

SHOW YOUR WORK: William Mulholland
David A. Wheeler, 2007-09-27

I'm delighted that all of you seem to be understanding the material. I want everyone to get 100%! Some of you should be getting even higher scores, but aren't because you aren't showing your work. Showing your work matters, and I'm at a loss as to how to get all of you to do it. So...

In a few tests I plan to start taking away points for *correct* answers if no work is shown. None of the problems we're doing now takes only one step. **Show the steps** to the answer. You should have *at least* several steps in your answer; when in doubt, slow it down and take more steps. In the professional world, you *cannot* just show "the answer" without the justification on important problems. Anybody can make up numbers, and even experts make mistakes. An important decision will normally get reviewed (which requires something to review!), and you have to back up your claims if you want to be heard. "No proof" is the same as "wrong answer".

William Mulholland (September 11, 1855 – July 22, 1935) was a famous man who led development of the Los Angeles water supply, making the city possible. He was considered a great man in L.A. for years. But his career ended when his St. Francis Dam failed on March 12, 1928, just hours after being inspected by Mulholland himself. A 10-story wall of water destroyed everything below, including the town of Santa Paula. The final death count is estimated at 450 or higher, including 42 school children.

The causes were numerous: The surrounding ground was not a good place to build a dam, the concrete was not made well, etc. One was that "extra stress, not engineered for, was placed on the Dam when, at some point during construction after the foundation was poured, the Dam's height grew from 175 feet with a water capacity of 30,000 acre feet to 185 feet and a 38,000 acre feet capacity. Calculations to validate changes made to the St. Francis Dam when the additional ten feet of height were added do not appear in the records nor does any other documentation as to when or how it was to be accomplished."

In short, the problem is that Mulholland did *everything* himself, and he kept most of the justifications in his head. He designed it and ran every bit of the project... *without* showing his work to anyone else (to check it). He was a very smart and able man; he had probably read every book relating to the topic, and was one of the world's leading experts. But he made a number of horrific blunders that were only possible because he didn't have to show his work to others for checking. He deeply regretted what happened; after the disaster Mulholland resigned, saying, "The only people I envy in this thing are the dead." He was widely reviled after this, and lived in seclusion for a few years before his death.

Now, I'm *not* saying that those who don't show their work have Mulholland's hubris. My point is that even very smart and experienced people can make terrible mistakes. Thus, it's important to *write down* why you believe something is true (in math), so that you and others can check it. You'd need to do it in the real world, and you need to do it now so you can get partial credit. So – please do it!!

Use **LEGIBLE WRITING** for the steps. Many mistakes appears to be caused by mistakes in reading your own writing! Paper is cheap; use lots of it.

References:

- "The St. Francis Dam collapse and its impact on the construction of the Hoover Dam " Thomas M. McMullen, Master of Science, 2004 (Thesis). <https://drum.umd.edu/dspace/bitstream/1903/1672/1/umi-umd-1629.pdf>
- "Grim Society Interview: Dr. J. David Rogers on the St. Francis Dam Disaster" by Dave Hogan and Wendy Larsen-Cleaves. <http://www.grimsociety.com/archives/rogers.html>
- "William Mulholland". Wikipedia. 2007-10-08. http://en.wikipedia.org/wiki/William_Mulholland