ABC Quilts

ABC Quilts is a volunteer organization that, "sends love and comfort wrapped in quilts to thousands of small children who are born HIV positive, who are abandoned and living in foster care, or who are born affected by alcohol or other drugs."

Our team of 47 students has decided to make some ABC quilts, using squares of cotton muslin fabric. Each square will be decorated with fabric markers or appliqué designs. The squares will be joined as "window panes" by fabric strips running in both directions (framing each square). The quilt guidelines request the overall size to be from 36" x 36" (for newborns) up to 40" x 44" (for toddlers to age 6), with at least a 1-inch to 2-inch border around the outside edges of the finished quilt. All seams are 1/4-inch wide.

Your task is to decide how many of these quilts we should make. How many squares should there be? What size should the squares be? What should the dimensions of the quilt be? How wide should the framing be? How wide should we make the borders? Do not forget about the seams. If cotton muslin is 45 inches wide, how many yards will we need? How many yards of 45-inch wide print material will be needed for framing, borders and the back? (We can use 1 print for all 3 purposes.) Organize your findings so that parent volunteers will be able to follow your directions to purchase the materials and cut out the pieces with no error.

ABC Quilts

Suggested Grade Span

6-8

Task

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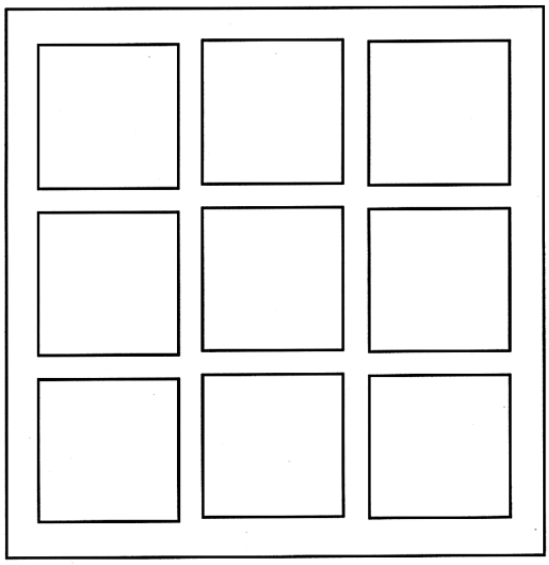
Alternate Versions of Task

More Accessible Version:

ABC Quilts is a volunteer organization that "sends love and Comfort wrapped in quilts to thousands of small children who are born HIV positive, who are abandoned and living in foster care, or who are born affected by alcohol or other drugs."

We will make a quilt that has a total of 9 squares. There will be 6-inch by 6-inch cotton squares of muslin decorated with fabric markers or appliqué designs. The squares will be joined by 1/4-inch fabric strips running in both directions (framing each square), with a 2-inch border around the outside edges of the finished quilt.



Your task is to complete the shopping list below showing what we will need to buy in order to make 1 quilt.

Shopping List

Item	Amount Needed
Cotton Muslin	
Fabric for 1/4-inch strips framing the squares	
Fabric for the 2-inch boarder	
Fabric for backing the entire quilt	

More Challenging Version:

Given the open-endedness of this task, it is challenging as is.

Context

After a presentation by a representative of the ABC Quilt Project, our team decided to make quilts to be given to at-risk babies through this organization as a community service project. At first we were just going to get parent volunteers to purchase and prepare the fabric so that students could decorate the squares and then work with parents to piece the quilts together and tie them. Then I thought about the difference between community service and service learning and realized that this was a golden opportunity for some mathematical learning while carrying out this service project. Many of the students had worked earlier in the year in Family and Consumer Science class with the teacher to put a quilt together. Most of the students had the concept of piecing a quilt together, although there were some who believed it was okay to simply sew the squares onto a large piece of fabric to form the quilt.

Once the task was complete, we sent copies of our solutions to the volunteer coordinator and she chose to go with 38" x 38" and a 42" x 42" sizes. She thought we could make two of each so both homerooms could participate. The students then calculated the amount of muslin and print material needed for these quilts - a quick job after having done this task. Squares were brought in and decorated with fabric markers. The coordinator is meeting with small groups of students during free time and after school to put the quilts together and then we will have a quilting bee to tie them. The students are very excited to be doing good work for babies and doing good math as well.

What This Task Accomplishes

This is a great measurement task, as the students have to visualize the yardage of the two fabrics (each 45" wide) and determine how much to buy. I did tell them that most fabric clerks will only sell fabric to the nearest 1/4 yard so they needed to convert their inches to yards and calculate to the nearest 1/4 yard. They knew from past experience that cotton fabric does shrink and many accounted for this factor.

What the Student Will Do

Most of my students used grid paper and did a lot of sketching and modeling to come to their answers. It took many a while to figure out that the window-pane cross pieces would be long pieces going one way, but not the other as they cannot overlap. They also slowly figured out that making two quilts would not necessarily mean buying twice as much fabric as there was generally space for cutting small pieces left from the first quilt. They also saw that when cutting the squares, you could only cut whole squares from a strip, even if there were a few inches of fabric left over. Piecing the squares would not work very well and was discouraged. We also had a conversation about the "straight of grain" of the fabric so that they saw that cross-wise pieces needed to be cut in one direction and length-wise pieces in the other. This would have a major impact on the yardage required.

Time Required for Task

More than 2 hours

We spent two 50-minute class periods on this and then the students did their final drafts on their own time over five days. Some chose to do more work on them after getting them handed back and did so over school vacation.

