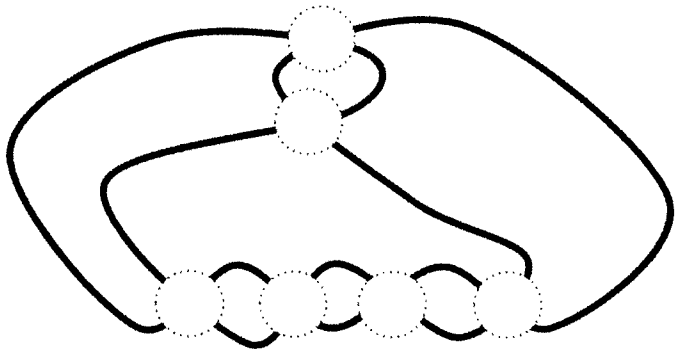
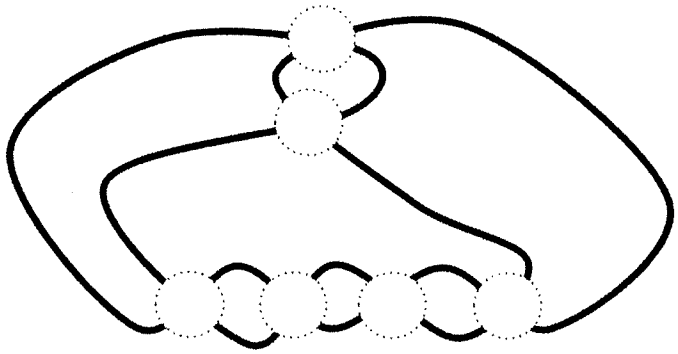
The Knotting-Unknotting Game

Find a partner and decide who will be *Knot* and who will be *Unknot*. Then play the following games.

1. In this game, *Knot* plays first on the following game board. Who wins?



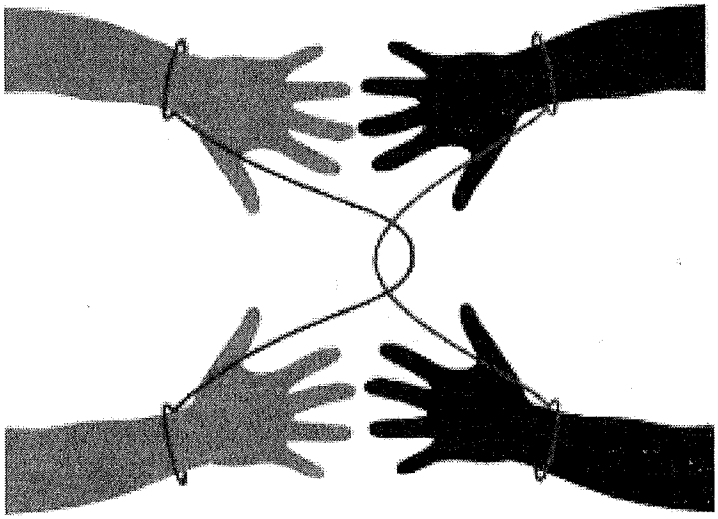
2. In this game, *Unknot* plays first on the following game board. Who wins?



3. Draw your own game board and decide who will play first. Then, play your game!

4. This is a puzzle for you and a partner. Each of you needs one string. Take your string and tie one end (not too tightly!) to each of your wrists. Your partner will do the same so that you're linked together, as shown.

   Can you and your partner get unlinked without untying or removing the wrist loops?



