Analyzing a loan payment:

The process of paying off a loan is called amortization. A table that shows the sequence of balances as the loan is being paid off is called an amortization table. You are to design a console mode program which calculates the amortization table for a car loan.

A car loan is affected by the following numbers:

- The Price (Also known as Principal of the loan)
- The Term (Length of the loan in years).
- The Interest Rate on the loan (expressed as an annual rate).

The following represents a set of typical parameters which affect the loan:

<table>
<thead>
<tr>
<th>Principal</th>
<th>$2000.00</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual interest</td>
<td>8%</td>
</tr>
<tr>
<td>Term (years)</td>
<td>1</td>
</tr>
<tr>
<td>Periods per year</td>
<td>12</td>
</tr>
<tr>
<td>No. of Payments</td>
<td>12</td>
</tr>
<tr>
<td>Monthly Payment</td>
<td>$173.98</td>
</tr>
</tbody>
</table>

The following is a sample amortization table:

<table>
<thead>
<tr>
<th>Pmt No.</th>
<th>Beginning Balance</th>
<th>Interest</th>
<th>Principal</th>
<th>Ending Balance</th>
<th>Interest to Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2000.00</td>
<td>13.33</td>
<td>160.64</td>
<td>1839.36</td>
<td>13.33</td>
</tr>
<tr>
<td>2</td>
<td>1839.36</td>
<td>12.26</td>
<td>161.71</td>
<td>1677.64</td>
<td>25.60</td>
</tr>
<tr>
<td>3</td>
<td>1677.64</td>
<td>11.18</td>
<td>162.79</td>
<td>1514.85</td>
<td>36.78</td>
</tr>
<tr>
<td>4</td>
<td>1514.85</td>
<td>10.10</td>
<td>163.88</td>
<td>1350.97</td>
<td>46.88</td>
</tr>
<tr>
<td>. . . . .</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Problem Definition:

Write a program which prompts the user to enter the principal, annual interest rate, the number of years and the number of periods per year. Then using this information, calculate the monthly payment for the loan. The formula for calculating the loan is as follows:

\[
PMT = \text{Principal} \times \frac{\text{Periodic\_Interest\_Rate}}{1 - (\text{Periodic\_Interest\_Rate} + 1)^{-\text{Term}}}
\]

Note:

\[
\text{Periodic\_Interest\_Rate} = \frac{\text{Annual interest rate}}{\text{Periods per year}}
\]
\[
\text{Term} = \text{Years} \times \text{Periods per year}
\]

The following procedures and functions are needed to implement the amortization program. We will work on some of the sub programs in class.

Procedures:

ReadLoanInfo(Principal, Rate, Years, Period)
PrintLoanInfo(Principal, Rate, Monthly\_Payment, Years, Period)
PrintAmortizationSchedule(Principal, Rate, Years, Period)

Functions:

Payment(Principal, Rate, Years, Period) as double

Basically, all input, output and calculations should be done in the procedures and functions. The main body of the program should be a series of subroutine calls.

Review the chapter(s) on procedures and functions, pass by value and pass by reference in our notes, and text book before attempting this program. Also, make sure to review/complete relevant labs such as lab 5, 9 and 10 before starting this program.
What to hand in:

1) Project directory (zipped)
   Make sure to documentation your code, including documentation for the procedures and functions also make sure that Option Strict and Explicit are turned on. Upload the zipped project folder on to canvas.

2) Testing:
   Make sure to test your final program with the following set of data and include the results in a word document and upload that to the drop box.

