

Name _____

1. a. (9 points) Suppose the benefits of taking an action x are given by a linear function $B(x) = 12x$ while costs are given by the general function $C(x)$. The objective is to maximize net benefits. What are the first-order and second-order conditions for a maximum? Why must these conditions hold? (I.e., what changes should be made in x if the conditions do not hold?) Draw a graph to show how the optimal amount of x is determined.
- b. (9 points) Suppose, as in part a, that the benefit function is $B(x) = 12x$ and the cost function is $C(x) = \frac{2}{3}x^3 - 5x^2 + 16.5x + 10$. Find the value of x that maximizes net benefits. Check that you have *maximized* net benefits and have not minimized them.
2. (6 points) Suppose olive oil and vegetable oil are substitutes and both markets are competitive. Suppose there is an increase in the cost of producing olive oil. What will happen to the quantity of olive oil bought and sold? What will happen to the price of vegetable oil. Explain in words and graphs.
3. (10 points) Carefully explain what is meant by the *law of demand* and explain why the law holds. What does the concept of *price elasticity of demand* have to do with the law of demand? Does the law of demand hold for both elastic and inelastic demand? Explain. What is the relationship between price elasticity of demand and changes in total revenue (or total expenditure) as price changes? Why does this relationship hold?
4. (3 points) Suppose the market for raisins is competitive, $|E_d| = 2$, and $E_s = 3$. If an increase in demand for raisins raises the quantity bought and sold by 30%, by what percentage does the price of raisins rise?
5. (3 points) Suppose $|E_d|$ for peanut butter is .75. If the price of peanut butter falls, will a larger or smaller number of jars of peanut butter be sold? Will more or fewer dollars be spent on peanut butter? Explain.
6. (6 points) Suppose the demand function is given by $Q = 30 - .4P$. Find an expression for total revenue, and use this expression to find the price that maximizes total revenue. Then show that for prices lower than this amount, demand is inelastic.
7. (4 points) Suppose the demand function is given by $Q = 3/P^3$. Show that the price elasticity of demand is constant for all prices.