

1. (15%) Evaluate the integral

$$\int_0^{1/\sqrt{2}} \frac{\arccos x}{\sqrt{1-x^2}} dx.$$

2. (15%) Find the equation of the tangent line to the graph of the equation $\arcsin x + \arcsin y = \frac{\pi}{2}$ at the point $(\frac{\sqrt{2}}{2}, \frac{\sqrt{2}}{2})$.

3. (15%) Find the derivative of $F(x) = \int_{\pi}^{\ln x} \cos e^t dt$.

4. (15%) Find the indefinite integral $\int e^{-x} \tan(e^{-x}) dx$.

5. (10%) Find $\frac{dy}{dx}$ where $y = (x-2)^{x+1}$.

6. Let $f(x) = \int_2^x \sqrt{1+t^2} dt$,

(a) (5%) show that it is one-to-one, and

(b) (5%) find $(f^{-1})'(0)$.

7. (10%) Evaluate the definite integral $\int_e^{e^2} \frac{1}{x \ln x} dx$.

8. (10%) Determine

$$\lim_{n \rightarrow \infty} \frac{1}{n^3} [1^2 + 2^2 + 3^2 + \cdots + n^2]$$

by using an appropriate Riemann sum.