

★ Answer and mark clearly the questions in the provided answer sheets.
Write down your name and student's ID on the each answer sheet you used.
* **Note:** No points will be given if no arguments are provided for an answer.

For your information:

- $\int \sin u \, du = -\cos u + C$
- $\int \cos u \, du = \sin u + C$
- $\int \sec^2 u \, du = \tan u + C$
- $\int \sec u \tan u \, du = \sec u + C$
- $\sin^2 u + \cos^2 u = 1$ and $\tan^2 u + 1 = \sec^2 u$

Good Luck!

~~ Yuling ☺

1. (60 points) Find

$$(a) \int 5x \sqrt[3]{1-x^2} \, dx$$

$$(b) \int \frac{x^2 + 1}{\sqrt{x^3 + 3x + 4}} \, dx$$

$$(c) \int \frac{\ln x}{x} \, dx$$

$$(d) \int \frac{e^{-x}}{1 - e^{-x}} \, dx$$

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

$$(f) \int \frac{1 + e^{-x}}{1 + xe^{-x}} \, dx$$

2. (10 points) Find $f(x)$ whose graph passes through the point $(2, 4)$, and

$$f'(x) = \frac{x^2 + 4x + 3}{x - 1}.$$

3. (10 points) Find the function f that satisfies the initial conditions:

$$f''(x) = x^{-2/3}, \quad f'(8) = 6, \quad \text{and} \quad f(0) = 0.$$

4. (20 points) Find

$$(a) \int \frac{\sec x \tan x}{\sec x - 1} \, dx$$

$$(b) \int (\sin x + \cos x)^2 \, dx$$