Interdisciplinary Links

Students used the information and skills learned in Family and Consumer Science to complete this task. It would have been ideal to do the task during that rotation, but it did not work out. There are several adolescent literature choices that feature quilting as a major theme. Early American Social Studies Units make a great thematic tie to this task as well. Art teachers might join you in working to design the individual squares with the students.

Teaching Tips

I needed to talk to the students about the idea that all the pieces should be cut as closely together as possible and drawn that way on the grid paper, as some just drew the pieces haphazardly across the paper not trying to conserve the fabric at all.

Students benefited from working in small groups, especially at the beginning of this task as they generated a lot more ideas and strategies than those working alone. Some students were not satisfied to stop with the design task and accept the class plan. Some actually made their own quilt that they had designed.

Suggested Materials

- Grid paper
- Calculators
- Picture books of quilts

Possible Solutions

Solutions will depend on the individual design. Print fabric measurements must include all framing and border pieces as well as the backing.

More Accessible Version Solution:

Item: cotton muslin

Amount needed:

6 inches x 6 inches x 9 squares = 324 square inches

Item: fabric for 1/4-inch strips framing the squares

Amount needed:

1/4 inch [(36 inches x 3) + (1/4 inch x 2)] = .25 inch [(108) + (.5)] = .25 inch x 108.5 inches = 27.125 square inches x 4 rows with overlapping = 108.5 square inches

Item: fabric for the 2-inch border

Amount needed:

2 inches [(36 inches x 3) + (1/4 inch x 2)] = 2 inches [(108) + (.5)] = 2 inches x 108.5 inches = 217 square inches x 4 rows with overlapping = 868 square inches

Item: fabric for backing the entire quilt

Amount needed:

(36 inches x 3) + (1/4 inch x 2) + (2 inches x 2) = 108 + .5 + 4 = 112.5 x 112.5 = 12656.25 square inches

More Challenging Solution:

See original solution.

Task Specific Assessment Notes

Novice
This child spent a lot of time and energy on this task, but still missed the mark. S/he really does not understand the difference between seams and framing pieces. The diagram on the last page shows a 36" square quilt with squares joined directly together. The "final draft" on the page before shows seven squares across with framing. One can only guess where the answers to the questions on page one came from, as there is no work to support them. Why would it require an extra yard of fabric if the "blanket shrunk?" This child is confused throughout.

Apprentice
These students did understand that there were to be 1/4" seams at every juncture and that there were to be printed fabric strips between squares. They did make diagrams of the quilt patterns, but not of the plan for cutting the pieces from the fabric. That is probably why their measurements are so far off. The reader is left without much of a clue how they arrived at needing five yards of muslin and 1 1/2 yards of print. The diagrams are not sufficiently labeled and are not particularly useful to the reader.

Practitioner
This student has some good reasoning evident. S/he has a good command of conversion of measurements. The third page seems to contradict his/her information on page one, as the measurements are not the same. The diagrams could be better - the scale is off and it is impossible to distinguish long strips from short ones. This student should have used grid paper to represent the uncut fabric and drawn in the pattern pieces to accurately determine the needed yardage.

Expert
This student did an excellent job of sharing his/her strategy with the reader. It is evident that the student had a deep understanding of the problem and was able to identify the appropriate mathematical concepts and information necessary for finding a solution. The reasoning is clearly stated with all the steps included and the reader is led to necessary diagrams for further explanation. The use of good math language enhances the reader's understanding, as does the careful use of diagrams, showing the quilt design and also the cutting guide for both fabrics. In the last paragraph, s/he does not tell us if s/he would buy an extra inch or so of fabric to account for the shrinkage or if there is an extra inch already present. I like how s/he eliminates the need to buy extra yardage by arranging the quilt top into smaller sections as seen in

diagram #1. I see this as evidence of a deep understanding of the concept of quilting, as well as using mathematics to your advantage.

Novice

New born Quilt

1. How many quilts: 2

2. What type of quilts newborn

3. How many squares: 42

4. Dimension of Quilt: 36" by 36"

5. What are the sizes of the squares: 5" by 5"

6. How wide should you make the border big 1 1/2" little 1/4

7. How wide should you make the seems: 1 1/4".

8. How many yards of 45" cotton muslin 2. yards

9. How many yards of 45" wide material will be needed for the framing, borders, and back: 3.2 yards.

10. How wide should the framing be: 1/2"

Where do these answers come from?

C: [illegible]

Novice

Where is the work to support the need for three yards of muslin?

These notes are not useful to the reader and I am not sure they were much use to the mathematician.

