

Place your name on the back of this sheet of paper and nowhere else. Staple your answers on the front of this sheet of paper. Failure to follow these directions will cost you 10 points. If you use double-sided printing or write on the back of scrap paper, I will give you one additional point.

Show all work for all questions.

1) (10 points) Suppose that the total revenue function is $TR(Q)=(100-Q)*Q$ and the production function is given by $Q(L) = 6L^{2/3}$. Find the $MRP(L)$ using the chain rule. $MRP(L)$ is defined as dTR/dL .

2) (10 points) Suppose the demand function is given by $Q(P) = 20 - \frac{1}{2}P$. When we plot the demand curve, we are actually plotting the inverse demand function, $P(Q) = \dots$ Find the slope of the curve we plot using the properties of derivatives of inverse functions.

3) (10 points) Suppose the population of the USA is $population(t) = 325 \text{ million} * e^{0.01t}$ where t is the number of years in the future because $t=0$ is this year. What is the function for the slope of the curve? Given that, find the function which determines the percent change.

4) (10 points) I will be changing the symbol for elasticity of demand from what the book has to what my *Principles of Microeconomics*' textbook uses because it is more standard and can be generalized to other elasticities more easily. The elasticity of demand, a.k.a. own price elasticity of demand, is E_p . Also, the book notes that many textbooks leave out the minus sign. I will do that for two reasons. One of which is that the book switches back and forth in a later chapter. So, using the math they have, we can get the following formula $E_p = [dQ/dP]*(P/Q)$. Find the elasticity of demand for $Q(P) = \ln(P^{-1/2})$

5) (40 points) Suppose a total cost function is given by $TC(Q) = Q^3 - 40Q^2 + 500Q + 100$. Find the ATC curve and the MC curve functions. Find the slope and curvature for all three functions. Are they strictly concave, concave, convex, strictly convex, or convex for part and concave for part? Briefly explain your logic.

6) (10 points each) Find the concavity if the following functions. I.e., is it strictly concave, concave, convex, strictly convex, or convex for part and concave for part?

A) $F(X) = X^4 + 4X^2 + 3 \quad X \in \mathbb{R}$

B) $F(X) = 5X^3 + 2X^2 + X + 8 \quad X \in \mathbb{R}_+$