

PRESENT VALUE OF AN ANNUITY

When buying a car, your budget determines what size monthly payment you can afford. If you can afford \$200 a month for 4 years, this does not mean that you are able to afford a \$9,600 (\$200 × 48 payments) car because you have not considered the interest that you would also owe on the loan.



When using the following formula, we will want to find P , the amount of principal that you can afford to borrow:

$$P \left(1 + \frac{r}{n} \right)^{nt} = R \cdot \left[\left(1 + \frac{r}{n} \right)^{nt} - 1 \right] \div \left(\frac{r}{n} \right) \quad \underline{\text{FORMULA FOR } P, \text{ THE PRINCIPAL YOU CAN BORROW}}$$

EXAMPLE If you can afford to spend \$200 each month on car payments and the bank offers you a 4 year car loan with an annual interest rate of 12%, what is the price you can afford to spend on a car?

$$P = \underline{?}$$

$$R = \underline{\hspace{2cm}}$$

$$r = \underline{\hspace{2cm}}$$

$$n = \underline{\hspace{2cm}}$$

$$t = \underline{\hspace{2cm}}$$

REFINANCING OR UNPAID BALANCE

Sometimes you may want to sell your home BEFORE the term of the loan has expired (you need to move or get a bigger or smaller home). You will need to pay the lender the remaining unpaid balance on the loan. You could create an amortization schedule for the time period that you have lived in the house, but that might be *years!!*

Instead, consider this: the amount that you still owe the lender is:

TOTAL AMOUNT YOU OWE OVER THE *ELAPSED TIME* minus THE TOTAL AMOUNT PAID THUS FAR OVER THE *ELAPSED TIME*

EXAMPLE Assume that you take out a 30 year mortgage for \$100,000 at an annual interest rate of 9%.

$$P \left(1 + \frac{r}{n} \right)^{nt} = R \cdot \left[\left(1 + \frac{r}{n} \right)^{nt} - 1 \right] \div \left(\frac{r}{n} \right) \qquad \text{Unpaid Balance} = P \left(1 + \frac{r}{n} \right)^{nt} - R \cdot \left[\left(1 + \frac{r}{n} \right)^{nt} - 1 \right] \div \left(\frac{r}{n} \right)$$

<p>P = _____</p> <p>R = _____</p> <p>r = _____</p> <p>n = _____</p> <p>t = _____ (total time)</p> <p>† = _____ (elapsed time thus far)</p>
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a. What is your monthly mortgage payment?

b. After 10 years, interest rates drop and you want to refinance. How much remains to be paid on your mortgage?

c. If you can refinance your mortgage for the remaining 20 years at an annual interest rate of 7.2%, what will your monthly payment be?

d. How much will you save in interest in 20 years by paying the lower rate?

EXAMPLE You have taken an amortized loan at 8.5% for 5 years of monthly payments to pay off your new car, which cost \$12,000. After 3 years, you decide to payoff the loan. Find the unpaid balance of the loan.

$$P\left(1 + \frac{r}{n}\right)^{nt} = R \cdot \left[\left(1 + \frac{r}{n}\right)^{nt} - 1\right] \div \left(\frac{r}{n}\right)$$

$$\text{Unpaid Balance} = P\left(1 + \frac{r}{n}\right)^{nt} - R \cdot \left[\left(1 + \frac{r}{n}\right)^{nt} - 1\right] \div \left(\frac{r}{n}\right)$$

P = _____
R = _____
r = _____
n = _____
t = _____ (total time)
t = _____ (elapsed time thus far)