

8. [9 points] Sally, the marine scientist, is reeling in a large shark she caught onto her boat. The edge of her boat lies 5 meters above the water as shown in the figure below. The total length of the sharking line is 30 meters. The shark weighs 500 newtons in water, and her sharking line weighs 30 newtons per meter out of water, and 10 newtons per meter in water. The figure below depicts this situation - the sharking line is the thick dark line and the boat is shaded. Write an expression which gives the work Sally does pulling the shark's snout to the surface of the water.

*Solution:* Suppose Sally has already reeled in  $x$  meters of line. The weight of the shark and remaining line is then  $F(x) = 500 + 30(5) + 10(25 - x)$  N. Then the work done in pulling the shark's snout to the surface of the water is given by

$$\int_0^{25} F(x)dx = \int_0^{25} 900 - 10x dx = 19375J.$$