Consider the fixed rate mortgage of M dollars, for T months, with yearly interest $p\,\%$. We want to calculate the monthly payment x (in dollars); without the escrow. Denote the debt after t months by $d(t)$. Then,

$$d(0) = M, \qquad d(T) = 0.$$

Each month we pay x dollars, which are divided between the interest and principal. The interest is $\frac{p}{12}\,\%$ of the current debt $d(t)$, that is, $d(t)\frac{p}{1200}$ dollars. The rest is the principal, so next month the debt is

$$d(t+1) = d(t) - \left(x - \frac{d(t)p}{1200}\right) = d(t)\left(1 + \frac{p}{1200}\right) - x.$$

This means that we iterate the map f, given by

$$f(y) = \left(1 + \frac{p}{1200}\right) y - x.$$

To find the formula for the n-th iterate of f, we find the fixed point y_0 of f by solving the equation

$$y_0 = \left(1 + \frac{p}{1200}\right) y_0 - x.$$

The solution is $y_0 = 1200x/p$. Thus, we write our map in the new coordinate $z = y - y_0$ as

$$g(z) = \left(1 + \frac{p}{1200}\right) z,$$

so

$$g^n(z) = \left(1 + \frac{p}{1200}\right)^n z.$$

Going back to the old coordinate, we get

$$f^n(y) = \left(1 + \frac{p}{1200}\right)^n (y - y_0) + y_0 = \left(1 + \frac{p}{1200}\right)^n \left(y - \frac{1200x}{p}\right) + \frac{1200x}{p}.$$

Hence,

$$\left(1 + \frac{p}{1200}\right)^T \left(M - \frac{1200x}{p}\right) + \frac{1200x}{p} = 0.$$

Solving it we get

$$\left(1 + \frac{p}{1200}\right)^T M = \frac{1200x}{p}\left(\left(1 + \frac{p}{1200}\right)^T - 1\right),$$

so we get the formula for x:

$$x = \frac{\left(1 + \frac{p}{1200}\right)^T}{\left(1 + \frac{p}{1200}\right)^T - 1} \cdot \frac{p}{1200} \cdot M.$$