Instructions: You have 15 minutes to solve the following problems and the total score is 10 points. There are bonus problems on the back.

1. Use integral by parts to evaluate \( \int x^2 e^{-x} \, dx \) (5 pts)

2. \( \int_0^1 \sqrt{1 - z^2} \, dz \) (3 pts)
   
   Hint: substitution \( z = \sin \theta \)

3. \( \int \frac{\sin 2x}{1 + \sin x} \, dx \) (2 pts)
Bonus 1: Prove $\int \tan^n x \, dx = \frac{1}{n-1} \tan^{n-1} x - \int \tan^{n-2} x \, dx$ (1pt) and use it to calculate $\int \tan^3 x \, dx$ (2 pts)

Bonus 2: $\int e^{\sin^2 x} \sin(2x) \, dx$ (2 pts)