

Show all work for full credit, and use correct notation. Simplify answers completely.
Unless told or implied otherwise, assume all lives are independent.

1. You are given:

- (i) Male mortality follows DeMoivre's Law with terminal age 80
- (ii) Female mortality follows DeMoivre's Law with terminal age 100

Determine ${}_{10}q_{30:\overline{20}}$ where (20) is female and (30) is male.

2. The force of mortality for smokers is $\mu = .04$, and the force of mortality for non-smokers is $\mu = .02$.

Determine ${}_{40}q_{x:\overline{1}y}$ where (x) is a smoker and (y) is a non-smoker.

3. Given ${}_nq_{x:\overline{2}y} = .02$ and ${}_nq_{x:\overline{2}y} = .03$, determine ${}_np_{\overline{xy}}$

4. For a common shock model with $\lambda = .001$, in the absence of the shock the future lifetimes of (x) and (y) follow constant force models with $\mu_x^* = .010$ and $\mu_y^* = .009$. Determine the probability that both (x) and (y) die at the same time.

5. For 25-year old males and 30-year old females, you are given:

(i) $\mu_{25}(t) = .2$ for $0 \leq t \leq 1$

(ii) ${}_tq_{30} = .01t$ for $0 \leq t \leq 1$ (deaths are uniformly distributed for females)

Determine the probability that a 30-year old female will die before a 25-year old male and within the next year.