1. (3 points) Does \( \int_0^\frac{1}{2x} dx \) converge or diverge? Support your answer.

\[
\lim_{t \to 0^+} \int_0^1 2x \, dx = \frac{1}{2} \lim_{t \to 0^+} \int_1^t \frac{1}{x} \, dx = \frac{1}{2} \lim_{t \to 0^+} \left[ \ln x \right]_1^t \\
= \frac{1}{2} \lim_{t \to 0^+} \left( 0 - \ln t \right) = -\frac{1}{2} \lim_{t \to 0^+} \ln t = -\frac{1}{2} (-\infty) = \infty \\
\therefore \text{ diverges}
\]

2. (4 points) Find the area between \( f(x) = 4 \) and \( g(x) = x^2 \)

a. Draw a graph of the situation.

b. Find the bounds of integration (ie: find a and b).

\[ a = -2 \quad \quad 4 = x^2 \]
\[ b = 2 \quad \quad \pm 2 = x \]

c. Calculate the area.

\[
\int_{-2}^{2} 4 - x^2 \, dx = 2 \int_{0}^{2} 4 - x^2 \, dx \\
= 2 \left[ 4x - \frac{x^3}{3} \right]_0^2 \\
= 8 \left( -\frac{8}{3} \right) \\
= \frac{16}{3} - 0 = \frac{32}{3} = \boxed{10.67} \\
\]

3. (3 points) Give the 5th term in the sequence, and then find the \( n \text{th} \) term in the sequence (ie: \( a_n \) in terms of \( n \)).

\[
a_1 = 6 = 3 \cdot 2^1 \\
a_2 = 12 = 3 \cdot 2^2 \\
a_3 = 24 = 3 \cdot 2^3 \\
a_4 = 48 = 3 \cdot 2^4 \\
a_5 = 96 = 3 \cdot 32 = 3 \cdot 2^5 \\
\ldots \\
a_n = 3 \cdot 2^n \\
\]