

1. (20 pts.) Sketch the graph of the function $f(x) = x \cdot e^x$ by showing all local maxima and minima, and the inflection point(s), asymptotes and where the graph is concave up or down.

2. (15 pts.) Find the following limit

$$\lim_{x \rightarrow 1} \left(\frac{1}{x-1} - \frac{1}{\ln(x)} \right)$$

3. (15 pts.) Find $f'(x)$ if $f(x) = \int_0^{e^{-x}} \sin(t^2) dt$

4. (15 pts.) Find the integral

$$\int \frac{x e^{x^2} \ln(1 + e^{x^2})}{1 + e^{x^2}} dx$$

5. (20 pts.) Find the volume of the solid obtained by rotating the graph of $y = \tan^{-1}(x)$ for $0 \leq x \leq 1$ around the y -axis.

6. (15 pts.) Compute the integral

$$\int_1^2 \frac{x+2}{\sqrt{3+2x-x^2}} dx$$