

HOMEWORK 13
DIFFERENTIAL EQUATIONS
DUE 09-28

Show your work!

- (1) In class, we considered the following problem:

Suppose that a river containing 10000 m^3 of initially pure water is fed by stream A, flowing at $500 \frac{\text{m}^3}{\text{day}}$, and stream B, flowing at $750 \frac{\text{m}^3}{\text{day}}$. Stream A is contaminated

by rock salt at a concentration of $\frac{5 \text{ kg}}{1000 \text{ m}^3}$, but the water in stream B is pure.

Further, trash is dumped into the river, reducing the volume of water a rate of $50 \frac{\text{m}^3}{\text{day}}$. The overflow spills into stream C, which flows at $1300 \frac{\text{m}^3}{\text{day}}$. How much rock salt is in the river at time t ?

We found that the amount S of rock salt at time t is given by

$$S = \frac{1}{10}(200 - t) + C(200 - t)^{26}$$

for some constant C . (In class, I accidentally wrote $20 - t$ instead of $200 - t$. Fortunately, this doesn't affect any of the rest of the calculations. Please update your notes accordingly!)

- (a) What is the value of C ?
 - (b) What is the *concentration* of salt in the river at time t ?
 - (c) The formula for S makes perfectly good sense for all times t , but the formula for the concentration does not. Give a 'common-sense' explanation (without any formulas) of why this happens.
- (2) **Three** book problems: #1.9.21, 23, 27.