<table>
<thead>
<tr>
<th>Principal</th>
<th>Rate</th>
<th>Year</th>
<th>Period</th>
</tr>
</thead>
<tbody>
<tr>
<td>11000.00</td>
<td>10.00%</td>
<td>4</td>
<td>12</td>
</tr>
<tr>
<td>15500.00</td>
<td>05.70%</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>5100.00</td>
<td>18.00%</td>
<td>2</td>
<td>12</td>
</tr>
</tbody>
</table>

   (For more information on amortization see http://en.wikipedia.org/wiki/Amortization)

NOTE: USE LAB 10 as your starting point for this assignment.
Option Explicit On
Option Strict On

Module Module1

Sub Main()
    Dim Principal As Double = 0.0
    Dim AnnualIntRate As Double = 0.0
    Dim TermInYears As Integer = 0
    Dim MonthlyPayment As Double = 0.0
    Dim PeriodsPerYear As Integer = 0

    ReadLoanInfo(Principal, AnnualIntRate, TermInYears, PeriodsPerYear)
    MonthlyPayment = Payment(Principal, AnnualIntRate, TermInYears, PeriodsPerYear)
    PrintLoanInfo(Principal, AnnualIntRate, TermInYears, PeriodsPerYear, MonthlyPayment)
    PrintAmortization(Principal, AnnualIntRate, TermInYears, PeriodsPerYear, MonthlyPayment)

    Console.ReadLine()
End Sub

Sub ReadLoanInfo(ByRef Principal As Double, _
                  ByRef AnnualIntRate As Double, _
                  ByRef TermInYears As Integer, _
                  ByRef PeriodsPerYear As Integer)
    Console.Write("Enter Principal: ")
    Principal = CDbl(Console.ReadLine())

    Console.Write("Enter Annual Int. Rate: (e.g., 8.25% type 8.25")
    AnnualIntRate = CDbl(Console.ReadLine()) / 100

    Console.Write("Enter Term (in years): ")
    TermInYears = CInt(Console.ReadLine())

    Console.Write("Enter Periods per Year: (typically this is 12 for the number of months in the year")
    PeriodsPerYear = CInt(Console.ReadLine())

End Sub

Sub Payment(ByVal Principal As Double, ByVal AnnualIntRate As Double, ByVal TermInYears As Integer, ByVal PeriodsPerYear As Integer)
    Dim MonthlyPayment As Double = 0.0
    Dim TotalPayments As Integer = TermInYears * PeriodsPerYear
    Dim InterestFactor As Double = AnnualIntRate / 1200
    Dim PresentValue As Double = Principal

    For i = 1 To TotalPayments
        MonthlyPayment = PresentValue * InterestFactor / (1 - (1 + InterestFactor) ^ (-TotalPayments))
        PresentValue = PresentValue - MonthlyPayment
    Next

    Console.Write("The monthly payment is: ")
    Console.Write(MonthlyPayment)
End Sub

Sub PrintLoanInfo(ByVal Principal As Double, ByVal AnnualIntRate As Double, ByVal TermInYears As Integer, ByVal PeriodsPerYear As Integer, ByVal MonthlyPayment As Double)
    Console.Write("The loan information is as follows:
    Principal: ", Principal)
    Console.Write("Annual Interest Rate: ", AnnualIntRate)
    Console.Write("Term in Years: ", TermInYears)
    Console.Write("Periods per Year: ", PeriodsPerYear)
    Console.Write("Monthly Payment: ", MonthlyPayment)
End Sub

Sub PrintAmortization(ByVal Principal As Double, ByVal AnnualIntRate As Double, ByVal TermInYears As Integer, ByVal PeriodsPerYear As Integer, ByVal MonthlyPayment As Double)
    Dim TotalPayments As Integer = TermInYears * PeriodsPerYear
    Dim InterestFactor As Double = AnnualIntRate / 1200
    Dim PresentValue As Double = Principal
    Dim PaymentsMade As Integer = 0
    Dim InterestPaid As Double = 0
    Dim PrincipalPaidAsDouble As Double = 0
    Dim PaymentsMadeAsInteger As Integer
    Dim InterestPaidAsInteger As Integer
    Dim PrincipalPaidAsInteger As Integer

    For i = 1 To TotalPayments
        PaymentsMadeAsInteger = PaymentsMade
        InterestPaidAsInteger = InterestPaid
        PrincipalPaidAsInteger = PrincipalPaid