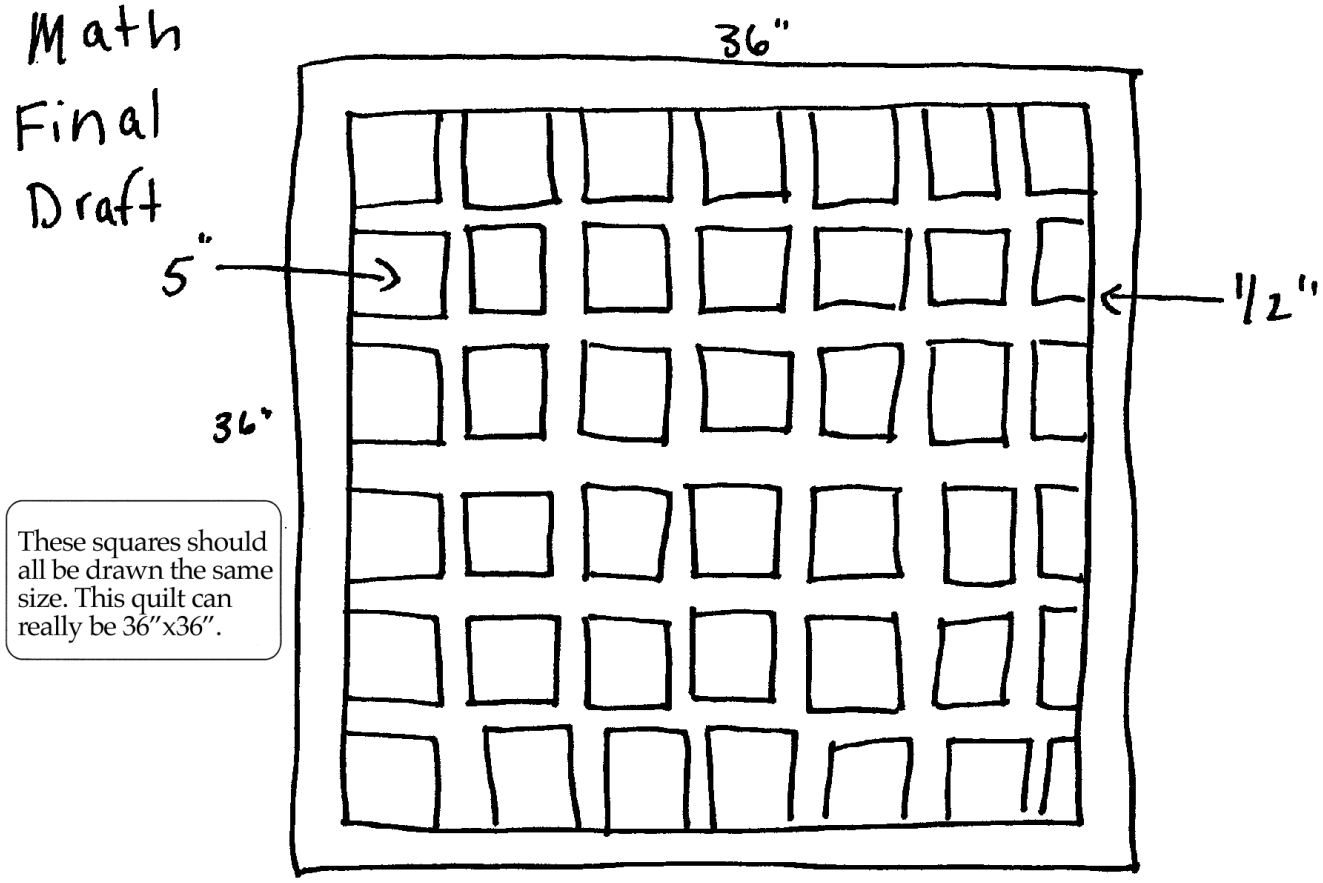
What If

What if you washed the blanket and it shrunk. You would have to use 3 yards of cotton muslin.

