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Worksheet week 6 - MAC 2312, Spring 2014

1. You have previously found the formula for the volume of a torus, next let's find its surface area. Rotate the circle $(x = a\cos t,\ y = a\sin t),\ t \in [0, 2\pi]$, around the line $x = b$, where $0 < a < b$. Set up an integral that represents the surface area of the torus obtained and then compute the integral to find a simple formula.

2. (a) A 50 meter chain is hanging from a spool. Assuming the density of the chain is given by 10 Newtons per meter, compute the minimum work required to wind the chain up onto the spool. (Assume that the spool is on the top of a building and you are pulling the chain up to the top of the building.)

(b) The same problem as in part (a), but now assume that there is also a weight of 300 Newtons hanging at the end of the chain.

3. (A slightly more challenging version of Pb. 1)
(a) As in Pb. 1, suppose that a 50 meter chain is hanging from a side of a spool and assume that the density of the chain is given by 10 Newtons per meter. This time think that the spool is the tip of a crane and we are pulling the chain on the other side of the spool, so that the part that you already pulled helps you in pulling the remaining part. What is the minimum work required to turn completely the chain on the other side of the spool?

(b) What would the minimum work be, in this case, if there was also a weight of 300 N hanging at the end of the chain?