(Proposed)

Newton's Method

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)}, \text{ where } x_0 \text{ in an initial guess.}$$

Integral Formulas

1. $\int a^u \, du = \frac{a^u}{\ln a} + C$
2. $\int \sec u \, du = \ln|\sec u + \tan u| + C$
3. $\int \csc u \, du = -\ln|\csc u + \cot u| + C$
4. $\int \sec^2 u \, du = \tan u + C$
5. $\int \csc^2 u \, du = -\cot u + C$
6. $\int \sec u \tan u \, du = \sec u + C$
7. $\int \csc u \cot u \, du = -\csc u + C$

Numerical Integration

1. Trapezoidal Rule:

$$\int_b^a f(x)\,dx \approx T(n) \equiv \frac{b-a}{2n}\left[f(x_0) + 2f(x_1) + 2f(x_2) + \cdots + 2f(x_{n-1}) + f(x_n)\right]$$

Also, $T(n) = \frac{1}{2}[L(n) + R(n)]$, where $L(n)$ and $R(n)$ are the left end point and right end point Riemannian sums, respectively.

2. Simpson's Rule:

$$\int_b^a f(x)\,dx \approx S(n) \equiv \frac{b-a}{3n}\left[f(x_0) + 4f(x_1) + 2f(x_2) + \cdots + 2f(x_{n-2}) + 4f(x_{n-1}) + f(x_n)\right]$$

Also, $S(n) = \frac{1}{3}[T(n/2) + 2M(n/2)]$, where $M(n/2)$ is the midpoint Riemannian sum and $T(n/2)$ is defined above. Note that n must be even in Simpson's Rule.

Volumes of Revolution

1. Disk Method: $V = \pi \int_b^a [R(x)]^2 \, dx$

2. Washer Method: $V = \pi \int_b^a \left([R(x)]^2 - [r(x)]^2\right) dx$

3. Shell Method: $V = 2\pi \int_b^a p(x)h(x)\,dx$, where $p(x)$ is the radius of the shells and $h(x)$ is the height of the shells.

Arc Length

$$L = \int_b^a \sqrt{1 + [f'(x)]^2}\, dx$$

Surface Area of Revolution

$$S = 2\pi \int_b^a r(x)\sqrt{1 + [f'(x)]^2}\, dx$$

Note: The formulas for volume, length, and surface area all have analogs for dy integration.