8. (12 points) Each day a certain factory in Detroit produces high quality ball-bearings for use in the auto-racing industry. The daily revenue, R, and the daily cost, C, obtained from producing and selling q ball bearings are given by:

$$R(q) = \frac{1}{3}q^3 + 15q, \quad \text{and} \quad C(q) = 4q^2 + \frac{34}{3},$$

where both revenue and cost are measured in tens of thousands of dollars, and the quantity, q is in thousands of ball bearings. The Detroit factory produces a minimum of 1000 bearings a day, but due to machinery and manpower constraints, the factory can produce no more than 6000 ball-bearings in a day. In your answers to the following, be sure to include units where appropriate.

(a) What are the daily fixed costs at the factory?

(b) Recall that the profit function, π, is given by $\pi(q) = R(q) - C(q)$. For which value(s) of q is the daily profit maximized at the Detroit factory? [Show how you determine your answer.]

(c) The maximum daily profit at the factory is ____________.

(d) Another ball-bearing factory is located in Pittsburgh. The daily revenue and cost functions of this factory are identical to the ones above. However, the Pittsburgh factory produces between 500 and 8000 ball-bearings a day (depending on who is playing in Heinz Field). For which value(s) of q is the daily profit maximized at the Pittsburgh factory, and what is the maximum profit?