(1) Evaluate each of the following integrals. (25pts)

(i) \( \int \sec^4 3x \tan 3x \, dx \).

(ii) \( \int_{-1}^{0} \frac{x^3 + x^2 + x - 1}{x^2 + 2x + 1} \, dx \).

(iii) \( \int \frac{\sin x}{1 + 2 \cos^2 x} \, dx \).

(iv) \( \int_{\frac{1}{\sqrt{3}}}^{1} \frac{dx}{x \sqrt{4x^2 - 1}} \).

(v) \( \int_{0}^{3} \sqrt{6x - x^2} \, dx \).
(2) (a) Set up, BUT DO NOT EVALUATE, an integral or sum of integrals that gives the area of the region R in the first quadrant enclosed by \( y = x^2 \), \( y = 2 + x \), and \( x = 0 \).

(i) integrate with respect to \( x \).  

(ii) integrate with respect to \( y \).  

(10pts)

(b) Set up, BUT DO NOT EVALUATE, an integral or sum of integrals that gives the volume generated by revolving the region enclosed by \( x = 9 \) and \( x = y^2 \) about \( x \)-axis.

(i) integrate with respect to \( x \).  

(ii) integrate with respect to \( y \).  

(15pts)
(3) (a) Find the arc length of $y = \frac{1}{3}(x^2+2)^{3/2}$, $0 \leq x \leq 3$. (10pts)

(b) If $f(x) = \int_{0}^{x} t^2 \sin(t^2) dt$, find $f'(x)$. (5pts)
(4) (a) Find the interval \([a, b]\) for which the value of the integral \(\int_{a}^{b} (-x^2 + x + 2)\,dx\) is a maximum. (10pts)

(b) Evaluate \(\int_{0}^{n} [[x]]\,dx\), where \(n\) is a positive integer. (5pts)