Pi Math Contest Fermat Division

2025

INSTRUCTIONS

1. DO **NOT** OPEN THIS BOOKLET UNTIL YOUR PROCTOR TELLS YOU!
2. This is a 25 question test. Each question has a two digit answer: 00, 01, 02, 03, . . ., 99. For example, if the answer is 1, you must bubble 01 instead of 1.
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 10 points for each correct answer, 1 point for each problem left unanswered, and 0 points for each incorrect answer.
5. Only pencils, pencil sharpeners, erasers, and blank scratch papers are allowed. All other aids, including but not limited to calculators and notes, are not allowed.
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, Test Booklet and scratch papers** to your proctor.
9. Do NOT discuss any exam questions until **March 24, 2025**, after which problems and solutions will be available on the contest website.

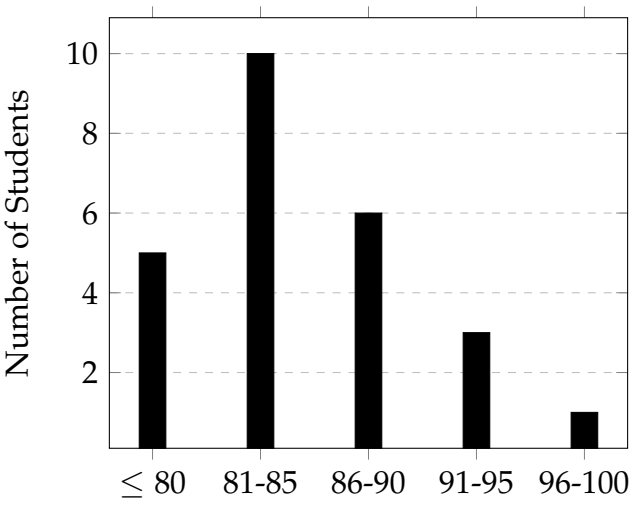
1. One gallon of gasoline costs \$3.85. How many dollars will Inbar pay for 20 gallons of gasoline?

2. Farmer John uses 36 feet of fencing to enclose a square pigpen. In square feet, what is the area of the pigpen?

3. How many integers n satisfy the inequality $|n| < 4\pi$?

4. What is the value of $\frac{5}{3} \times \frac{6}{4} \times \frac{7}{5} \times \ldots \times \frac{23}{21} \times \frac{24}{22}$?

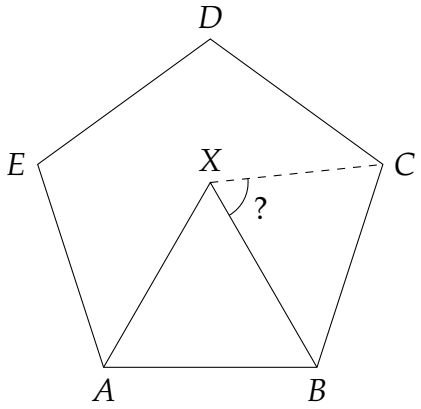
5. The histogram shows the distribution of the students' quiz scores in Ms. Wood's geometry class. What percentage of the students in the class scored greater than or equal to 91 points?



6. The diagonal of a TV measures 65 inches, and the ratio of the length of the TV to its width is 4 : 3. What is the length of the TV, in inches?

7. How many positive 3-digit integers are there, such as 105, whose digits add up to 6?

8. Equilateral triangle ABX is drawn inside regular pentagon $ABCDE$. What is the degree measure of $\angle BXC$?



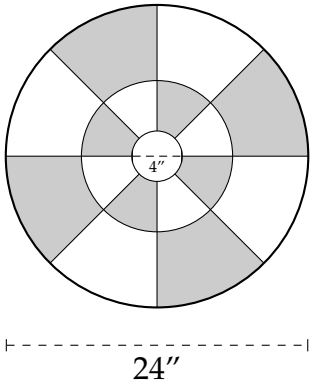
9. When $4^{14} \times 5^{20}$ is multiplied and written out, how many digits does it contain?

10. Alyssa has an unfair coin which lands heads with probability 60%. Expressed as a percent, if Alyssa flips this coin twice, what is the probability that she obtains exactly one head?

11. What two-digit integer is equal to 6 times the sum of its digits?

12. Five students, including Gilbert and Raymond, sit in a row of five seats. How many different ways can all five students seat themselves so that Gilbert and Raymond do **not** sit next to each other?

13. A custom dartboard is divided into 17 regions as shown. The diameters of the dartboard and the central bullseye are 24 inches and 4 inches, respectively. If the total area of the shaded regions is $k\pi$ square inches, what is k?



14. A function $f(x)$ satisfies the property that $f(x+y) = f(x) + f(y) - 7$ for all integers x and y. What is $f(1) + f(-1)$?

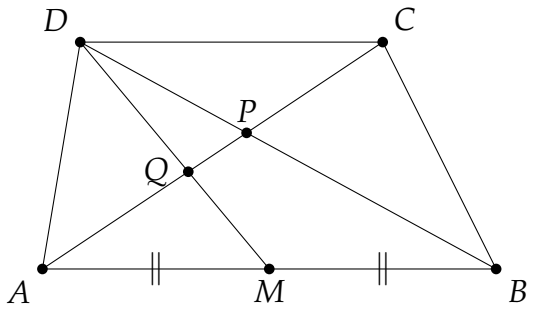
15. Jesse rode his bicycle along a path consisting of uphill and downhill segments. He averaged 6 miles per hour (mph) going uphill, and 15 mph going downhill. Jesse averaged 10 mph throughout his trip, and rode for a total of 90 minutes. How many minutes did Jesse spend riding downhill?

