Remember you are competing as a team. Work together rather than divide up the questions.

Total possible points: (point values can be seen in parenthesis next to each problem)

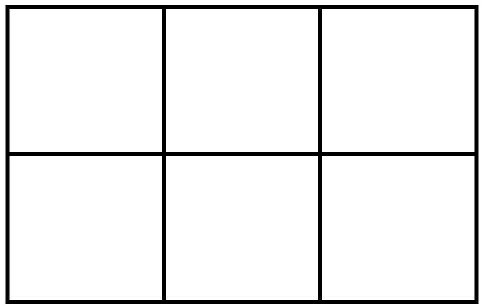
1. (5) Joy was excited when she was able to solve one of the mathematics challenge problems from her teacher. She decided to see if her older brother could solve the problem.
   She explained, "There are nine containers which are identical and which contain prizes. Eight of the containers have exactly the same prize in them, but the other one has a special prize. The only difference which you will be able to detect, however, is that the container holding the special prize weights slightly less than each of the other containers which all weight the same amount. You will win the special prize if you can identify the container with the special prize in exactly two weighings using a balance scale.
   How can Joy's brother win the special prize?

2. (5) The Pichons, who love mountain views, bought a summer home in the Adirondacks. The window next to the dining room table faces a beautiful view of the mountains. This window is a square two meters high and two meters wide. The Pichons would like to see more of the view when they eat than they have now. Mr. Brashear, their carpenter, told them that he could double the size of the window to provide twice the view. The window, however, would still be two meters high and two meters wide and it would also still be square. How can this be possible?

3. (8 – 5 for the description of the path; 3 for the length of the path)

Danny's bedroom is 10 feet by 20 feet and has a 10 foot ceiling. One evening Danny sees a spider in the middle of the end wall six inches above the floor and a fly in the middle of the opposite wall six inches below the ceiling. He wonders if the spider notices the fly and how far it would have to crawl if it took the shortest path along the walls, floor, and ceiling to reach the fly. What is the shortest path the spider can take and how long is it?

4. Notice we can build a 2 x 3 grid of squares with 17 toothpicks. Each toothpick can be considered a unit segment.



(2 How many toothpicks are required to build a 5 x 7 grid of squares?

(4) Explain your solution.

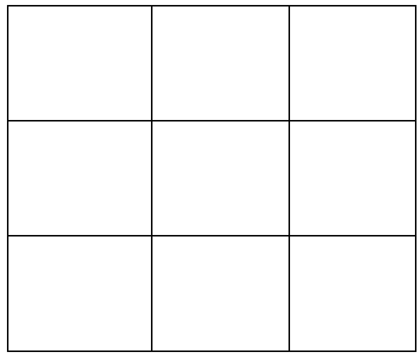
5. (2) How many squares of all sizes are outlined by the toothpicks in the 5 x 7 grid?

(4) Explain your process.

Problems 6-8 involve the arrangement and rearrangement of toothpicks. Each toothpick can be considered a unit segment.

6. In the same way as the above 2 x 3 grid has 8 subsquares. Remove exactly four toothpicks to produce a figure with exactly 3 subsquares. Draw your solution.

7. (5) Next, consider the 3 x 3 square grid shown below. Remove exactly 8 toothpicks to produce a figure with exactly 2 squares.



Draw your solution below.

8. (5) Beginning with the three by three square grid above remove exactly 4 toothpicks to produce a figure with exactly 6 squares. Draw your solution.

9. (8) Gilbert was working on lighting for the school play and thought that he could make a cool pair of sunglasses by attaching some of the red filter film to his glasses.

   He did some research and learned that 20 percent of the light passing through the filter is absorbed. He also read that good sunglasses should absorb 80 percent of the incoming light, so he figured that if he put four layers of filter film on his glasses he'd be all set.

   a) Is Gilbert right? How do you know?

   b) Write a formula that will calculate the percentage of light that will pass through n layers of filter film.

10. (24 pts. – 1 per correct match) Match the situation with the graph and formula:

Situation	***Graph (G cards)***	***Formula (A cards)***
A. Plumber		
B. Cycling		
C. Movie subscription		
D. Internet café		
E. Cooling kettle		
F. Ferris wheel		
G. Folding paper		
H. Speed of golf shot		
I. Test drive		
J. Balloon		
K. Height of golf shot		
L. Film projector		

11. (2) Ailee, Bailey, Camie and Demi grew up on the same street and have been best friends since elementary school. The girls are all different ages ranging from 14 to 17 years old. Bailey is younger than Camie, but older than Demi. Demi, who is not 15 years old, is a year younger than Ailee. What is Ailee's age? How do you know? (4)

(2) Each girl participates in a different one of four extracurricular activities: cheerleading, field hockey, softball and basketball. Camie does not play field hockey or basketball. Neither Bailey nor Demi plays softball. Ailee participates in an activity that does not utilize a ball. Bailey participates in an activity that typically takes place indoors. In which extracurricular activity does Bailey participate? Explain your process. (4)

(2) Ailee, Bailey, Camie and Demi have decided to try something new. So next month, all four girls will attend a week-long golf camp at a local university. While attending the golf camp, the girls will stay in separate rooms in the same dorm. The four consecutive rooms to which the girls have been assigned are adjoining rooms 101 and 102 and adjoining rooms 103 and 104. Bailey and Camie have not be assigned to adjoining rooms. There is one room between Ailee's and Bailey's assigned rooms. Demi's assigned room number is prime. What is the sum of Camie's and Demi's assigned room numbers? How did you figure it out? (4)