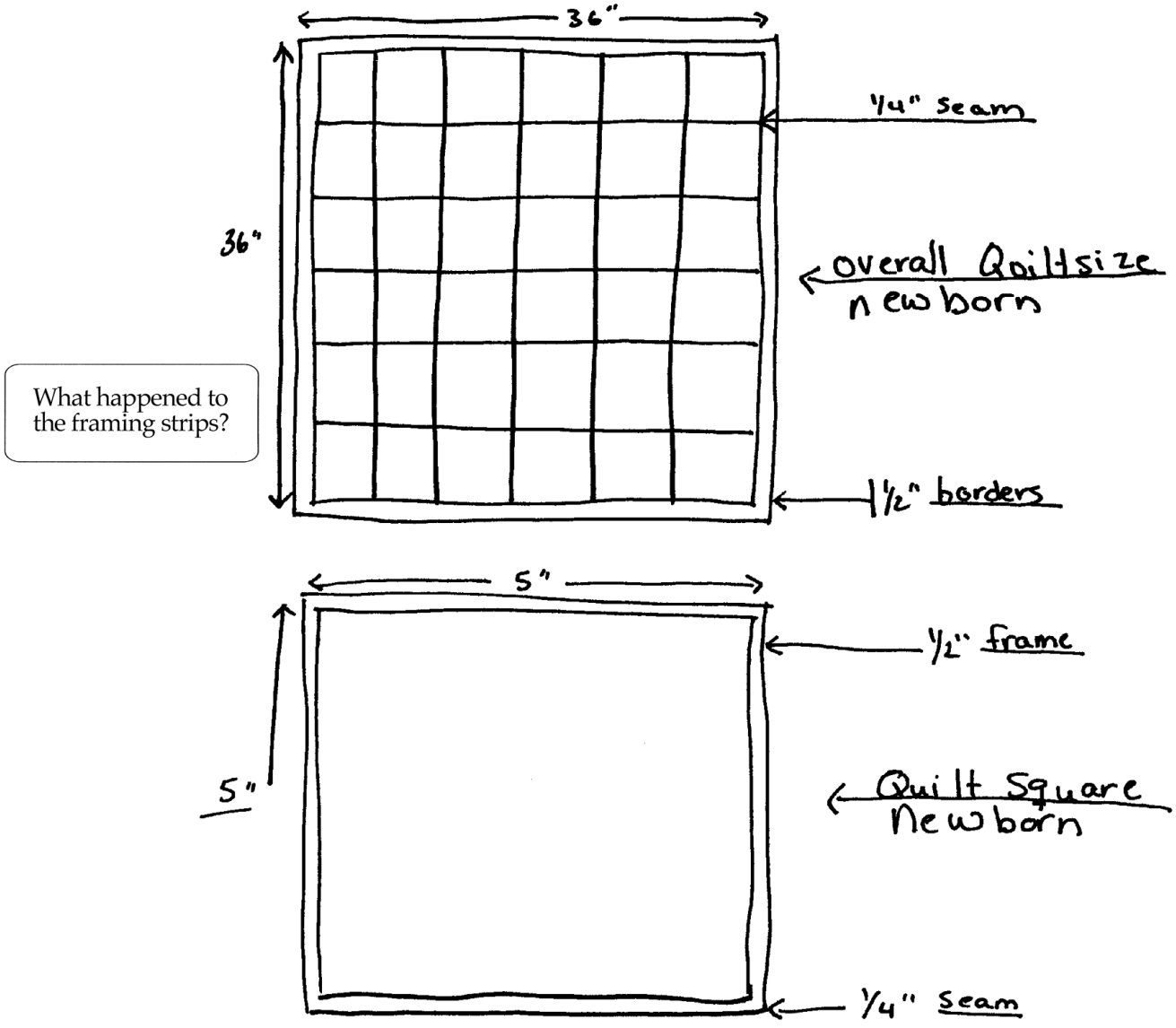
Notes

① I made the squares and then counted them.
⑤ 5x6 = 30 + 1½ + 1½ = 33.
⑥ I had to pickle between 1" and 2" and I picked 1½".
⑦ it had to to be small so I decided ¼"
⑧ 72 ÷ 36 = 2 yards
⑨ 72 ÷ 45 = 1.6 + 1.6 = 3.2 yards
⑩ they had to be small so I decided ½ would be a good size

Novice



Novice



What happened to the framing strips?

Apprentice

There is no evidence to support the needing of 4 yards of muslin.

Why 3/4 yards?

We decided to make 5 quilts. Four quilts will have 9 squares in it and will have the dimensions 39.5" x 39.5" The fifth quilt will have 16 squares and be a 40" x 40" quilt.

The 4 39.5" x 39.5" quilts -

- ★ squares will be 10½" x 10½" without a seam. With a seam the squares are 10" x 10".
- ★ We will need 4 yards of muslin for the four quilts.
- ★ the dividers will be 34" x 2¼" with no seam. With a seam it is 1¾" x 33½". Will need 4 dividers for each of the quilts.
- ★ the border with out seams will be 40" x 3½ with a seam it is 39.5" x 3". Four are needed for each quilt.
- ★ We need 3/4 of printed material for both the dividers and border together. They will be the same print the backing for each quilt is 40" x 40 with no seam and 39.5" x 39.5 with one.

The 1 40" * 40" quit -

- ★ squares will be 8½" x 8½" with no seam.

over →

Apprentice

40" x 40" quilt (cont.)

with a seam it is a 8" x 8" square.

* this will require one yard of muslin.
* the dividers will be 37" x 2" with no seam and 36.5" x 1½" with a seam. Six will be needed
* the border without seams is 40½" x 2¼". With seams it will be 40" x 1¾". Four are needed.
* this will require ¾ of a yard for both the borders and dividers. They will be the same pattern
* the backing is 40½" x 40½" without seams and 40" x 40" with seams.

Oc figured this out by drawing models and diagrams and doing basic math, like ading subtracting, multiplying, and dividing.

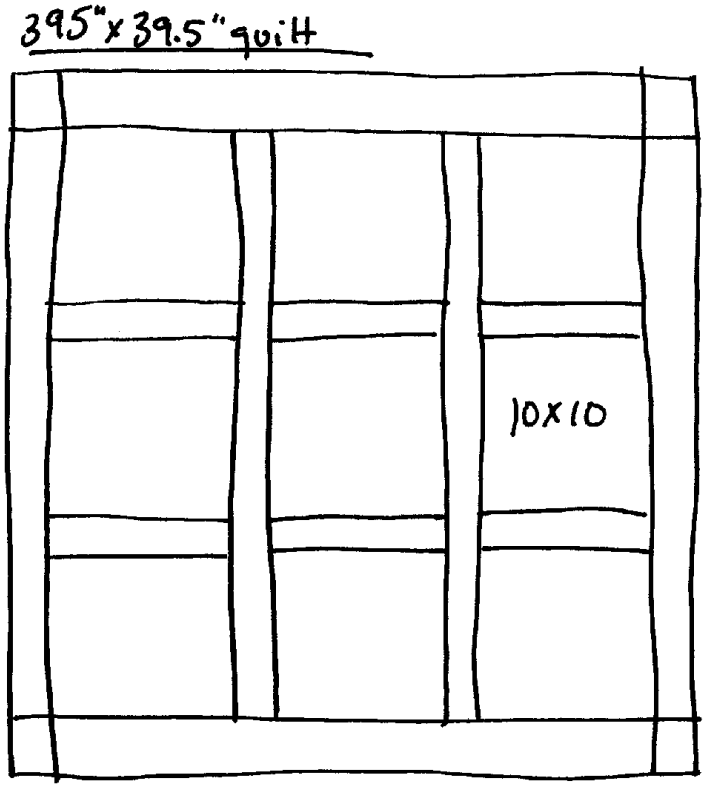
One thing we thought about is that the material is probably going to shrink and it will reduce the dimensions of the material. One way to stop this is to air or hang dry it, or buy it around 1 inch bigger so it has room to shrink.

Will an added inch take care of the shrinkage?