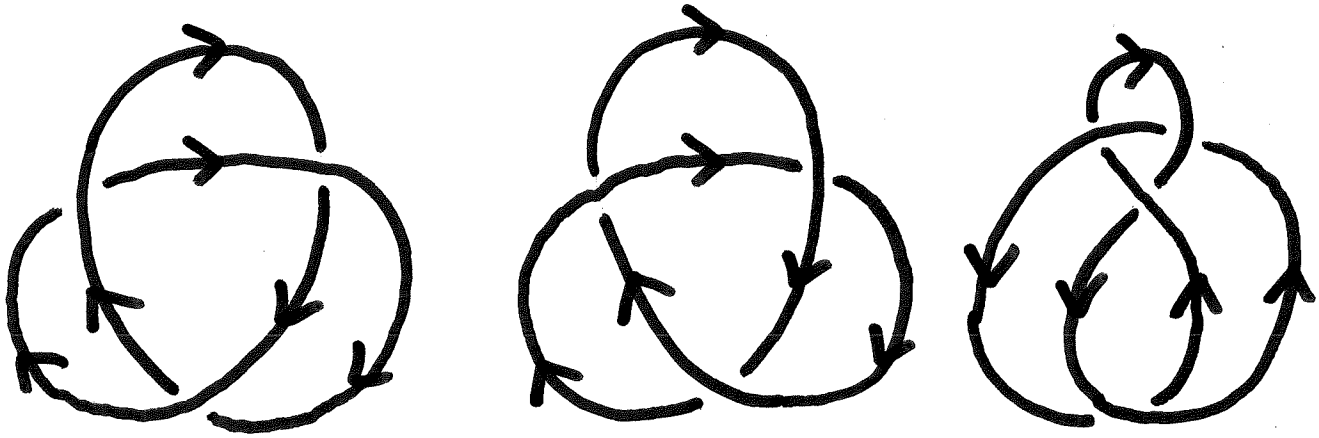
5. Cut out the four quarter-circles on page 3. Can you assemble them into a circle so that the resulting knot diagram is equivalent to an unknot?

6. Cut out the three strips on page 5. Can you assemble them end-to-end in a loop so that the resulting knot diagram is equivalent to the unknot? Note: each strip is two-sided! When you flip one over, you'll see the same string from the opposite direction – so the parts crossing "over" and "under" will be reversed.

7. Cut out the three strips on page 7. As in problem 6, can you assemble them end-to-end in a loop so that the resulting knot diagram is equivalent to the unknot?

8. An *oriented knot* is a knot with tiny arrows drawn on the string, pointing in one direction all the way around. An oriented knot is *invertible* if you can transform it so it looks just like the original, but with the arrows reversed.

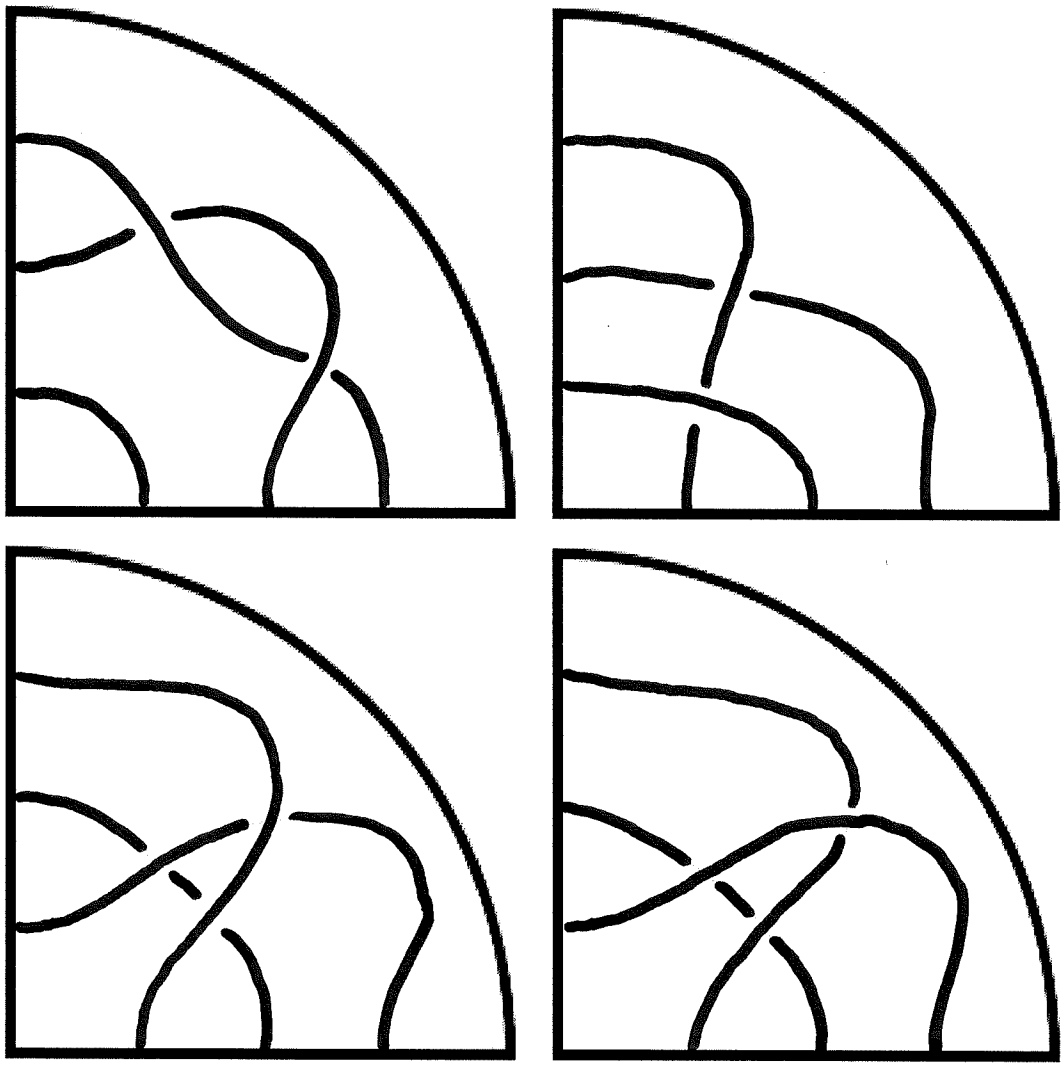
   Which of the following knots are invertible?



