Chapter 16 Problem 31 †

Given

$$\begin{split} l &= 12 \ m \\ w &= 8.0 \ m \\ \Delta x &= 23 \ cm = 0.23 \ m \\ T_i &= 20 \ ^\circ C \\ T_g &= 10 \ ^\circ C \\ k_{concrete} &= 1W/m \ K \end{split}$$

Solution

Find the heat flow into the ground.

The formula for heat loss due to conduction is

$$H = -kA\frac{\Delta T}{\Delta x}$$

The area of the floor is just the length times the width. Therefore, our equation becomes

$$H = -klw \frac{(T_g - T_i)}{\Delta x}$$

Substituting in the known values gives us

$$H = -(1 \ W/m \cdot K)(12 \ m)(8.0 \ m) \frac{(10 \ ^{\circ}C - 20 \ ^{\circ}C)}{(0.23 \ m)}$$
$$H = 4170 \ W = 4.17 \ kW$$