

Car Loan

The yearly interest is derived from the principal and is constant throughout the entire loan, independent of the balance or net value of the loan. (Note: The derivation below assumes that the interest rates are in their original multiplicative forms, not in percentages.)

Let

P = Principal

n = Duration in years

i = Annual interest rate

I₁ = Initial yearly interest = Pi

M = Monthly payment

T = Net value or total

$$\sum_{k=1}^n I_k = \text{Cumulative annual interest}$$
$$= I_1 + I_2 + I_3 \cdots I_n$$

Since $I_1 = I_2 = I_3 = \cdots = I_n$,

$$\sum_{k=1}^n I_k = I_1 + I_1 + I_1 \cdots I_1$$
$$= nI_1$$
$$= n(Pi)$$

$$T = P + \sum_{k=1}^n I_k$$
$$= P + nPi$$
$$= P(1 + ni)$$

The constant monthly payment is obtained by dividing the net total by the duration in months:

$$M = \frac{T}{12n}$$
$$= \frac{P(1 + ni)}{12n}$$

From the same final equation, the annual interest rate, *i*, and the duration, *n*, can be calculated:

$$i = \frac{\frac{12nM}{P} - 1}{n}$$
$$n = \frac{P}{12M - Pi}$$