

STEP III, 2014 , Q9 MS

9. $\mathbf{v} = \frac{1-e^{-kt}}{k} \mathbf{g} + e^{-kt} \mathbf{u}$ and a further differentiation yields $m\mathbf{a} = m\mathbf{g} - mk\mathbf{v}$. Using $\mathbf{r} \cdot \mathbf{j} = 0$ obtains the first displayed result after re-arrangement, as does $\tan \beta = \frac{-\mathbf{v} \cdot \mathbf{j}}{\mathbf{v} \cdot \mathbf{i}}$ the second.

$\tan \beta - \tan \alpha$ can be shown to be $\frac{2g}{uk \cos \alpha (1-e^{-kT})} (\sinh kT - kT)$ which leads to the two final inequalities.



NextStepMaths.com

To view mark schemes, fully worked solutions and examiner's comments, and for more details about tutoring and other services offered, go to NextStepMaths.com