Handout on Indefinite Integrals and Net Change Theorem

Here is a modified version of the table of indefinite integrals from section 5.4 of our text. I added a line for the indefinite integral of a fraction $f'(x) / f(x)$.

1 Table of Indefinite Integrals

$$\int cf(x)\,dx = c\int f(x)\,dx \qquad \int [f(x) + g(x)]\,dx = \int f(x)\,dx + \int g(x)\,dx$$

$$\int k\,dx = kx + C \qquad \int \frac{f'(x)}{f(x)}\,dx = \ln(|f(x)|) + C \quad \text{(added)}$$

$$\int x^n\,dx = \frac{x^{n+1}}{n+1} + C \quad (n \neq -1) \qquad \int \frac{1}{x}\,dx = \ln|x| + C$$

$$\int e^x\,dx = e^x + C \qquad \int a^x\,dx = \frac{a^x}{\ln a} + C$$

$$\int \sin x\,dx = -\cos x + C \qquad \int \cos x\,dx = \sin x + C$$

$$\int \sec^2 x\,dx = \tan x + C \qquad \int \csc^2 x\,dx = -\cot x + C$$

$$\int \sec x \tan x\,dx = \sec x + C \qquad \int \csc x \cot x\,dx = -\csc x + C$$

$$\int \frac{1}{x^2+1}\,dx = \tan^{-1} x + C \qquad \int \frac{1}{\sqrt{1-x^2}}\,dx = \sin^{-1} x + C$$

$$\int \sinh x\,dx = \cosh x + C \qquad \int \cosh x\,dx = \sinh x + C$$

Net Change Theorem Sample Problem

An exothermic chemical reaction produces heat as it occurs. In a mathematical model for one such reaction, when two chemicals are mixed together, the temperature of the solution rises at a rate

$$q(t) = \frac{140e^t}{(1+e^t)^2} \frac{\text{degrees}}{\text{min}}$$

where t is the number of minutes measured from when the chemicals are mixed. Assuming the temperature was initially 70 degrees when the chemicals were mixed, what was the temperature of the mixture after 5 minutes?