

### Examples 4.3

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

Use the monthly payment formula.

$$M = \frac{p \left( \frac{r}{12} \right) \left( 1 + \frac{r}{12} \right)^{12t}}{\left( 1 + \frac{r}{12} \right)^{12t} - 1} \quad (P(R/12)(1+R/12)^T)/((1+R/12)^T-1)$$

Substitute  $p = 10,000$ ,  $r = 0.06$ , and  $t = 5$ .

Use your calculator. Enter in one keystroke sequence. Think about the order of operations to determine where parentheses are needed.

$$M = 193.3280$$

The monthly payment is approximately \$193.33.

Multiply the amount of the monthly payments by the number of monthly payments to find the total of the monthly payments.

$$193.33 \times 60 = 11,599.80$$

The total of the monthly payments is \$11,599.80.

Keep in mind that this is not the exact amount. The amount of the monthly payment was rounded to the nearest cent, or two decimal places, but in reality, banks keep decimal amounts when performing calculations.

To find the interest you must pay, subtract the loan principal from the total payback.

$$11,599.80 - 10,000 = 1,599.80$$

The interest on a \$10,000 loan at 6% APR taken out for 5 years is approximately \$1,599.80.

**1b. Determine the total interest owed on a 3-year \$14,000 loan at 7% APR.**

- a. What is the monthly payment amount?
- b. What is the total of the monthly payments?
- c. What is the total interest paid on this loan?

### Example 2

Claude wants to borrow \$25,000 to purchase a car. After looking at his monthly budget, he realizes that all he can afford to pay per month is \$300. The bank is offering a 5.9% loan. What would the length of his loan need to be so that he can stay within his budget?

M = monthly payment

P = principal

R = interest rate

T = number of years

$$t = \frac{\ln\left(\frac{M}{p}\right) - \left(\ln\left(\frac{M}{p} - \frac{r}{12}\right)\right)}{12\ln\left(1 + \frac{r}{12}\right)}$$
$$t = \frac{\ln\left(\frac{300}{25,000}\right) - \left(\ln\left(\frac{300}{25,000} - \frac{0.059}{12}\right)\right)}{12\ln\left(1 + \frac{0.059}{12}\right)}$$

#### How to enter on calculator

$$(1\ln(300/25000) - (1\ln(300/25000 - 0.059/12)))/(12\ln(1 + 0.059/12))$$

where M = monthly payment

p = principal

r = interest rate

t = number of years

Substitute p = 25,000, M = 300, and r = 0.059.

Calculate to the nearest hundredth of a year.

$$t \approx 8.96$$

Claude would need to take out a loan for about 9 years

**2b.** Jessica wants to borrow \$12,000 to purchase a car. After looking at her monthly budget, she realizes that all she can afford to pay per month is \$150. The bank is offering a 7.9% loan. What would the length of her loan need to be so that she can stay within his budget?

1. What is the total interest on a ten-year 6.1% loan with a principal of \$32,000?
  
2. Jamie wants to borrow \$15,000 from South Western Bank. They offered her a 4-year loan with an APR of 5.5%. How much will she pay in interest over the life of the loan?
  
3. Charlie and Kathy want to borrow \$20,000 to make some home improvements. Their bank will lend them the money for 10 years at an interest rate of  $5\frac{3}{4}\%$ . How much will they pay in interest?
  
5. Devon is considering taking out a \$7,000 loan. He went to two banks. Stevenson Trust Company offered him an 8-year loan with an interest rate of 8.6%. First National Bank offered him a 5-year loan with an interest rate of 10%. Which loan will have the lower interest over its lifetime?
  
6. A bank offers a \$25,000 loan at an interest rate of 7.7% that can be paid back over 8 years. How much will you pay in interest?
  
7. Jennifer wants to borrow \$20,000. Her bank offers a 7.1% interest rate. She can afford \$500 a month for loan payments. What should be the length of her loan to the nearest tenth of a year?
  
8. Louis wants to take out a \$14,000 loan with a 6.8% APR. He can afford to pay no more than \$400 per month for loan payments. What would be the length of his loan? Round to the nearest tenth of a year.
  
9. Use your answer and the loan information from Exercise 8 to determine what effect a \$50 decrease in Louis' monthly payment would have on the length of his loan.

10. Dave wants to borrow \$22,000 from First Finance Bank. The bank will give him a 15-year loan at an interest rate of 4.85%. How much will he pay the bank in interest over the life of the loan? Round to the nearest hundred dollars.

11. Use the given yearly payment schedule.

Year	Principal Paid	Interest Paid	Loan Balance
			\$ 10,000.00
1	\$ 680.52	\$ 775.41	\$ 9,319.48
2	\$ 737.01	\$ 718.92	\$ 8,582.47
3	\$ 798.18	\$ 657.75	\$ 7,784.29
4	\$ 864.43	\$ 591.50	\$ 6,919.86
5	\$ 936.17	\$ 519.76	\$ 5,983.69
6	\$ 1,013.88	\$ 442.05	\$ 4,969.81
7	\$ 1,098.03	\$ 357.90	\$ 3,871.78
8	\$ 1,189.16	\$ 266.77	\$ 2,682.62
9	\$ 1,287.86	\$ 168.07	\$ 1,394.76
10	\$ 1,394.76	\$ 61.18	\$ 0.00

- What is the loan amount?
- What is the length of the loan?
- What is the monthly payment?
- What is the total interest paid?

12. Use the given payment schedule.

<b>Yearly Payment Schedule</b>			
<b>Year</b>	<b>Principal Paid</b>	<b>Interest Paid</b>	<b>Loan Balance</b>
			\$ 35,000.00
2010	\$ 773.32	\$3,291.90	\$ 34,226.68
2011	\$ 850.08	\$ 3,215.15	\$ 33,376.60
2012	\$ 934.44	\$ 3,130.78	\$ 32,442.16
2013	\$ 1,027.18	\$ 3,038.04	\$ 31,414.97
2014	\$ 1,129.13	\$ 2,936.10	\$ 30,285.84
2015	\$ 1,241.19	\$ 2,824.03	\$ 29,044.65
2016	\$ 1,364.38	\$ 2,700.85	\$ 27,680.27
2017	\$ 1,499.79	\$ 2,565.44	\$ 26,180.48
2018	\$ 1,648.64	\$ 2,416.59	\$ 24,531.84
2019	\$ 1,812.26	\$ 2,252.96	\$ 22,719.57
2020	\$ 1,992.13	\$ 2,073.10	\$ 20,727.45
2021	\$ 2,189.84	\$ 1,875.39	\$ 18,537.61
2022	\$ 2,407.18	\$ 1,658.05	\$ 16,130.43
2023	\$ 2,646.08	\$ 1,419.14	\$ 13,484.34
2024	\$ 2,908.70	\$ 1,156.53	\$ 10,575.64
2025	\$ 3,197.38	\$ 867.84	\$ 7,378.26
2026	\$ 3,514.72	\$ 550.51	\$ 3,863.54
2027	\$ 3,863.54	\$ 201.69	\$ 0.00

- What is the loan amount?
- What is the length of the loan?
- What is the monthly payment?
- What is the total interest paid?