Exam IV covers 11.1-11.3. You should know/understand all of the following:

- Know the following integration rules:

$$\begin{array}{lcl}
\int x^n \mathrm{d}x & = & \frac{x^{n+1}}{n+1} + C (\mathrm{for} n \neq -1) \\
\int k \mathrm{d}x & = & kx + C \\
\int e^x \mathrm{d}x & = & e^x + C \\
\int e^{kx} \mathrm{d}x & = & \frac{1}{k} e^{kx} + C \\
\int a^x \mathrm{d}x & = & \frac{1}{\ln a} a^x \\
\int \left[f(x) + g(x) \right] \mathrm{d}x & = & \int f(x) + \int g(x) \\
\int \left[f(x) - g(x) \right] \mathrm{d}x & = & \int f(x) - \int g(x) \\
\int c f(x) \, \mathrm{d}x & = & c \int f(x)
\end{array}$$

- Know that there is no way to integrate an expression involving products or quotients using these rules. To integrate an expression involving a product or quotient, you must rewrite the expression so that it is a sum or difference of functions of the above types. The methods needed to do this may include:
  - factoring and cancellation
  - expanding squares or cubes
  - rewriting radicals as fractional exponents
  - combining numerators and denominators using properties of exponents
  - any combination of the above
- How to evaluate an integral using FTC
- How to approximate an integral using Riemann sums. This includes writing down the values of $a, b, n, \Delta x$, and $x_0, \ldots, x_{n-1}$ in alongside the sum.
- That when asked to find the exact value of an integral (or any quantity in a word/area problem found using integrals), you must use FTC since Riemann sums are only an approximation to the true value.
- The area under the graph of $f(x)$ for $a \leq x \leq b$ is given by

$$\int_a^b f(x) \mathrm{d}x$$

- How to use indefinite integrals in a word problem to transform a rate of change into a total quantity: If $r(t)$ is a rate of change, then the original quantity is given by

$$\int r(t) \mathrm{d}t$$

  This includes solving for the constant C using the initial conditions in the statement of the problem.
- How to use definite integrals in a word problem to transform a rate of change into the total change between two values of a total quantity: If $r(t)$ is a rate of change, then the total change between times $t = a$ and $t = b$ will be given by the definite integral

$$\int_a^b r(t) \mathrm{d}t$$