

We are going to raise only the lower half of the chain to do the wind, so we consider the coordinate system at the center of the chain, our job now is the rise every  $\lambda dz$  ( $\lambda$  is the mass per unit length) which is the unit mass of the chain from the coordinate  $z$  to  $(-z)$ , so we do this integral from 0 (chain middle) to 5 (end of the chain):

Unit potential energy required to raise the  $\lambda dz$  of the chain to the height  $z$  is (comparing with  $E = mgh$ ):

$$dE = \lambda dz gz$$

We are going to raise every part twice, once from  $z$  to 0 then from 0 to  $-z$  so we will multiply by 2 (or you can integrate instead from  $-5$  to 5) (Note that the integration must be from 5 to  $-5$  due to the direction of raising but the consequence for the flip is only a minus sign which we don't care about) :

$$E = 2\lambda g \int_0^5 z dz = 2\lambda g \frac{1}{2} [z^2]_0^5 = 25\lambda g$$

Substituting  $\lambda = 2 \frac{kg}{m}$  and  $g = 10 \frac{m}{s^2}$  we get:

$$E = 25 \times 2 \times 10 = 500 \text{ Joules}$$