

Question #133

Key: C

$$E(X | q) = 3q, \text{Var}(X | q) = 3q(1 - q)$$

$$\mu = E(3q) = \int_0^1 3q \cdot 2q \, dq = 2q^3 \Big|_0^1 = 2$$

$$v = E[3q(1 - q)] = \int_0^1 3q(1 - q) \cdot 2q \, dq = 2q^3 - 1.5q^4 \Big|_0^1 = 0.5$$

$$a = \text{Var}(3q) = E(9q^2) - \mu^2 = \int_0^1 9q^2 \cdot 2q \, dq - 2^2 = 4.5q^4 \Big|_0^1 - 4 = 4.5 - 4 = 0.5$$

$$k = v/a = 0.5/0.5 = 1$$

$$Z = \frac{1}{1+1} = 0.5$$

The estimate is

$$0.5(0) + 0.5(2) = 1.$$