

Last Name \_\_\_\_\_ First Name \_\_\_\_\_  
 UIN \_\_\_\_\_ Math 141 - \_\_\_\_\_

**Finance: Amortization**

**Part I**

You purchase a diamond ring for \$4500. To pay for it, you make a down payment of \$500 and take out a \$4000 loan for the remaining balance. The terms of the 1-year loan are 9.3% annual interest compounded monthly on the unpaid balance.

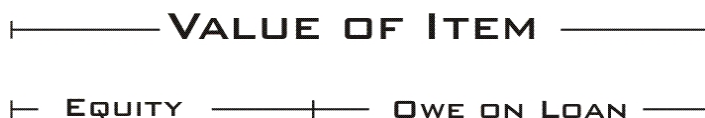
1. How much are the monthly payments? \$ \_\_\_\_\_
2. How much interest is paid in total? \$ \_\_\_\_\_
3. If the interest was compounded annually, instead, and you just paid the entire loan off at the end of the year, how much would the total interest be? \$ \_\_\_\_\_
4. Why are the answers in 2. and 3. different? \_\_\_\_\_

Each payment is broken down into two parts; the interest owed is paid first and then the rest of the payment goes towards paying off (paying down) the amount owed (principal).



The amount of interest paid is the largest in your first payment, while nearly all of the last payment goes towards the principal. **Even though the payment is the same each month, the distribution of interest and principal changes with every payment.**

As you pay off the loan, you gain equity in the item. The **equity** is the dollar amount of the item that belongs to you. The rest of the value of the item belongs to the bank (the amount you still owe).



Continuing with the \$4500 diamond ring, \$500 was the down payment and the remaining \$4000 was a loan. The terms of the 1-year loan are 9.3% annual interest compounded monthly on the unpaid balance.

5. How much equity do you have at the start of the loan? \_\_\_\_\_ *Hint: This is your down payment.*
6. How much do you owe at the start of the loan? \_\_\_\_\_  
 Note: Your answers to 5. and 6. add up to the value of the item.  
 During the first month, before you make a payment at the end of the month, the loan has accrued (accumulated) interest. In order to figure out how much interest, you need the periodic interest rate.
7. What is the periodic, in this case monthly, interest rate? \_\_\_\_\_% *Hint: There are 12 months in a year.*

8. How much of the first payment is interest and how much pays down the loan? *Hint:* Use the monthly interest rate as a decimal.

$$\frac{\text{amount owed}}{\text{amount owed}} \times \frac{\text{monthly interest rate}}{\text{monthly interest rate}} = \frac{\text{monthly interest owed}}{\text{monthly interest owed}}$$

$$\frac{\text{payment amount}}{\text{payment amount}} - \frac{\text{monthly interest owed}}{\text{monthly interest owed}} = \frac{\text{amount towards principal}}{\text{amount towards principal}}$$

9. What is the outstanding principal after the first payment is made? *Hint:* The current loan balance is \$4000.

$$\frac{\text{current loan balance}}{\text{current loan balance}} - \frac{\text{amount towards principal}}{\text{amount towards principal}} = \frac{\text{new loan balance}}{\text{new loan balance}}$$

10. What is your equity in the diamond ring after one payment? \$ \_\_\_\_\_

11. How much of the second payment is interest and how much pays down the loan?  
*Hint:* Use the same process you used in 8. with the new loan balance (the current outstanding principal).

\$ \_\_\_\_\_ is interest and \$ \_\_\_\_\_ is towards paying off the loan

12. What is the outstanding balance on the loan and your equity in the ring after the second payment?

\$ \_\_\_\_\_ is the outstanding balance and \$ \_\_\_\_\_ is the equity

13. An **amortization table** summarizes these calculations. Complete the table below.

End of Period	Payments Remaining	Payment Amount	Amount Towards Interest	Amount Towards Principal	Outstanding Principal	Equity
0	12	n/a	n/a	n/a	\$4000	\$500
1	11	\$350.36	\$ _____	\$ _____	\$3680.64	\$ _____
2	10	\$ _____	\$28.52	\$ _____	\$ _____	\$ _____
3	9	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____

To find the outstanding balance at any time during the loan the TVM Solver can be used. Change the number of payments, N, to the number of remaining payments and solve for the new PV.

14. What is your equity in the diamond ring after 8 months?  
 First find the outstanding principal after 8 months using the TVM Solver.

a. How many payments are remaining after 8 months? \_\_\_\_\_

b. What is the outstanding principal? \_\_\_\_\_

*Hint:* Use the following values in the TVM Solver:

N = 12 - 8 = 4, I = 9.3, PV = ?, PMT = -350.36, FV = 0, P/Y = 12.

c. What is your equity after 8 months? \_\_\_\_\_

*Hint:* Your equity is the value of the ring minus what you still owe (PV).

**Part II**

A house is typically a person’s largest investment. The loan on a house is called a mortgage. The equity in your home is the value of the home at the present time minus the amount owed to the bank on the mortgage.

Suppose you want to buy a house that costs \$175,000.

1. If you make a 10% down payment, how much do you need to finance? \_\_\_\_\_
2. If you finance with a 30-year mortgage at 6% annual interest compounded monthly on the unpaid balance, how large are the monthly payments and how much interest is paid in all?  
 Payments are \$ \_\_\_\_\_  
 Total interest is \$ \_\_\_\_\_
3. If you finance with a 20-year mortgage at 6% annual interest compounded monthly on the unpaid balance, how large are the monthly payments and how much interest is paid in all?  
 Payments are \$ \_\_\_\_\_  
 Total interest is \$ \_\_\_\_\_

Note: In **2.**, you will have a lower monthly payment, but pay more in interest in all. In **3.**, you will have a higher monthly payment, but pay less interest in all.

4. You choose the 30-year mortgage at 6% annual interest compounded monthly for 30 years. Complete the table below:

End of Period	Payments Remaining	Payment Amount	Amt Towards Interest	Amt Towards Principal	Outstanding Principal	Equity
0	360	n/a	n/a	n/a	\$ _____	\$ _____
1	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____
2	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____	\$ _____

5. After 10 years you want to refinance the house. How much do you owe the bank at this point? In other words, what is your outstanding principal? \_\_\_\_\_  
*Hint: This is like Part I, 14.*
6. What is your equity after 10 years? \_\_\_\_\_
7. Suppose, instead, that after 10 years, the value of the house is 15% higher than when you bought it.
  - a. What would be the value of the house at this point? \_\_\_\_\_
  - b. What would be your equity? \_\_\_\_\_