Equation from Jacob, 2000:

\[ k_i = \int_a^b 4\pi r^2 N \left( \frac{r}{D_g} + \frac{4}{v\gamma} \right)^{-1} \, dr \]

since Area (A) = \[ \int_a^b 4\pi r^2 N \, dr \]

Simplify:

\[ k_i = 4\pi N \int_a^b r^2 \left( \frac{r}{D_g} + c \right)^{-1} \, dr \]

where \( c = \frac{4}{v\gamma} \) (in my code (get_alk), \( c = \text{CONST1, CONST2} \))

\[ k_i = 4\pi N \int_a^b \frac{r^2}{r/D_g + c} \, dr \]

Let \( x = \frac{r}{D_g} + c \) (in my code (get_alk), \( x = A1, B1, A2, B2 \) for different values of \( r \))

Solve for \( r \): \( r = (x - c)D_g = D_g x - D_g c \)

\[ dx = dr \]

Substitution:

\[ k_i = 4\pi N \int_a^b \frac{(D_g x - D_g c)^2}{x} \, dx = 4\pi N \int_a^b D_g^2 \frac{(x^2 - 2xc + c^2)}{x} \, dx \]

\[ k_i = 4\pi ND_g \left[ \int_a^b x \, dx - \int_a^b 2cdx + \int_a^b \frac{dx}{x} \right] = 4\pi ND_g \left[ \frac{x^2}{2} - 2cx + c^2 \ln x \right]_a^b \]

In my code (get_alk), TERM 1, TERM 2 and TERM 3 are the 3 parts of equation in the square brackets above.