

1. Prove, that

$$1^3 + 2^3 + \dots + n^3 = (1 + 2 + \dots + n)^2$$

for every $n \in \mathbb{N}$.

2. Compute the following limit of sequence

$$\lim \frac{\sqrt{n^2 + 2n + 2} - n}{\sqrt{n}}.$$

3. Compute

$$\left(\frac{x \sin x}{\sqrt{x^2 + 4x + 6}} \right)'$$

4. Find intervals where is the function

$$f(x) = x^3 - 3x^2 - 9x + 1$$

increasing and where it is decreasing.