QUILTING
Exploration by a Mathematics Teacher

SNEHA TITUS

What is quilting?

Quilting is the process of sewing two or more layers of fabric together to make a thicker padded material, usually to create a quilt or quilted garment. Typically, quilting is done with three layers: the top fabric or quilt top, batting or insulating material (middle layer) and backing material (inner layer), but many different styles are adopted.[1] Refer to [1] for an explanation of different quilting methods.

I must confess that it was the top layer that attracted me to quilting. This was clearly a case of the whole being greater than the sum of its parts- I was wonderstruck at how scraps of material could be pieced together to make beautiful patterns that were all at once eye-catching and pleasing.
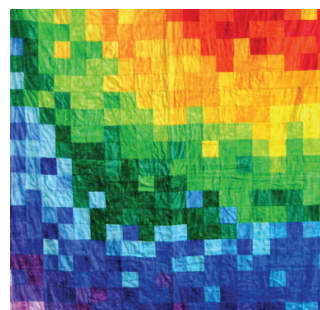

Figure 1

Figure 2

Figure 3

In all the quilts shown in Figures 1-3, the patches are square or rectangular. However the choice of patches leads to varied patterns, each attractive in its own way![2]

Quilting has a checkered history and many people, particularly women, have brought their own creativity into designing quilts. In this article, I will describe only my adventures in quilting and how I began to realise that my math teacher hat was beginning to make its presence felt as I explored the craft further. In this article, I will describe three quilts stitched by me, and elucidate how the process of designing the quilts gave me an opportunity to explore specific mathematical concepts and exercise certain basic yet important mathematical skills.

Symmetry and Transformations

Figure 4 shows my first quilt! It was only after I painstakingly hand-sewed the three layers together that I realised why a quilt was also called a comforter! Cosy has taken on a whole new meaning in my house! The top layer continues to intrigue me but I realised the value of the middle layer – the batting- and the lining. And also the cushioning provided by the painstaking hand-stitching which a machine made quilt would never possess.

Figure 4

The process of making this quilt alerted me to the permutations possible when different patches are aligned differently. Though the basic patch was only made of rectangles and squares, numerous possibilities surfaced when these patches were connected in strips and the strips were laid side by side. The impact was really mind-boggling and the designs were indeed a feast for the eyes.

Figure 5 shows the basic patch comprising a white square surrounded by a black L shaped portion and a red strip.
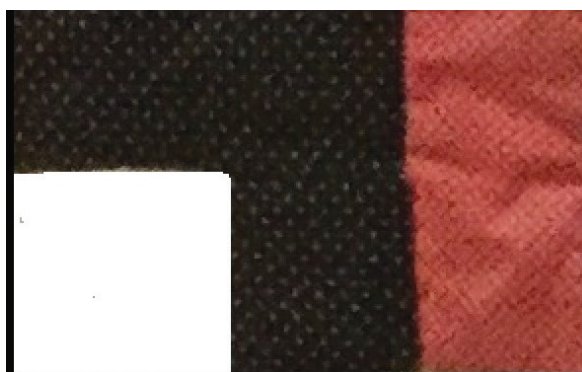

Figure 5: The basic patch

Figure 6 shows a quilt design quite different from the original quilt. This is obtained by rotating the basic patch counterclockwise by 90 degrees, 180 degrees and 270 degrees respectively and creating a larger patch (comprising of 4 copies of the basic patch). The four white squares come together making a larger inner white square and an outer black square with a red surround. This bigger patch is then reflected leading to a new quilt design.
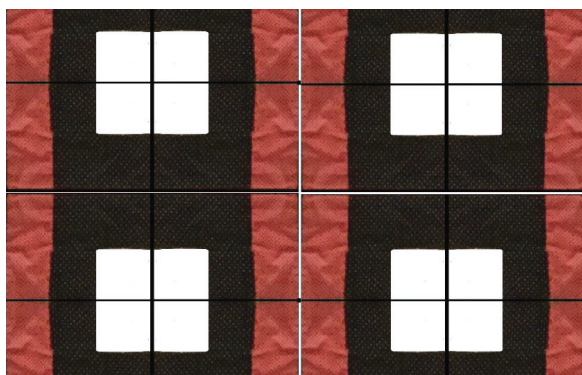

Figure 6: Reflection of the basic patch resulting in a different quilt.

