

Instructions: Show all work. Use exact answers unless specifically asked to round. Be sure to complete all parts of each problem.

1. Find the first five terms of the sequence $A_N = \left(-\frac{1}{N}\right)^{N-1}$. (6 points)

$$A_1 = \left(-\frac{1}{1}\right)^{1-1} = (-1)^0 = 1 \quad A_2 = \left(-\frac{1}{2}\right)^{2-1} = \left(-\frac{1}{2}\right)^1 = -\frac{1}{2}$$

$$A_3 = \left(-\frac{1}{3}\right)^{3-1} = \left(-\frac{1}{3}\right)^2 = \frac{1}{9}, \quad A_4 = \left(-\frac{1}{4}\right)^{4-1} = \left(-\frac{1}{4}\right)^3 = -\frac{1}{64}$$

$$A_5 = \left(-\frac{1}{5}\right)^{5-1} = \left(-\frac{1}{5}\right)^4 = \frac{1}{625}$$

$1, -\frac{1}{2}, \frac{1}{9}, -\frac{1}{64}, \frac{1}{625}, \dots$

2. Find a formula for the sequence 21, 28, 35, ... (6 points)

$$A_N = 21 + 7N \quad \left\{ \begin{array}{l} n=0 \\ 7=d \end{array} \right. \quad \text{or} \quad A_N = 21 + 7(N-1) \quad \left\{ \begin{array}{l} n=1 \\ 7=d \end{array} \right.$$

$$= 14 + 7N$$

3. Find the sum of $21 + 28 + 35 + \dots + 413$. [Hint: first determine which term in the sequence is 413.] (8 points)

$$413 = A_{N-1} = 21 + 7(N-1) \Rightarrow N-1 = 56 \Rightarrow N = 57$$

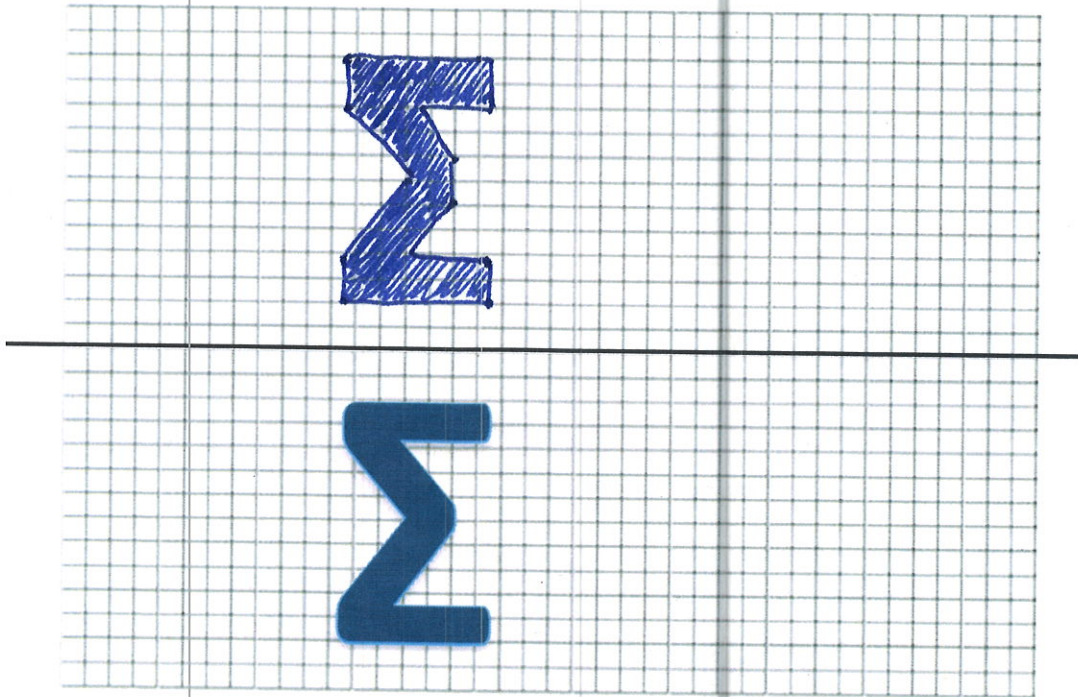
$$\frac{(21+413)57}{2} = 12,369$$

4. A geometric series is defined by $P_N = 4P_{N-1}$, $P_0 = \frac{1}{8}$. Find the sum of the first 20 terms. (7 points)

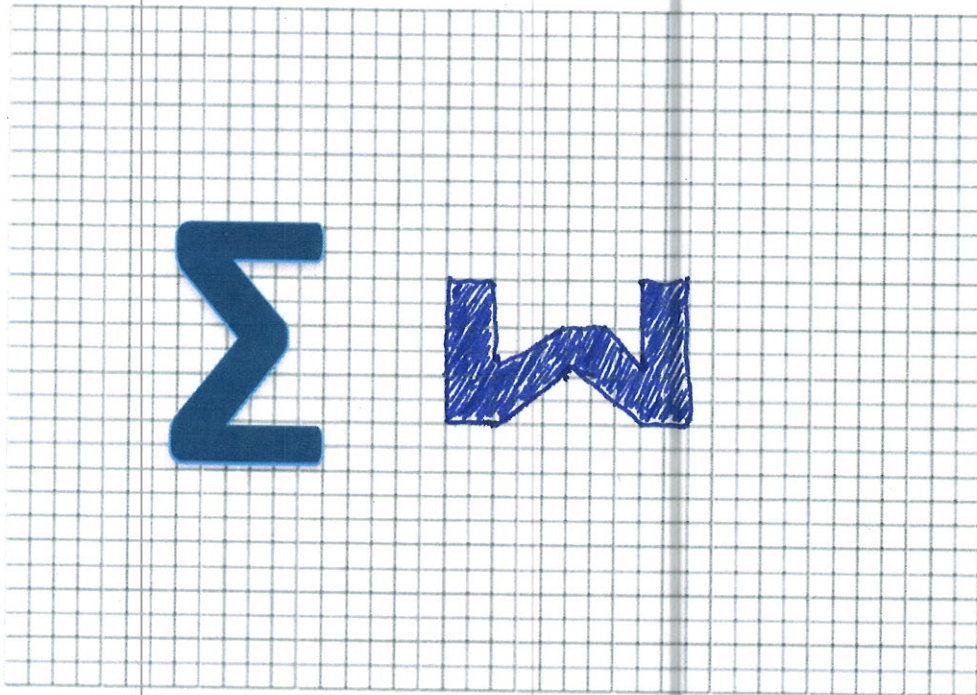
$$P_0 + \dots + P_{N-1} = P_{20} \quad R=4$$