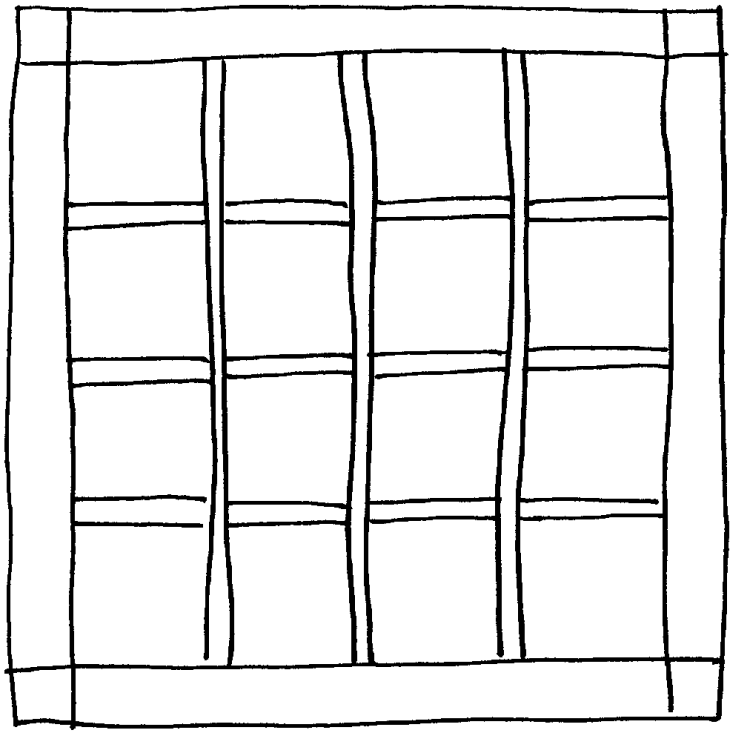
In total we will need 5 yards of muslin, 1½ yards of printed material, and 2 yards of backing.

Now they need 5 yards of muslin. Why?

Apprentice



Should add measurements to diagram even though a scale is given.



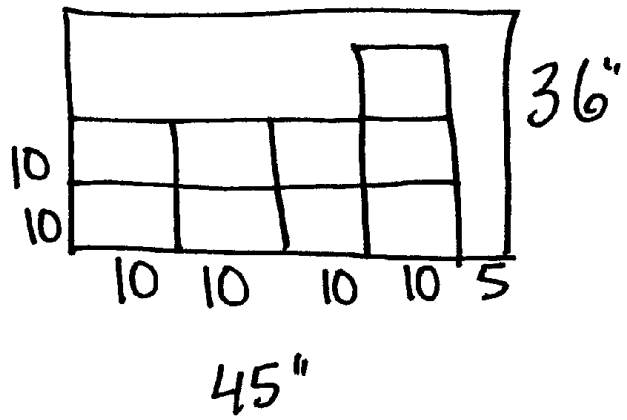
No scale or measurements given.

Apprentice

Diagrams -

example of my little scratch diagrams -

@



- around one yard

Could extra fabric be used for another quilt?

Practitioner

You do not really need a "square" number of blocks, but it should be a rectangular number.

ABC QUILT PROJECT

There is no evidence shown for needing these amounts of fabric. The student should have said to see last page.

In this problem I am told that my team, the Challengers, wants to make quilts for the ABC organization. I need to design a quilt(s) and find out how much material the parents will have to buy. I have to decide on the size of the squares for the pictures and decide on the size of the quilts. I need to decide on the size of the framing, also. I know that the quilt has to be at least 36 inches by 36 inches, but it could be no more that 40 inches wide and 44 inches long. The larger quilts will be given to older kids, and the smaller quilts to infants. I also know that the seams will be one quarter of an inch wide and that the muslin that we are going to use for the pictures will shrink three percent. Cotton muslin is sold in 45 inch wide pieces for as long as we want.

Before I found an answer to this problem, I tried several different sizes of squares for the pictures. First I tried five inches squared, and then I tried four and a quarter inches squared (not counting the seams. For the seam I took a quarter of an inch from every side.). I know that there are 47 kids on my team, but 47 is not a square number (that is, you can not make a square out of 47 dots), so the teachers will make a square too. That makes 49, and 49 is a square number. Each square will have three and a half inches for the picture, and a half inch on the edges for the seams on each side of the square. The framing will be on inch wide, and will also have a half inch added to that width for seams. The border will be two and a half inches wide, and have an additional half inch on each side for seams. The framing will be 31 inches long and the border will be 36 inches long.

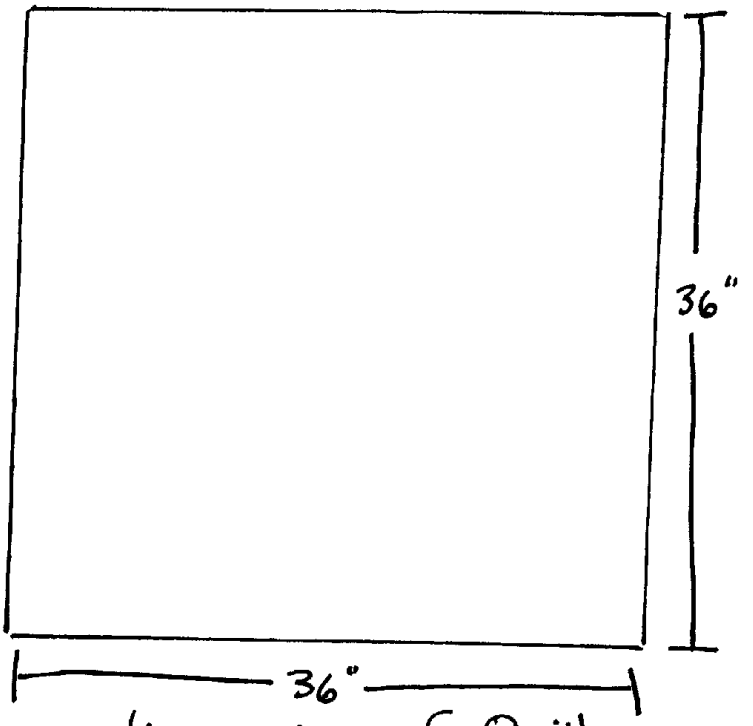
All in all parents need to buy 5/9 of a yard of muslin, or 20 inches by 45 inches. They also need to buy 1 and 19/36 of print material for the back, borders, and framing. That is 55 inches by 45 inches. The total size of the quilt when finished will be 36 inches by 36 inches, the smallest the quilt can be.

