1. [30 points] Find the following integrals

(a) \( \int x^3 \ln(x) \, dx \)

(b) \( \int \frac{\ln((\ln x)^3)}{x} \, dx \)

(c) \( \int \sin \theta \cos^3 \theta \, d\theta \)
2. [30 points] Find the following integrals

(a) \[ \int \frac{1}{x^2 + 8x + 15} \, dx \]

(b) \[ \int \frac{2x^2 - x - 1}{(x^2 + 1)(x - 2)} \, dx \]
3. [20 points] Find the following integral

\[ \int \frac{1}{x \sqrt{9 - 4x^2}} \, dx. \]
4. [10 points] Evaluate the following improper integrals
\[ \int_{0}^{\infty} \frac{1}{1 + x^2} \, dx. \]

5. [10 points] Order the following approximations to the integral \( \int_{a}^{b} f(x) \, dx \) and its exact value from smallest to greatest, EXPLAIN:

\( \text{LEFT}(n), \text{RIGHT}(n), \text{MID}(n), \text{TRAP}(n), \int_{a}^{b} f(x) \, dx. \)