

College of the Holy Cross  
Math 110 Environmental Math  
Professor Catherine A. Roberts  
Fall 2004  
Exam #1

Name: \_\_\_\_\_

Score: \_\_\_\_\_ out of 100  
Take Home Portion: \_\_\_\_\_ out of 25

**True/False questions are worth 2 points each.**

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TRUE FALSE The Nature Conservancy is a political action group that supports a politically conservative agenda for governmental laws and policies about nature.

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TRUE FALSE Materials that water can easily be transmitted through would have a small value for  $K$ , whereas those that provide significant resistance to the flow of water would have a large value of  $K$ .

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TRUE FALSE Our neighbors Canada and Mexico are listed among the top five countries from which the United States imports oil.

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TRUE FALSE The *hydraulic head* is the height of the water level, measured straight down from the surface of the earth to the point where one first encounters water.

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TRUE FALSE The Clean Water Act was passed in the 1970's and it regulates pollution discharges into the waters of the United States.

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TRUE FALSE The units of the porosity,  $\eta$ , are length/time, such as feet per day.

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TRUE FALSE A billion is a thousand millions.

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TRUE FALSE Peggy Middaugh, the executive director of the Regional Environmental Council, described their mission as including a desire to increase awareness within the Worcester community of issues such as nuclear power plant emissions and sudden infant death syndrome.

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TRUE FALSE After the *Civil Action* verdict, lawyer Jan Schlichtmann went to Hawaii for several years.

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TRUE FALSE Ed Augustus, one of the candidates for the 2<sup>nd</sup> Worcester district state Senate seat, has very little experience in politics and is heavily backed by the MA governor, Republican Mitt Romney.

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[10 points] In A Civil Action, J. Harr writes: “Gordon spent the entire weekend in his office, adding up the bills. By the time he finished on Monday morning, he has a precise total of the cost to date: \$1,803,195.84. And the trial was still several weeks away.”(p. 263)

If the cost of the trial was all debt, and the lawyers were being charged an interest rate of 4% per year by the Bank and other creditors, how much interest was due per day? For full credit, show how you use multiplication and the cancellation of your units to obtain the right answer.

[10 points] Assume a scenario with a volumetric flow rate,  $Q$ , of  $3,500 \text{ ft}^3/\text{day}$ . Suppose a contaminant is leaking into the aquifer at a rate of 20 pounds per week. Find the concentration,  $C$ , of the contaminant in the aquifer. Show your work. Remember units. Use four significant figures when rounding your answers.

[10 points] Assume a different scenario where the concentration,  $C$ , of a contaminant is given as  $0.042 \text{ lb}/\text{ft}^3$ . Suppose that this contaminant is considered dangerous at any levels over 500 ppm (parts per million). Is this concentration level dangerous? Show your work to justify your answer. Remember units.

*The remaining three problems on this exam pertain to the new scenario described in the figure provided.*

[10 points] Consider a buried silt deposit with a hydraulic conductivity that averages 0.08 ft/day. Use Darcy's Law and the information provided in the figure to determine the volumetric flow rate,  $Q$ . Show work. Remember units.

[10 points] Find the interstitial velocity for this scenario, given that the porosity for silt is 35%. Show your work. Remember units.

[10 points] Estimate how long it'll take for the ground water in this scenario to travel a distance of 10 feet? Approximately how many years is this?

[20 points] Here are TWO short essay questions based on A Civil Action by Jonathan Harr. Select ONLY ONE of the short essay question. CHOOSE ONE. ONLY ONE.

PLEASE NOTE THAT THIS ONLY COUNTS FOR 20 POINTS SO DON'T SPEND TOO MUCH TIME ON THIS. IT IS A SHORT ESSAY QUESTION. YOUR ANSWER SHOULDN'T BE LONGER THAN A PAGE OR TWO.

### **ESSAY QUESTION A**

Here is an excerpt from a review of the movie A CIVIL ACTION that is located on the website ChristianAnswers.net. (<http://www.christiananswers.net/spotlight/movies/pre2000/i-acivilaction.html>). The points made in this review could pertain equally well to one who has read the book A Civil Action, by J. Harr. Comment upon this excerpt, taking any direction that you find compelling.

“Definition of the word *Civil* "Of or relating to citizens and their interrelations with one another".

Definition of the word *Action* "The series of events and episodes that form the plot of a story or play".

By this definition, a civil action would mean "a series of events and episodes that reveal the interactions between citizens of a specified society". *A Civil Action* does just that, but with a unique twist. By revealing the true motives of many who practice law, it actually exposes the corruption of some members of our legal system and the coldness of some of those who are supposed to represent us (the ordinary citizens).

According to law, however, the word "civil" means "Relating to the rights of private individuals and legal proceedings concerning these rights as distinguished from criminal, military, or international regulations or proceedings." While most of us associate the term "a civil action" in this fashion, Steven Zaillian, the director, gives us a glimpse of the greed and avarice which motivates our judicial advocates. Jan Schlichtmann (John Travolta), while being interviewed on a radio talk show, tells the listeners that to get the big money, a case shouldn't ever go to trial. He tells them to forget due process, justice or any feelings for the client. After all, empathy clouds judgment. He says that when it comes to personal injury suits, the goal is to reach an out-of-court settlement because, in a court of law, litigants are "lucky to find anything...that resembles the truth". So much for defending the rights of private individuals!"

### **ESSAY QUESTION B**

Here is a para-phrased quotation from the book A Civil Action. Write a response to this, taking any direction that seems compelling to you.

A professor at the Harvard School of Public Health, a statistician named Marvin Zelen, had been intrigued by the story of Woburn's leukemia cluster. Woburn seems to him like an interesting riddle. Was there or was there not a link between the well water and the cluster of leukemia? Zelen thought he knew a way to solve this riddle.

Statistical studies of the sort Zelen specialized in had proved, for example, an irrefutable link between cigarette smoking and lung cancer, but those studies had been based on an analysis of tens of thousands of cases of lung cancer. Statistical studies rely upon large numbers, and Zelen had only twelve cases of leukemia to work with in Woburn. But Zelen thought he saw a way to get larger numbers. He reasoned that if the well water had, in fact, caused leukemia, it might also have caused a variety of other childhood health problems. If an unusual pattern of birth defects and reproductive disorders emerged among families that had gotten their water from wells G and H, that would tend to support the theory that the cluster of leukemia cases was not simply a coincidence, a statistical fluke.

‘The combined weight of evidence,’ wrote Zelen and his colleagues in the complete 153-page Harvard Health Study, ‘strongly suggests that water from wells G and H is linked to a variety of adverse health effects.’”