==This test was too long.==
Write your name on the cover of the test booklet and nowhere else. Enclose this sheet with the booklet. Failure to follow these directions will cost you 1 point. The test has 100 points (to be scaled up to 170 points) and is scheduled to take 50 minutes. Therefore, expect to spend 1 minute for every 2 points. For example, a 12-point question should take 6 minutes. I cannot give much extra time.

Show all work for all questions.

1) (12 points) Answer EITHER Part A OR Part B.
A) Find the stationary point(s) of $F(x) = x^3 - 6x^2 + 12x + 8$. Show all work. Is (are) your answer(s) a local maximum, a local minimum, or an inflection point? Explain your answer and show all work.
B) Find the stationary point(s) of $F(x) = 4x^3 - 18x^2 - 120x + 12$. Show all work. Is (are) your answer(s) a local maximum, a local minimum, or an inflection point? Explain your answer and show all work.

2) (14 points) Find the maximum and minimum of $F(x) = 2x^3 + 3x^2 - 36x + 8$ over the interval [-1, 10]. Show all work. Explain your answer and show all work.

3) (14 points) Suppose a regulated monopoly has a demand function of $Q_D = 102 - 3P$, what is their revenue function as a function of P? Their total cost function is $TC = 2Q + 5$. Write the total cost function as a function of P. Find the profit function as a function of P. Find the profit maximizing price subject to the constraint that $P \le 10$. What is the shadow price of the price ceiling?

4) (10 points) Solve the system of equations. $x + 2y + 3z = 9$, $2x - y + 6z = 8$, $3x + y + 9z = 15$. How would it be different if the last equation equaled 17 instead of 15? Explain your logic.

5) (10 points) Solve the system of equations by using <u>row operations</u>. The first equation is the IS curve and the second is the LM curve. $r = 42 - Y/10$, $r = Y/30 + 2$.

6) (12 points) Write the following equations in matrix form. Use row operations to get the matrix in <u>reduced row-echelon form</u>. What are the values of the variables? $3x + y + z = 4$. $2x + 4y + z = 0$, $x + 2y - z = -3$.

7) (12 points) Find all solutions to the following set of equations. $w + 2x + y = 0$, $2w + 3x + 2y = 0$, $5w + 8x + 5y = 0$.

8) (16 points) Answer EITHER Part A OR Part B.
A) Plot $P_D = 5 - Q_D/100$, $P_S = 1 + Q_S/300$. (Hint: you might want your x-axis scale go to 500 and your y-axis scale go to 5.) Use the graph to estimate the price and quantity. Then solve the equations to find the actual equilibrium.
B) Suppose the demand function is given by $Q_D = 135 - 7P_D$ and the supply function is given by $Q_S = -15 + 23P_S$. The tax rate is represented by t. What is the equation relating the two prices? What is the equation which says we are in equilibrium? Find the equation which determines the quantity produced at equilibrium as a function of t. What is the function for total tax revenue? Find the tax rate which maximizes tax revenue. Prove it is a maximum not a minimum. For each step, show all work and briefly explain what you did. <u>Do not worry </u>about finding the Q and prices for the optimum tax.