Important Formulas for Test 3:

1. **Antiderivatives**:

	Function	Antiderivative		Function	Antiderivative
1.	x^n	$\frac{1}{n+1}x^{n+1}+C$	2.	$\sin kx$	$-\frac{1}{k}\cos kx + C$
3.	$\cos kx$	$\frac{1}{k}\sin kx + C$	4.	$\sec^2 kx$	$\frac{1}{k}\tan kx + C$
5.	$\csc^2 kx$	$-\frac{1}{k}\cot kx + C$	6.	$\sec kx \tan kx$	$\frac{1}{k}\sec kx + C$
7.	$\csc kx \cot kx$	$-\frac{1}{k}\csc kx + C$	8.	e^{kx}	$\frac{1}{k}e^{kx} + C$
9.	$\frac{1}{\sqrt{1-k^2x^2}}$	$\frac{1}{k}\arcsin kx + C$	10.	$\frac{1}{1+k^2x^2}$	$\frac{1}{k}\arctan kx + C$
11.	$\frac{1}{x}$	$\ln\lvert x\rvert + C, \quad x \neq 0$			
12.	a^{kx}	$\left(\frac{1}{k\ln a}\right)a^{kx} + C, \quad a \geq 0, a \neq 1$			

2. **Summation:**

$$\sum_{k=1}^{n} k = \frac{n(n+1)}{2}, \qquad \sum_{k=1}^{n} k^2 = \frac{n(n+1)(2n+1)}{2}, \qquad \sum_{k=1}^{n} k^3 = \left(\frac{n(n+1)}{2}\right)^2$$

3. **Riemann Sum** of $\int_a^b f(x)dx$:

Right Hand Rule: $\frac{b-a}{n}\sum_{k=1}^{n} f\left(a + k\left(\frac{b-a}{n}\right)\right)$

Left Hand Rule: $\frac{b-a}{n}\sum_{k=1}^{n} f\left(a + (k-1)\left(\frac{b-a}{n}\right)\right)$

4. **Integration Rules:**

Order of Integration: $\int_b^a f(x)dx = -\int_a^b f(x)dx$ Zero Width: $\int_a^a f(x) = 0$

Constant Multiple: $\int_a^b kf(x)dx = k\int_a^b f(x)dx$

Additivity: $\int_a^b f(x)dx + \int_b^c f(x)dx = \int_a^c f(x)dx$

Summation: $$\int_a^b (f(x)+g(x))dx = \int_a^b f(x)dx + \int_a^b g(x)dx$$

5. **Area under a curve** $f(x)$ for x on $[a,b]$: $A = \int_a^b f(x)dx$

   Area between the curves $f(x)$ and $g(x)$ for x on $[a,b]$: $A = \int_a^b (f(x)-g(x))dx$

6. **Fundamental Theorem of Calculus:** If f is continuous on $[a,b]$ then $F(x) = \int_a^x f(t)dt$ is continuous on $[a,b]$ and differentiable on (a,b) and its derivative is $f(x)$:

   F.T.C.1: $$F'(x) = \frac{d}{dx}\int_a^x f(t)dt = f(x)$$ and

   F.T.C.2: $$\int_a^b f(x)dx = F(b) - F(a)$$

7. **Substitution Rules:**

   Indefinite Integrals: If $u = g(x)$ is a differentiable function whose range is an interval I and f is continuous on I, then

   $$\int f(g(x)) \cdot g'(x)dx = \int f(u)du$$

   Definite Integrals: If g' is continuous on the interval $[a,b]$ and f is continuous on the range of g, then

   $$\int_a^b f(g(x)) \cdot g'(x)dx = \int_{g(a)}^{g(b)} f(u)du$$

8. **Volumes by Slicing and Rotation About an Axis:**

   Disc or Washer Method: For a solid of revolution about the x-axis, if the cross-sectional area is $A(x)$, where $R(x)$ is the outer radius and $r(x)$ is the inner radius, the volume is

   $$V = \int_a^b A(x)dx = \int_a^b \pi\left([R(x)]^2 - [r(x)]^2\right) dx$$

   Cylindrical Shell Method: For a solid generated by revolving the region between the x-axis and the graph of $y = f(x) \geq 0$ with $L \leq a \leq x \leq b$ about a vertical line $x = L$, the volume is given by

   $$V = \int_a^b 2\pi(x-L)f(x)dx$$

   Use the Cylindrical Shell Method for solids of revolution about the y-axis that are difficult to do with the washer method.