

The Mandelbrot Competition

Round Three Test

Time Limit:
40 minutes

Name: _____

1. Each of the cards at right has a single digit from 1 to 9 written on the back. The statement shown on each card is true, unless the digit on the other side is a 4, in which case it is false. What is the sum of the two hidden numbers?

The sum of the numbers is 11.

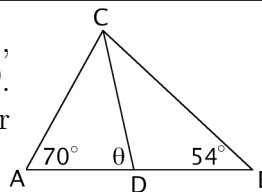
The product of the numbers is 28.

1

2. Two congruent circular outlets in a dam together permit 1000 gallons per minute (gpm) of water to flow through. Assuming that flow rate is proportional to the area of the outlet, what would the total flow rate be, in gpm, if the diameter of one hole were doubled while the other diameter were halved?

1

3. Let ABC be a triangular piece of paper with $m\angle A = 70^\circ$, $m\angle B = 54^\circ$. Mark a point D along \overline{AB} with $m\angle ADC = \theta$. Fold and crease the paper so that C lands on top of D . For what value of θ is the resulting quadrilateral cyclic?

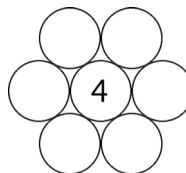


2

4. Let $P = (13)(17)(23) \cdots (97)$ be the product of all two digit numbers that end with either a 3 or a 7. What are the last two digits of P ?

2

5. One can place the digits from 1 to 7 in the circles, with the 4 in the middle, so that the sums of the numbers within any row or diagonal—nine sums in all—are all different. Which two digits (other than the 4) must be placed next to the 1?

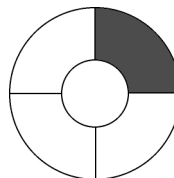


2

6. Given triangle ABC , draw its circumcircle and let the angle bisector of $\angle A$ intersect this circumcircle at point P . Suppose that the circumradius is 10, $BC = 17$, and $\sin(m\angle ABP) = \frac{3}{5}$. Compute the area of quadrilateral $ABPC$.

3

7. In the game “Going in Circles” one places a marker on the shaded region, then repeatedly rolls a fair four-sided die (which comes up 1, 2, 3, or 4) and advances the marker that number of spaces in a counterclockwise direction until it eventually lands on the shaded region to end the game. On average, how many times does the marker circle the board during the game?



3

SCORE: