

## MECH105: Homework 21

Fick's first diffusion law states that

$$MassFlux = -D \frac{dc}{dx}$$

where mass flux is the quantity of mass that passess across a unit area per unit time  $g/cm^2/s$ .  $D$  is a diffusion coefficient ( $cm^2/s$ ),  $c$  is the concentration ( $g/cm^3$ ), and  $x$  is the distance ( $cm$ ).

An engineerg measures the following concenration of a pollutant in the pore waters of sediments underlying a lake ( $x = 0$  at the defiment-water interface and increases downward).

x,cm	c, $10^{-6} g/cm^3$
0	0.06
1	0.32
3	0.6

Use the best numerical differentiation technique to estimate the derivative at  $x = 0$ . Employ this estimate in conjunction with the equation above to compute the mass flux of pollutant out of the sediments and into the overlying waters ( $D = 1.52 * 10^{-6} cm^2/s$ ). For a lake with  $3.6 * 10^6 m^2$  of sediments, how much pollutant would be transported into the lake over a year's time?