Nassau County Interscholastic Mathematics League

Contest #2 Answers must be integers from 0 to 999, inclusive. 2025 – 2026

Calculators are allowed.

Time: 10 minutes **Name: _____**

7. The sum of two prime numbers is 75. Compute the product of the two prime numbers.

8. Compute the number of integers between 400 and 999 that have 3 distinct digits.

7. ☐ 8. ☐

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9. If $\frac{x+y}{x} = 9$, $\frac{y+z}{y} = 17$, and x, y, and z are positive integers, compute $\frac{x+y+z}{x}$.

10. Three tangent segments are sides of a triangle that circumscribes the circle whose equation is $(x+2)^2 + y^2 = 1$. Two of the tangent segments contain the origin and the third tangent segment is vertical. If the area of the triangle formed by these three segments may be expressed in simplest radical form as $a\sqrt{b}$, compute $a + b$.

9. ☐ 10. ☐

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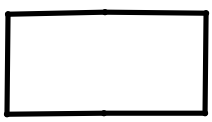
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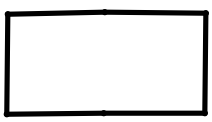
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Time: 10 minutes **Name: _____**

11. Quadrilateral $ABCD$ is inscribed in a circle with $AB = 7, BC = 15, CD = 20$, and $AD = 24$. Compute the area of the quadrilateral.

12. Compute the value of $(\sin 14°)(\tan 7° + \cot 7°) + (\sin 28°)(\tan 14° + \cot 14°) +$ $(\sin 42°)(\tan 21° + \cot 21°) + \ldots + (\sin 448°)(\tan 224° + \cot 224°) +$ $(\sin 462°)(\tan 231° + \cot 231°) + (\sin 476°)(\tan 238° + \cot 238°)$.

11. 

12. 

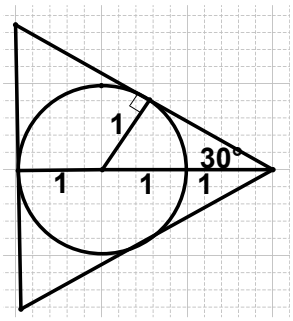
Solutions for Contest #2

7. If the sum of two prime numbers is odd, then one of the prime numbers must be 2. The other in this case is 73 and the product of those numbers is **146**.

8. There are 6 choices for the hundreds digit, 9 choices for the tens digit and 8 choices for the units digit. That is a total of $6 \cdot 9 \cdot 8 = \mathbf{432}$.

9. Transform the given equations to: $x + y = 9x,\ y + z = 17y \rightarrow y = 8x,\ z = 16y \rightarrow$ $z = 128x \rightarrow \frac{x+y+z}{x} = \frac{x+8x+128x}{x} = \frac{137x}{x} = \mathbf{137}$.

10. The coordinates of the center of the circle are $(-2,0)$ and the radius is 1. Draw a radius to one of the non-vertical tangent lines to form a right triangle with leg of length 1 and hypotenuse of length 2. This means that the angle between the tangent line and the x-axis is 30 degrees. Thus, the larger triangle formed is equilateral with altitude of length 3. The base of the triangle is $2\sqrt{3}$ and its area is $\frac{1}{4}\left(2\sqrt{3}\right)^2\left(\sqrt{3}\right) = 3\sqrt{3}$. The required sum is **6**. Alternatively, the vertices of the larger triangle are $(0,0)$, $\left(-3, 3\sqrt{3}\right)$, and $(-3, -3\sqrt{3})$. So, the area of the triangle is $\frac{1}{2}bh = \frac{1}{2}(2\sqrt{3})(3) = 3\sqrt{3}$. Continue as above.



11. By inspection, we note that 7-24-25 and 15-20-25 are Pythagorean triples. So, $BD = 25$ and $\measuredangle A$ and $\measuredangle C$ are right angles. Thus, $|ABCD| = |\Delta ABD| + |\Delta BCD| = \frac{1}{2}(7)(24) + \frac{1}{2}(15)(20) = 84 + 150 = \mathbf{234}$.
Alternatively, use Brahmagupta's formula, $A = \sqrt{(s-a)(s-b)(s-c)(s-d)}$, where $s = \frac{1}{2}(a+b+c+d) = 33$.

12. If $x = 7°$, then the first term is $(\sin(2x))(\tan x + \cot x) = (2\sin x \cos x)\left(\frac{\sin x}{\cos x} + \frac{\cos x}{\sin x}\right) = (2\sin x \cos x)\frac{\left(\sin^2 x + \cos^2 x\right)}{\sin x \cos x} = 2 \cdot 1 = 2$. Every term of the series has a value of 2. Using $a_n = a_1 + d(n-1),\ 476 = 14 + 14(n-1) \rightarrow 33 = n - 1 \rightarrow n = 34$. Since there are 34 terms, the sum of the series is $2(34) = \mathbf{68}$.