        PresentValue = PresentValue - MonthlyPayment
        InterestPaid = PresentValue * InterestFactor
        PrincipalPaid = MonthlyPayment - InterestPaid
        PaymentsMade = PaymentsMade + 1
    Next

End Sub

End Module
Function Payment(ByVal Principal As Double, ByVal AnnualIntRate As Double, ByVal TermInYears As Integer, ByVal PeriodsPerYear As Integer) As Double

Dim MtlyPayment As Double
Dim PeriodicIntRate As Double
Dim TermInMonths As Integer

TermInMonths = TermInYears * PeriodsPerYear
PeriodicIntRate = AnnualIntRate / PeriodsPerYear

MtlyPayment = Complete the rest of this line... Look at the formula in the assignment sheet for guidance

Return MtlyPayment
End Function

Sub PrintLoanInfo(DECIDE PASS BY VALUE OR REFERENCE Principal As Double, DECIDE PASS BY VALUE OR REFERENCE AnnualIntRate As Double, DECIDE PASS BY VALUE OR REFERENCE TermInYears As Integer, DECIDE PASS BY VALUE OR REFERENCE PeriodsPerYear As Integer, DECIDE PASS BY VALUE OR REFERENCE MtlyPmt As Double)

Console.WriteLine("-------------------------------")
Console.WriteLine("Principal        = {0}", Principal)
Console.WriteLine("Annual Int. Rate = {0}", AnnualIntRate)
Console.WriteLine("Term (in years)  = {0}", TermInYears)
Console.WriteLine("Periods per Year = {0}", PeriodsPerYear)
Console.WriteLine("Monthly Payment  = {0,11:c}", MtlyPmt)
Console.WriteLine("-------------------------------")
End Sub

Private Sub PrintAmortization(DECIDE PASS BY VALUE OR REFERENCE Principal As Double, DECIDE PASS BY VALUE OR REFERENCE AnnualIntRate As Double, DECIDE PASS BY VALUE OR REFERENCE TermInYears As Integer, DECIDE PASS BY VALUE OR REFERENCE PeriodsPerYear As Integer, DECIDE PASS BY VALUE OR REFERENCE MtlyPmt As Double)

Dim MtlyIntRate As Double
Dim TermInMonths As Integer
Dim PaymentNo As Integer
Dim BegBal As Double
Dim InterestThisMonth As Double
Dim PrincipalThisMonth As Double
Dim EndBal As Double
Dim IntToDate As Double = 0.0
TermInMonths = TermInYears * PeriodsPerYear
MtlyIntRate = AnnualIntRate / PeriodsPerYear

BegBal = Principal

Console.WriteLine("{0,4}{1,12}{2,12}{3,12}{4,12}{5,12}", "Pmt", "Begining", "Interest", "Principal", "Ending", "Interest")
Console.WriteLine("{0,4}{1,12}{2,12}{3,12}{4,12}{5,12}", "No.", "Balance", "This Month", "This Month", "Balance", "ToDate")
Console.WriteLine("{0,4}{1,12}{2,12}{3,12}{4,12}{5,12}", "---", "-------", "----------", "----------", "-------", "-------")

For PaymentNo = 1 To TermInMonths
    InterestThisMonth = CALCULATE THE INTEREST FOR THIS MONTH
    PrincipalThisMonth = CALCULATE THE PRINCIPAL FOR THIS MONTH
    EndBal = CALCULATE THE ENDING BALANCE FOR THIS MONTH
    IntToDate = IntToDate + InterestThisMonth
    Console.WriteLine("{0,4} {1,11:c} {2,11:c} {3,11:c} {4,11:c} {5,11:c}", PaymentNo, BegBal, InterestThisMonth, PrincipalThisMonth, EndBal, IntToDate)
    BegBal = DETERMINE THE BEGINNING BALANCE FOR THE NEXT MONTH

Next PaymentNo

End Sub

End Module
Hacker's Corner:

Convert the above program to a Windows Application.