1 Formulas

- The Power Rule: $\frac{d}{dx}x^s = sx^{s-1},\ s \neq 0.$

- The Product Rule and Quotient Rule:

$$(fg)' = f'g + fg', \quad \left(\frac{f}{g}\right)' = \frac{f'g - fg'}{g^2}$$

- $\frac{d}{dx}e^x = e^x, \quad \frac{d}{dx}\ln|x| = \frac{1}{x}$

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

- $\frac{d}{dx}\tan(x) = \sec^2(x), \quad \frac{d}{dx}\sec(x) = \sec(x)\tan(x)$

- The Mean Value Theorem's useful equation is:

$$f(b) - f(a) = f'(s)(b - a)$$

  for some $s \in (a, b)$.

- $\int x^s\ dx = \frac{1}{s+1}x^{s+1} + C,\ s \neq -1.$

- $\int \frac{1}{x}\ dx = \ln|x| + C, \quad \int e^x\ dx = e^x + C$

- Integration by Substitution:

$$\int f'(g(x))g'(x)\ dx = f(g(x)) + C$$

- Newton's Law of Cooling:

$$T(t) = (T_0 - T_E)e^{kt} + T_E$$

  where T_E is the temperature of the environment.

- Exponential Growth: $P(t) = P(0)e^{kt}$