[2] https://www.google.co.in/search?q=images+of+quilts&rlz=1C1RUCY_enIN689IN689&tbm=isch&tbo=u&source=univ&sa=X&ved=2ahUKEwjQ-4Xzx9_eAhUEbo8KHbNOC-8Q7Al6BAgEEB0&biw=1364&bih=617

Measurement, Perimeter, Scaling

My next adventure into quilting was creating a larger version of the one shown in Figure 7. It turned out to be a wonderful exercise in scaling.[3]
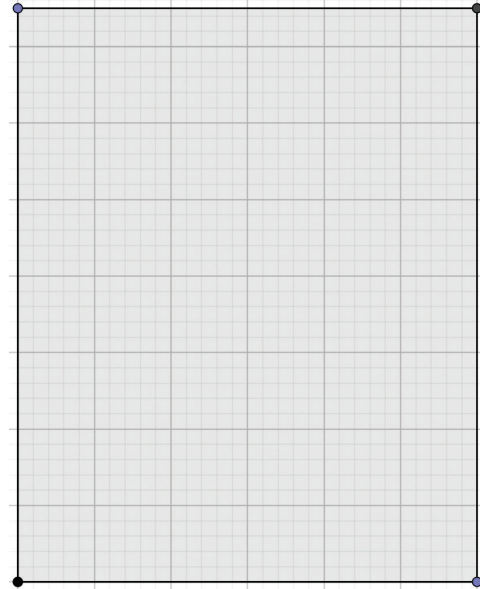

Figure 7

Now that I had some experience, I went about planning this quilt in a very mathematical fashion. My first step was to transfer this sketch on to GeoGebra. This was for my niece's son and I wanted him to use it for a while; so I planned to make it a 72" × 90" quilt. GeoGebra helped me plan the size of the patches nicely! I first outlined the rectangle on the grid (Figure 8).

I needed each small 5 × 5 grid to be 2.4" × 2.4", so that the 30 × 37.5 rectangle shown would represent my 72" × 90" quilt.

I quickly realised that I was getting into very complicated calculations! So I started working with a 48 × 60 grid from the outside-in. The outer yellow border would be 6" all around, the inner blue border would be 3". That meant that the inner square would have to be 54" by 72". I made each 5 × 5 grid 1.5" × 1.5". The joy of using GeoGebra was that my sketch didn't change but my calculations immediately became easier. I was able

[3]https://in.pinterest.com/pin/373798837804286079/

Figure 8

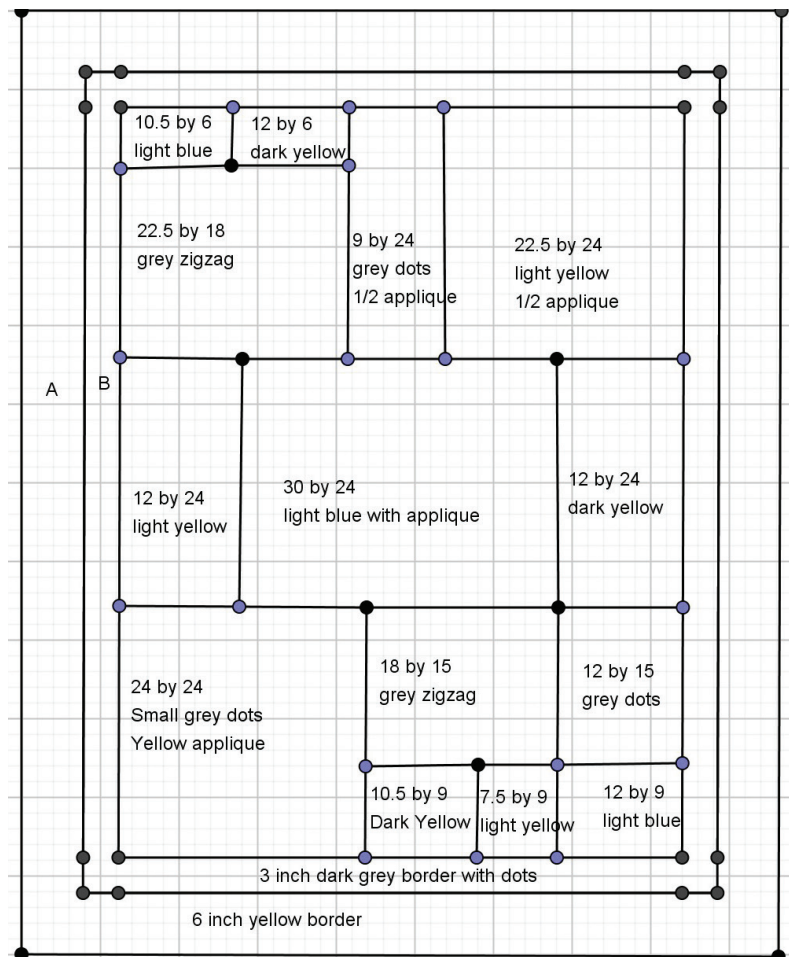to move the boundaries of the inner patches to get a pleasing proportion. This was the result. (Figure 9.)

