Warm-up Problems - January 27, 2006

1. The formula for future values of a continuous income stream is:

\[ FV = e^{rT} \int_0^T f(t)e^{-rt} \, dt \]

Explain what each term stands for:

(a) \( f(t) \)
(b) \( r \)
(c) \( T \)
(d) \( FV \) (what does future value mean?)

2. What is the equation \( FV = Pe^{rt} \)? Why isn’t this used for an income stream? (In what situations is this equation used?)

3. Find the following integrals:

(a) \( \int \frac{x^2}{x^3+1} \, dx \)

(b) \( \int xe^{rx^2+5} \, dx \)
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4. Find the Gini index for the Lorenz curve \( f(x) = xe^{x-1} \).

5. For each of the following integrals, identify the method to use to integrate. Choices: Easy integral, substitution, integration by parts.

(a) \( \int x^3 - 3x \, dx \)
(b) \( \int e^{4x} \, dx \)
(c) \( \int \ln x \, dx \)
(d) \( \int x \ln x \, dx \)
(e) \( \int \frac{\ln x}{x} \, dx \)
(f) \( \int x^5 e^{2x} \, dx \)
(g) \( \int e^{x^2} \, dx \)
(h) \( \int e^x + x^3 \, dx \)