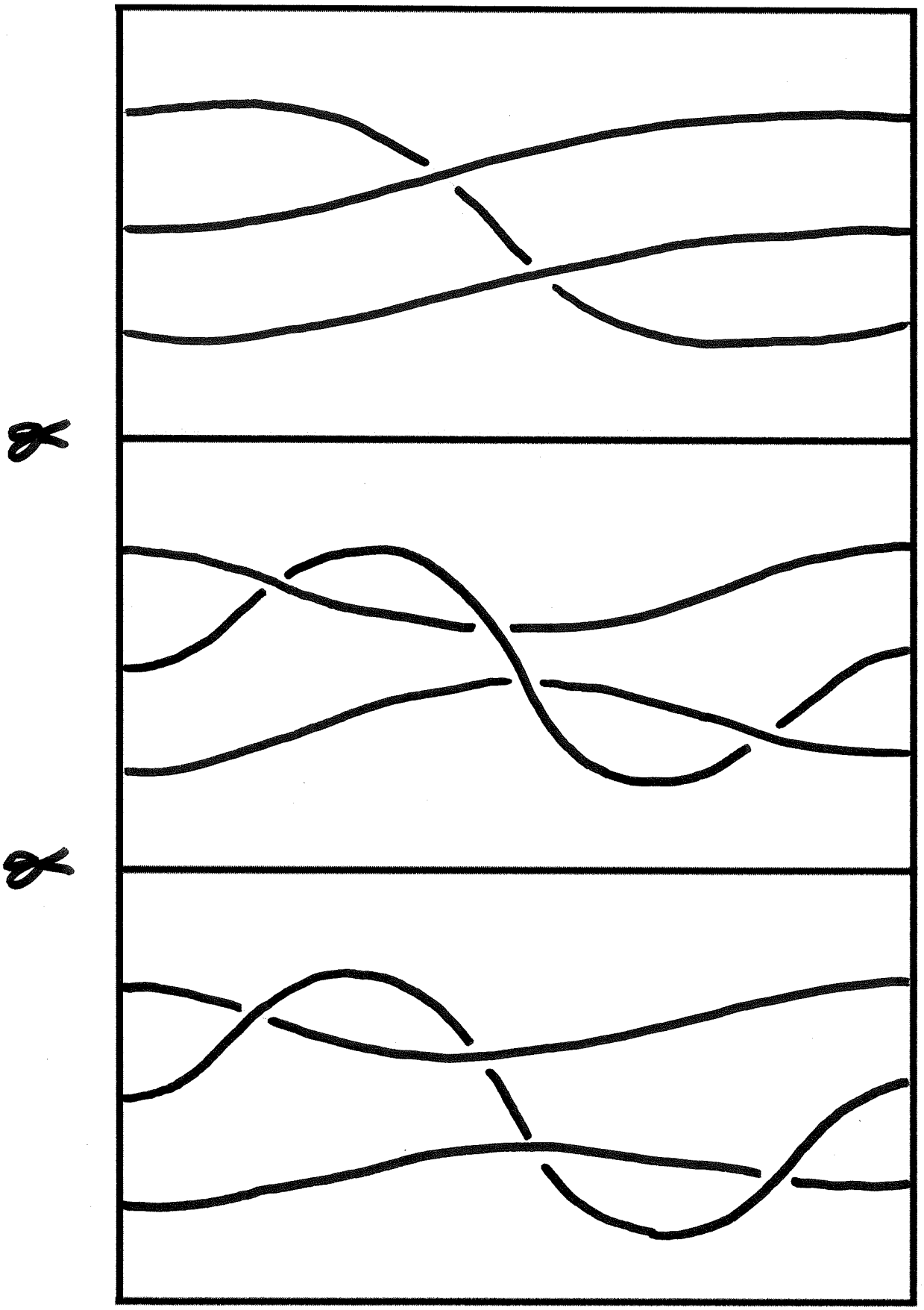
9. Can you find a non-invertible knot different from the ones in problem 8?

