

## 3.1 From particles to fields

**Problem 3.1:** For the functional

$$V[f] = \int dx [af(x)^2 + bf(x)f'(x) + cf''(x)^2 f'(x)]$$

calculate the functional derivatives  $\frac{\delta V}{\delta f}$  and  $\frac{\delta^2 V}{\delta f^2} = \frac{\delta}{\delta f} \frac{\delta V}{\delta f}$  assuming  $a$ ,  $b$ , and  $c$  are constants.

**Problem 3.2:** Perform the generalised gradient expansion (3.1.10) to determine the force density acting