Formula Sheet

Quadratic Formula

$$ax^2 + bx + c = 0 \quad \Rightarrow \quad x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

Exponential and Logarithm Formulas:

$$e^n e^m = e^{n+m} \qquad \ln 1 = 0 \qquad e^{\ln x} = x \qquad \ln(n/m) = \ln n - \ln m$$
$$(e^n)^m = e^{nm} \qquad \ln e^x = x \qquad \ln(nm) = \ln n + \ln m \qquad \ln(n^p) = p \ln n$$

Differentiation Formulas:

Power Rule: $\frac{d}{dx} x^n = n x^{n-1}$

Product Rule: $\frac{d}{dx}[f(x)g(x)] = f'(x)g(x) + f(x)g'(x)$

Quotient Rule: $\frac{d}{dx}\left[\frac{f(x)}{g(x)}\right] = \frac{g(x)f'(x) - g'(x)f(x)}{[g(x)]^2}$

Gen. P. Rule: $\frac{d}{dx}[f(x)]^n = n[f(x)]^{n-1} f'(x)$

Logarithms: $\frac{d}{dx} \ln f(x) = \frac{f'(x)}{f(x)}$

Exponentials: $\frac{d}{dx} e^{f(x)} = e^{f(x)} f'(x)$

Indefinite Integral Formulas:

$$\begin{aligned} \int x^n \, dx &= \frac{1}{n+1} x^{n+1} + C \\ \int e^{kx} \, dx &= \frac{1}{k} e^{kx} + C \\ \int \frac{1}{x} \, dx &= \ln|x| + C \end{aligned}$$

Differentials

$$u = f(x) \quad \Rightarrow \quad du = f'(x) \, dx$$

Interest Formulas: Given present value P and yearly tax rate r:

Compounded m times a year: $P\left(1 + \frac{r}{m}\right)^{mt}$ Compounded continuously: Pe^{rt}

Economic Formulas:

- $P(x) = R(x) - C(x)$ where $P(x)$ = profit of producing x, units, $R(x)$ = revenue for selling x units, $C(x)$ = cost of producing x units.
- Marginal Cost $MC(x) = C'(x)$. Similar for Marginal Revenue $MR(x)$ and Marginal Profit $MP(x)$.
- Tax Revenue $= tS(t)$, where t = tax rate and $S(t)$ = expected sales of a product when taxed at rate t.