[10pts] 1. Find the area under the graph over the interval $[-1, \quad 3]$, where

$$f(x)=\begin{cases} x^2+1, & if \quad x<1 \\ 2, & if \quad x\geq 1 \end{cases}$$

Area=

[24pts] 2. Evaluate using a substitution

(1) $\int 3te^{-t^2}\ dt$

(2) $\int \frac{\ln(2x)}{x} dx$

(3) $\int_0^2 x(x^2+1)^4 \, dx$

[24 pts] 3. Evaluate using integration by parts.

(1) $\int (x+2)\ln x \quad dx$

(2) $\int_0^{\pi/2} 2x\cos x \quad dx$

(3) $\int xe^{-2x}dx$

[16 pts] 4. Find the volume generated by revolving about the x-axis the regions bounded by the graphs of the following equations.

(1). $y = e^{-x}, x = -1, \quad x = 2$

$V =$

(2). $y = x^3, x = 0, \quad x = 4$

$V =$

[16pts]5. Determine whether the improper integral is convergent or divergent, and calculate its value if it is divergent.

(1). $\int_2^{\infty} \frac{1}{x^3} \, dx$

(2). $\int_1^{\infty} e^{3x} \, dx$

[10pts] 6. Tree growth. The diameter of a tree grows at the rate of

$$D'(t) = 0.35 + 0.001t,$$

Where $D(t)$ is the diameter of the trunk of the tree in inches t years after 1910. In 1910, the tree had a diameter of 2 in. What will the diameter of the tree be in 2010 ?