

Mathematics Day for lower secondary 2014: Patchwork

During a schoolday, you will be working in groups of 3 or 4 students on an open ended problem. At the end of the day, there will be a written report as a result of your work.

Below you will find a checklist we strongly advise yo use:

<i>The method of working</i>	<i>check</i>
Read the complete assignment. Think about: <ul style="list-style-type: none"> ○ approach ○ dividing tasks ○ use of computer ○ time table 	
Cooperate: confer with each other on a regular basis about your planning, and if you're still on the right track; don't forget at the end of the day you do need time to produce a report that is a coherent whole;	
Don't be satisfied too easily. Try different approaches in the assignments, and mention these in your report.	
Justify your choices, describe your method of working.	
Produce a coherent report, not just a 'list of answers'.	
Your report must be written in such a way that it can be read independently from the assignment. Put the answers to questions 1 and 2 in an appendix. The report will consist of three parts: FINAL ASSIGNMENT A, FINAL ASSIGNMENT B and the appendix.	
Don't forget to paginate the pages.	
Put the names of the teammembers and the name of the school on the frontpage.	

The judgement

"The only good answer" is not the issue in this assignment: there is not one good answer, there are several possible right answers at the different assignments. In assessing the work, the jury will mainly pay attention to:

- whether your way of working is clear;
- whether your choices and results are justified clearly;
- what kind of approach you chose, whether you worked in a systmatic way, whether the use of mathematics is correct, meaningful and clear;
- how you dealt with FINAL ASSIGNMENT A, and how you justified the choices you made in FINAL ASSIGNMENT B. (FINAL ASSIGNMENT A will be more important in judging that FINAL ASSIGNMENT B);
- whether the report is a coherent whole which can be understood without the assignments next to it.

Lots of fun, and good luck!

Patchwork



Introduction

Patchwork is a form of needlework that involves sewing together pieces of fabric into a larger design. They are often colourful and the diverse types of patches are stitched together in regular patterns, in these instances they often show a repetition or symmetry.

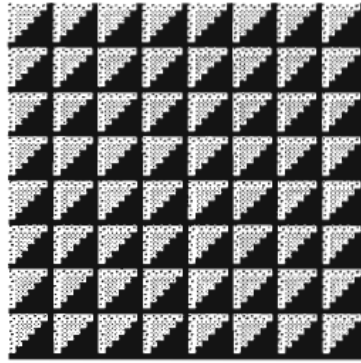
During this Mathematics Day you will investigate the regular patterns in patchwork. You will also investigate how many different types of patchwork quilts you can create based on just one type of patch. Of course we will also appeal to your creativity to come to an original final product!

Basic assignments



1. Above are two pictures of different patchwork quilts. Describe the above patchwork quilts (for the part that is visible on the pictures), describing among other things;
 - The number of patches and different types of fabric
 - Whether there is any regularity (if so, explain)
 - Whether and how you could make other patchwork quilts with the same patches and what these would look like (you can create a draft).

One basic form



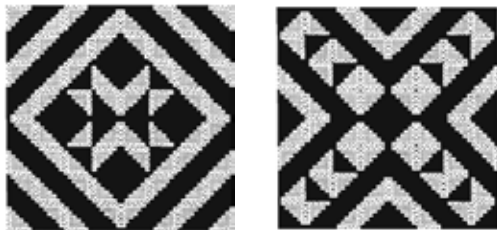
The patchwork quilt above has a very simple design. The same square has been used 64 times in creating this blanket. This basic shape (in this case one square) is called a *basic form*.

basic form



By rearranging this basic form (rotating is optional) an entirely different result can be reached.

Here are two examples formed with the same basic form used 64 times (see also the worksheet).



Using the basic form (with use of the computer)

Using the link

<http://www.fisme.science.uu.nl/toepassingen/00914/>

you will reach a tool, which allows you to create patchwork quilts yourself using this same square as a basic form.

You can drag the square into the grid, and by clicking on it you can rotate the square.



2. Use the tool to create four different patchwork quilts with this identical square as a basic form used 100 times (10x10). Create:
 - An example that has line symmetry
 - An example that has rotational symmetry
 - An example that has reflection and rotational symmetry
 - An example that does not have reflection symmetry, nor rotation symmetry

Final assignment A

It is a lot of work to determine how many truly different quilts can possibly be made using the aforementioned basic form in a quilt of ten by ten. In this final assignment you are going to find out how many truly different, but much smaller, quilts can be designed with this basic form.

Exploration

Use the basic form below to form a number of patterns of two-by-two squares. One example has been given. Use the worksheet.

Basic form	Two-by-two pattern
	

The question that you can now ask is how many *truly* different two-by-two patterns there are. An agreement has to be reached on what 'truly different' signifies:

We agree that two patterns are similar when after rotation they are a perfect match. If this is not an option, the pattern is *truly different* from all other patterns.

Assignment

Find out how many truly different two-by-two patterns can be made with the above basic form. Try to handle this in a systematic way. It is optional to use the tool to experiment and make pictures.

The final product is a report in which you clearly define the result. You show all the two-by-two patterns that you have found and give a (concise) description in which you e.g. classify the patterns in certain types, determine whether they are symmetrical and what type of symmetry is used, etc. Add a description of your work method. Try to do this in a way that this method (with some small adjustments) can be used to find out how many possible patterns there are of other measurements, so three by three, four by four, etc.

Tips:

- First find out how many different two-by-two patterns can be made using the basic form without any colour.



- Come up with a code for the four different positions of the original coloured basic forms



Final assignment B

Design a (beautiful) quilt using one of the two-by-two patterns you have found in final assignment A. This two-by-two pattern will now be your new basic form.

The design cannot be over ten by fourteen of these two-by-two patterns (basic forms).

Add your design (or a picture of it) to the report and give a precise description of how you came from your basic form to the patchwork quilt. Explain why you have chosen this specific basic form, the choices you have made in designing the quilt and why you like the design, use 'mathematical terms', such as symmetry.