

## Mortgage Loan

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Captions:

You know, we take out these **loans to buy houses**. Let's say you take out a **\$200,000 mortgage loan**.

...

And let's say you're **paying 6% interest**.

## Mortgage Loan

\$200K Loan

30 years (360 months)

6% interest (0.5% / month)

\$1200 / month

$$((200K(1.005) - (1200)1.005 - (1200)) \dots = 0$$

Captions:

And at the end, it's all going to be equal to 0. Because after you've **paid your final payment**, you're done **paying off the house**.

$$L = P \left( \frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \dots + \frac{1}{(1+i)^n} \right)$$

geometric series =  $\sum_{j=1}^n \frac{1}{(1+i)^j}$

Captions:

It's equal to **the sum of 1 over 1 plus i** to the, well I'll use some other letter here, **to the j from j is equal to 1**. This is to the one power you could view this is to the **first power to j is equal to n**.

$$L = P \left( \frac{1}{(1+i)} + \frac{1}{(1+i)^2} + \dots + \frac{1}{(1+i)^n} \right)$$

geometric series =  $\sum_{j=1}^n \frac{1}{(1+i)^j} = S$

$$r = \frac{1}{1+i}$$

$$S = r^1 + r^2 + r^3 + \dots + r^{n-1} + r^n$$

$$rS = r^2 + r^3 + \dots + r^n + r^{n+1}$$

$$S - rS = r^1 - r^{n+1}$$

$$S(1-r) = r^1 - r^{n+1}$$

$$S = \frac{r - r^{n+1}}{1-r}$$

Captions:

Your **sum is equal to r minus r to the n plus 1 over 1 minus r**. That's what our sum is equal to, where we defined our r in this way. So now we can rewrite this **whole crazy formula**.

