

Formula Sheet

Arithmetic Series

$$a_n = a_1 + (n - 1)k$$

$$S_n = \sum_{i=1}^n a_1 + (i - 1)k$$
$$= \frac{n}{2}(a_1 + a_n)$$

Geometric Series

$$a_n = a_1 r^{n-1}$$

$$S_n = \sum_{i=1}^n a_1 r^{i-1}$$
$$= a_1 \frac{1 - r^n}{1 - r}$$

Binomial Theorem

$$(x + y)^n =$$

$$\sum_{k=0}^n \frac{n!}{(n-k)!k!} x^{n-k} y^k$$

Line equation

$$y = ax + b$$

Quadratic formula

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Definition of the derivative

$$\frac{d}{dx} f(x) = \lim_{\Delta x \rightarrow 0} \frac{f(x + \Delta x) - f(x)}{\Delta x}$$

Rules of differentiation

$$\frac{d}{dx}(f(x)g(x)) = f(x) \frac{d}{dx}(g(x)) + g(x) \frac{d}{dx}(f(x)) \quad (\text{product rule})$$

$$\frac{d}{dx} \left(\frac{f(x)}{g(x)} \right) = \frac{g(x) \frac{d}{dx}(f(x)) - f(x) \frac{d}{dx}(g(x))}{(g(x))^2} \quad (\text{quotient rule})$$

$$\frac{d}{dx}(f(g(x))) = \frac{d}{dx}(f(g(x))) \frac{d}{dx}(g(x)) \quad (\text{chain rule})$$

Derivatives of select functions

$$\frac{d}{dx}(ax^n) = anx^{n-1}$$

$$\frac{d}{dx}(\sin(x)) = \cos(x)$$

$$\frac{d}{dx}(\cos(x)) = -\sin(x)$$

$$\frac{d}{dx}(\tan(x)) = \frac{1}{(\cos(x))^2}$$

$$\frac{d}{dx}(a^x) = a^x \ln(a)$$

$$\frac{d}{dx}(\log_a x) = \frac{1}{x \ln(a)}$$

Integrals of select functions

$$\int ax^n dx = \left\{ \begin{array}{ll} \frac{a}{n+1} x^{n+1} & , n \neq -1 \\ a \ln(|x|) & , n = -1 \end{array} \right\} \quad (\text{polynomials})$$

$$\int \sin(ax) dx = -\frac{1}{a} \cos(ax)$$

$$\int \cos(ax) dx = \frac{1}{a} \sin(ax) \quad (\text{trigonometry})$$

$$\int \tan(ax) dx = \frac{1}{a} \ln(|\sec(ax)|)$$

$$\int a^x dx = \frac{1}{\ln(a)} a^x$$

$$\int \ln(x) dx = x \ln(x) - x \quad (\text{exponentials})$$

Taylor series expansion

$$f(x) = \sum_{n=0}^{\infty} \frac{f^{(n)}(x_o)}{n!} (x - x_o)^n$$

Integration by parts

$$\int u dv = uv - \int v du$$