

Multi-Variable Taylor Series Homework Problems

1. Expand $f(x, y) = (x + 2y)^3$ in a Taylor series about $(x, y) = (1, 1)$. Include the constant, linear and quadratic terms. Evaluate $f(x, y)$ at $(x, y) = (0.1, 0.1)$ i) Exactly ii) Using the Taylor series. iii) Using the Taylor series, but neglecting the quadratic terms.
2. Expand $f(x, y) = e^{(x+2y)}$ in a Taylor series about $(x, y) = (0, 0)$. Include the constant, linear and quadratic terms. Evaluate $f(x, y)$ at $(x, y) = (0.1, 0.1)$ i) Exactly ii) Using the Taylor series. iii) Using the Taylor series, but neglecting the quadratic terms.
3. Starting from $PV = nRT$, express P as a function of V and T. Expand P(V,T) as a Taylor Series in V and T, and retain only the constant, linear and quadratic terms.

For one mole of ideal gas at 300 K in a one liter container, calculate the change in pressure when the temperature is increased to 301 K using:

- i) only the constant and linear terms in the Taylor series.
- ii) the constant, linear and quadratic terms in the Taylor series.
- iii) the exact function P(V,T)

Use the Taylor series to evaluate the change in pressure of one mole of ideal gas at 300 K in a 1 liter container when

- (a) The temperature is increased to 301 K
- (b) the volume is decreased to 0.9 liter
- (c) both (a) and (b) are carried out simultaneously.