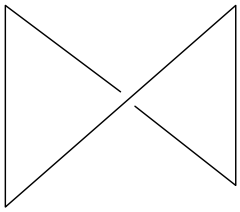
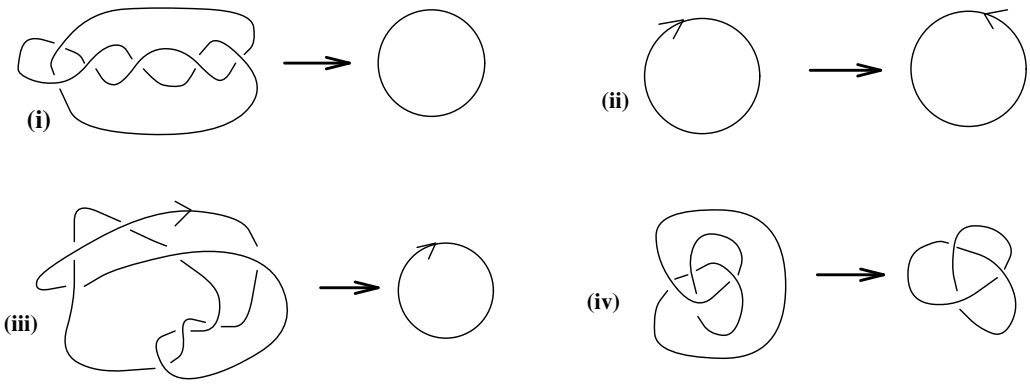
1. **(i)** Two unknots K_1 and K_2 are in the form of triangles in $\mathbf{R}^3$ having the same orthogonal projection on to $\mathbf{R}^2$. Show that K_1 and K_2 are equivalent by Δ and Δ^{-1} moves.

   (ii) Repeat for the case where K_1 and K_2 are quadrilaterals in $\mathbf{R}^3$ with the same projection in $\mathbf{R}^2$ having one crossing point.

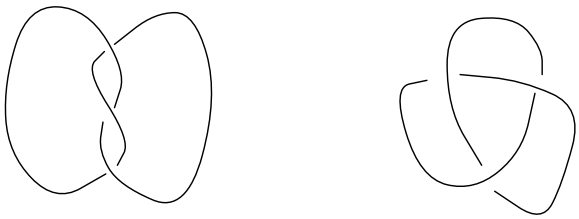


2. For each of the following pairs of knot diagrams, find a sequence of Reidemeister moves which (combined with suitable planar isotopies) will change the first diagram into the second.

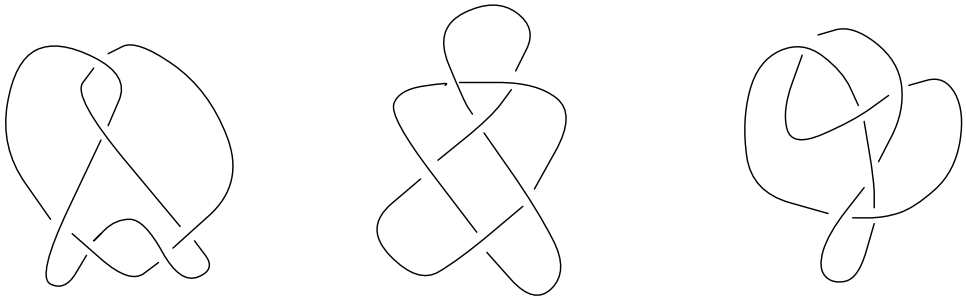


3. By reducing each of them to one of the standard forms on page 21 of your notes, show that the knot universes

   are not regularly isotopic. Deduce that the trefoil knots below cannot be interchanged by using Reidemeister moves II and III alone.



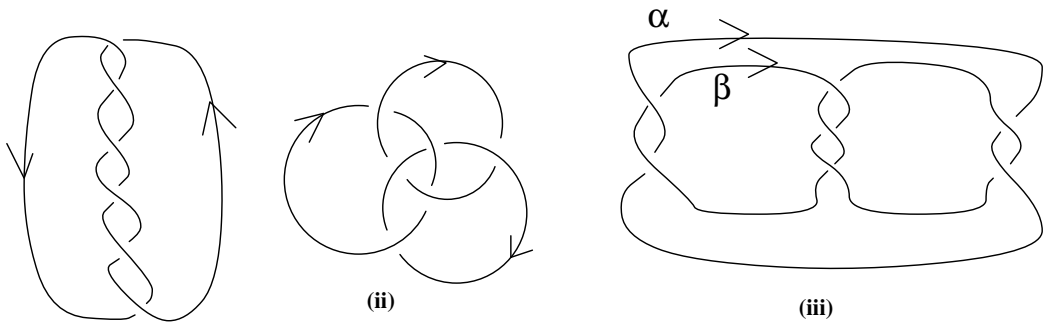
4. For each of the following knot diagrams, decide whether the knot is 3-colourable or not.



5. **(i)** Show that the property of colourability mod n is a knot or link invariant, for any $n \geq 3$.

   (ii) Show that the figure eight knot can be coloured mod 5, and deduce that the figure eight knot is not equivalent to the unknot.

6. **(i)** Mark each crossing in the following knot and link diagrams positive or negative.



(i) **(ii)** **(iii)**

   (ii) Calculate the linking numbers for each pair of components of the above links.