Problem 5.5.6: A steam pipe with a diameter of 12.85" is buried with its center 9 ft below the surface in soil. Calculate the heat loss if the pipe is 100 ft long. The steam is saturated at a temperature of 320°F. The surface of the soil is at a temperature of 50°F.

Solution:

$$k = 0.3\ \frac{Btu}{h.ft.^\circ F},\ L = 100\ ft$$

$$d = 1.0708\ ft,\quad z = 9\ ft,\ T_s = 780^\circ R,\ T_a = 510^\circ R$$

$$\cosh^{-1}\left(\frac{2*z}{d}\right) = \cosh^{-1}(16.809) = 3.515$$

$$S = \frac{2*\pi.L}{\cosh^{-1}\left(\frac{2*z}{d}\right)} = 178.794\ ft$$

$$Q = S.k.(T_s - T_a) = 1.448*10^4\ \frac{Btu}{h}$$