11. [12 points] Quinn is a patient taking a new experimental medicine.

a. [4 points] Quinn knows that the amount of the medicine in her body decays at a rate proportional to the current amount of the medicine in her body with constant of proportionality $k > 0$. Let $Q = Q(t)$ be the quantity, in mg, of this medicine that is in Quinn's body t days after she begins taking it. Assuming the medicine enters her body at a continuous rate of 200mg per day, write a differential equation that models $Q(t)$, and give an appropriate initial condition.

Answer: Differential Equation: ______________________

Initial Condition: ______________________

For parts **b.-d.** below, suppose that the medicine has a half-life of 12 hours in her body and that, rather than entering her body continuously throughout the day, Quinn takes one 200mg pill each morning at 8am.

Let Q_n be the quantity, in mg, of this medicine that is in Quinn's body immediately after she takes the nth pill. For example, Q_1 is the amount of medicine in her body immediately after she takes her first dose.

b. [2 points] Find the values of Q_1, Q_2 and Q_3.

Answers: $Q_1 =$ __________ $Q_2 =$ __________ $Q_3 =$ __________

c. [4 points] Write a closed form expression for Q_n. (Your answer should not include sigma notation or ellipses $(\cdots)$.)

Answer: $Q_n =$ ______________________

d. [2 points] What is $\lim_{n\to\infty} Q_n$? Interpret your answer in the context of the problem.