# EXAM MLC QUESTIONS OF THE WEEK

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## Week of February 5/07

Suppose that survival follows DeMoivre's law with $\omega = 100$ , and $i = .08$ .
Find $\ddot{a}_{90}$ , ${}^2\ddot{a}_{90}$ and $Var[Y]$ , where $Y$ is the PVRV for a whole life annuity-due of 1 issued to $(90)$.

**The solution can be found below.**

# Week of February 5/07 - Solution

$$\ddot{a}_{90} = \sum_{k=0}^{\infty} v^k \,{}_kp_{90} = \sum_{k=0}^{9} v^k (\tfrac{10-k}{10}) = (\tfrac{1}{10})(10 + 9v + 8v^2 + \cdots + v^9)$$
$$= (\tfrac{1}{10})(D\ddot{a})_{\overline{10}|.08} = (\tfrac{1}{10})(\tfrac{10-a_{\overline{10}|.08}}{d}) = (\tfrac{1}{10})(\tfrac{10-6.710}{.0741}) = 4.44 \ .$$

$${}^2\ddot{a}_{90} = \sum_{k=0}^{\infty} v^{2k} \,{}_kp_{90} = \sum_{k=0}^{9} v^{2k} (\tfrac{10-k}{10}) = (\tfrac{1}{10})[10 + 9v^2 + 8(v^2)^2 + \cdots + (v^2)^9]$$
$$= (\tfrac{1}{10})({}^2D\ddot{a})_{\overline{10}|.08} = (\tfrac{1}{10})(\tfrac{10-{}^2a_{\overline{10}|}}{2d-d^2}) = (\tfrac{1}{10})(\tfrac{10-4.720}{.1427}) = 3.70 \ .$$

$Var[Y] = \frac{2}{d}[\ddot{a}_{90} - {}^2\ddot{a}_{90}] + {}^2\ddot{a}_{90} - \ddot{a}_{90}^2 = 3.97$ , or

$Var[Y] = \frac{1}{d^2}[{}^2A_{90} - A_{90}^2] = (\frac{1}{.0741})^2[\frac{{}^2a_{\overline{10}|}}{10} - (\frac{a_{\overline{10}|}}{10})^2] = 3.97$ .