

$$\begin{aligned}
 & \lim_{x \rightarrow \infty} \frac{x^2(1 - \cos \frac{\beta}{x})}{\frac{x^2}{2}} = \lim_{x \rightarrow \infty} \frac{(1 - \cos \frac{\beta}{x})}{\frac{1}{x^2}} = \lim_{x \rightarrow \infty} \frac{2 \sin^2 \frac{\beta}{2x}}{\frac{1}{x^2}} = \lim_{x \rightarrow \infty} \frac{\sin^2 \frac{\beta}{2x} \cdot \frac{\beta^2}{2^2}}{\frac{1}{x^2}} = \frac{\beta^2}{2}
 \end{aligned}$$

$1 - \cos x = 2 \sin^2 \frac{x}{2}$