OEMC Individual Round

The OEMC was created by SuperJJ on AoPS as he partnered with MathJams to help make the contest possible. Endless nights of discussion, website desigining, problem writing, and other tiring things helped make what the OEMC is today. The goal was to help young talented kids discover and pursue the love and talent for mathematics both competitively and cooperatively.

A huge thank you to the OEMC test-writing team for helping me write the test. I couldn't have done it without you guys, and I can't express my gratitude for the amount of effort you put into helping this contest become possible. Each one of you guys spent days working on making/editing problems, choosing which ones to use and which ones to discard, and helping the overall quality of the test. Thank you to the OEMC test-solving team, for helping edit and notice any errors in the test. All of their AoPS usernames can be found on our website.

Another huge thank you to The Daily Challenge and Explore Math for Sponsoring the Contest for prizes. Both of these organizations are dedicated to helping people excel in mathematics and boost their performance on math contests. I can't thank you guys enough. More information about them is on our website.

Talking about the test before 6:25 EST on January 9th is strictly forbidden, as well as having outside help through the internet or interaction through people. Actions like these will result in disqualification and possible banning from ever taking the test again.

The individual round is 45 Minutes. Only pencils, paper, and rulers are allowed on the exam. Calculators are prohibited. Your test will start on the next page.

Question 1.

What is the sum of the first 10 positive integers?

Question 2.

Big Guy is biking to Little Guy. Big Guy rides at 30 mph and Little Guy lives 120 miles away. How many minutes will it take for Big Guy to reach Little Guy's house?

Question 3.

What is the value of $(1000 - 333) \cdot (47 - 23) \cdot (13 - 12 - 1)$?

Question 4.

Benny visits a local store. In the store, 2 pencils and 3 pens cost 21 dollars, and a pen costs 2 more dollars than a pencil. How much money will Benny need to buy 1 pencil and 1 pen?

Question 5.

Lilly is making Lollipop Syrup! She needs to make the mixture by mixing Lollipops and hot water in a ratio of 2:1. She has 50 cups of Lollipops and 19 cups of water. Lilly makes the maximum number of cups of

Lollipop Syrup. How many cups of Lollipops must she get rid of?

Question 6.

If $a : b = 1 : 3$ and $b : c = 2 : 5$, and $a : c$ are integers in the lowest terms, what is $a + c$?

Question 7.

Joey has 48 fruits, but his sister only has 16 fruits. How many fruits should Joey give his sister so that he has one more than double the number of his sister's fruits?

Question 8.

Chip likes playing Polly Gon with his friends Shawn, Rob, and Todd. Chip often gets angry after losing a game, and may remove a couple of his teammates from his team. How many possible teams could Chip end up with after losing a game?

Question 9.

What is the remainder when 112358 is divided by 3?

Question 10.

Bob, Joe, Henry, and Tanay want to stand in a line. Bob and Joe must have exactly 1 person between them. How many ways can they line up?

Question 11.

The number a leaves a remainder of 2 when divided by 5, and the number b leaves a remainder of 4 when divided by 5. What is the remainder when ab is divided by 5?

Question 12.

Square $ABCD$ is graphed on a coordinate plane with A at $(0,0)$, B at $(4,0)$, C at $(4,4)$, and D at $(0,4)$.Circle O is drawn such that its area is double that of $ABCD$. The radius of circle O can be expressed as $\sqrt{\frac{a}{\pi}}$.What is a ?

Question 13.

Avi goes to buy pizza for his 5 friends. However, on his way back, Terry the thief steals 2 pizza slices. Gary the generous then gives 1 pizza slice to Avi. After Avi splits it with his 5 friends (plus himself), each friend is able to eat 1 slice exactly. How many pizza slices were there originally (before Terry the thief stole 2 slices of pizza)?

Question 14.

