Problem 3: Prove and interpret musically the equation

\[ 1 + r + r^2 + \cdots + r^m + r^{m+1} = \frac{1 - r^{m+1}}{1 - r} \]

Solution:

\[ 1 - r^{m+1} = 1 + r - r + r^2 - r^2 + \cdots + r^m - r^m + r^{m+1} = \]
\[ = 1(1+r+r^2+\cdots+r^m+r^{m+1}) - r(1+r+r^2+\cdots+r^m+r^{m+1}) = (1-r)(1+r+r^2+\cdots+r^m+r^{m+1}) \]
\[ \Rightarrow 1 + r + r^2 + \cdots + r^m + r^{m+1} = \frac{1 - r^{m+1}}{1 - r} \]

Setting \( r = \frac{1}{2} \) gives the formula for the duration of a dotted note.

Problems 9 and 10: Find the form of the refrain of Someone to Watch Over Me. Also identify examples of rhythmic/melodic translation, as well as diatonic/chromatic transposition.

Solution:

The form is standard American song form, AABA. Measures 2-4 are examples of both rhythmic translation and diatonic transposition. Measures 18 and 19 exhibit melodic translation.