Work independently, ask questions! Seek help during TA office hours .

If using any reference for any purpose, make sure to cite the source. Add citations as a comment.

Submit your source code to Canvas, follow the submission naming policies.

Objective: User-defined and library functions, Fundamental programming and problem solving

Loan Calculator:

A loan calculator will help you determine your monthly payments if you decide to borrow money in the form of student loans, car loans and renovation loans. You would be creating your very own and fully accurate loan calculator for this assignment.

The good news is that interest on a loan is paid on a declining balance, and hence a loan with an interest rate of, say, 14 percent can cost significantly less than 14 percent of the balance if paid within a year.

Loans usually have some terms associated with them like loan amount, interest rate, and the duration of the loan. For example, you can borrow $5000 with an interest of 5% for 18 months.

Write a program that takes as input the loan amount (P), annual percentage rate (APR), and the loan term (in years and/or months). As an example, for $20,000 loan with 10% APR for duration of 2 years:

P = 20000 (dollars and cents)

APR = 10 (percentage)

n = 24 (months)

The program calculates and displays the monthly payments and balance of the loan until the loan is paid off. This is known as “amortization schedule” and a sample table is shown below.

Amortization Schedule

	Beginning Balance	Interest	Principal	Ending Balance
1	$20,000.00	$159.48	$759.44	$19,240.56
2	$19,240.56	$153.43	$765.50	$18,475.06
3	$18,475.06	$147.32	$771.60	$17,703.46
4	$17,703.46	$141.17	$777.75	$16,925.70
5	$16,925.70	$134.97	$783.96	$16,141.75
6	$16,141.75	$128.72	$790.21	$15,351.54
7	$15,351.54	$122.42	$796.51	$14,555.03
8	$14,555.03	$116.06	$802.86	$13,752.17
9	$13,752.17	$109.66	$809.26	$12,942.90
10	$12,942.90	$103.21	$815.72	$12,127.19
11	$12,127.19	$96.70	$822.22	$11,304.97
12	$11,304.97	$90.15	$828.78	$10,476.19
Year #1 End				
13	$10,476.19	$83.54	$835.39	$9,640.80
14	$9,640.80	$76.88	$842.05	$8,798.76
15	$8,798.76	$70.16	$848.76	$7,949.99
16	$7,949.99	$63.39	$855.53	$7,094.46
17	$7,094.46	$56.57	$862.35	$6,232.11
18	$6,232.11	$49.70	$869.23	$5,362.88
19	$5,362.88	$42.76	$876.16	$4,486.72
20	$4,486.72	$35.78	$883.15	$3,603.58
21	$3,603.58	$28.74	$890.19	$2,713.39
22	$2,713.39	$21.64	$897.29	$1,816.10
23	$1,816.10	$14.48	$904.44	$911.66
24	$911.66	$7.27	$911.66	-$0.00
Year #2 End				

https://www.calculator.net/

Steps to Solve the problem:

To solve this problem, you would need to figure out the monthly fixed payments first. Typically, the monthly payments are calculated using the amortization equation as follows:

$$M = P\,\frac{r\,(1+r)^n}{(1+r)^n - 1}$$

Where M is the monthly payments, P is the principal loan amount, r is the monthly interest rate and n is the number of payments over loan's lifetime.

The first step would be conversion of the APR to r, i.e., the annual percentage rate of interest to monthly rate of interest. The loan interest per month is slightly less than one twelfth of the interest loan per year. So, simply dividing the annual interest by 12 would not produce an accurate rate of interest per month. The exact formula for the monthly interest would require taking the 12^{th} root of annual interest as follows:

$$r = \left(1 + \frac{APR}{100}\right)^{1/12} - 1$$

On a loan of $20,000, with 10% APR:

r = 0.007974

Therefore:

M = $918.92

This monthly payment of *$918.92* covers both the balance owed, and the interest accumulated. Therefore, the interest accounts for a portion of the monthly payment and the remaining portion of the payment would go towards the principal.

Monthly Payment = Interest + Principal

For month 1, interest would be P*r = $159.48, and the remaining $759.44 would decrease the balance to $19240.56.

Month 1

Payment = $918.92 Interest = $159.48 principal = $759.44 Balance = 19,240.56

For month 2, interest would be paid on the remaining balances as *r * $19,240.56*.

Month 2

Payment = $918.92 Interest = $153.43 principal = $765.50 Balance = 18,475.06

The program iterates over the term of the loan till the balance is zero.

Your program should display a table like above that shows the *interest* and *principal* portion of the loan for every month as well as the remaining balance.

In addition, the program should output the total interest paid over the life of the loan like follows:

Payment Every Month	$918.92
Total Payments	$22,054.19
Total Interest	$2,054.19

Your program should allow the user to repeat this calculation as often as desired until done.

Functions that are needed to run the program (You may add more functions to this list):

- A function that calculates and returns monthly interest rate *(r)* using the APR as input argument. This can be a call-by-value function.
- A function that calculates and returns amortization, *M* using inputs of *P, r, and n*. This can be a call-by value function.
- A function that calculates the interest and principal balance for every month. This can be a call-by reference function.
- A function that keeps track of total payment and total interest accumulated. This can be a call-by-reference function.
- An input function which prompts and fills the input with values for *P, APR, and n*. This is a call by reference function.
- An output function which displays tabular information. This can be a call-by-reference function.
- An output function which displays the summary of payments at the end. This can be a call-by-reference function.

Note: To create tabular data, use the `\t` for equally spaced data. Alternatively, use the `cout.width(4)` to create equal length data fields (4 is just an example).