Math 230 **EQUATIONS - Exam 1** **Spring 2004**

Area between 2 curves: $f(x) \geq g(x)$ for all $x \in (a,b) \Longrightarrow \int_a^b [f(x) - g(x)]dx$

Volume of solid of revolution:

1. disk: $\int_a^b \pi r^2 dr$
2. washer: $\int_a^b \pi(R^2 - r^2)dr$
3. cylindrical shells: $\int_a^b 2\pi r h dr$

Inverse function theorem: $[f^{-1}]'(a) = \dfrac{1}{f'(f^{-1}(a))}$

Logarithms:

$\ln(xy) = \ln x + \ln y$

$\ln 1 = 0$

$\ln\left(\dfrac{x}{y}\right) = \ln x - \ln y$

$\ln e = 1$

$\ln(x^r) = r \ln x$

$\dfrac{d}{dx} \ln f(x) = \dfrac{f'(x)}{f(x)} = \dfrac{d}{dx} \ln |f(x)|$

$\int \dfrac{f'(x)}{f(x)} dx = \ln |f(x)| + c$

$\log_a x = \dfrac{\ln x}{\ln a}$

$\dfrac{d}{dx} \log_a x = \dfrac{1}{x \ln a}$

Exponential Functions:

$e^{\ln x} = x$

$e^{\ln f(x)} = f(x)$

$\ln(e^x) = x$

$\ln(e^{f(x)}) = f(x)$

$e^{x+y} = e^x e^y$

$a^{x+y} = a^x a^y$

$e^{x-y} = \dfrac{e^x}{e^y}$

$a^{x-y} = \dfrac{a^x}{a^y}$

$(e^x)^r = e^{rx}$

$(a^x)^r = a^{rx}$

$(ab)^x = a^x b^x$

$\dfrac{d}{dx} e^x = e^x$

$\dfrac{d}{dx} e^{f(x)} = e^{f(x)} f'(x)$

$\int e^x dx = e^x + c$

$\int e^{f(x)} f'(x) dx = e^{f(x)} + c$

$a^x = e^{x \ln a}$

$\dfrac{d}{dx} a^x = a^x \ln a$

$\int a^x dx = \dfrac{a^x}{\ln a} + c, a \neq 1$

$\dfrac{d}{dx} f(x)^{g(x)}$, use either logarithmic differentiation or express in the form $e^{g(x) \ln f(x)}$ and differentiate it.

Exponential Growth and Decay:

$$y'(t) = ky(t) \Longrightarrow y(t) = y_0 e^{kt}$$

where $y(t)$ gives amount at time t, t is time, k is the growth/proportionality constant, and y_0 is the intial value.