

The Thirty-Eighth Annual Eastern Shore High School Mathematics Competition

November 16, 2022

Team Contest Exam

Instructions

Answer as many questions as possible in the time provided. To receive full credit for a correct solution, show all work and provide a clearly written explanation (when indicated). Solutions will be judged based on correctness, completeness and clarity. (Little credit, if any, will be given for a solution consisting of just a number or a single sentence.) Calculators are allowed **only** on the team contest exam.

Your answers for Part A and Part B of problem 1 must be color coded and submitted on the enclosed problem 1 answer form.

Your answer for Part A of problem 2 must be submitted on the enclosed problem 2 answer form.

Your answer for Part B of problem 2 must be written on the provided sheets of plain white paper.

Your answer for problem 3 must be color coded and submitted on the enclosed problem 3 answer form.

At the start of the team round, your team will receive a copy of only Problem 1. Your team must submit a response to Problem 1 within the first 15 minutes of the team round time interval.

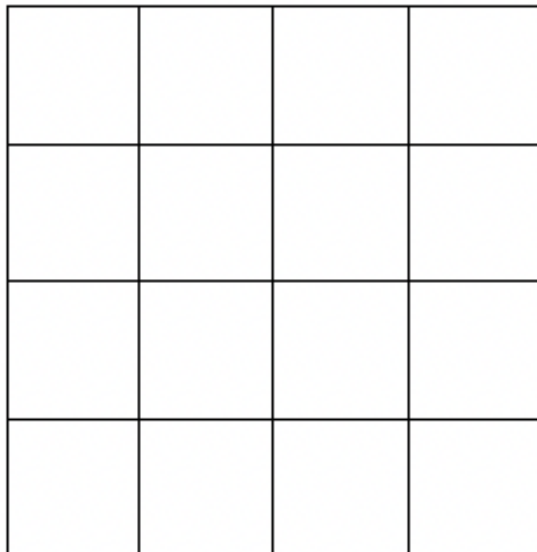
When you submit your response for Problem 1, you will receive a copy of Problem 2 and a copy of Problem 3. Your team will then have the time remaining in the team round to complete a response for each problem.

Note: if your team completes Problem 1 before the end of the allotted time, you may submit it and receive copies of Problem 2 and Problem 3 in advance.

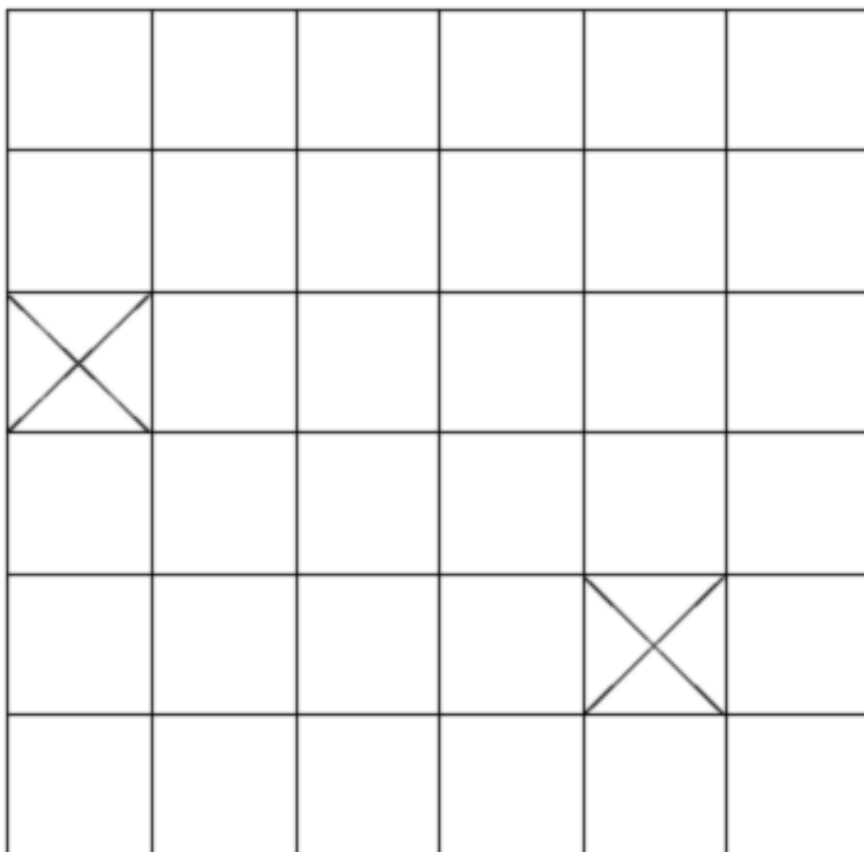
School: _____

Answer Form for Problem 1

1. **Part A:** Consider the 4 x 4 grid depicted below. Color the 4 x 4 grid in such a way that each color appears exactly once in each row and each column. Use 4 different color pencils to show your solution. (Note: using the different color chips you have may help you discover a solution.)



- Part B:** Consider the 6 x 6 grid shown below. Shade 6 of the un-shaded cells in the 6 x 6 grid in such a way that (a) there is only one shaded cell in each column, (b) there is only one shaded cell in each row, (c) no shaded cells share a vertex, and (d) no cell with an “x” is shaded.



School: _____

Problem 2 Answer Form

2. **Part A:** Use six different positive digits, to write a six-digit number, N , that when the values of N , $2N$, $3N$, $4N$, $5N$ and $6N$ are entered in the respective rows of the 6×6 grid below each of the six digits appear in each row and each of the six digits appear in each column.

N					
$2N$					
$3N$					
$4N$					
$5N$					
$6N$					

Part B: Explain your solution procedure. Your explanation should include more than just “trial-and-error”. i.e., your explanation should also include appropriate “mathematical reasoning”.

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Problem 3 Answer Form

3. There are 2 ovals in each of the 16 cells of the 4 x 4 grid and they will be referred to as either the top oval or the bottom oval. Color the ovals in each cell in such a way that:
- in each row the top ovals are all different colors
 - in each column the top ovals are all different colors
 - in each row the bottom ovals are all different colors
 - in each column the bottom ovals are all different colors
 - no two cells have the exact same coloring of the top oval and bottom oval
 - the top oval and bottom oval in the same cell may be the same color or they may be different colors

Use 4 colored pencils to show your solution.

