Scenario C

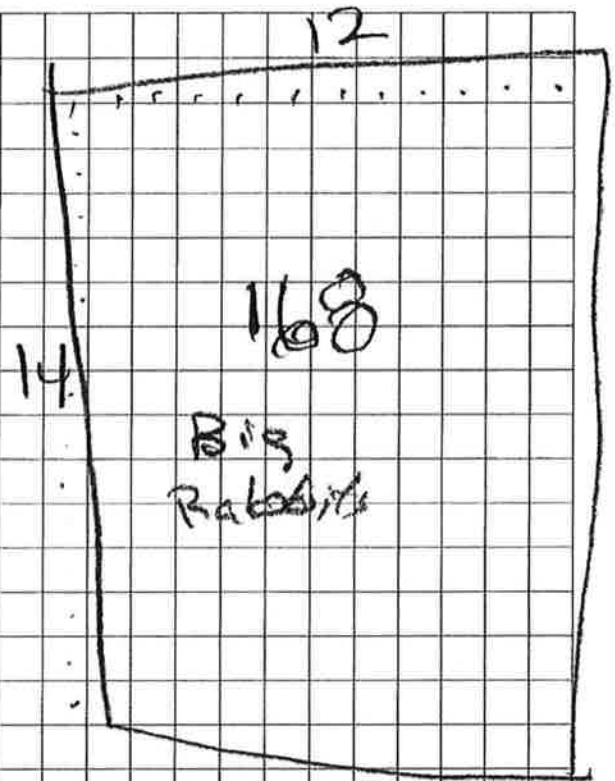Ms. Fagan has posted the following problem on the blackboard. As they arrive in the classroom, her students begin to work on the problem immediately with their partners.

> Ms. Brown's class will raise rabbits for their spring science fair. They have 24 feet of fencing with which to build a rectangular rabbit pen to keep rabbits.
> - If Ms. Brown's students want their rabbits to have as much room as possible how long would each of the sides of the pen be?
> - How long would each of the sides of the pen be if they had only 16 feet of fencing?
> - How would you go about determining the pen with the most room for any amount of fencing? Organize your work so that someone else who reads it will understand it.

One-third of the way into a 40-minute period, Ms. Fagan notices that students have made little or no progress. Although many have begun testing out different configurations of pens, most are unsystematic in how they keep track of their work. At this point, Ms. Fagan determines that students will never get to the answer by the end of the period. She puts the following table on the blackboard and tells students they should complete it.

Pen Configuration (length and width)	Length	Width	Perimeter 2 (l + w)	Area l x w
11 x 1				
10 x 2				
9 x 3				
8 x 4				
7 x 5				
6 x 6				
5 x 7				
4 x 8				
3 x 9				
2 x 10				
1 x 11				

Students busily complete the table, relieved that they now know "what to do." With 5 minutes left in the period, Ms. Fagan asks a pair of students to come to the overhead projector to complete the table and identify which pen configuration would hold the most rabbits. For homework, Ms. Fagan asks the students to construct the same table for 16 feet of fencing.

A.

Length width	Length	Width	Perimeter	Area
11 × 1	11	1	24	11
10 × 2	10	2	24	20
9 × 3	9	3	24	27
8 × 4	8	4	24	32
7 × 5	7	5	24	35
6 × 6	6	6	24	36
5 × 7	5	7	24	35
4 × 8	4	8	24	32
3 × 9	3	9	24	27
2 × 10	2	10	24	20
1 × 11	1	11	24	11

B.

| Length width	Length	Width	Perimeter	Area
12 × 4	12	4	16	48
10 × 6	10	6	16	60
9 × 7	9	7	16	63
16 × 1	16	1	16	16
8 × 8	8	8	16	64
7 × 9	7	9	16	63
6 × 10	6	10	16	60

Scenario B

Mr. Chambers has posted the following problem on the blackboard. As they arrive in the classroom, his students begin to work on the problem immediately with their partners.

> Ms. Brown's class will raise rabbits for their spring science fair. They have 24 feet of fencing with which to build a rectangular rabbit pen to keep rabbits.
> - If Ms. Brown's students want their rabbits to have as much room as possible how long would each of the sides of the pen be?
> - How long would each of the sides of the pen be if they had only 16 feet of fencing?
> - How would you go about determining the pen with the most room for any amount of fencing? Organize your work so that someone else who reads it will understand it.
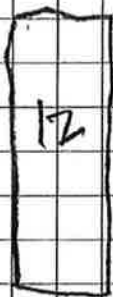
As students begin to work on the problem, Mr. Chambers circulates around the room, noticing approvingly that students are taking the task seriously. There are plenty of interesting ideas being discussed although some of them, he had to admit, were not going to lead students toward a strategy for solving the core problem. For example, he hears question such as, "How big are the rabbits?", "How much space does a rabbit need?", and "How much does the fencing cost?" Mr. Chambers decides not to intervene and tell the students how to solve the problem; rather he keeps circulating and observing, hoping that the students will make progress on their own.

