**Geometry through folding**

**Please return this exercise individually through My Courses *before* the lecture on Tue 21st of March. All honest attempts are accepted.**

**Parallel to this exercise there is a related group task (video) to be returned by Tue 21st March as well. Reflections about the task will be returned through normal weekly reflections by 28th March. For the material you need some sheets of (roughly) square paper.**

**Step I Individual part**

Goal: Find an equilateral triangle which is maximal in the sense that it has the biggest possible area among all equilateral triangles inside a fixed square. **You can follow the steps given below or discover your own way. Explain in either case, why your method works.**

**1.**

1. Fold a triangle with angles 30 degree, 60 degree and 90 degree from your square.

Hint: The longest edge (hypotenuse) must then be twice as long as one of the sides.

1. Make use of your observation in a) to produce an equilateral triangle with side length equal to your original square.

1. Can you find an equilateral triangle, whose area is bigger than the one above, inside your square?

**2**.

1. If a triangle is maximal, does it mean a restriction to assume that one of its vertices is in a vertex of the square? Why?
2. Assume that one of the vertices of the triangle is at the lower left vertex of the square. Denote by Θ the angle between the bottom edge of the square and the bottom edge of the triangle. Write down the area of the triangle in terms of Θ and find the maximal triangle. Assume the side length of the square is 1.
3. You may also suggest other ways to find a maximal triangle.
4. Find a folding method that produces this triangle.

Follow up question (voluntary):

Find the largest regular hexagon inside a square.

Hint: The previous exercise can be utilized here.

Return your own solution to My Courses by 21st March

**Step II Group part**

Goal: compare different strategies to solve the problem in Step 1 and record your discussion (max 10min).

Instructions for recording the group work:

* Place a smartphone near the table you are working on in such way, that all of you are (at least partly) visible in the picture and your voices can be heard.
* Start recording before your start working on your task.
* Record the whole working process and share the video with your groupmates.
* Upload the video to MyCourses by 21st March.

**Step III Analyzing group work**

After completing the group task, you will be asked to analyze your involvement, actions, and emotions during the task. You can watch the video to recall, how the process went.

Instructions for analyzing your involvement in the group work:

* Watch the video recorded during the group task.
* How did you experience the task?
  + Did you feel for example enthusiasm, enjoyment, satisfaction, frustration, boredom, or anger? Why?
  + Did your emotions change during the group task?
* How do you see your own participation in the group work?
  + Did you present ideas? Why / why not?
  + How did the other members react to your ideas?
  + Did you comment on other group members’ ideas? How?
  + Do you see yourself as one of the more active or passive members in this task? What caused this level of activity?
  + Do you see some way of improving your involvement in the future? How?
* Do you feel that there are some major issues negatively affecting your group work in general?

Include your answers to your weekly reflections by Tue 28th March