



1. Compute $f'(0)$ if

$$f(x) = \frac{6x - x^3 + 5x^4 + e^x}{5 + 3x^2 + 2x^3 + \cos(x)}.$$

2. A curve contained in the first quadrant of the xy -plane originates from $(1, 0)$ and has the following property: at each point (x, y) on the curve, the segment of the tangent line connecting (x, y) to the intersection of the tangent with the y -axis has length 1.

What is the area of the region bounded by the curve, the x -axis, and the y -axis?

3. Compute

$$\sum_{n=0}^{\infty} \left(\int_0^{\pi} \sin^{2n}(x) dx \int_0^{\pi} \sin^{2n+1}(x) dx \right)^2.$$