

SHOW ALL THE STEPS TO GET FROM

$$\left. \frac{d^2 U(x_1)}{dx_1} \right|_{x_1=x_0} = \frac{d}{dx_1} \left\{ -m_1 g + \frac{m_2 g}{4} \frac{(b-x_1)}{\sqrt{\left(\frac{b-x_1}{2}\right)^2 - d^2}} \right\}$$

TO

$$\left. \frac{d^2 U(x_1)}{dx_1} \right|_{x_1=x_0} = \frac{g(4m_1^2 - m_2^2)^{3/2}}{4m_2^2 d}$$

TAKE THE DERIVATIVE

$$\begin{aligned} \frac{d^2 U(x_1)}{dx_1} &= 0 + \frac{m_2 g}{4} \left\{ \frac{-1}{\sqrt{\left(\frac{b-x_1}{2}\right)^2 - d^2}} - \frac{(b-x_1)}{2} \frac{2 \left(\frac{b-x_1}{2}\right) \left(-\frac{1}{2}\right)}{\left[\left(\frac{b-x_1}{2}\right)^2 - d^2\right]^{3/2}} \right\} \\ &= \frac{m_2 g}{4} \left\{ \frac{-1}{\sqrt{\left(\frac{b-x_1}{2}\right)^2 - d^2}} + \frac{(b-x_1)^2}{4 \left[\left(\frac{b-x_1}{2}\right)^2 - d^2\right]^{3/2}} \right\} \end{aligned}$$

FIND A COMMON DENOMINATOR

$$\begin{aligned} &= \frac{m_2 g}{4} \left\{ \frac{-\left(\frac{b-x_1}{2}\right)^2 + d^2 + \frac{(b-x_1)^2}{4}}{\left[\left(\frac{b-x_1}{2}\right)^2 - d^2\right]^{3/2}} \right\} \\ &= \frac{m_2 g d^2}{4} \left\{ \frac{1}{\left[\left(\frac{b-x_1}{2}\right)^2 - d^2\right]^{3/2}} \right\} \end{aligned}$$

SUBSTITUTE $x_1 = x_0 = b - \frac{4m_1 d}{\sqrt{4m_1^2 - m_2^2}} \Rightarrow \left(\frac{b-x_1}{2}\right) = \frac{4m_1^2 d^2}{(4m_1^2 - m_2^2)}$

$$\begin{aligned} \left. \frac{d^2 U(x_1)}{dx_1} \right|_{x_1=x_0} &= \frac{m_2 g d^2}{4} \left[\frac{4m_1^2 d^2}{(4m_1^2 - m_2^2)} - d^2 \right]^{-3/2} \\ &= \frac{m_2 g d^2}{4} \left[\frac{4m_1^2 - m_2^2}{4m_1^2 d^2 - 4m_1^2 d^2 + m_2^2 d^2} \right]^{+3/2} \\ &= \frac{m_2 g d^2}{4} \frac{(4m_1^2 - m_2^2)^{3/2}}{m_2^2 d^3} \end{aligned}$$

$$\boxed{\left. \frac{d^2 U(x_1)}{dx_1} \right|_{x_1=x_0} = \frac{g(4m_1^2 - m_2^2)^{3/2}}{m_2^2 d} \quad \underline{\underline{\text{QED!}}}}$$