Chapter 13 Formula Overview

- $\int f(x)\,dx$ = indefinite integral = general antiderivative of $f(x)$ (will include a $+C$)
- $\int_a^b f(x)\,dx$ = definite integral = signed area between $f(x)$ and x axis from $x = a$ to $x = b$ (this will be a number).
- $\int_a^b f(x)\,dx = F(b) - F(a)$, where $F(x)$ is any antiderivative of $f(x)$ (that means $F'(x) = f(x)$). This is the fundamental theorem of calculus.
  Notable business uses of the fundamental theorem:
  - $TR(x) = \int_0^x MR(q)\,dq$
  - $VC(x) = \int_0^x MC(q)\,dq$
  - $TC(x) - TC(0) = \int_0^x MC(q)\,dq$, so $TC(x) = \int_0^x MC(q)\,dq + FC$
  - $P(x) = \int_0^x MR(x)\,dx - \int_0^x MC(x)\,dx - FC = \int_0^x MR(x) - MC(x)\,dx - FC$
  - If $r(t)$ is the rate of income flow (in other words it is the derivative of the income formula) in dollars/years, then
    "Total income from $t = 0$ to $t = a$" $= \int_0^a r(t)\,dt$.
- If $f(x)$ is above $g(x)$ from $x = a$ to $x = b$, then the area between $f(x)$ and $g(x)$ from $x = a$ to $x = b$ is given by
  Area between $= \int_a^b f(x) - g(x)\,dx$.
- Suppose $p = f(x)$ is the demand function and $p = g(x)$ is the supply function. If market equilibrium occurs at $x = x_1$ and $p = p_1$ (you find this by getting the x and y coordinates of the intersection from $f(x) = g(x)$), then
  Consumer Surplus $= \int_0^{x_1} f(x)\,dx - p_1 x_1$
  Producer Surplus $= p_1 x_1 - \int_0^{x_1} g(x)\,dx$.