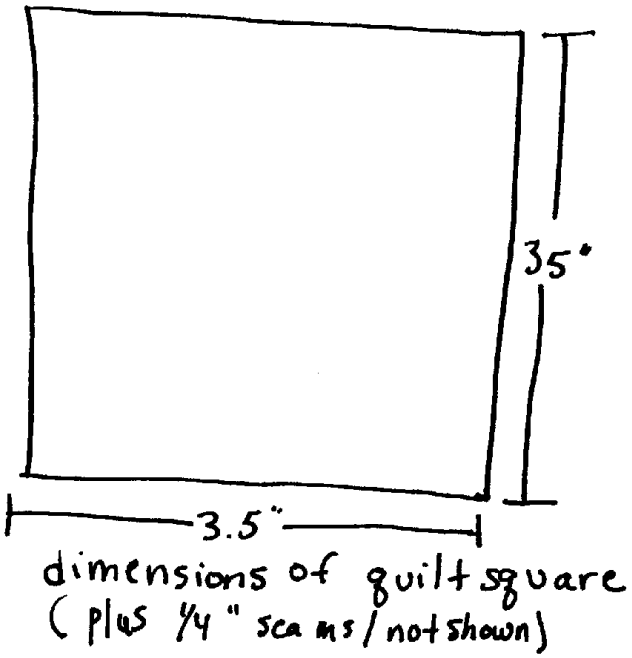
If you would care to refer to pages three, four, and five of this problem, you will see drawings representing parts of the quilt.

This situation could have many problems. For instance, if the price of cloth suddenly went sky-high, people might not be willing to contribute that much money to the project. Or if all the sewing machines suddenly broke, the project might be abandoned. If you wanted to have a large quilt, the size of the cloth and muslin would go higher, and new problems would come into your horizon. Many things could go wrong during the making of the quilts, but with careful planning, just about anything can be accomplished.

The last paragraph adds nothing to your understanding of the solution and should be left out.

Practitioner





Practitioner

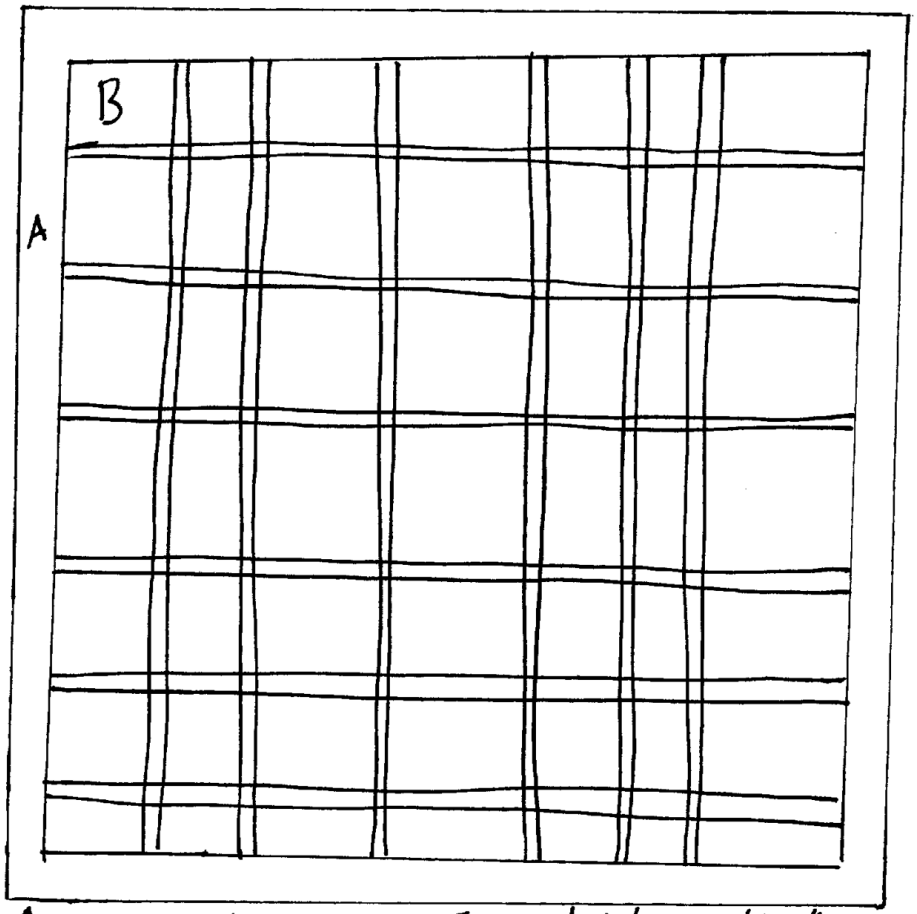
These numbers do not agree with those on page one.

Which are the long framing strips and which are the short?

Cloth Needed

Muslim = 1.8 yards; 20" x 95"
Counting skrinkage

Print = 1.5 yards 54" x 45"
for back, borders, and framing



A - border / 2 sq

B - box / 3.5²"

C = Framing / 1½" / 31 Long / 3.5" Lon
vertically horizontally

(Add ¼ "seams to all pieces)

Practitioner

1.) How many quilts?

2.) How many squares?
49

3.) What should the dimensions of each quilt be?
36" x 36"

4.) How wide should the framing be?
1/2" x 3/4"

5.) How wide should we make the borders?
2.5"

6.) Cotton is 45" wide? How many yards?
20 20x45" 1.8 yards of muslim
36

7.) How wide are the seams?
1/4"

8.) How many yards of 45" wide print material will be needed for framing borders, and back?
54" x 45" 1.5 yards of 45" matrial.

9.) What should the dimensions of each square be?
4" x 4"

Expert

Good use of math language and notation.

ABC Quilt Project

I was asked to design a quilt and give clear instructions on what to buy and how to make it. I needed to decide how many quilts to make, how many squares will be in each quilt, the size of the squares, the dimensions of the quilt, and the size of the frames and border. I know that there are 47 students to decorate the squares with fabric markers or appliqué designs. I know that the quilts dimensions have to be between 36"*36" to 40"*42". I know that there are ¼ inch seems. I know that there must be at least two inch border around the squares. I know the quilt will be put together like "window panes" with strips of fabric between each square. I know that the cotton muslin used for the squares and the print for the borders, frames, and back are 45" wide at the store.

I had to figure out how much material to buy for the squares and the trim, the sizes of all of the pieces in the quilt, and how to piece the quilt together.

First I decided to make a small quilt that is 36"*36". Then I decided to make three quilts with sixteen squares each, so each student can make on square (and a parent or someone can make the last one). Next I took graph paper (using the key of one square equals 2") and drew a diagram of the 36" quilt. Looking at the square I decided to make 6" squares. I centered the four rows of four squares on the quilt. The area that remained was the border and the frames. The frames are 2" wide and the borders are 3" wide. They deciding that it would look better I divided the frames and borders into squares and rectangles. So there are twelve little rectangles and three large ones. I divided the border rectangles so that it looks like there are nine 2" squares and twenty-four of the 2"*6" rectangles. This is diagram #1.

Next I drew another diagram to figure out how much material to buy for the muslin squares. Because of the ¼" seems on every side the squares had to be 6.5" wide when you cut them out. 45" wide fabric/6.5" squares per row on the fabric. So could fit six squares on every row with three rows/quilt. There is a 6" wide strip left that is extra. This is diagram #2. I marked all of the extra fabric with an X. For the border and frame print I drew another diagram with the same scale as the other two. The twelve of the 2.5" wide frame pieces fit in one row, so there was almost one row of just the rectangles. Then the long Border strips went under those. This diagram #3. For the back I drew a fourth diagram with the same scale. It is just a 36.5"*36.5" square. I arranged the three long frame strips next to the back. This is diagram #4.

Expert

I made a list of materials and instructions on what to cut out.

But, what if the cotton shrinks. I know that the cotton can shrink about 3%. 3% of the 36" quilt is 1.08" (36"*.03=1.08"). So in order to keep my quilt big enough, I would add ½" on very border, and I would probably pre-shrink (wash) all of the material before making the quilt.

Thank is how I designed my quilt.

Will she need to buy extra fabric to get this 1.08" or was there extra?

Materials for 3 ABC Quilts

1 2/3 yards of 45" wide muslin fabric
4 3/4 yards of print for border, frames, and back
Quilting thread

Instructions for 1 (3) Quilt(s):

1. Cut out as diagram shows:
   16 (48) 6.5" squares from the muslin.
   12 (36) 2.5"*6.5" rectangles from the print
   4 (12) 3.5"*33.5" inch rectangles from the print
   3 (9) 2.5"*30.5" rectangles from the print
2. Sew together with 1/4" seems as the diagram shows.

