$\boldsymbol{f(t, y) = -ay}$

$\boldsymbol{\hat{y}_{i+1} = \hat{y}_i + h(-a\hat{y}_i)}$

$\boldsymbol{= (1 - ah)(\hat{y}_i)}$

$\boldsymbol{\Rightarrow \hat{y}_i = (1 - ah)^i y_0}$

We find that if |1-ah| $>$ 1 then the equation will explode so for Euler's method to work, we need $\boldsymbol{|1 - ah| < 1}$ which implies $\boldsymbol{0 < ah < 2}$ and finally: $\boldsymbol{h < \frac{2}{a}}$

The last part is just an easy rearrangement of the equation:

$\boldsymbol{\hat{y}_{i+1} = \hat{y}_i - 10h\hat{y}_{i+1}}$

$$\boldsymbol{\hat{y}_{i+1} = \frac{\hat{y}_i}{1 + 10h}}$$

$\boldsymbol{\hat{y}_i = \frac{y_0}{(1+10h)^i}}$ which is stable since h is positive