Amortization: An "installment loan" is a loan that is repaid by making all payments equal.

The bank is basically investing a lump sum of dollars and getting a periodic return which is exactly like PV of an ordinary annuity.

\[ R = S \left( \frac{r}{1 - (1 + r)^{-N}} \right) \]

Amortization Formula

S = loan amount \quad R = payment amount

Ex 1: When you graduate college, you buy a new car and can afford a monthly payment of $250/month. If you get a special rate of 3.6% interest, compounded monthly, for 6 years, how much can you afford to borrow?
Ex 2: Alex buys a house for $200,000. They put $15,000 down and get a loan for the rest at 5.4% interest compounded monthly for 20 years. What will their payments be?

Amortization Schedule
A loan of $10,000 with interest rate of 10% could be repaid in 5 equal annual payments.

\[
R = \frac{p}{1-(1+r)^{-N}}
\]

<table>
<thead>
<tr>
<th>payment</th>
<th>interest</th>
<th>principal</th>
<th>unpaid balance</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2637.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>2</td>
<td>2637.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>2637.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>2637.97</td>
<td></td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>2637.97</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Ex 3: A company that buys a piece of equipment by borrowing $250,000 for 10 years at 6% compounded monthly has monthly payments of $2,775.51.

a) Find the unpaid balance after 1 year.

b) During that first year, how much interest does the company pay?

Loan Payoff Amount

\[
S_{N-k} = R \left[ \frac{1-(1+r)^{-(N-k)}}{r} \right]
\]

\[
k = \text{number of payments that have been made.}
\]

\[
N = nt = \text{total number of payments that were originally due.}
\]

\[
N-k = \text{number of payments "missing" from the loan.}
\]