**5.** [8 points]  Reggie is starting a fruit punch company. He has determined that the total cost, in dollars, for him to produce $q$ gallons of fruit punch can be modeled by

$$C(q) = 100 + q + 25e^{q/100}.$$

Reggie can sell up to 100 gallons to Chris at a price of \$4 per gallon, and he can sell the rest to Alice at a price of \$3 per gallon. Assume that Reggie sells all of the fruit punch that he produces.

Note: Assume that the quantities of fruit punch produced and sold do <u>not</u> have to be whole numbers of gallons. (For example, Reggie could produce exactly $50\sqrt{2}$ gallons of fruit punch and sell all of these to Chris, who would pay a total of $200\sqrt{2}$ dollars for them.)

**a.** [4 points] For what quantities of fruit punch sold would Reggie's marginal revenue equal his marginal cost?

**Answer:** _____

**b.** [4 points] Assuming that Reggie can produce at most 200 gallons of fruit punch, how much fruit punch should he produce in order to maximize his profit, and what would that maximum profit be? *You must use calculus to find and justify your answer. Be sure to provide enough evidence to justify your answer fully.*

**Answer:**   gallons of fruit punch: _____   and   max profit: _____