As usual, take no more than 5 minutes on question 0

0.)

Oops! Looks like the American dollar went belly-up last week, and as a result, society has completely collapsed across the globe![1] Eventually, maybe civilization will rebuild, but for now, it's total chaos—there's no longer such thing as currency, half the city is on fire, and the police and army have both fractured into a complicated web of warring factions. You and your group have to band up to survive. In the space below, determine a) what your top priorities for survival should be in the immediate term and b) what role each member will play for your team.

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[1]Maybe next time, consider using something less volatile as the world's reserve currency—for now though, tough luck.

1.)

a) A square tank with side length 5m is being filled at a rate of 3m/s. At what rate is the height in the tank rising? Does it matter how much water is in the tank?

b) Now, suppose while the tank is being filled at the same rate a vacuum tube begins sucking at time $t = 0s$ at a rate of $(0.2t^2)$m/s. At what time (in seconds) will the tank reach its *maximum* fillage?

2.)

Emily starts walking north at 9:00am on a tuesday and keeps walking at a constant rate of 2 m/s until her legs give out four days later. At 9:00am, Sarah is standing around at a location precisely 45 km north and 8 km east until some unknown force compels her to begin walking south at 3 m/s at 9:05am. At what time do they achieve their minimum distance from each other? What is that minimum distance?

3.)

Use linear approximation to estimate the following quantities (If you just plug each expression into a calculator I will be so, so deeply disappointed—unless you're just checking to see how close you are!):

a.)

$$\sin(.005) \approx$$

b.)

$$e^{\ln(2)+.03} \approx$$

c.)

$$(1000023)^{\frac{1}{6}} \approx$$