2 (25 pts): Integrate the following functions (5 pts per problem).

1. \[ \int (6x^3 - 2x^2 - 4x + 1) \, dx \]

2. \[ \int \frac{1}{\sqrt{x}} + \sqrt{x} \, dx \]

3. \[ \int_{0}^{1} 3e^{3x} - e^{-x} \, dx \]

4. \[ \int_{0}^{\pi} \sin(2x) - \cos(3x) \, dx \]

5. \[ \int \left( \frac{1}{2x} + \frac{1}{3x^2} \right) \, dx \]

1 (20 pts) Use substitution to evaluate the integrals (10 pts per problem)

1. \[ \int (x^2 - x + 3)^{3/2}(4x - 2) \, dx \]

2. \[ \int_{0}^{\sqrt{\pi/2}} x \sin(x^2) \, dx \]

3 (20 pts): Let \( f_1(x) = x^2 + 1 \) and \( f_2(x) = x + 3 \).

1. (5 pts) Find maxima and minima for each of the two functions, \(-3 \leq x \leq 3\).

2. (5 pts) Use the values found above to sketch the two functions.

3. (5 pts) Compute points of intersection of the two functions.

4. (5 pts) Calculate the area between the two graphs.
4 (20 pts): Use integration by parts to rewrite integrals as
\[
\int f \cdot g' \, dx = f \cdot g - \int f' \cdot g \, dx
\]
- Find \( f \) and \( g' \).
- Calculate \( f' \) and \( g = \int g' \, dx \)
- Insert \( f \), \( g \), \( f' \), and \( g' \) into the equation
- Extra credit (5 pts per problem) evaluate the integral \( \int f' \cdot g \, dx \) and find the final solution.

1. (10 pts)
\[
\int 2x\sqrt{3x-4} \, dx
\]
2. (10 pts)
\[
\int \frac{x+2}{e^{4x}} \, dx
\]

5 (20 pts): Check if the following integrals are convergent or divergent, if they are convergent calculate their value.

1. (10 pts)
\[
\int_0^\infty \frac{2}{(x+1)^3} \, dx
\]
2. (10 pts)
\[
\int_0^\infty e^{-0.5x} \, dx
\]