$$= \frac{\frac{1}{8}(1-4^{20})}{1-4} \approx 1.8325 \times 10^{11}$$

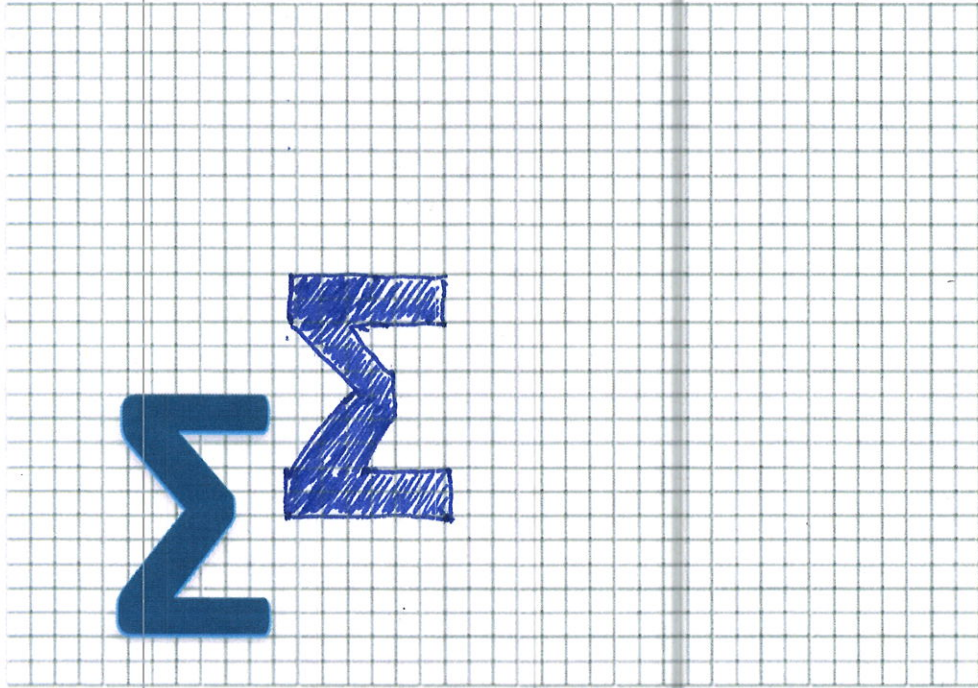
5. Perform the indicated rigid motions.
a. Reflect across the indicated line. (7 points)



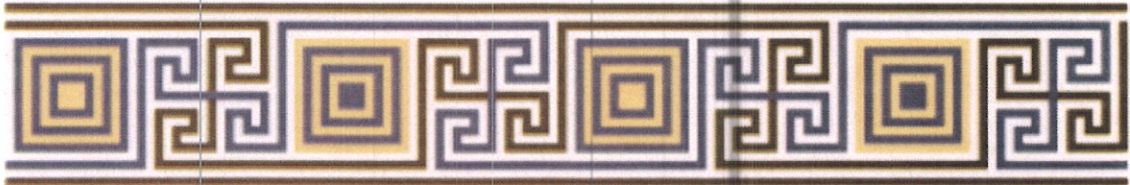
- b. Rotate by 90° counterclockwise. (7 points)



- c. Translate by the vector $\vec{v} = \langle 7, 5 \rangle$ (7 points)



6. State the symmetries of the border pattern below. [You do not need to provide notation.] (5 points)

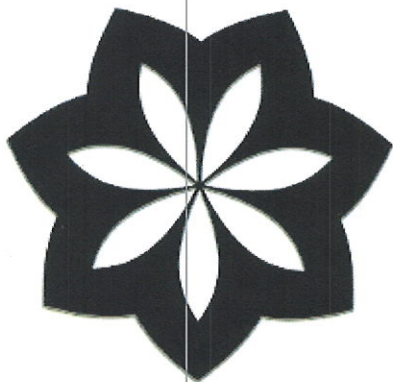


rotations - 180° & 360°

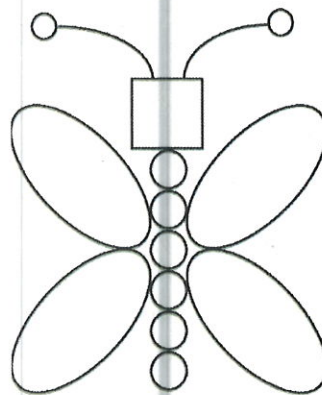
translation

no reflection symmetry

7. For each of the shapes below, use correct notation to indicate which type of symmetries are present. (5 points each).



D_6



D_1