1.5

$$\mathrm{var}[f] = E[(f(x) - E[f(x)])^2] \qquad (1.38)$$

$$= \int p(x)[f(x) - E[f(x)]]^2 \, dx \qquad \text{(according to 1.34)}$$

$$= \int p(x)[f^2(x) + E^2[f(x)] - 2f(x)E[f(x)]] \, dx$$

$$= \int p(x) f^2(x) \, dx + \int p(x) E^2[f(x)] \, dx$$
$$- 2\int p(x) f(x) E[f(x)] \, dx$$

$$= \cancel{E(f(x)^2) + E(E^2[f(x)]) - 2E[f(x)] \int p(x) f(x) dx}$$

$$\cancel{2E(}$$

$$= E[f(x)^2] + E^2[f(x)] \int p(x) \, dx - 2E[f(x)] \int p(x) f(x) \, dx$$

$$= E[f(x)^2] + E^2[f(x)] \cdot 1 - 2E[f(x)]E[f(x)]$$

$$= E[f(x)^2] - E^2[f(x)] \qquad (1.39)$$

Key point: $E(x)$ is constant. so is $E[f(x)]$
Therefore $E[f(x)]$ can be pulled out of the integral