1. (85 points) **Modeling the amount of water in a container.** Consider 3 containers, in which water flows into or out of each container at a different rate. Your job is to determine how much water is in each container at the end of 75 seconds.

   a. If $r(t)$ describes the flow of water into a container with units of milliliters per second (ml/sec), and t is measured in seconds, write a sentence or two explaining what $\int_a^b r(t)dt$ means in this context.

   b. ***Container 1*:** The initial amount of water in container 1 is 150 milliliters (ml). Water flows into container 1 at a rate $r_1(t)$ ml/sec described by the following data.

Time (sec)	0	25	50	75
$r_1(t)$ (ml/sec)	23	21	6	2

   What is the volume of water at the end of 75 seconds? Describe the method you use, and the accuracy of your method (i.e. exact, over/underestimate, etc.). If you've made assumptions that affect your answer, you should also explain those as well.

c. ***Container 2:*** The initial amount of water in container 2 is 150 milliliters (ml). Water flows into container 2 at a rate $r_2(t)$ ml/sec. *An anti-derivative* of $r_2(t)$ is $R_2(t) = \frac{100t}{35}\sin\left(\frac{t}{18} + 3\right)$. What is the volume of water at the end of 75 seconds? Describe the method you use, and the accuracy of your method (i.e. exact, over/underestimate, etc.). If you've made assumptions that affect your answer, you should also explain those as well.

d. ***Container 3:*** The initial amount of water in container 3 is 150 milliliters (ml). Water flows into container 3 at a rate $r_3(t) = \frac{50}{t^2 + 5t + 6} + 10\sin\left(\frac{2\pi}{75}t\right)$ ml/sec. What is the volume of water at the end of 75 seconds? Describe the method you use, and the accuracy of your method (i.e. exact, over/underestimate, etc.). If you've made assumptions that affect your answer, you should also explain those as well.

e. Considering only the first 75 seconds, does container 3 have its maximum amount of water at 75 seconds? Justify your response.