Payout Annuity Formula

$$P_0 = \frac{d(1-(1 + r/k)^{-Nk})}{(r/k)}$$

P_0 is the balance in the account at the beginning (starting amount, or _____).
d is the _____ (the amount you deposit each year, each month, etc.)
r is the annual interest rate in decimal form.
k is the _____ in one year.

When do you use this?

Payout annuities assume that you take money from the account on a _____(every month, year, quarter, etc.) and let the rest sit there earning interest.

Compound interest: _____
Annuity: _____
Payout Annuity: _____v

Example

After retiring, you plan to withdraw $1,500 every month for 25 years from your retirement account. The account earns 5% interest annually, compounded monthly. How much money will you need in your account when you retire?

d=1500: the monthly withdrawal
r=0.05: 5% annual interest rate
k=12: compounding occurs monthly
N=25: withdrawals are made for 25 years

$$P_0 = \frac{d(1-(1 + r/k)^{-Nk})}{(r/k)}$$

$$P_0 = \frac{1500(1-(1 + 0.05/12)^{-25 \cdot 12})}{(0.05/12)} = 279{,}495$$

Question

You plan to withdraw $2,000 every month for 15 years from your retirement account. The account earns 4% interest annually, compounded monthly. How much money will you need in your account when you retire?

Question

You want to withdraw $30,000 each year for 20 years. Your account earns 8% annual interest.

a) How much do you need in your account at the beginning?

Question

b) How much total money will you withdraw over the 20 years?

Question

c) How much of the withdrawn amount will come from interest?

Example

You know you will have $750,000 in your account when you retire. You want to take monthly withdrawals for a total of 25 years. Your retirement account earns 6% annual interest. How much will you be able to withdraw each month?

r=0.06: 6% annual interest rate
k=12: compounding monthly
N=25: withdrawals for 25 years
P_0 =750,000: starting balance

$$P_0 = \frac{d(1-(1 + r/k)^{-Nk})}{(r/k)}$$

$$d= \frac{P_N (r/k)}{(1-(1 + r/k)^{-Nk})} = \frac{(\quad / \quad)}{(1-(1 + \quad / \quad)^{-\ \cdot\ })} =4827.84$$

Question

You know you will have $400,000 in your account when you retire. You want to take monthly withdrawals for a total of 20 years. Your retirement account earns 7% annual interest. How much will you be able to withdraw each month?

Question

A donor contributes $250,000 to a hospital, with instructions that it should fund annual grants for the next 25 years. If the hospital can earn 5% annual interest, how much can they allocate for grants each year?

_____ Formula

$$P_0 = \frac{d(1-(1 + r/k)^{-Nk})}{(r/k)}$$

P_0 is the balance in the account at the _____(starting amount, or principal).

d is the loan payment (the amount you pay each year, each month, etc.)

r is the _____in decimal form.

k is the number of compounding periods in one year.

N is the length of the loan in years.

When do you use this?

The loan formula assumes that you make loan payments on a regular schedule (every month, year, quarter, etc.) and are paying interest on the loan.

Compound interest: _____
Annuity: _____
Payout Annuity: _____
Loans: _____

Example

You can afford $300 per month as a car payment. If you can get an auto loan at 4% interest for 72 months (6 years), how expensive of a car can you afford? In other words, what loan amount can you pay off with $300 per month?

d=300: the monthly loan payment
r=0.04: 4% annual interest rate
k=12: monthly compounding
N=6: payments for 6 years (72 months)

$$P_0 = \frac{d(1-(1 + r/k)^{-Nk})}{(r/k)}$$

$$P_0 = \frac{\_\_\_\_(1-(1 + \_\_\_/\_\_)^{-6 \cdot 12})}{(0.04/\_\_)} = 19{,}098$$

Question

You can afford $250 per month as a car payment. If you secure an auto loan at 5% interest for 48 months (4 years), how expensive of a car can you afford? In other words, what loan amount can you pay off with $250 per month?

Question

You want to take out a $200,000 mortgage (home loan). The interest rate on the loan is 4%, and the loan is for 15 years. How much will your monthly payments be?