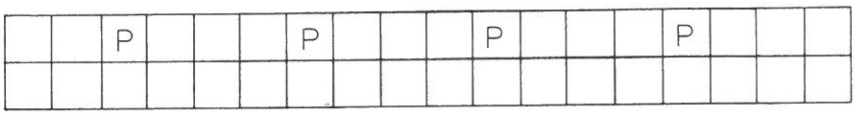
MONT 106Q – Mathematical Thinking
Problem Set 4 – Symmetric Strip Patterns
November 8, 2016

Background

To practice with our ideas about the mathematical description of symmetric strip patterns, let's look at the following questions.

Questions

I. The figure below shows a strip pattern of the type $p111$ (with only translation symmetries). For each of the six other types, complete this pattern to a pattern of that type by adding as little as possible and identify them by name (see the PowerPoint slides or Ascher's book for the "official" names). Show at least 4 basic units of the pattern in all cases.



II. Name the type of the strip patterns for each of the examples on the back of this sheet. (These are taken from a book called *Japanese Border Designs* by Theodore Menten.)

III. Using coordinate equations for transformations.

A) If $T(x, y) = (x + a, y)$ is a translation in $Symm(S)$ for a strip pattern S then show or explain why $T^{-1}(x, y) = (x - a, y)$
B) If $R(x, y) = (-x, -y)$, the 180 degree rotation about $(0, 0)$ is also in $Symm(S)$, then the composition TRT^{-1} must also be in $Symm(S)$. Compute the coordinate equations of $TRT^{-1}(x, y)$ and identify this mapping. (Is it another translation, a rotation, a reflection, or a glide reflection?)