

Question #201

Answer: A

$$S_0(80) = \frac{1}{2} * (e^{(-0.16 * 50)} + e^{(-0.08 * 50)}) = 0.00932555$$

$$S_0(81) = \frac{1}{2} * (e^{(-0.16 * 51)} + e^{(-0.08 * 51)}) = 0.008596664$$

$$p_{80} = s(81) / s(80) = 0.008596664 / 0.00932555 = 0.9218$$

$$q_{80} = 1 - 0.9218 = 0.078$$

Alternatively (and equivalent to the above)

For non-smokers, $p_x = e^{-0.08} = 0.923116$

$${}_{50}P_x = 0.018316$$

For smokers, $p_x = e^{-0.16} = 0.852144$

$${}_{50}P_x = 0.000335$$

So the probability of dying at 80, weighted by the probability of surviving to 80, is

$$\frac{0.018316 \times (1 - 0.923116) + 0.000335 \times (1 - 0.852144)}{0.018316 + 0.000335} = 0.078$$