

**2017 PiMC**

## FIRST ROUND

## INDIVIDUAL TEST

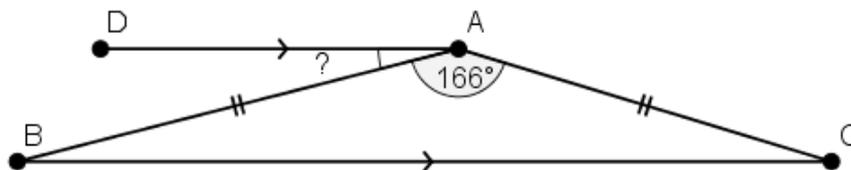
## INSTRUCTIONS

1. DO NOT OPEN THIS BOOKLET UNTIL YOUR PROCTOR TELLS YOU.
2. This is a 25 question test. Each question has a *single digit* answer: 0, 1, 2, 3, 4, 5, 6, 7, 8, or 9.
3. Mark your answer to each question on the Answer Form with a #2 pencil. Check the blackened circles for accuracy and erase errors and stray marks completely. Only answers properly marked on the answer form will be graded.
4. SCORING: You will receive 5 points for each correct answer, 1 point for each problem left unanswered, and 0 point for each incorrect answer.
5. As computational aids Rulers and Compasses are allowed. No calculators are allowed. No problem on the test will *require* the use of a calculator.
6. Figures are not necessarily drawn to scale.
7. When your proctor gives the signal, begin working on the problems. You will have **40 minutes** to complete the test.
8. After the exam, return your **Answer Form and Test Booklet** to your proctor.
9. You should NOT discuss any aspect of the exam problems with anyone until January 30, 2017. Problems and solutions to the test will be posted on the contest web site after January 30, 2017.

1. What is  $2 + 2 \times 2$ ?
  
  
  
  
  
  
  
  
  
  
2. Find the remainder when 2017 is divided by 67.
  
  
  
  
  
  
  
  
  
  
3. A *diagonal* of a polygon is a line segment between two vertices of the polygon that is NOT a side of the polygon. How many diagonals does a rectangle have?
  
  
  
  
  
  
  
  
  
  
4. What is  $(1 \times 2) + (2 \times 3) + (3 \times 4) - (4 \times 3) - (3 \times 2) - (2 \times 1)$ ?
  
  
  
  
  
  
  
  
  
  
5. The *absolute value* of a number  $n$ , denoted  $|n|$ , is the distance between  $n$  and 0 on the number line. For example,  $|11| = 11$  and  $|-12| = 12$ . Find  $|2 \times (1 - 3)|$ .
  
  
  
  
  
  
  
  
  
  
6. Andy and Sandy are siblings. Andy is a boy and Sandy is a girl. Sandy has 1 brother and Andy has 3 sisters. How many siblings does Andy have?
  
  
  
  
  
  
  
  
  
  
7. Freya realizes that the letters in the word “WHO” can be rearranged to form the word “HOW”. She notices that all *other* arrangements of those three letters result in bogus words. How many bogus words can she make by rearranging the letters W, H, O?
  
  
  
  
  
  
  
  
  
  
8. What is the hundreds digit of the first power of 2 greater than 600?

9. Edwin has a penguin machine. On day 1, the penguin machine produces 1 penguin. On day 2, it produces 2 penguins. On each day after the second day, the penguin machine produces one more penguin than it did on the previous day. How many days does it take the penguin machine to produce 36 penguins in total, including the first two days?
  
10. There is a square with integer side lengths. The sum of its area and perimeter is 21. What is the side length of the square?
  
11. An *emirp* is a prime number that is also prime if you reverse the digits. For example, the prime number 107 is an emirp since 701 is also a prime number. What is the number of emirps less than 50?
  
12. What is the units digit of the number of ways that I can put 3 different envelopes into 7 different mailboxes if more than one envelope can be put into the same mailbox?
  
13. Banana O'Reo can eat 240 sandwich cookies in 12 minutes. Apple O'Reo can eat the same number of sandwich cookies in 6 minutes. In how many minutes can Banana O'Reo and Apple O'Reo eat 240 sandwich cookies together?
  
14. The circumference of a circle with radius 1 is equal to the perimeter of a square. Which integer is closest to the side length of the square?
  
15. Picasso and Lola ran four laps. Picasso, increasing his run time by 25% at each lap, ran the second lap in 80 seconds. Lola ran each lap in 90 seconds. If they started running at the same time, by how many seconds did Lola beat Picasso?

16. In the figure below,  $\triangle ABC$  is an isosceles triangle with  $AB = AC$ .  $DA$  is parallel to  $BC$ . If  $\angle BAC = 166^\circ$ , then what is  $\angle DAB$ , in degrees?



17. For the 25-question Individual Round, the Pi Math Contest has the following scoring system: 5 points for a correct answer, 1 point for a blank answer, and 0 points for an incorrect answer. Harry took the Individual Round and scored 50 points. At least how many questions did he answer correctly?
18. Chomas Toy and Wanli Stang are swimming laps. Chomas and Wanli start at opposite ends of the pool and start swimming towards each other at constant rates. The first time they meet, Chomas has swum two-fifths of a lap. Chomas stops swimming after 6 laps. If Wanli stops swimming at the same time, how many laps did he swim?
19. Kevin is ordering pizza for the Pi Math Contest. He can order from 3 types of pizza: algebra pizza, geometry pizza, and number theory pizza. He needs to order at least 1 algebra pizza, at least 2 geometry pizzas, and at least 3 number theory pizzas. How many ways can Kevin order exactly 8 pizzas for the Pi Math Contest?
20. The sum of two numbers is 10 and the sum of their reciprocals is 5. What is their product?

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21. Alice and Bob are at the same house. Bob starts walking to school, and 10 minutes later, Alice starts walking to school. They both walk at constant speeds, but Alice walks 3 times as fast as Bob. They reach school at the same time. Alice was walking for how many minutes?
22. Find the difference between the two smallest numbers with exactly 6 positive factors.
23. Anna wrote four letters to four different people and labeled four different envelopes with their names. However, Anna's sister, Hanna, wants to mix up the letters. In how many ways can Hanna put letters in envelopes so that no letter is in the envelope with the correct name?
24. Paco has 10 squares. He puts 1 grain of rice in the first square, 2 grains of rice in the second square, 4 grains of rice in the third square, and so on, doubling the number of grains of rice in the next square. Find the first (leftmost) digit of the the number of grains of rice he puts to fill all the squares.
25. An equilateral triangle and a regular hexagon have equal perimeters. If the area of the regular hexagon is 12, what is the area of the equilateral triangle?