Bergen County Math League
Calculators Permitted

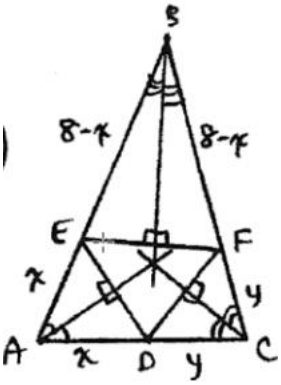
Contest #2 **2023-2024** **Answers/Solutions**

2-1. **Answer:** 3
Apply the Pythagorean Theorem five times, starting with triangle ABC and moving counterclockwise.

2-2. **Answer:** $-3, 4, 0, -1, 3$
The fraction is undefined if $x + 3 = 0$, if $x - 4 = 0$, if $x = 0$, or if $x - 2 - \frac{3}{x} = 0$. There are 5 elements in the union of the solution sets of these equations, namely $-3, 4, 0, -1, 3$.

2-3. **Answer:** $(3, 1)$
$2^{2x} - 3^{2y} = (2^x + 3^y)(2^x - 3^y) = 55 \times 1 = 11 \times 5$
Taking $2^x + 3^y = 11$ and $2^x - 3^y = 5$, adding these equations together yields $2(2^x) = 2^{x+1} = 16$, so $x + 1 = 4$ and $x = 3$. Substitute back into $2^x - 3^y = 5$ to find $y = 1$.
Note that attempting the same technique with 55 and 1 results in $2^{x+1} = 56$, which has no integer solution.

2-4. **Answer:** 4



There are 3 pairs of ≅ triangles.
$(8 - x + x) + (x + y) + (y + 8 - x) = 24 \Rightarrow y = 4.$

2-5. **Answer:** 7
$x + x + \frac{1}{2}x + \frac{5}{2} = 20 \Rightarrow x = 7.$

2-6. **Answer:** 33 or $33
Open three links from one chain, join to form a circle. Then close the three links $\Rightarrow 3(5 + 6) = 33$ or $33.