

Place your name on the back of this sheet of paper and nowhere else. Staple your answers face up on the front of this sheet of paper. Failure to follow these directions will cost you 1 point. If you use double-sided printing or print on the back of scrap paper, I will give you one additional point.

1) (20 points) A normal total cost function can look like  $TC(Q) = \frac{1}{3}Q^3 - 10Q^2 + 100Q + 5$ . Use this equation to answer the parts. Show all work and briefly explain what you did.

A) What is the equation for the marginal cost?

B) What is the equation for the average total cost?

C) Is the total cost curve convex, strictly convex, concave, strictly concave, or none of these?

D) Is the marginal cost curve convex, strictly convex, concave, strictly concave, or none of these?

2) (20 points) The Keynesian consumption function is given by  $C(Y) = a + bY$ , where  $a$  and  $b$  are constants. Use this equation to answer the parts. Show all work and briefly explain what you did.

A) Find the MPC (marginal propensity to consume).

B) Find the APC (average propensity to consume).

C) Find the slope of the APC.

D) Is the APC convex, strictly convex, concave, strictly concave, or none of these?

3) (10 points) Profit functions are often similar to  $\Pi(Q) = -Q^2 + 25Q - 100$ . What is the marginal profit function? Is the profit function convex, strictly convex, concave, strictly concave, or none of these?

4) (10 points each) For each of the equations below, find the first and second derivatives. Show all work.

A)  $Y = U^2 + 3U$ ,  $U = 3X^{-2}$ . Find  $dY/dX$  and  $d^2Y/dX^2$

B)  $F(X) = \ln(4X^2 - 3X)$ . Find  $F'(X)$  and  $F''(X)$

C)  $F(X) = (3X^2)e^X$ . Find  $dY/dX$  and  $d^2Y/dX^2$

D)  $F(X) = (X^3 - X)/(X+2)$ . Find  $F'(X)$  and  $F''(X)$

E)  $F(X) = 8e^{4X^2+3}$ . Find  $dY/dX$  and  $d^2Y/dX^2$