mar. 2017	\$1,465.12	\$444.99	\$95,624.66
Apr. 2017	\$1,471.84	\$438.28	\$94,152.82
May 2017	\$1,478.58	\$431.53	\$92,674.24
Jun. 2017	\$1,485.36	\$424.76	\$91,188.88
Jul. 2017	\$1,492.17	\$417.95	\$89,696.71
Aug. 2017	\$1,499.01	\$411.11	\$88,197.71
Sept. 2017	\$1,505.88	\$404.24	\$86,691.83
Oct. 2017	\$1,512.78	\$397.34	\$85,179.05
Nov. 2017	\$1,519.71	\$390.40	\$83,659.34
Dec. 2017	\$1,526.68	\$383.44	\$82,132.66

# Example 1 - total interest

- Determine the total interest owed on a 5-year, \$10,000 loan at 6% APR.

- SOLUTION:

- Use the monthly payment formula:  $M = \frac{\left(\frac{P}{12}\right)\left(1 + \frac{r}{12}\right)^{(12 \cdot t)}}{\left(1 + \frac{r}{12}\right)^{(12 \cdot t)} - 1} =$

$$\frac{10000\left(\frac{.06}{12}\right)\left(1 + \frac{.06}{12}\right)^{(12 \cdot 5)}}{\left(1 + \frac{.06}{12}\right)^{(12 \cdot 5)} - 1}$$

- $M \approx \$193.33$  is the monthly payment required on this loan.

## Example 2 - total payments



What is the total amount of the monthly payments for a \$4,000, 2-year loan with an APR of 4% according to the table in Example 1?



SOLUTION:



The monthly payments were \$173.68 and must be paid for two years which is 24 months.



$\$173.68 * 24 = \$4,168.32$  in total payments

## Example 3 - finance charge

- Find the finance charge for a \$4,000, 2-year loan with a 4% APR.
- SOLUTION:
- Total amount paid during those two years was \$4,168.32
- The original loan principal amount was only \$4,000
- Subtract  $\$4,168.32 - \$4,000 = \underline{\$168.32}$  **finance charge**

# Monthly Payment Formula (do not memorize)

- You can use the monthly payment formula instead of the table we used in example #1.

## Monthly Payment Formula

$$M = \frac{P \left( \frac{r}{12} \right) \left( 1 + \frac{r}{12} \right)^{12t}}{\left( 1 + \frac{r}{12} \right)^{12t} - 1}$$

where  $M$  = monthly payment

$P$  = principal

$r$  = interest rate

$t$  = number of years

## Example 4 - using monthly payment formula

- Mark bought a new car. The total amount he needs to borrow is \$28,716. He plans on taking out a 4-year loan at an APR of 3.12%. What is the monthly payment?

- SOLUTION:

- Use the monthly payment formula:  $M = \frac{\left(\frac{P}{12}\right)\left(1 + \frac{r}{12}\right)^{(12 \cdot t)}}{\left[\left(1 + \frac{r}{12}\right)^{(12 \cdot t)} - 1\right]}$  =

$$\frac{(28716)\left(\frac{.0312}{12}\right)\left(1 + \frac{.0312}{12}\right)^{(12 \cdot 4)}}{\left[\left(1 + \frac{.0312}{12}\right)^{(12 \cdot 4)} - 1\right]}$$



# Assignment: pg 162 # 3, 6, 8, 14, 15, 17

- #3

How many more monthly payments are made for a five-year loan than for a two-year loan?

- #6

Darnelle has a \$10,000, three-year loan with an APR of 5%. She uses the table on page 159 to compute information on the loan.

a. What is her monthly payment?

b. What is the total of all her monthly payments?

c. What is the total finance charge?

# Assignment: pg 162 # 3, 6, 8, 14, 15, 17 con't

- #8

The policy of the Broadway Pawnshop is to lend up to 35% of the value of a borrower's collateral. John wants to use a \$3,000 ring and a \$1,200 necklace as collateral for a loan. What is the maximum amount that he could borrow from Broadway?

- #14

Olivia is considering membership to the Regional Teachers' Credit Union so that she can save money on a loan. The credit union will lend her \$8,000 for three years at 2.25% APR. The same loan at her savings bank has an APR of 2.9% How much would Olivia save in finance charges if she joined the credit union and took out her loan there? Round to the nearest 10 dollars.

# Assignment: pg 162 # 3, 6, 8, 14, 15, 17 con't

- #15

Rob wants to purchase a \$5,000 drum set. The music store offers him a two-year installment agreement requiring \$800 down and monthly payments of \$202.50. Rob has a poor credit rating.

- What is his interest on this installment agreement?
- Instead of using the store's installment plan, Rob can borrow \$5,000 at an APR of 7% from a local consumer finance company. What would be the monthly payment for this loan using the table from Example 1? Round to the nearest cent.
- How much interest would the finance company charge?
- Should Rob use the installment plan or borrow the money from the finance company?

# Assignment: pg 162 # 3, 6, 8, 14, 15, 17 con't

- #17

A loan used for buying a home is called a *mortgage*. The Fortunato family is borrowing \$430,000 to buy a home. They are taking out a 30-year mortgage at a rate of 3.55%.

- Compute the monthly payment to the nearest cent.
- Find the total of all of the monthly payments for 30 years.
- What is the total interest?
- Which is greater, the interest or the original cost of the home?