

An **installment loan** is a loan that the borrower pays off by periodic payments of fixed amount.

Example 1. Suppose we want to purchase a used car for \$12,000. In case of most purchases, the buyer must pay at least some of the price. This amount is called a **down payment**. Suppose that our purchase requires a down payment of \$1500.

As we drive the car home, we owe a big portion of the price. In effect, we borrowed this amount from the seller. The amount that we borrowed is also called the **amount financed**.

$$\text{Amount Financed} = \text{Price} - \text{Down Payment}$$

In this particular case, the amount financed is \$10,500. In exchange for lending us money, the seller will collect interest that is called the **finance charge**.

The finance charge can be calculated in several different ways. There is a formula called the installment loan formula. There is also a way to compute the finance charge using an APR (annual percentage rate) table. **In our course, we will use an annual simple interest, compounded annually.**

Suppose that the car dealership is offering financing with an annual simple interest of 8%, for three years. We compute the finance charge exactly as we charge interest: $I = Prt$ (interest is principal times interest rate times number of years)

$$\text{Finance Charge} = \text{Financed Amount} \cdot \text{interest rate} \cdot \text{time (in years)}$$

In our case, the finance charge is

$$\text{Finance Charge} = \$10,500 \cdot 0.08 \cdot 3 = \$2520$$

When we drive the car home, we owe the dealership the amount financed + finance charge.

$$\text{We owe: Amount Financed} + \text{Finance Charge} = \$10,500 + \$2520 = \$13,020$$

In case of installment buying, we use equal monthly payments. If the loan was for three years, then we will make $3 \cdot 12 = 36$ equal payments. So the monthly payments will be

$$\text{Monthly Payment} = \frac{\$13,020}{36} \approx \$361.67$$

The total installment price is the total amount we end up paying for the car. This is more than the actual price because it also includes the finance charge. In this particular case,

$$\text{total installment price} = \text{price} + \text{finance charge} = \$12,000 + \$2520 = \$14,520$$

We can also compute the total installment price by following our payments:

$$\text{total installment price} = \text{downpayment} + \text{all monthly payments} = \$1,500 + 36 \cdot \$361.67 \approx \$14,520.12$$

The discrepancy between the two amounts is the result of rounding 361.666666... up to 361.67

Example 2. We want to purchase a used car for \$9,000. The dealership offers us financing for four years, with a 7% interest rate, with a down payment of \$1000. Find the amount financed, the finance charge, the monthly payment, and the total installment price.

Solution: The amount financed is what we owe as we drive the car home:

$$\text{Amount Financed} = \text{Price} - \text{Down Payment} = \$9000 - \$1000 = \$8000$$

The finance charge is computed as simple interest:

$$\begin{aligned}\text{Finance Charge} &= \text{Amount Financed} \cdot r \cdot t \\ &= \$8000 \cdot 0.07 \cdot 4 = \$2240\end{aligned}$$

and so we owe the dealership the amount financed and the finance charge. This will need to be paid off in 48 equal payments:

$$\text{Monthly Payment} = \frac{\text{amount financed} + \text{finance charge}}{48} = \frac{\$8000 + \$2240}{48} = \frac{\$10,240}{48} \approx \$213.33$$

Finally, the total installment price is the sum of all payments:

$$\text{total installment price} = \text{price} + \text{finance charge} = \$9000 + \$2240 = \$11,240$$

Example 3. A couple buys \$14,200 worth of furniture. The downpayment is \$2800. They financed the remaining balance. If the couple will pay 36 monthly payments of \$392.67, what interest rate was used?

Solution: Given the price and the down payment, the amount financed is $\$14,200 - \$2800 = \$11,400$. The monthly payments add up to

$$\text{monthly payments} = 36 \cdot \$392.67 = \$14,136.12$$

The finance charge is how much more these payments add up to than the amount financed. $\frac{2736.12}{34200} = 8.00035087719298 \times 10^{-2}$

$$\text{finance charge} = \$14,136.12 - \$11,400 = \$2736.12$$

The amount financed was \$11,400, we borrowed it for three years, with an annual simple interest rate of r .

$$\begin{aligned}\$2736.12 &= \$11,400 \cdot r \cdot 3 \\ \$2736.12 &= \$34,200r && \text{divide by } \$34,200 \\ \frac{\$2736.12}{\$34,200} &= r \\ r &= 0.080035 = 8.0035\%\end{aligned}$$

Therefore the dealership used an annual percentage rate (APR) of 8%.

Notice that if we use a monthly payment of \$392.666666..., then the finance charge is exactly 2736 and then *we* get exactly 0.08 for r . The discrepancy is coming from rounding 0.66666666 to 0.67.



Practice Problems

1. A couple buys \$12,900 worth of furniture. The downpayment is \$2,100. They financed the remaining balance for 6 years at 11% simple interest per year (use annual compounding). Find the amount financed, the finance charge, total installment price and monthly payment.
2. A couple buys \$7,600 worth of furniture. The downpayment is \$1,200. They financed the remaining balance for 3 years at 5% simple interest per year (use annual compounding). Find the amount financed, the finance charge, total installment price and monthly payment.
3. We plan to buy a computer for \$5,200. The downpayment is \$600. The store offers financing for 36 monthly payments of \$171.68. What interest rate was used?
4. We plan to buy a used car for \$7,200. The downpayment is \$900. The dealership offers financing for 60 monthly payments of \$141.75. What interest rate was used?
5. The finance charge can be computed using an APR table. The one shown below tells us the finance charge for each \$100 borrowed. Suppose we buy \$9,500 worth of furniture. The downpayment is \$1,700. They financed the remaining balance for 2 years at 9% simple interest per year. Compute the monthly payment using the APR table.

Table 5 Annual Percentage Rate (APR) for Monthly Payment Loans

Number of Monthly Payments (<i>n</i>)	Annual Percentage Rate (APR)										
	8.0%	8.5%	9.0%	9.5%	10.0%	10.5%	11.0%	11.5%	12.0%	12.5%	13.0%
	(Finance charge per \$100 of amount financed) (<i>h</i>)										
6	\$2.35	\$2.49	\$2.64	\$2.79	\$2.94	\$3.08	\$3.23	\$3.38	\$3.53	\$3.68	\$3.83
12	4.39	4.66	4.94	5.22	5.50	5.78	6.06	6.34	6.62	6.90	7.18
18	6.45	6.86	7.28	7.69	8.10	8.52	8.93	9.35	9.77	10.19	10.61
24	8.55	9.09	9.64	10.19	10.75	11.30	11.86	12.42	12.98	13.54	14.10
30	10.66	11.35	12.04	12.74	13.43	14.13	14.83	15.54	16.24	16.95	17.66
36	12.81	13.64	14.48	15.32	16.16	17.01	17.86	18.71	19.57	20.43	21.30
48	17.18	18.31	19.45	20.59	21.74	22.90	24.06	25.23	26.40	27.58	28.77
60	21.66	23.10	24.55	26.01	27.48	28.96	30.45	31.96	33.47	34.99	36.52



Answers

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|-----------------------------------|----------------------------------|----------|-------|-------------|
| 1. Amount Financed: \$10,800 | 2. Amount Financed: \$6,400 | 3. 10.5% | 4. 7% | 5. \$356.33 |
| Finance Charge: \$7128 | Finance Charge: \$960 | | | |
| Total Installment Price: \$20,028 | Total Installment Price: \$8,560 | | | |
| Monthly Payment: \$249 | Monthly Payment: \$204.44 | | | |

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