A ladder is leaning against a smooth wall. The coefficient of friction between the ladder and the floor is $\mu = 0.4$. It is at a critical orientation with height $h$ and base line $b$. Jill is standing at a point where $L' = \beta L$, with $\beta < 0.5$.

What would happen to the ladder?

A) It is stable.
B) Critical condition remains.
C) It will slip.

About $O$, the torque equation is

$$h f' = \frac{bW}{2} + \beta b W_1.$$  \hfill (1)\\

For the ladder to be stable, it requires

$$F' = f' = \left( \frac{W}{2 + \beta W_1} \right) \frac{b}{h} \leq f_{\text{max}} = \mu (W + W_1).$$  \hfill (2)\\

From given, when $W_1 = 0$, (2) becomes an equality. So

$$\left( \frac{W}{2 + 0} \right) \frac{b}{h} = \mu (W + 0), \quad \text{or} \quad \mu = \frac{b}{2h}.  \hfill (3)$$

Substituting (3) into (2) gives

$$\left( \frac{W}{2 + \beta W_1} \right) \frac{b}{h} \leq \frac{b}{2h} (W + W_1), \quad \text{or} \quad \beta \leq \frac{1}{2}.  \hfill (4)$$

This implies that as long as Jill is below the midway point, the ladder is stable.

At $\beta = \frac{1}{2}$, it is at the critical situation.

Answer $\text{A}$.

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