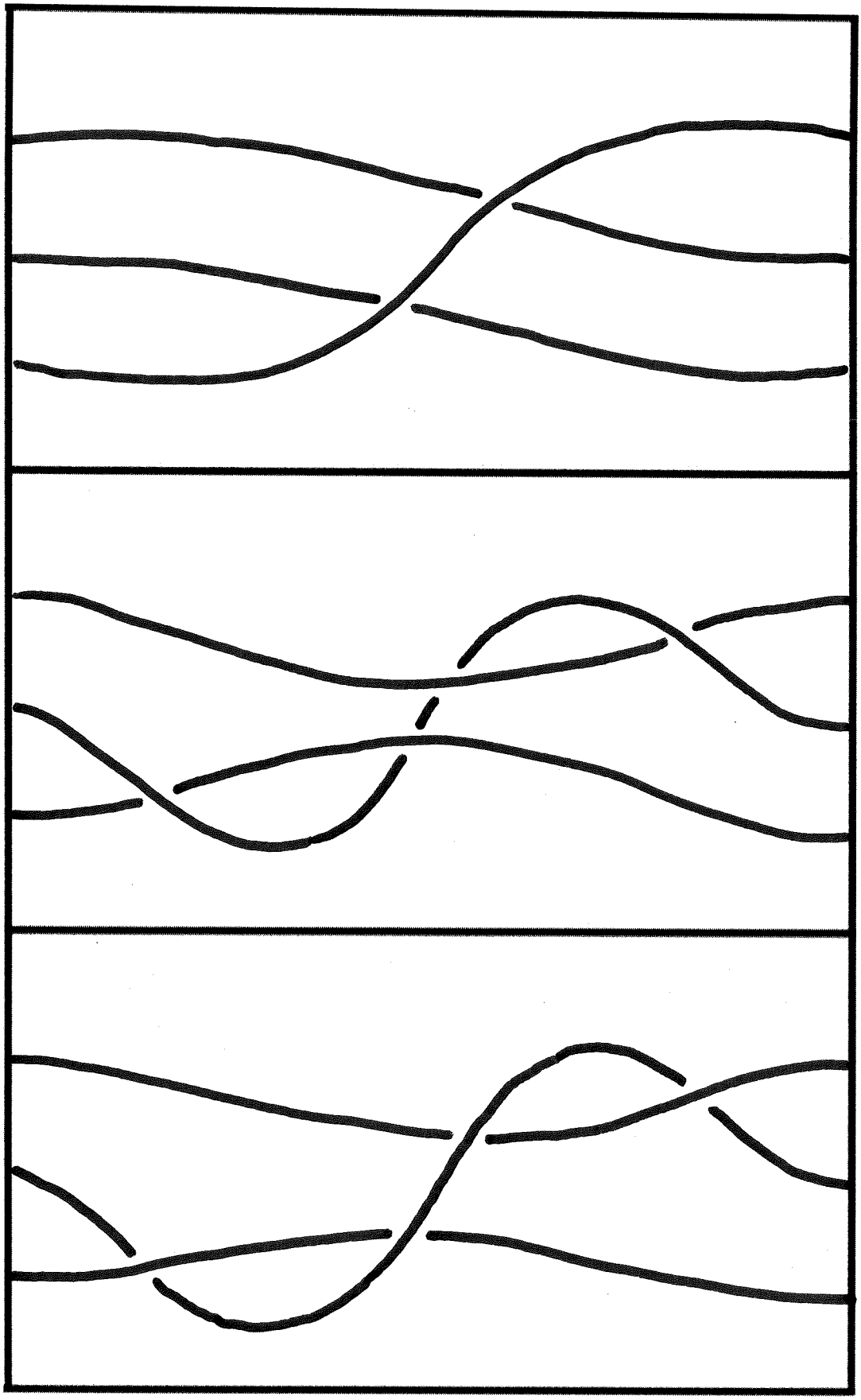
10. Cut out the six squares on page 9. Can you assemble them into a cube so that the resulting knot diagram is equivalent to the unknot? Note: this is an oriented knot, so the arrows have to point the same direction all the way around the string!