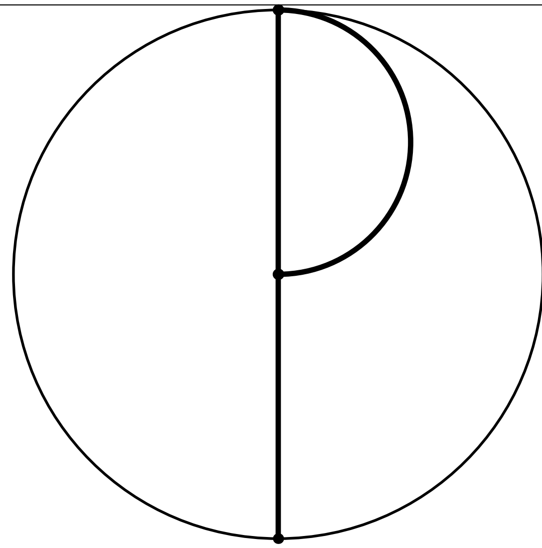
If two prime numbers sum to 75, what is their difference?

Question 15.

If $\frac{3x+y}{2x+5y} = 1$, what is the greatest common factor of all possible values of $x + y$, where x and y are integers?

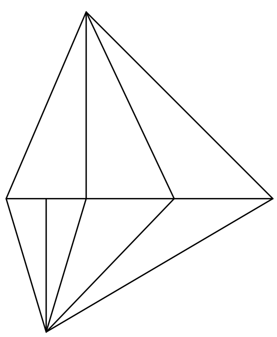
Question 16.

Luke Rob decides to draw circle A and inscribe the letter "P" in it. If the radius of circle A is 4, and the dome of the letter P is a semicircle with diameter 4, the perimeter of the letter P can be expressed as $a + \pi b$, what is $a + b$?



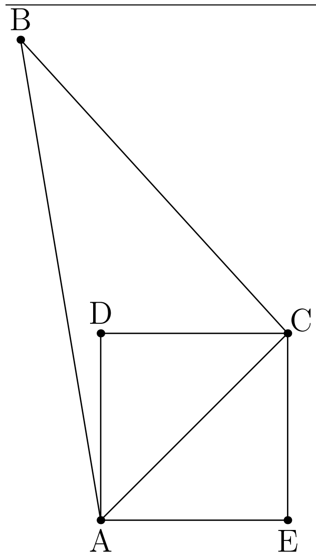
Question 17.

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



Question 18.

Right triangle ABC has hypotenuse 17 and a leg length of 15. The triangle is attached to square $ADCE$ such that the shortest side of the triangle is the diagonal of the square as shown in the diagram. What is the area of $ABCD$? The figure is not to scale.



Question 19.

How many real solutions are there to $\sqrt{x^2} = x + 1$?

Question 20.

Let X be the set of positive multiples of 8 from 8 to 304 :8, 16, 24, 32..., 296, 304 and Y be the set of positive multiples of 6 from 6 to 306: 6, 12, 18, 24..., 300, 306. Let p be the sum of all the remainders when each number in X is divided by 3. Let q be the sum of all the remainders when each number in Y is divided by 5. What is $q - p$?

Question 21.

How many solutions does $(x-1)^2 + (x-2)^2 + (x-3)^2 + (x-4)^2 + (x-5)^2 = 0$ have?

Question 22.

What is the greatest 2 digit integer with 8 factors?

Question 23.

Let there be an equilateral triangle ABC. Inscribe circle O in ABC such that circle O is tangent to all three sides of ABC. Construct altitude AD of ABC. Segment AD intersects circle O at two points, which are D and E. If AE is 1, then the length of AB can be expressed as $a\sqrt{b}$ such that $a \neq 1$ and b isn't divisible by the square of any prime. What is $a + b$?

Question 24.

A group of 8 girls are very picky about their group picture. Angelina must sit next to Bella and Emily refuses to sit next to Franchesca. They are sitting in a circle. How many ways can they be placed? Two seatings are considered equivalent if one is a rotation of the other.

Question 25.

$ABCD$ is a trapezoid with $AD \parallel BC$. $\angle B = 90$, and $AB = 2AD = BC$. Let P be a point in $ABCD$ such that $AP = 1, BP = 2, CP = 3$. The area of trapezoid $ABCD$ can be expressed in simplest form as $\frac{a+b\sqrt{2}}{c}$. Find $a^2 + b^2 + c^2$