Figure 9: Making the mock-up of the quilt with GeoGebra.

One problem remained- I usually made each small patch out of 3" squares. So I changed a few of the patches around, for example 10.5"× 9" became 12"× 9" and correspondingly 7.5" × 9" became 6" × 9". Finally I was ready to start! And I knew that if I ever wanted to resize to a bigger quilt, I could use the same pattern with a different grid size – this was a keeper! I also realised that creating a sketch of a quilt was a good project for a student who needed to practise measurement and scaling and differentiate between area and perimeter.

Quadrilaterals and Triangles

By far, the most interesting quilt that I made was my second one- a wedding present for my daughter. She had selected this pattern from Pinterest[4] (Figure 10).

Figure 10

It looked difficult but really beautiful and since I had a great quilting teacher (a self-confessed math phobic who nevertheless used mathematics unselfconsciously every day), I decided to give it a shot. My very first class was an eye-opener on quadrilaterals, when she taught me how to quickly churn out triangles!

[4] https://in.pinterest.com/pin/365354588504109625/

We first pinned together a layer of black cloth to a layer of white cloth. Then I drew out a 4 × 4 square on the top layer. I drew all the segments shown, noticing that every square had been bisected. Then I machined along the dotted lines. Next, I cut out the outer square and then carefully cut on either side (1/4" away) of the dotted lines. When I cut out the smaller squares, 16 black and white squares (Figure 11) dropped into my lap. Considering that I needed about 200 of these, this ingenious use of the symmetries of a square was a terrific time save.
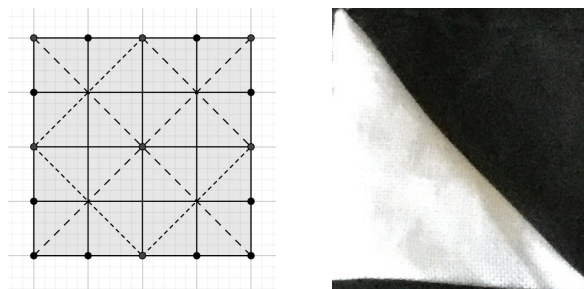

Figure 11

Next we cut out more than 200 plain black and plain white squares. These were slightly smaller than the squares in the 4× 4 grid in Figure 10 so that when cut, their size matched the square in Figure 11. Now came the fun part. Depending on how I aligned the square patches, I got a variety of shapes:

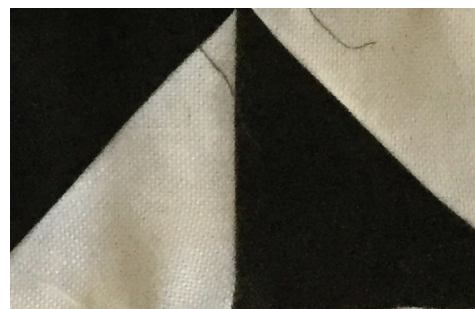
Figure 12: A right angled isosceles black triangle

Figure 13: The same, but with the colours switched

Figure 14: A black parallelogram

Figure 15: A black isosceles trapezium
(adjacent sides equal)

You can imagine the scope for permutations. I painstakingly followed the pattern and, this was the quilt that I finally made. A truly mathematical gift for a couple that met at an undergraduate math programme.

Figure 16

I am looking forward to more mathematical explorations with quilts. Someone once remarked that quilting was nothing but cutting up pieces of cloth into patches and then piecing them together to make a piece of cloth. I hope this article has convinced the reader that quilting is indeed much more!!

SNEHA TITUS works as Asst. Professor in the School of Continuing Education, Azim Premji University. Sharing the beauty, logic and relevance of mathematics is her passion. She is the Associate Editor of the high school math resource *At Right Angles* and she also mentors mathematics teachers from rural and city schools. She conducts workshops in which she focusses on skill development through problem solving as well as pedagogical strategies used in teaching mathematics. She may be contacted on sneha.titus@apu.edu.in.