Name: _____ Section: _____

1 Approximating Net Area

1. Understand and be able to sketch a picture for (1) Right Sums, (2) Left Sums, and (3) the Midpoint Rule (aka Midpoint Sums).
2. Know how to write the Right and Left Sum formulas in $\sum$ notation.
3. Given a function's *graph*, approximate the net area using Right, Left, and Midpoint Sums.
4. Given a function's *equation*, approximate the net area using Right, Left, and Midpoint Sums.
5. Given an *integral*, be able to approximate its value using Right, Left, and Midpoint Sums.

2 The Meaning of Integrals

1. Know that the integral is the limit of the approximating right/left/midpoint sums.
2. Be able to write an integral as the limit of its approximating sums.
3. Be able to evaluate a definite integral using a graph (either one given, or one that you sketch).
4. Know the properties that integrals have
   (a) because they are sums, and
   (b) because they compute net area.
5. Be able to use properties of integrals to compute complicated integrals.

3 The Fundamental Theorem(s)

1. The First Fundamental Theorem: $\frac{d}{dx}\left[\int_a^x f(t)\,dt\right] = f(x)$
   This means: the area's rate of change equals the function's value at the right endpoint.
   This also means: $\int_a^x f(t)\,dt$ is *an* antiderivative of $f(x)$.
2. The Second Fundamental Theorem:
   If $F(x)$ is *any* antiderivative of $f(x)$, then $\int_a^b f(x)\,dx = F(b) - F(a)$
3. Be able to use the Second Fundamental theorem to evaluate definite integrals.
4. Understand how the two fundamental theorems apply to the area function $A(x) = \int_a^x f(t)\,dt$. Also, make sure you can evaluate $A(x)$ using the graph of $f(x)$.

4 Computing Definite and Indefinite Integrals

1. Know the basic integration formulas very well.
2. Be very comfortable rewriting complicated integrals until you can evaluate them more easily.
3. Be very comfortable with the substitution rule!