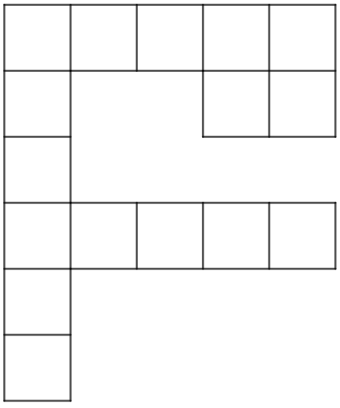
Part I: SHORT ANSWER

You only write your final answer. The maximum points for each number are 5 points.

1. Let p, q, and r be nonzero real numbers such that $p + \frac{1}{q} = 10$, $q + \frac{1}{r} = 24$, and $r + \frac{1}{p} = 26$. Find $pqr + \frac{1}{pqr}$.

Answer_____

2. What is the largest number of non-overlapping F-polyominos that can be cut out of the 3012×3012 square? The Polyominoes can be rotated and flipped.



Answer_____

3. In triangle PQR, point S is on $\overline{PR}$, and $\overline{QS}$ is an altitude of triangle PQR. Point T on $\overline{QR}$ and $\overline{ST}$ is a median of triangle QSR. The measure of $\angle PRQ = 50°$ and $\angle PQS = 60°$. What is the measure of $\angle TSP$ in degree?

Answer_____

4. Tara has 8 sticks, each having an integer length. She realized that she cannot form a triangle using any three of her collections of sticks as side lengths. What is the shortest possible length of the longest of her eight sticks?

Answer_____

5. Consider the following sequence of 250 numbers in base 23:
$1, 2, 3, \ldots, 249, 250$
What is the greatest difference between the values of consecutive numbers in base 10?

Answer_____

Part II: ESSAY

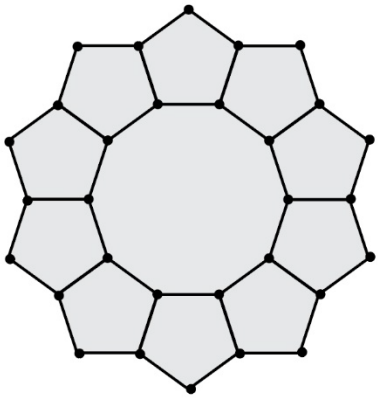
Write your answers completely with step–by–step. The maximum points for each number are 15 points.

6. Suppose there are integer numbers written on a glass board, which are 1 to 2023. At each step, Nemo selects any two numbers (randomly) and replace them with their difference. Is it possible to have 29 in the end as the only remaining number?

7. Let V be the set of vertices of a regular 27 sided polygon with the center at point O. How many triangles have vertices in V and contain the point O in the interior of the triangle?

8. Let n is a positive integer, can you find an integer p such that $p^2 = n^2 + n + 1$?

9. Fibo makes the following figure, a regular decagon (10 sided polygon) is exactly enclosed by 10 regular pentagon.



Aci want to make similar pattern. She wants to use a dodecagon (12 sided polygon). Is it possible that she can find a regular polygon used to enclose the dodecagon? Explain it.

10. Two distinct lines l_1 and l_2 with positive gradient m_1 and m_2 respectively, pass through point $P(4,12)$. The area of triangle formed by P and the x −intercepts of l_1 and l_2 equals 288. If $m_1 \leq 0.24$, how many different number of integer values m_2 can take on?

ANSWER

No.	ANSWER
1	6,180
2	504,008
3	130
4	21
5	313
6	Impossible
7	819
8	No
9	Impossible
10	6