

1. (20%) A firm's production function is given by $f(l, k) = 10l^{0.8}k^{0.2}$

where l represents the units of labor (at \$4 per unit) and k represents the unit of capital (at \$10 per unit). The total cost of labor and capital is limited to \$500. Find the maximum production level for this manufacturer.

2. (20%) Ignoring resistance, a sailboat starting from rest accelerates (dv/dt) at a rate proportional to the difference between the velocities of the wind and the boat.

(a) Write the velocity as a function of time if the wind is blowing at 20 knots, and after 1 minute the boat is moving at 5 knots.

(b) Use the result in part (a) to write the distance traveled by the boat as a function of time.

3. (10%) Let $f''(x) = x^{3/2}$, $f'(0) = 5$ and $f(0) = 5$, please solve the differential equation.

4. (20%) Suppose X and Y are two independent random variables such that $E[X^4] = 2$, $E[Y^2] = 1$, $E[X^2] = 1$ and $E[Y] = 0$.

(a) Prove that $E[XY] = E[X]E[Y]$.

(b) Compute $Var(X^2Y)$.

5. (30%) Given these five pairs of (x, y) values,

X	2	3	4	5	6
Y	.9	2.1	2.4	3.3	3.8

(a) Calculate the least squares estimates $\hat{\beta}_0$ and $\hat{\beta}_1$. Also estimate the error variance σ^2 .

(b) Test $H_0: \beta_1 = 1$ versus $H_1: \beta_1 \neq 1$ with $\alpha = .05$.

Microeconomics

1. There are two goods, bananas and potatoes. The price of bananas increases and the price of potatoes decreases. If after the price change a consumer (whose preferences satisfy WARP) can still exactly afford her old consumption bundle, then she will consume at least as many potatoes as before, can if potatoes are a Giffen good. Is this statement correct? Explain your answer. (25%)
(WARP: Weak Axiom of Revealed Preference)
2. Explain why monopoly is not Pareto efficiency when price discrimination is not feasible. (25%)
3. Explain why monotonic preferences (preferring more to less) imply the marginal rate of substitution is negative. (25%)
4. Is it a sufficient or necessary condition that every one playing a dominant strategy is a sufficient not necessary condition for a Nash equilibrium? (25%)

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This part contains three essay questions and amounts to 100 points. Please make sure that your answers are legible and coherent, and leave much space between each of questions.

1. (30 points) Consider the production function:

$$Y = AK^{\alpha}N^{\beta}, \quad (1)$$

where Y is total output, K is capital, N is labor force, and A is total factor productivity. The growth accounting equation can be expressed as:

$$g_Y = g_A + \alpha g_K + \beta g_N, \quad (2)$$

where g denotes the growth rate.

- (5 points) Derive equation (2) from equation (1).
 - (6 points) Give two factors which may cause the Solow residual (g_A) to change.
 - (5 points) Let $k = K/N$, what is g_k at the steady state in the Solow growth model?
 - (8 points) Continuously given the situation in part (c), what is the meaning of Golden Rule k ? Draw a plausible diagram to explain your answer.
 - (6 points) How does the production function in an endogenous growth model differ from the function in the Solow model?
2. (30 points) Under each of the following cases, use the AD-AS framework to analyze monetary neutrality both in the short run and in the long run?
- (10 points) The basic classical model
 - (10 points) The Keynesian model
 - ✓ (10 points) The extended classical model with misperceptions

3. (40 points) Define and explain the economic significance or relevant argument of the following:

- a. (10 points) Ricardian Equivalence
- b. (10 points) Lucas Critique
- c. (10 points) Seigniorage Revenue
- d. (10 points) Purchasing Power Parity