Slope of a Line: m=$\frac{\Delta y}{\Delta x}=\frac{y_2-y_1}{x_2-x_1}$, $x_1 \neq x_2$

Point-Slope Equation of a Line: $y-y_1=m(x-x_1)$

The Slope-Intercept Equation of a Line: y=mx+b

Definition of Tangent Line with Slope m: $\lim_{\Delta x\to 0}\frac{\Delta y}{\Delta x}=\lim_{\Delta x\to 0}\frac{f(c+\Delta x)-f(c)}{\Delta x}=m=f`(x)$

Area of a Region under a Curve: A=$\int_a^b f(x)dx$

Mean Value Theorem of Integrals: $\int_a^b f(x)dx=f(c)(b-a)$

Average Value of a Function on an Interval: $f(c)=\frac{1}{b-a}\int_a^b f(x)dx$

Inverse Function: f(g(x))=x, xϵD(g)   g(f(x))=x, xϵD(f)

f(x) and g(x) are one-to-one functions → strictly monotonic on their entire domain

The Derivative of an Inverse Function: $g`(x)=\frac{1}{f`(g(x))}$, $f`(g(x))\neq 0$

Area of a Region Between Two Curves: $A=\int_a^b [f(x)-g(x)]dx$, $f(x)\geq g(x)$ on [a,b]

The Volume of a Solid of Revolution:

The Disc Method: $V=\pi\int_a^b [R(x)]^2dx$ (horizontal axis of revolution)

$V=\pi\int_c^d [R(y)]^2dy$ (vertical axis of revolution)

The Washer Method: $V=\pi\int_a^b ([R(x)]^2-[r(x)]^2)dx$

The Shell Method: $V=2\pi\int_a^b r(x)h(x)dx$ (vertical axis of revolution)

$V=2\pi\int_c^d r(y)h(y)dy$ (horizontal axis of revolution)

Arc Length: $s=\int_a^b \sqrt{1+[f`(x)]^2}dx$     $s=\int_c^d \sqrt{1+[g`(y)]^2}dy$

The Area of a Surface of Revolution: $S=2\pi\int_a^b r(x)\sqrt{1+[f`(x)]^2}dx$     $S=2\pi\int_c^d r(y)\sqrt{1+[g`(y)]^2}dy$

Integration by Parts: $\int u\frac{dv}{dx}dx=uv-\int v\frac{du}{dx}dx$

Trigonometric Integrals:

Sine to the odd power → convert to cosines   Cosine to the odd power → convert to sines

$\sin^2 x=\frac{1-\cos 2x}{2}$ $\cos^2 x=\frac{1+\cos 2x}{2}$

Secant to the even power → convert to tangents   Tangent to the odd power → convert to secants

Tangent to the even power without secants → convert to secants

Secant to the odd power → integration by parts   u=secx du/dx=$\sec^2$x

OR convert to sines and cosines

Trigonometric Substitution:

$\sqrt{a^2-u^2}=a\cos\theta$ $u=a\sin\theta$ $\cos^2\theta=1-\sin^2\theta$

$\sqrt{a^2+u^2}=a\sec\theta$ $u=a\tan\theta$ $\sec^2\theta=1+\tan^2\theta$

$\sqrt{u^2-a^2}=\pm a\tan\theta$ $u=a\sec\theta$ $\tan^2\theta=\sec^2\theta-1$

The Trapezoidal Rule:

$$\int_a^b f(x)dx \approx \Delta x[\tfrac{1}{2} f(x_0) + f(x_1) + f(x_3) + \ldots + f(x_{n-1}) + \tfrac{1}{2} f(x_n)]$$

$$E \le \frac{(b-a)^3}{12n^2}[\max|f''(x)|] \qquad a \le x \le b$$

The Simpson's Rule (*n* is even):

$$\int_a^b f(x)dx \approx \frac{\Delta x}{3}[f(x_0) + 4f(x_1) + 2f(x_2) + 4f(x_3) + \ldots + 4f(x_{n-1}) + f(x_n)]$$

$$E \le \frac{(b-a)^5}{180n^4}[\max|f^{(4)}(x)|] \qquad a \le x \le b$$

L'Hôpital's Rule: $\lim_{x\to c}\frac{f(x)}{g(x)} = \lim_{x\to c}\frac{f'(x)}{g'(x)} \qquad \frac{0}{0}, \frac{\infty}{\infty}$

Indeterminate Forms: $\frac{0}{0}$, $\frac{\infty}{\infty}$, $0\cdot\infty$, 1^∞, ∞^0, 0^0, $\infty-\infty$

Determinate Forms: $\infty+\infty \to \infty$, $-\infty-\infty \to -\infty$, $0^\infty \to 0$, $0^{-\infty} \to \infty$