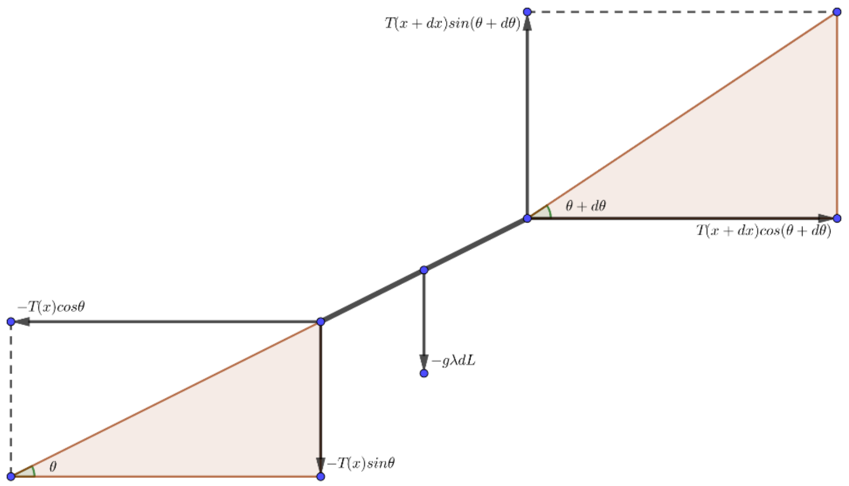

$$\begin{cases} T(x+dx)\,cos(\theta+d\theta) - T(x)\,cos\,\theta = 0 \\ T(x+dx)\,sin(\theta+d\theta) - T(x)\,sin\,\theta - g\lambda\,dL = 0 \end{cases}$$

$$T(x)\,cos\,\theta = T(x+dx)\,cos(\theta+d\theta) = T_x$$

$$T(x) = \frac{T_x}{cos\,\theta} \qquad T(x+dx) = \frac{T_x}{cos(\theta+d\theta)}$$

$$\frac{T_x}{cos(\theta+d\theta)}sin(\theta+d\theta) - \frac{T_x}{cos\,\theta}sin\,\theta - g\lambda\,dL = 0$$

$$T_x(tan(\theta+d\theta) - tan\,\theta) - g\lambda\,dL = 0$$

$$T_x\,d\,tan\,\theta = g\lambda\,dL \qquad T_x\,dy' = g\lambda\sqrt{1+(y')^2}\,dx$$

$$\frac{1}{\sqrt{1+(y')^2}}\frac{dy'}{dx} = \frac{g\lambda}{T_x} \qquad \therefore \frac{y''}{\sqrt{1+(y')^2}} = \frac{g\lambda}{T_x}$$

$$\frac{y''}{\sqrt{1+(y')^2}} = (sinh^{-1} y')' = \frac{g\lambda}{T_x}$$

$$sinh^{-1} y' = \frac{g\lambda}{T_x} x + c_1$$

$$y' = sinh\left(\frac{g\lambda}{T_x} x + c_1\right)$$

$$\therefore y = \frac{T_x}{g\lambda} cosh\left(\frac{g\lambda}{T_x} x + c_1\right) + c_2$$

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