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# MATHCOUNTS®

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2014  
■ State Competition ■  
Team Round  
Problems 1–10

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School \_\_\_\_\_  
Chapter \_\_\_\_\_  
Team \_\_\_\_\_  
Members \_\_\_\_\_, Captain  
\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

**DO NOT BEGIN UNTIL YOU ARE INSTRUCTED TO DO SO.**

This section of the competition consists of 10 problems which the team has 20 minutes to complete. Team members may work together in any way to solve the problems. Team members may talk to each other during this section of the competition. This round assumes the use of calculators, and calculations also may be done on scratch paper, but no other aids are allowed. All answers must be complete, legible and simplified to lowest terms. The team captain must record the team's official answers on his/her own competition booklet, which is the only booklet that will be scored. If the team completes the problems before time is called, use the remaining time to check your answers.

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Total Correct	Scorer's Initials

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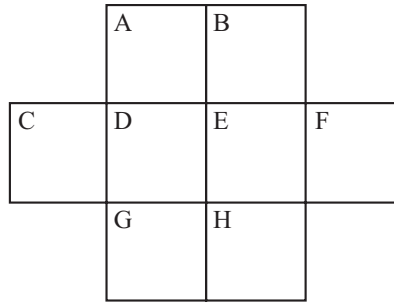
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1. \_\_\_\_\_ The numerals 1 to 8 are arranged in the figure so that no two consecutive integers touch at a side or on a corner. What is the product of the numbers in boxes C and F?

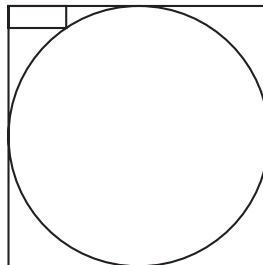


2. \_\_\_\_\_ The chart shown was generated using the equation  $y = ax^2 + bx + c$ . What is the value of  $a$ ? Express your answer as a common fraction.

$x$	$y$
-5	8
-3	5
-1	4
1	5
3	8

3. \_\_\_\_\_ If  $f(x) = x + 2$  and  $g(x) = x^2$ , then for what value of  $x$  does  $f(g(x)) = g(f(x))$ ? Express your answer as a common fraction.

4. \_\_\_\_\_ cm In the figure shown, the side lengths of the small rectangle are 5 cm and 10 cm and the lower right vertex of the rectangle is on the circle. What is the radius of the circle?



5. \_\_\_\_\_ integers How many positive 3-digit integers are palindromes and multiples of 11?

6. \_\_\_\_\_ miles Zhiyuan and his family are planning to attend a football game. The time it takes Zhiyuan to get to the football stadium is dependent upon the traffic. If traffic is heavy, he will only average 30 mi/h and he will arrive right on time. If traffic is light, he will average 55 mi/h and arrive 1 hour and 15 minutes early. In miles, what is the distance from Zhiyuan's house to the football stadium? Express your answer as a decimal to the nearest tenth.



7. \_\_\_\_\_ solids Four 1-cm cubes are joined face-to-face in all possible ways to form geometric solids. Two such solids are considered the same if one can be obtained from the other by rotation. How many such solids are possible?

8. ( \_\_\_\_\_ , \_\_\_\_\_ ) Triangle ABC with vertices A(1, 2), B(4, 4) and C(5, 1) is translated horizontally to the right 5 units, then translated vertically up 3 units. The triangle is then rotated 90° clockwise about the point (4, 4). What are the coordinates of the image of C after these transformations? Express your answer as an ordered pair.

9. \_\_\_\_\_ If  $a$  and  $b$  are positive integers such that  $\frac{1}{2} + \frac{1}{a} = \frac{1}{3} + \frac{1}{b}$ , what is the sum of all possible values of  $a$ ?

10. \_\_\_\_\_ In square ABCD, each vertex is connected to the midpoints of its two opposite sides, as shown. What is  $\frac{QR}{PQ}$ ? Express your answer as a common fraction.