16. Nigel has a collection of \$1, \$5, and \$20 bills in his savings jar. He has 22 bills in his savings jar, which are worth a total of \$164. How many \$5 bills does Nigel have in his savings jar?

17. Which two-digit positive integer has exactly 6 odd positive factors and 6 even positive factors?

18. In the xy-plane, the graphs of the equations $y = x$ and $y = -x - 4$ divide the circle whose equation is $x^2 + y^2 = 16$ into four regions, consisting of two congruent, larger regions and two congruent, smaller regions. The area of one of the larger regions is $m\pi + n$ square units, for some integers m and n. What is $m + n$?

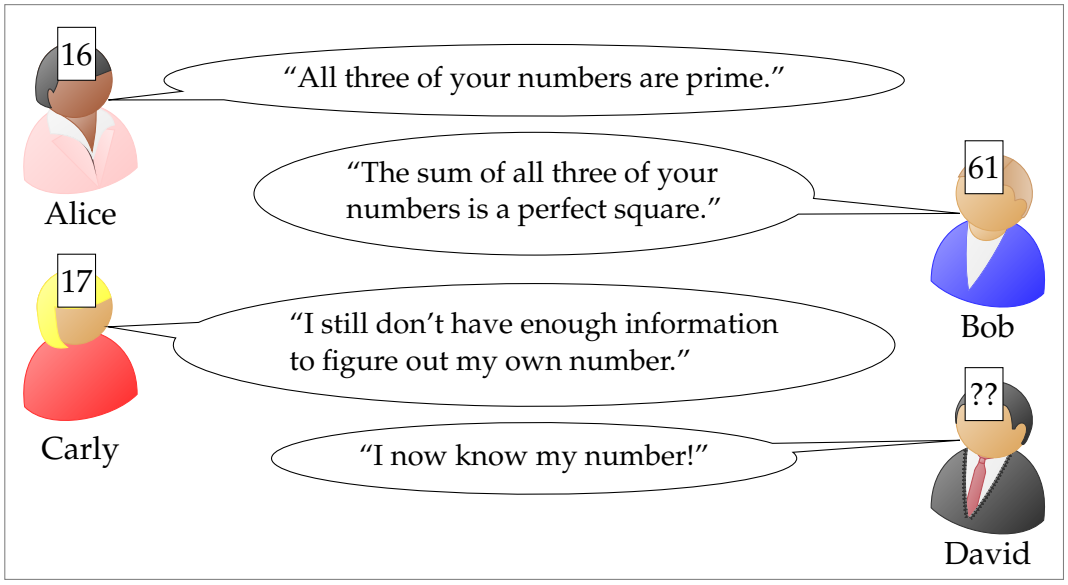
19. In trapezoid $ABCD$ with parallel bases $\overline{AB}$ and $\overline{CD}$, point M is the midpoint of $\overline{AB}$, point P is the intersection of diagonals $\overline{AC}$ and $\overline{BD}$, and point Q is the intersection of diagonal $\overline{AC}$ and segment $\overline{DM}$. Given that $AB = 6$ and $CD = 4$, what integer is closest to the ratio of the area of trapezoid $ABCD$ to the area of $\triangle DPQ$?



20. A digital scale displays weights in grams (g), with a random error of ≤ 5 g from the actual weight. Jo has one apricot, one lime, and one plum, each weighing a whole number of grams. When she places the apricot and lime on the scale, the scale displays 87 g. When she places the apricot and plum on the scale, the scale displays 85 g. Finally, when she places the lime and plum on the scale, the scale displays 106 g. What is the smallest possible weight (in grams) of the apricot?

21. How many positive integers are factors of both $10^{2022} - 1$ and $10^{2025} - 1$?

22. A deck contains 100 cards numbered 1 through 100. Alice, Bob, Carly, and David are each given a different card. Each person tapes their card to their forehead, so that they can see everyone's cards except their own. They have the following conversation:



Assuming everyone speaks truthfully, what number is on David's card?

23. The 4-digit integer 2025 has the property that, when split between the hundreds and tens digits to form two 2-digit integers (20 and 25), the second integer is 5 greater than the first integer. Other than 45, there is exactly one other positive 2-digit integer n such that n^2 is a 4-digit integer with this property. What is n?

24. When the fraction $\frac{a}{b}$ is rounded to the nearest hundredth, the result is 0.51. Given that a and b are 2-digit positive integers, what is the smallest possible value of $a + b$?

25. Points B and C are on a semicircle with diameter $\overline{AD}$, so that B is closer than C to A, and $BC = CD$. Given that the areas of $\triangle ABD$ and $\triangle BCD$ are $56\sqrt{2}$ cm^2 and $8\sqrt{2}$ cm^2, respectively, what is the perimeter of quadrilateral $ABCD$, in cm?