

1. (15%) Let $f(x) = \int_x^{x^2} \frac{1}{1+t^4} dt$ and $F(x) = xe^{f(x)}$.
 - (a) (10%) Evaluate $f'(x)$.
 - (b) (5%) Evaluate $F'(1)$.
2. (15%) Let $F(x) = \int_0^x e^{-t^2} dt$. Derive the Taylor expansion of $F(x)$ at $x = 0$ and write down the explicit form of the general term.
3. (10%) Find the integral: $\int_{-1}^0 \frac{x}{\sqrt{3-2x-x^2}} dx$.
4. (15%) Find the integral: $\int_1^2 \frac{x^4+x^2-1}{x^3+x} dx$.
5. (10%) Find $\lim_{x \rightarrow \infty} \left(1 + \sin \frac{3}{x}\right)^x$.
6. (10%) Find the area of the bounded region enclosed by $x^4 - x^2 - y^2 = 0$ and $x = 2$.
7. (15%) Let R be the region enclosed by $y = \cos\left(\frac{\pi}{2}x\right)$, $y = 0$ and $0 \leq x \leq 1$.
 - (a) (8%) Find the volume of the solid obtained by rotating R with respect to x -axis.
 - (b) (7%) Find the volume of the solid obtained by rotating R with respect to y -axis.
8. (10%) Find the length of the curve $y = \frac{e^x + e^{-x}}{2}$ from $x = -1$ to $x = 1$.