(problem 5)

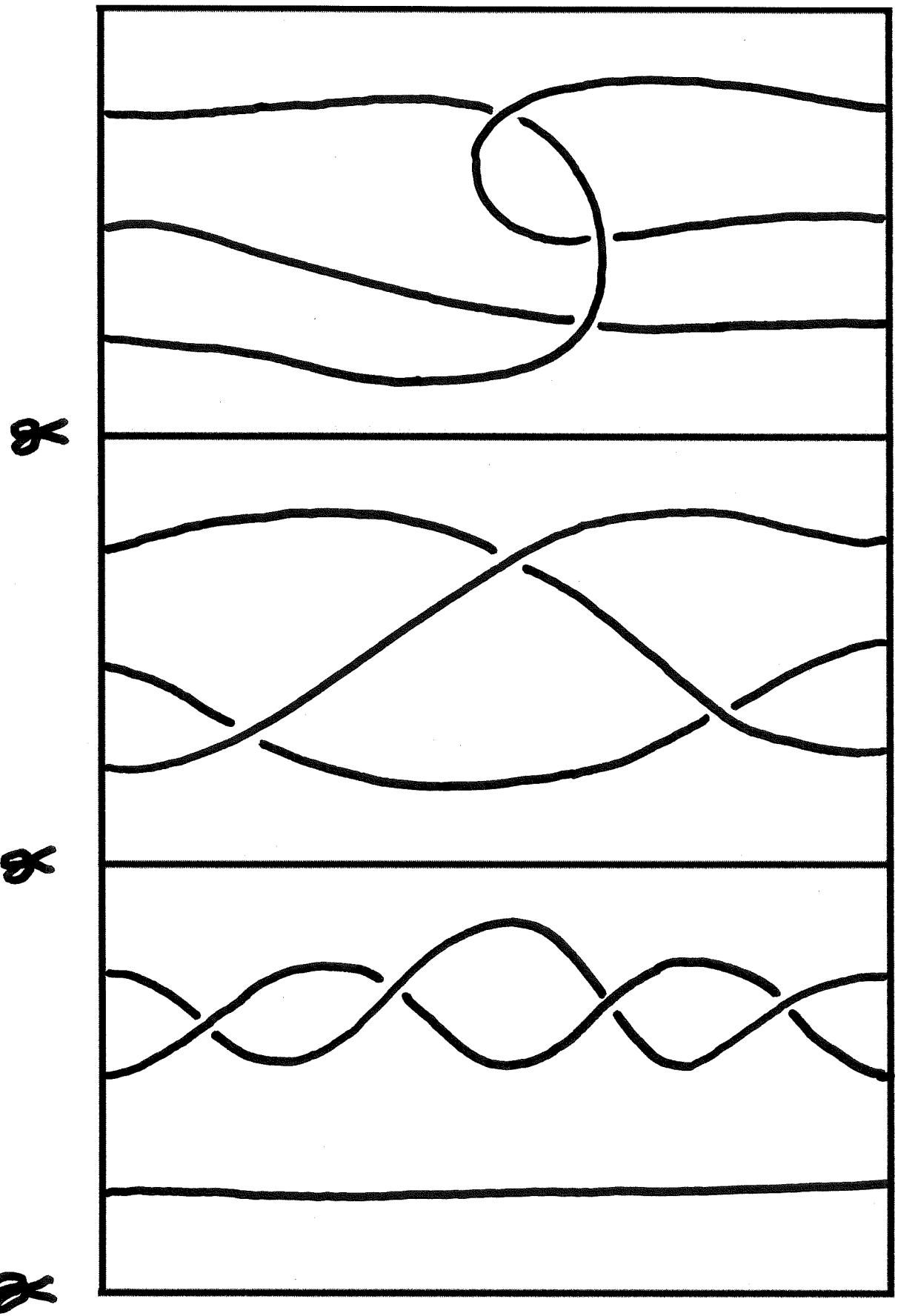