With 10 minutes remaining, a few pairs have reached the correct answer for the first question. However, none of the pairs has made progress toward discovering the big mathematical idea: that a square would enclose the greatest amount of area for any given amount of fencing. Mr. Chambers decides to have the students continue to work on the problem for homework and to revisit it again the next day.

A.

7

12

49
Little
Rabbits

7

168
Big
Rabbits

14
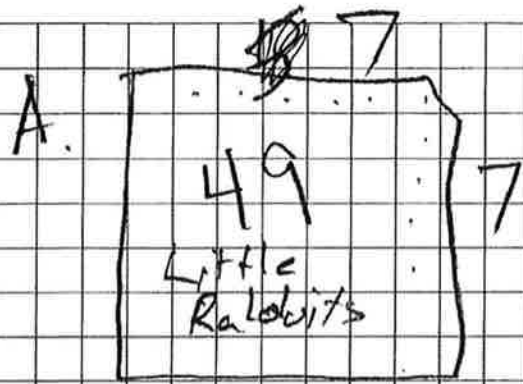
If the rabbits are little I
would make a little box. If it
is big rabbits I would make
a big box.

B. If I only had 16 feet of
fence I would make it like this

12

This would be little so I
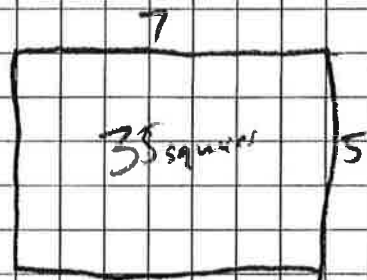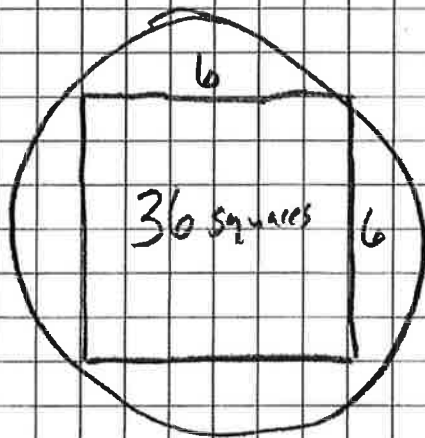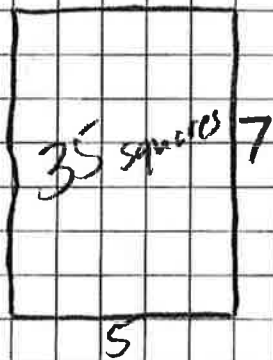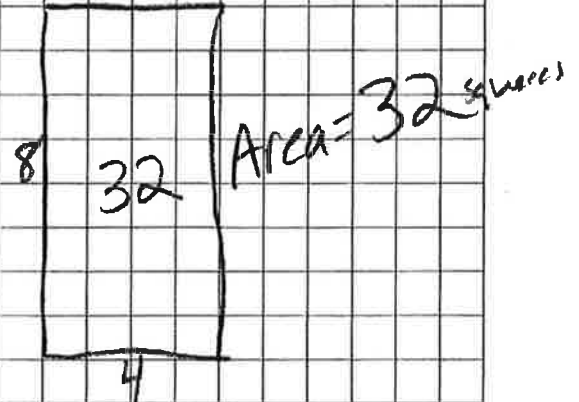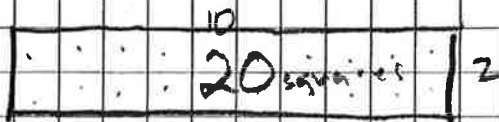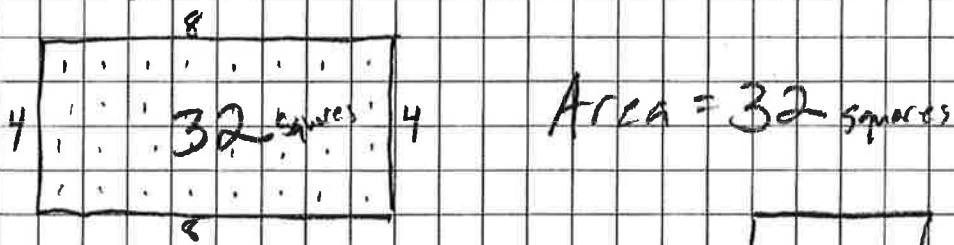would put baby rabbits
in here.

