

Rate Parameter Calculation October 15, 2018

1 Raw mark variable

Solve system of equations:

$$1) \exp(\alpha + \beta * \log_{10}(0.5) + \gamma) = 1 - VE(v)$$

$$2) \exp(\alpha + \beta * \log_{10}(50) + \gamma) = 1$$

$$1)/2) = \exp(\beta * \log_{10}(0.5/50)) = 1 - VE(v)$$

$$\iff \beta = \frac{\log(1 - VE(v))}{\log_{10}(0.5/50)}$$

$$1) * 2) = \exp(2\alpha + (\log_{10}(0.5) + \log_{10}(50)) * \beta + 2\gamma) = 1 - VE(v)$$

$$\iff 2(\alpha + \gamma) + \log_{10}(50 * 0.5)\beta = \log(1 - VE(v))$$

$$\iff \phi = \alpha + \gamma = \frac{\log(1 - VE(v)) - \log_{10}(50 * 0.5)\beta}{2}$$

To find α , solve $\int_0^\infty f_v(v|z=0) \exp(\alpha + \beta * v) dv = 1$

$$\iff \int_0^\infty \lambda_v * \exp(-\lambda_v * v) * \exp(\alpha + \beta * v) dv = 1$$

$$\iff \exp(\alpha) * \lambda_v \int_0^\infty \exp(-(\lambda_v - \beta) * v) dv = 1$$

$$\iff \exp(\alpha) * \lambda_v \left(-\frac{1}{\lambda_v - \beta}\right)(0 - 1) = 1$$

$$\iff \frac{\exp(\alpha) * \lambda_v}{\lambda_v - \beta} = 1$$

$$\iff \exp(\alpha) * \lambda_v = \lambda_v - \beta$$

$$\iff \exp(\alpha) = 1 - \frac{\beta}{\lambda_v}$$

$$\iff \alpha = \log\left(1 - \frac{\beta}{\lambda_v}\right)$$

$$\implies \gamma = \phi - \alpha$$

Therefore, $\beta = \frac{\log(1 - VE(v))}{\log_{10}(0.5/50)}$

$$\phi = \frac{\log(1 - VE(v)) - \log_{10}(0.5 * 50)\beta}{2}$$

$$\alpha = \log\left(1 - \frac{\beta}{\lambda_v}\right)$$

$$\gamma = \phi - \alpha$$