Derivatives

$$f'(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}$$
$$\frac{d}{dx}[c] = 0$$
$$\frac{d}{dx}[x^c] = cx^{c-1}$$
$$\frac{d}{dx}[cf(x)] = cf'(x)$$
$$\frac{d}{dx}[f(x) \pm g(x)] = f'(x) \pm g'(x)$$
$$\frac{d}{dx}[f(x)g(x)] = f(x)g'(x) + f'(x)g(x)$$
$$\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - g'(x)f(x)}{[g(x)]^2}$$
$$\frac{d}{dx}[f(u(x))] = f'(u)u'(x)$$
$$\frac{d}{dx}\left[\frac{1}{x}\right] = -\frac{1}{x^2}$$
$$\frac{d}{dx}[e^x] = e^x$$
$$\frac{d}{dx}\left[e^{u(x)}\right] = e^{u(x)}u'(x)$$
$$\frac{d}{dx}[a^x] = a^x \ln(a)$$
$$\frac{d}{dx}\left[a^{u(x)}\right] = a^{u(x)}u'(x)\ln(a)$$
$$\frac{d}{dx}[\ln(x)] = \frac{1}{x}$$
$$\frac{d}{dx}[\ln(u(x))] = \frac{u'(x)}{u(x)}$$
$$\frac{d}{dx}[\log_a(x)] = \frac{1}{\ln(a)} \cdot \frac{1}{x}$$
$$\frac{d}{dx}[\log_a(u(x))] = \frac{1}{\ln(a)} \cdot \frac{u'(x)}{u(x)}$$

Probability

$$p(x) = \frac{1}{\sigma\sqrt{2\pi}}e^{\frac{-(x-\mu)^2}{2\sigma^2}}$$

68–95–99.7 rule

First/Second Derivative Tests

	< 0	> 0
$f'(x)$	decreasing	increasing
$f''(x)$	concave down	concave up

Business

$$C(n) = F + n(p)V$$
$$R(n) = pn(p)$$
$$P(n) = R(n) - C(n)$$

Lagrange Multiplier

$$f_x = \lambda g_x$$
$$f_y = \lambda g_y$$
$$\vdots$$
$$g(x, y, \ldots) = 0$$

Interest

Compound Interest	$A = P\left(1 + \frac{r}{n}\right)^{nt}$
Population Growth	$P(t) = P(0)e^{rt}$
Radioactive Decay	$m(t) = m(0)e^{-\frac{t\ln(2)}{h_0}}$

Logarithms

$$\ln(1) = 0$$
$$\ln(e) = 1$$
$$e^{\ln(x)} = x$$
$$\ln(e^x) = x$$
$$e^x = e^y \iff x = y$$
$$\ln(x) = \ln(y) \iff x = y$$
$$\ln(xy) = \ln(x) + \ln(y)$$
$$\ln\left(\frac{x}{y}\right) = \ln(x) - \ln(y)$$
$$\ln\left(x^y\right) = y\ln(x)$$

Indefinite Integrals

$$\int k dx = kx + C$$
$$\int x^k dx = \frac{x^{k+1}}{k+1}$$
$$\int kf(x)dx = k\int f(x)dx$$
$$\int [f(x) \pm g(x)]\, dx = \int f(x)dx \pm \int g(x)dx$$
$$\int e^x dx = e^x + C$$
$$\int \left[u'(x)e^{u(x)}\right] dx = e^{u(x)} + C$$
$$\int \frac{dx}{x} = \ln|x| + C$$
$$\int \frac{u'(x)}{u(x)}dx = \ln|u(x)| + C$$

Definite Integrals

$$\int_a^b f(x)dx = F(b) - F(a)$$
$$\int_a^b kf(x)dx = k\int_a^b f(x)dx$$
$$\int_a^b [f(x) \pm g(x)]\, dx = \int_a^b f(x)dx \pm \int_a^b g(x)dx$$
$$\int_a^b f(x)dx = \int_a^c f(x)dx + \int_c^b f(x)dx$$
$$\int_a^a f(x)dx = 0$$
$$\int_a^b f(x)dx = -\int_b^a f(x)dx$$
$$\int_{-a}^a f(x)dx = 2\int_0^a f(x)dx \qquad (f(x) \text{ even})$$
$$\int_{-a}^a f(x)dx = 0 \qquad (f(x) \text{ odd})$$

Numerical Integration

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

Even/Odd

$$E + E = E$$
$$O + O = O$$
$$E \cdot E = E$$
$$O \cdot O = E$$
$$E \cdot O = O$$