

# Emmy Noether – Circle 3 for 2004-2005

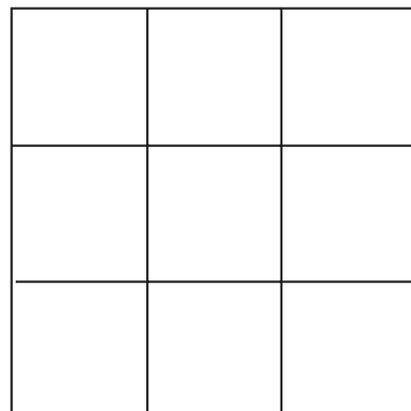
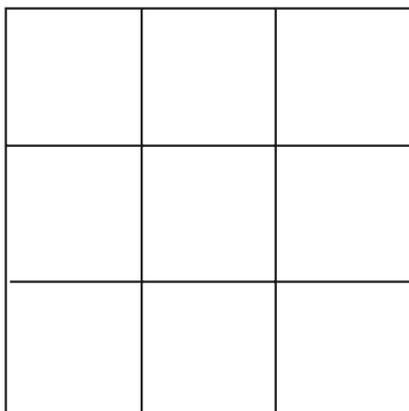


## Part I: Problems

### Problem 1:

In a magic square, all the numbers in any row, column, or diagonal, have the same sum.

- In the left 3x3 square, fill in the numbers 1-9, each used only once, to produce a magic square with a sum of 15.
- Is your answer to a) the only such magic square? Why or why not?
- Now try using the numbers 10-18 to produce a different magic square on the right.



### Extension:

- If you take half of each number in your answer to c), will you still have a magic square? Why?
- Create your own magic square.

### Problem 2:

Each of three families has one son and one daughter. The boys, Scott, Richard, and Alan, and the girls, Emily, Tanya, and Nancy, are friends. Four of the six friends are learning a new game. Each player has a partner, but no one wants a sibling (brother or sister) as a partner.

Scott and Tanya are too young to play. Tanya's brother and Alan's sister are partners. Nancy's brother and Emily are partners. Name the pairs who are brother and sister.



### Problem 3

- How many triangles are there in Figure 1?
- How many of the triangles you counted in a) are isosceles? Right angled?
- Figure 2 consists of four squares identical to the one in Figure 1. Is the number of triangles in this figure 4 times your answer to a)? Why or why not?

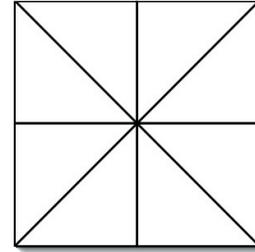


Figure 1

### Extension:

How many squares are in Figure 2?

