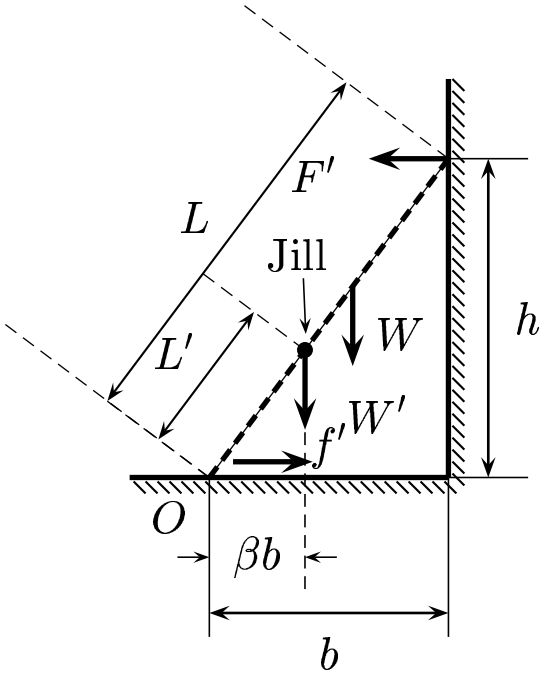

A ladder is leaning against a smooth wall. The coefficient of friction between the ladder and the floor is $\mu = 0.4$. It is at a critical orientation with height h and base line b. Jill is standing at a point where $L' = \beta L$, with $\beta < 0.5$.

What would happen to the ladder?

A) It is stable.

B) Critical condition remains.

C) It will slip.

About O, the torque − equation is $\quad h\,f' = \dfrac{b\,W}{2} + \beta\,b\,W_1\,. \qquad (1)$

For the ladder to be stable, it requires

$$F' = f' = \left(\frac{W}{2+\beta\,W_1}\right)\,\frac{b}{h} \le f^s_{max} = \mu\,(\,W + W_1\,)\,. \qquad (2)$$

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

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

Substituting (3) into (2) gives

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

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

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

Answer **A** .

12.03-10˙Leaning˙Ladder˙and˙Jill 2004-4-6