



# 2025 Chantilly Math Competition

Elementary School Division

6TH, 7TH, AND 8TH GRADERS **MUST** COMPETE IN THE MIDDLE SCHOOL DIVISION!

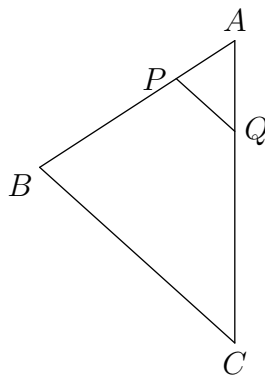
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## Competition Instructions

1. Do not open the test until instructed.
  2. No computational aids other than pencil/pen are permitted.
  3. Write answers in designated boxes on answer sheet.
  4. All answers must be nonnegative integers:  $\{0, 1, 2, \dots\}$ .
  5. Points per question range from 5 to 12.
  6. The test consists of 25 short-answer questions to be solved in 100 minutes.
  7. The final question will be used for tie-breaking.
  8. There is no penalty for incorrect answers.
  9. You will be graded on your answers—not your work.
  10. If you have any questions, ask your proctor.
  11. **Notation/Definitions:**
    - The dot  $\cdot$  denotes multiplication:  $a \cdot b = a \times b$ .
    - $n!$  denotes the factorial of  $n$ :  $n! = n \times (n - 1) \times \dots \times 1$ .
    - Two integers  $a$  and  $b$  are *relatively prime* if and only if  $\gcd(a, b) = 1$ .
- 



- (5 pts) Tyler has 23 candies on Halloween. Francis has 37 candies on Halloween. Tyler is sad because he has fewer candies. How many candies should Francis give to Tyler so that they both have the same number of candies?
- (5 pts) Neeraj has a pair of red socks, a pair of green socks, and a pair of blue socks, for a total of 6 socks. If Neeraj randomly picks 2 socks out of the 6 to wear, the probability that they are the same color can be expressed as  $\frac{m}{n}$  where  $m$  and  $n$  are relatively prime positive integers. Compute  $m + n$ .
- (5 pts) In the below diagram,  $\angle BAC = 57^\circ$ ,  $\angle PQA = 48^\circ$ , and  $PQ$  is parallel to  $BC$ . Compute the degree measure of  $\angle ABC$ .



- (5 pts) How many distinct prime divisors does 360 have?
- (6 pts) Compute 28% of 25.
- (6 pts) In how many ways can the letters in **CHANTILLY** be arranged such that there are two letters between C and T?
- (6 pts) A circle has a radius of 5. A chord of the circle is 8 units long. How far is the chord from the center of the circle?
- (6 pts) Which digit  $D$  makes  $\overline{12D4567}$  divisible by 9?  
Note that  $\overline{d_1d_2\dots d_n}$  represents the concatenation of digits  $d_1, d_2, \dots, d_n$ .
- (7 pts) Aarush is counting backwards by 8. His first three numbers are 1000, 992, 984. What is his 25th number?
- (7 pts) Consider a  $3 \times 5$  grid (15 unit squares) and seven  $1 \times 2$  dominoes, each fully covering exactly two adjacent unit squares. We wish to tile the grid with these dominoes so that the dominoes do not overlap and the only uncovered unit square is a corner of the grid.  
Determine the number of distinct tilings that satisfy these conditions. Note that the order in which the dominoes are placed does not matter.
- (7 pts) A square and a circle have the same perimeter. If the side of the square is 4 units, what is the area of the circle to the nearest integer?

12. (7 pts) Nischal thinks of a 3-digit positive integer  $N$  satisfying the following 3 properties:
- It is a palindrome (reads the same forwards and backwards).
  - The sum of its digits is 10.
  - It is divisible by 5.
- Find  $N$ .
13. (8 pts) What is the largest possible product of positive integers which sum to 16?
14. (8 pts) Aiden has 3 dice. One die has 4 sides numbered 1, 2, 3, 4. One die has 6 sides numbered 1, 2, 3, 4, 5, 6. One die has 8 sides numbered 1, 2, 3, 4, 5, 6, 7, 8. Aiden picked one die out of the three uniformly at random and rolled it. The bottom face of the rolled die had the number 1 on it. If the probability that he rolled the 8-sided die can be expressed as  $\frac{a}{b}$  for relatively prime positive integers  $a$  and  $b$ , compute  $a + 10b$ .
15. (8 pts) What is the maximum number of spheres of radius 1 that can fit into a cube with volume 64?
16. (8 pts) A group of 4 positive integers has an equal mean and range. What is the smallest possible sum of the squares of the 4 positive integers?
17. (9 pts) Sally's calculator shows the number 2. She repeatedly presses the square button, which multiplies the number on the calculator by itself. How many times must she press the square button until the number shown on the calculator has at least 2025 digits?
18. (9 pts) Daniel holds 12 real nuggets in his hand. 3 fanum-taxers, one after another, each randomly eat 1 of the 12 nuggets in Daniel's hand and put a fake nugget in Daniel's hand. The probability that Daniel ends up with exactly 10 real nuggets is  $\frac{m}{n}$  for relative prime positive integers  $m$  and  $n$ . Compute  $m + n$ .
19. (9 pts) What is the maximum number of acute angles that can be in a non-self-intersecting polygon with 2025 sides?
20. (9 pts) Let  $\tau(x)$  denote the number of positive integer divisors of  $x$ . Find the sum of all positive integers  $n$  such that  $n + \tau(n) = 38$ .
21. (12 pts) William writes the integers from 1 to 2025 inclusive in a row on a whiteboard. Sally sums all the digits written on the whiteboard. What sum does Sally get?
22. (12 pts) Let  $\tau(x)$  denote the number of positive integer divisors of  $x$ . Compute the number of positive integers  $n$  such that  $n \leq 100$  and  $\tau(\tau(n)) = \tau(n) - 1$ .
23. (12 pts) Note that  $x^5 = x \cdot x \cdot x \cdot x \cdot x$ . Compute the sum of all possible integer values of

$$\frac{x^5 - 5}{x - 1},$$

where  $x \neq 1$  is an integer.

24. (12 pts) In a cafeteria, there are 19 chairs arranged in a circle. Seven children each sit on a chair such that no two children are seated adjacent to each other. Out of these children, three are wearing blue shirts, three are wearing green shirts, and one is wearing a white shirt. Assume that children wearing the same shirt are indistinguishable and that any two seating arrangements that can be rotated to form the other are considered the same. How many possible seating arrangements are there?
25. (12 pts) All the words that can be formed by using all the letters in **CHANTILLY** are listed in alphabetical order. How many words are before the word **CHANTILLY**?
- TB. (Tiebreak) Nischal has 2025 squares in a row. He wants to color each of them red, green, or blue. Estimate the sum of the digits of the number of colorings where no 3 consecutive squares are the same color.

**2025 Chantilly Math Competition - Answer Sheet**  
**Elementary School Division**

**Name:** \_\_\_\_\_ **Grade:** \_\_\_\_\_

**Email:** \_\_\_\_\_

1	2	3	4	5
6	7	8	9	10
11	12	13	14	15
16	17	18	19	20
21	22	23	24	25

TB