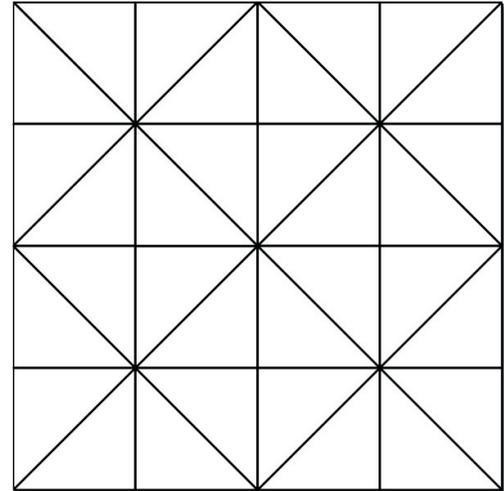
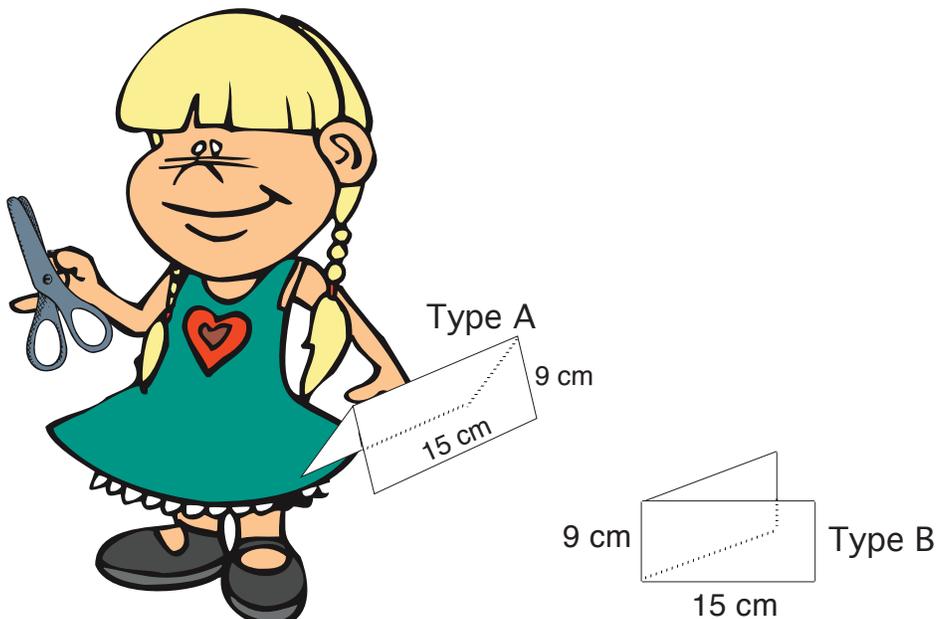
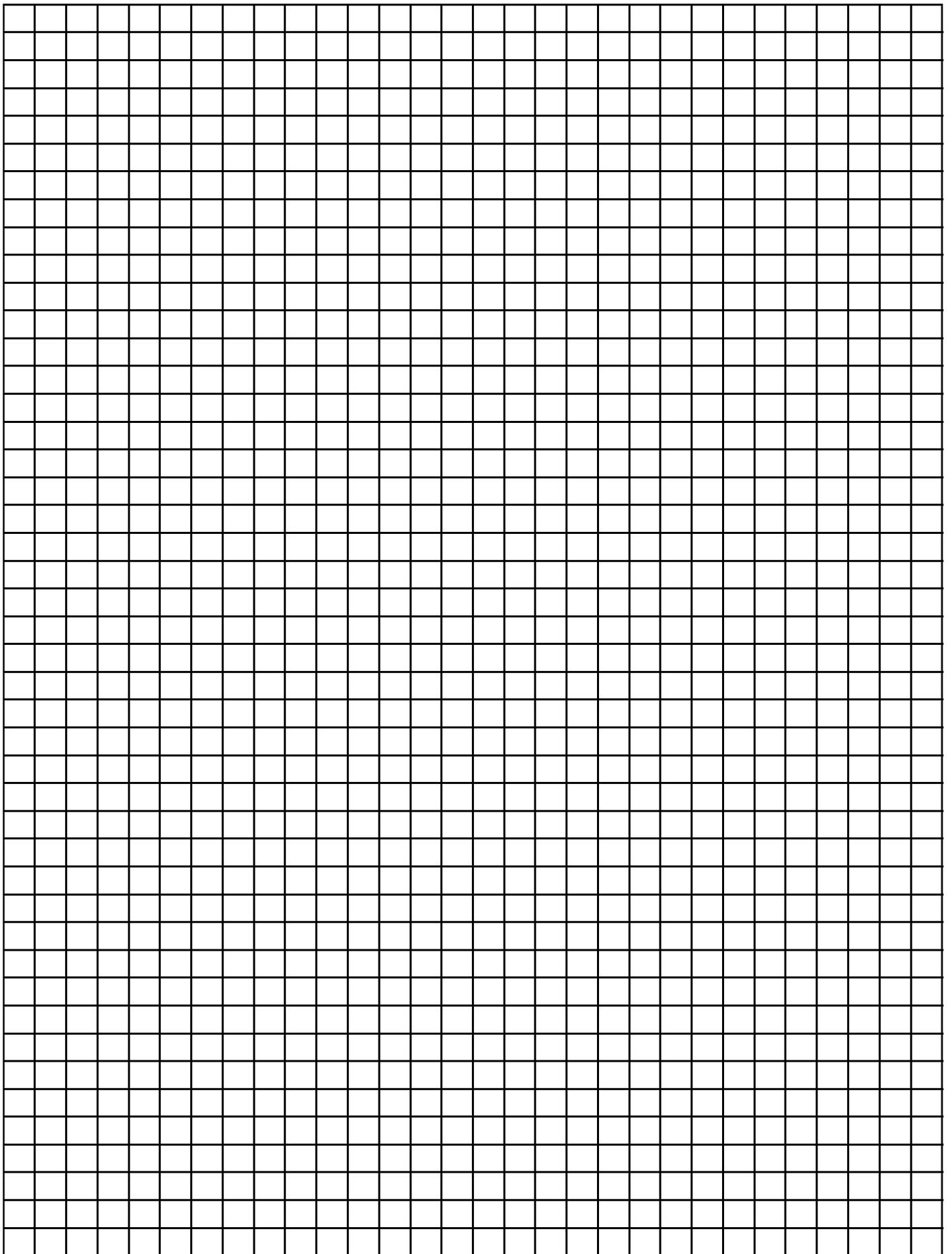


Figure 2

### Problem 4:

- Janey wants to make 24 invitations to her birthday party. Each card is made by folding a rectangle in half, so that the folded card measures 9 by 15 cm when closed. The fold can be made in either of the two ways shown below. The construction paper she has chosen comes in 30 by 45 cm sheets. Which way of folding the cards wastes the least amount of construction paper? How many sheets of construction paper will she need? (Use the 30 by 45 grid below to experiment.)
- Suppose Janey wants 12 of each type of card. Does this change your answer to a)?





**Problem 5:**

Andreas had a bag of jelly beans. When he opened the bag, 9 jelly beans spilled onto the ground, making them too dirty to eat. He gave half of what was left to his best friend, Ed, then wrapped up half of the remaining candies and gave them to his grandma. Then he gave half of what was left to his little sister Hilde. If, in the end, Andreas had 7 jelly beans left for himself, how many were in the unopened bag originally?

**Extension:**

Suppose your class went on a bus tour of Europe. The first day, one quarter of the entire journey was completed. The second day, half the remaining distance was completed. The third day, again, half the remaining distance was completed, leaving 75 km for the last day. What was the total length of the trip?



**Problem 6: (For groups of two)**

- a) Play the game of Emmy and win an “Emmy” award! This is a two player game. The object is to be the first player to reach 15. Each player adds 1 or 2 to the total, starting with 0. (see the sample below.)
- b) Try out your strategy on another partner. Can you guarantee yourself a win?
- c) Is this a fair game?

**Sample:** The start of a game between Alice and Fillipe:



Player	Added	Total
		0
A	+1	1
F	+1	2
A	+2	4
F	+1	5
A	+1	6
F	+2	8
A	+2	10
	.	.
	.	.
	.	.