

*2023 Castro Valley Junior Math Tournament
Hosted by CV Mu Alpha Theta*

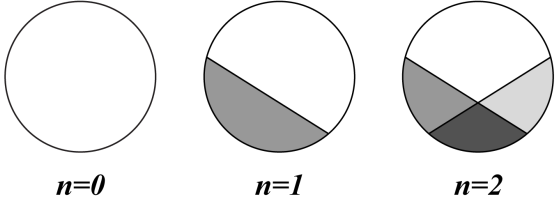
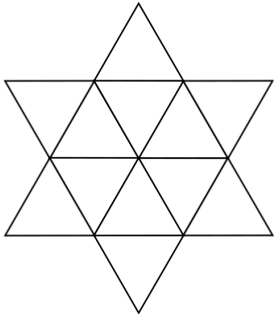
Middle School Division

Geometry & Number Theory Group Round

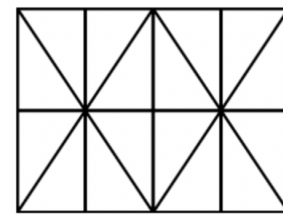
15 minutes 20 questions

Instructions

- Do not turn over this test until you are instructed to begin.
- Write your answers on the separate answer sheet.
- Express all of your answers in simplified form.
- Do not include units.

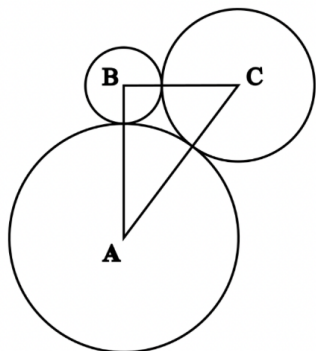
#	Problems
1	Two angles in a triangle measure 12 degrees and 34 degrees. What is the measure of the third angle?
2	What is the perimeter of a hexagon with side lengths of 4, 5, 8, 4, 5, and 8?
3	How many lines of symmetry are in an equilateral triangle?
4	What is the maximum number of right angles that a pentagon can have?
5	<p>What is the maximum number of pizza slices that can be made with only 4 straight cuts? An example with 0, 1, and 2 cuts is shown below.</p> <div style="text-align: center;">  <p style="display: flex; justify-content: space-around; margin-top: 10px;"> $n=0$ $n=1$ $n=2$ </p> </div>
6	What is the largest number smaller than 1000 that leaves a remainder of 11 when divided by 17?
7	What is the smallest possible product of a two-digit number and a three-digit number obtained from five distinct digits?
8	What is the greatest three-digit number divisible by both 7 and 8?
9	How many three-digit numbers have a tens digit that is 5, 6, or 9?
10	How many two-digit numbers have the property that their tens digit is less than their ones digit?
11	A number is called a Niven number if it is divisible by the sum of its digits. How many Niven numbers are there between 1 and 10 inclusive?
12	A Mersenne prime is a prime number of the form $2^n - 1$ for some integer n . In fact, the largest known prime number $2^{82,589,933} - 1$ is a Mersenne prime. How many Mersenne primes are there below 100?
13	<p>How many triangles of any size are in the figure shown?</p> <div style="text-align: right; margin-top: 20px;">  </div>

14 How many triangles of any size are in the figure shown?

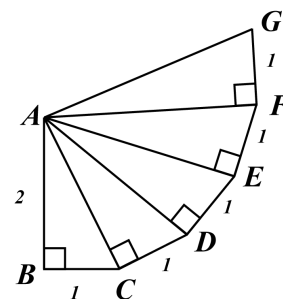


15

Circle A has a radius of 6, circle B has a radius of 2, and circle C has a radius of 4. They are tangent to each other as shown, and $m\angle ABC = 90^\circ$. What is the area of the triangle whose vertices are the centers of the circles A, B, and C?

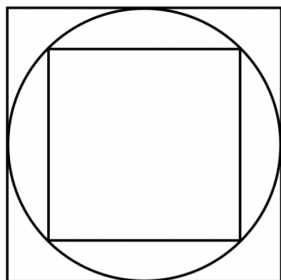


16 What is the length of AG?



17

A circle is inscribed in a large square and circumscribed about a smaller square. The area of the larger square is 6 square meters. What is the area of the smaller square?



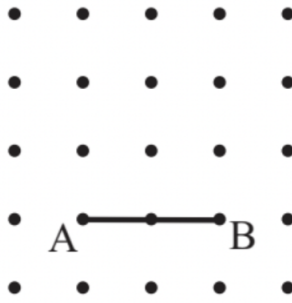
18

How many different *squares* can be formed by using four of the evenly-spaced dots below as vertices of the square?



19

The dots are evenly spaced vertically and horizontally. Segment AB is drawn using two points, as shown. Point C is to be chosen from the remaining 23 points. How many of these 23 points will result in an isosceles triangle ABC?



20

Consider the diagram below. It depicts a square with an area of 1. What is $\sum_{n=1}^{\infty} \left(\frac{1}{4}\right)^n = \frac{1}{4} + \frac{1}{16} + \frac{1}{64} + \dots$? (Hint: tilt your head to the right.)