C.

Scenario A

Mrs. Fox has posted the following problem on the blackboard. As they arrive in the classroom, her students begin to work on the problem immediately with their partners.
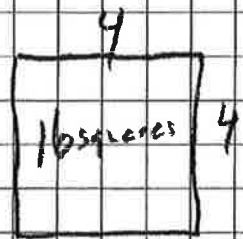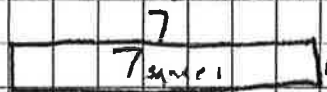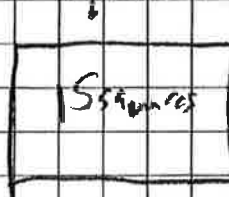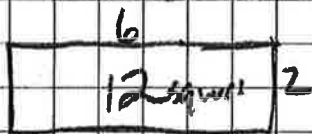
> Ms. Brown's class will raise rabbits for their spring science fair. They have 24 feet of fencing with which to build a rectangular rabbit pen to keep rabbits.
> - If Ms. Brown's students want their rabbits to have as much room as possible how long would each of the sides of the pen be?
> - How long would each of the sides of the pen be if they had only 16 feet of fencing?
> - How would you go about determining the pen with the most room for any amount of fencing? Organize your work so that someone else who reads it will understand it.

Mrs. Fox walks around the room as students begin their work, stopping at different groups to listen in on their conversations and to provide support as needed. She notes that many students started out by describing an assortment of pen configurations that could be built with 24 feet of fencing. As they keep coming up with more configurations, the students begin to realize they needed to keep track of the shapes they have already tried. Some begin to construct a crude table. During this time, Mrs. Fox circulates among the groups asking such questions as, "How do you know you have all the possible pen configurations?", "Which pen has the most room?", and "Do you see a pattern?" These questions lead students to see the need to organize their data, make conjectures, and test them out. As the period draws to a close, none of the groups have completed the task, but most are well on their way to discovering that a square would enclose the greatest amount of area for any given amount of fencing. For homework, Mrs. Fox asks students to summarize what they have learned so far from their exploration and what they want to continue to work on in the next class.

A. 1 [12 (crossed out)] 1   Area = 12 squares

12

8
4 [32 squares] 4   Area = 32 squares
8

10
[20 squares] 2

8
[32] Area = 32 squares
4

35 squares 7

6
[36 squares] 6
6

5

7
[35 squares] 5

B. The sides could be different as long as they added up to 16 just like the top had to be 24. But the one that looked like a square would be the best.

6
[12 squares] 2

[5 squares]

7
[7 squares] 1

4
[16 squares] 4

C. I think squares are the best. I would always try to make a square.

Scenario D

Ms. Jackson has posted the following problem on the blackboard. As they arrive in the classroom, her students begin to work on the problem immediately with their groups.

> Ms. Brown's class will raise rabbits for their spring science fair. They have 24 feet of fencing with which to build a rectangular rabbit pen to keep rabbits.
> - If Ms. Brown's students want their rabbits to have as much room as possible how long would each of the sides of the pen be?
> - How long would each of the sides of the pen be if they had only 16 feet of fencing?
> - How would you go about determining the pen with the most room for any amount of fencing? Organize your work so that someone else who reads it will understand it.

As she walks around the room, Ms. Jackson gives each group of students a large sheet of chart paper, explaining that she wants each group to produce a poster showing their work in an organized way. She notices that as soon as they get the chart paper and markers, the students' attention immediately turns to the creation of posters as works of art rather than as the result of mathematical thinking and activity. The students produce elaborate drawings of rabbits and pens and use carefully drawn calligraphy to produce a title. Although some students try to turn the discussion to figuring out the problem, the students who are not engaged in the artistic work are beginning to lose interest and to talk about other things. Ms. Jackson successfully pulls students' attention back to the task when she stops at a group, but the group's attention is not sustained once she leaves.

As the bell rings at the end of the period, Ms. Jackson looks up from the group she currently is talking to and tells the students to drop their posters off at the front of the room. They will discuss the posters in class the following day, she says, as students file out the door.
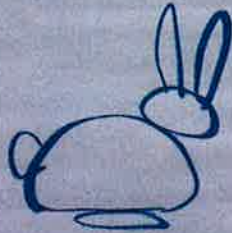
Mrs. Browns rabbits