Ex: Can you buy a house? San Diego:

- $750,000 loan
- 30 years (360 months)
- 6% interest/year (actually .5%/month) as a decimal

Divided into 360 monthly payments of $m each.

- Find m

- How much do you pay total over 30 years?

Tip: Take a guess - write it down!

Write $P = 750,000$ ("principal")
Amount owed initially = \( P \)

P grows to \((1.005)P\) in 1 mo

Pay off this much at the end of the month

Amount owed after 1 month = \((1.005)P - m\)

Amount owed after 2 months = \((1.005)^2P - (1.005)m - m\)

Amount owed after 3 months = \((1.005)^3P - (1.005)^2m - (1.005)m - m\)

\[ \vdots \]

Amount owed after \( n \) months = \((1.005)^nP - \frac{(1.005)^n - 1}{1 - (1.005)} m \)

\[ = (1.005)^nP - \sum_{k=0}^{n-1} (1.005)^k m \]

Recall

\[ S_n = \frac{a(1-r^{n+1})}{1-r} \]

partial sum \( S_{n-1} \)
of geom series

with \( r = 1.005 \)

\( a = m \)
\[
= (1.005)^n P - \frac{a(1-r^n)}{1-r} \\
= (1.005)^n P - \frac{m(1-(1.005)^n)}{1-1.005}
\]

Amount owed = 0 after 30 y (360 mo) 
(It's a 30-year mortgage)

\[
0 = (1.005)^{360} P - \frac{m(1-(1.005)^{360})}{1-1.005}
\]

Solve for \( m \):

\[
m = \frac{1-1.005}{1-(1.005)^{360}} (1.005)^{360} P
\]

\[\approx \$4,497\]

Total amount paid for mortgage 
\[\approx \$4,500/\text{mo} \times 360 \text{ mo} \]
\[= \$1,619,000\] 
(more than double the principal!)