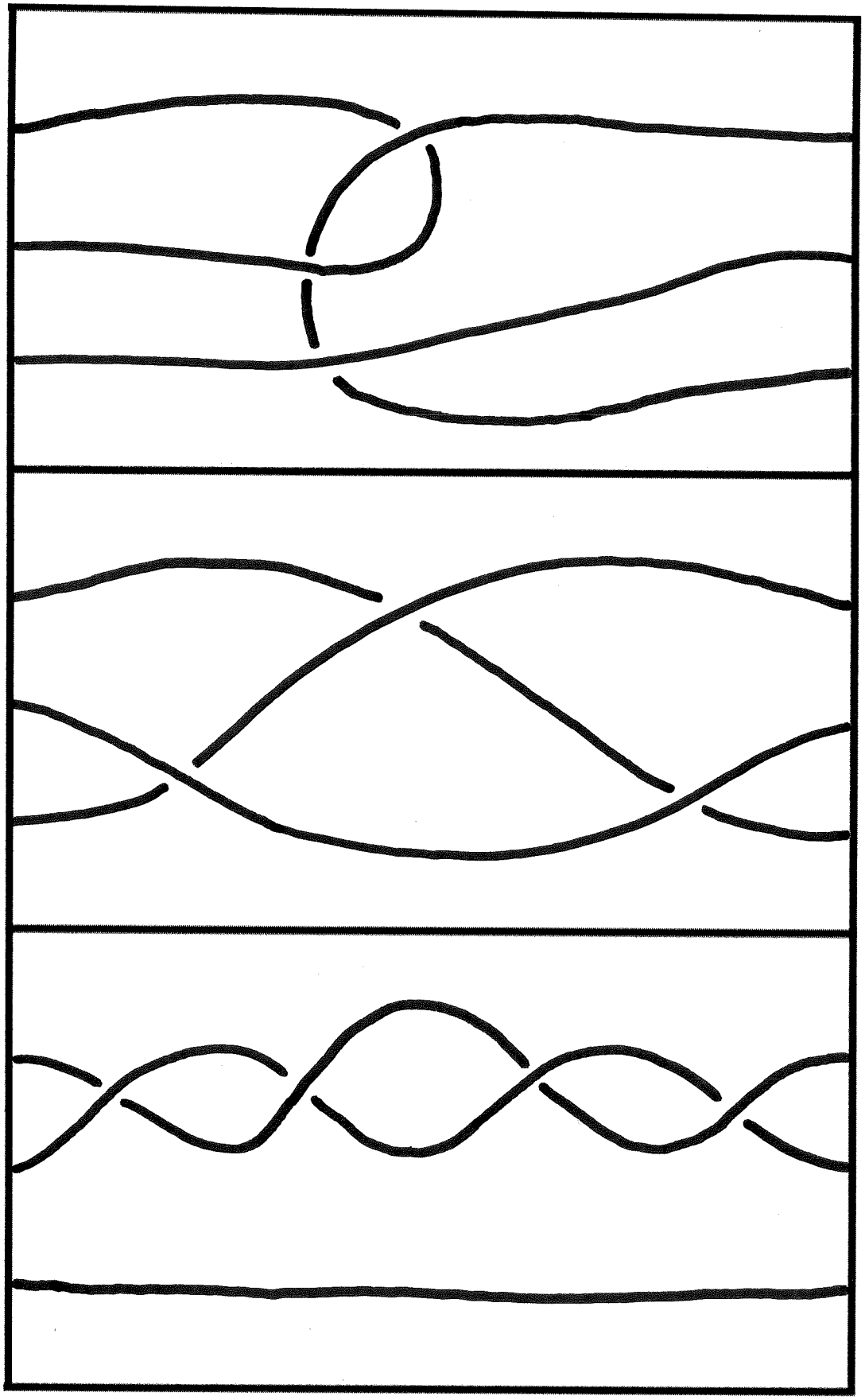
(problem 6)





(problem 7)





(problem 10)