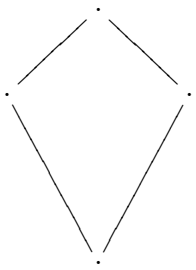
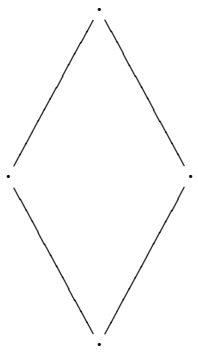
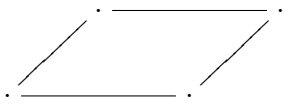
Math 331 **Exam 2** **Spring '06**

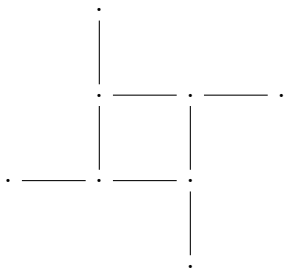
1. The following are rosette patterns. On each one, indicate the following with colored ink:
   - all lines of symmetry;
   - the shortest rotation preserving the pattern. Write the angle of rotation beside the arrow.

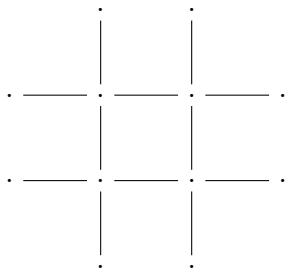
   Below the figure, write the group that preserves the pattern.





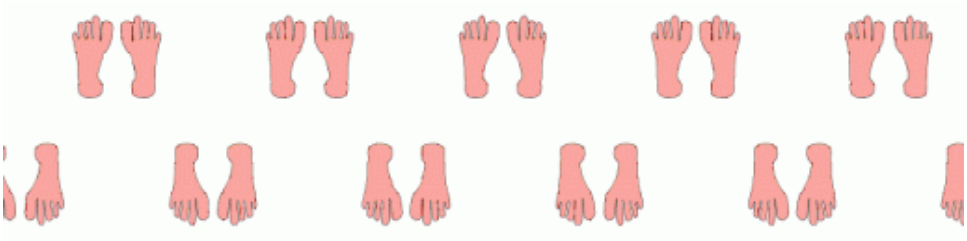






2. The following are frieze patterns. On each one, indicate the following with colored ink:
   - The shortest translation, τ, that preserves the pattern.
   - All points of symmetry (i.e., all points P for which $\rho_{P,\pi}$ is in the frieze group, $\mathcal{F}$).
   - All vertical lines of symmetry (i.e., all vertical lines n such that $\sigma_n \in \mathcal{F}$).

(a)



(i) Is there a horizontal line of symmetry?
(ii) Is there a glide reflection?
(iii) Is there a glide reflection whose square is τ?
(iv) Which of the seven listed groups is $\mathcal{F}$?

(b)

(i) Is there a horizontal line of symmetry?
(ii) Is there a glide reflection?
(iii) Is there a glide reflection whose square is τ?
(iv) Which of the seven listed groups is $\mathcal{F}$?

(c)

(i) Is there a horizontal line of symmetry?
(ii) Is there a glide reflection?
(iii) Is there a glide reflection whose square is τ?
(iv) Which of the seven listed groups is $\mathcal{F}$?