Expert

□ = 2" square

M = Muslin

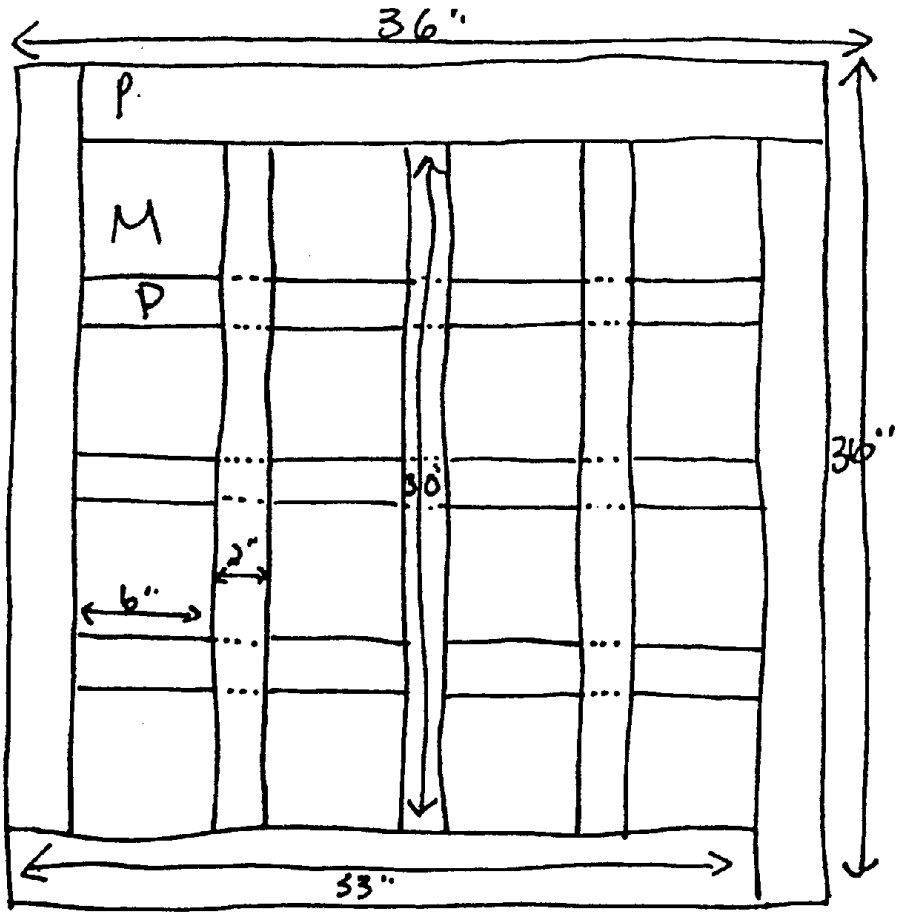
P = Print

.... = Stitch

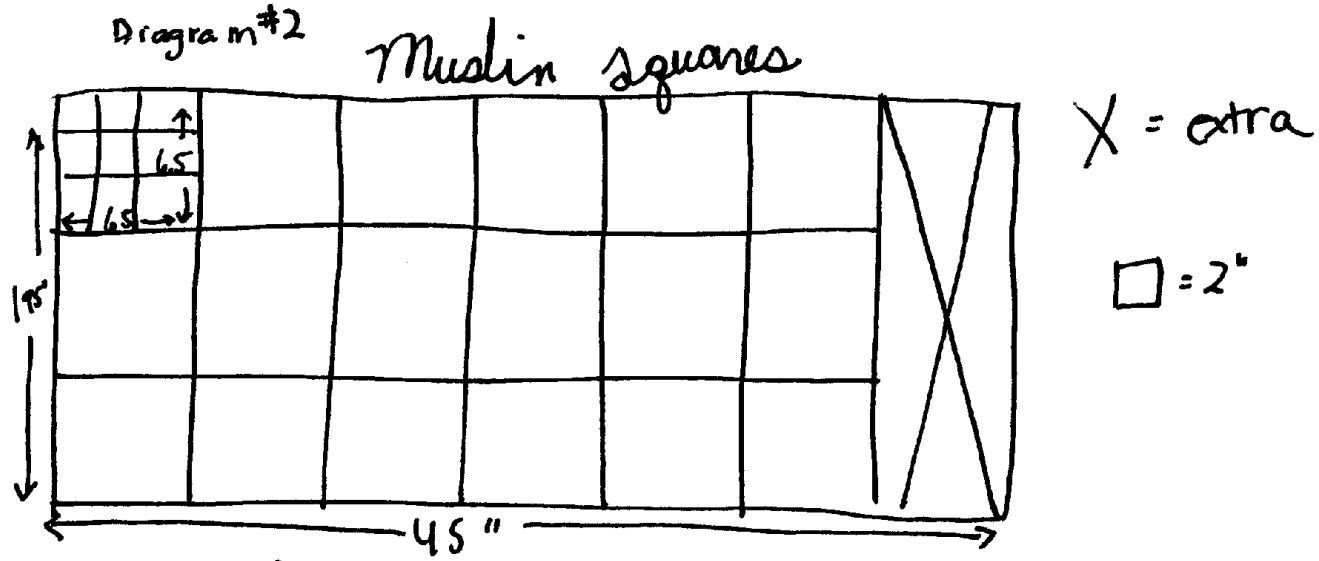
Diagram #1

Finished quilt

Good use of a key. Shows measurements on diagram well.



Expert



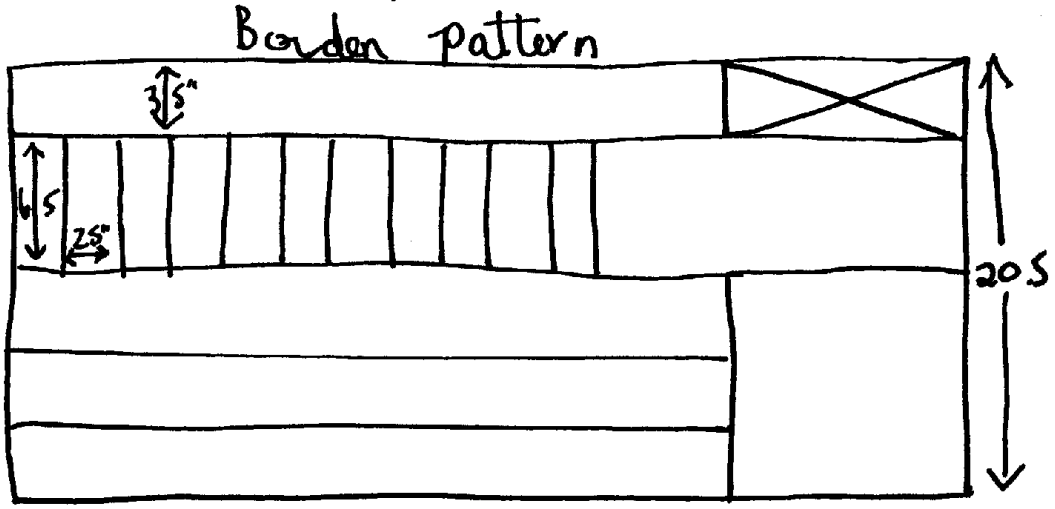


Diagram #s

1.66 yards of muslin
6" (one yard) √60" of muslin fabric total
36
246
216
240

4.75
36" yard √171" of pride in total
144
270
252
180
180
0

Expert

Diagram #4