§ 5.3, The Fundamental Theorem of Calculus, part 2.

FTC I: If $g(x) = \int_a^x f(t)\,dt$, then $g'(x) = f(x)$

FTC II: $\int_a^b f(x)\,dx = F(b) - F(a)$, where $F'(x) = f(x)$

Ex: $\int_1^4 2x + 6x^2\,dx = F(4) - F(1) = (16 + 2\cdot 64 + C) - (1 + 2 + C)$

$= 16 + 128 + \cancel{C} - 1 - 2 - \cancel{C}$

$= 144 - 3 = \boxed{141}$

$F(x) = x^2 + 2x^3 + C$

$F(b) - F(a) = F(x)\Big|_a^b$

Ex: $\int_0^2 e^x - x\,dx = \left[e^x - \tfrac{1}{2}x^2\right]_0^2 = \left(e^2 - \tfrac{1}{2}(2)^2\right) - \left(e^0 - \tfrac{1}{2}0^2\right)$

$= (e^2 - 2) - (1 - 0)$

$= \boxed{e^2 - 3}$

$\int_a^b f'(x)\,dx = f(b) - f(a)$