6. [11 points] Ammonia is leaked from a boat into a lake. The initial amount of ammonia spilled is 500 gallons. Include units in all your answers.

   a. [3 points] After the spill started, the amount of ammonia in the lake increased at a rate of 5 percent every minute. It took the crew in the boat 30 minutes to access and stop the leak from the boat. How much ammonia was spilled in the lake by the time the leak was repaired? Your answer must be in **exact form**.

Solution:
$500(1.05)^{30}$ gallons

   b. [2 points] Right after the leak was stopped, the chemical cleaning crew started to remove the ammonia from the lake. They are able to remove 100 gallons of ammonia from the lake every 5 minutes. How long does it take for the cleaning crew to remove all the ammonia from the lake? Your answer must be in **exact form**.

Solution: Every minute $\frac{100}{5} = 20$ gallons of ammonia are removed. Hence, it takes $\dfrac{500(1.05)^{30}}{20} = 25(1.05)^{30}$ minutes to remove all the ammonia.

   c. [6 points] Let $Q(t)$ be the amount of ammonia in the lake (in gallons) t minutes after the spill started. The function $Q(t)$ is only defined from the time the spill started until all the ammonia is removed from the lake by the cleaning crew. Find a piecewise defined formula for $Q(t)$. Your answer must be in **exact form**. Show all your work.

Solution:

$$Q(t) = \begin{cases} 500(1.05)^{t} & 0 \leq t \leq 30 \\ \\ -20(t-30) + 500(1.05)^{30} & 30 < t \leq 25(1.05)^{30} + 30 \end{cases}$$