Macroeconomics, ECON 302 **San Francisco State University**
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Midterm1, sec 2

Wednesday, September 24

50 minutes

Name: _____Answer Key_____

Instructions

1. This is closed book, closed notes exam.
2. No calculators of any kind are allowed.
3. Show all the calculations.
4. If you need more space, use the back of the page.
5. Fully label all graphs.

Good Luck ☺

1. (10 points). Suppose you deposit $x in a savings account that pays interest of *i*% per year. Write the equation that gives the amount of your savings after *t* years.

$S_t = x(1+i)^t$

2. (10 points). If a variable grows at constant rate, then the natural log of the variable is
    a. Increasing function of time
    b. Decreasing function of time
    c. Linear function of time
    d. Quadratic function of time
    e. Impossible to tell without more information

3. (15 points). The next table provides data on prices and output in some artificial economy for the years 2000 – 2002. The goods are labeled 1 and 2, so that P_1, P_2, Q_1, Q_2 are prices and quantities of the two goods respectively.

Year	P_1	Q_1	P_2	Q_2
2000	2	50	30	5
2001	3	57	30	19

Calculate the inflation rate between the years 2000 and 2001, using 2001 as the base year.

$P_{2001} = 1$ (base year).

$$P_{2000} = \frac{GDP_{2000}}{RGDP_{2000}} = \frac{2 \cdot 50 + 30 \cdot 5}{3 \cdot 50 + 30 \cdot 5} = \frac{250}{300} = \frac{5}{6}$$

Inflation: $\pi_{2000-2001} = \frac{P_{2001}}{P_{2000}} - 1 = \frac{6}{5} - 1 = \frac{1}{5} = 20\%$

4. (30 points). Suppose that consumer's utility function is $u(x, y)$. The prices of goods *X* and *Y* are P_X, P_Y and his income is *I*.
   a. Write the consumer's problem.

$$\max_{x,y} u(x, y)$$
$$s.t.$$
$$p_x x + p_y y = I$$

   b. Write the mathematical condition for optimality of consumption bundle and give a verbal interpretation of it.

The condition for optimal consumption bundle:

$$\frac{U_x(x, y)}{U_y(x, y)} = \frac{p_x}{P_y}$$

Interpretation 1: The left hand side is the slope (in absolute value) of the indifference curve and the right hand side is the slope of the budget constraint. Thus, at the optimum, the indifference curve is tangent to the budget constraint.
Interpretation 2: The above condition can be written as

$$\frac{U_x(x, y)}{p_x} = \frac{U_y(x, y)}{P_y}$$

The left hand side is the utility generated by extra dollar spent on X and the right hand side is the utility from extra dollar spent on Y. The optimal allocation of income between the two goods requires that those should be the same.

   c. Suppose that the utility function is $u(x, y) = x^3 y^6$. Circle the correct statement.

      i. The consumer will spend 50% of his income on the good X
      ii. The consumer will spend $3 on good X and $6 on good Y
      iii. The consumer will spend 1/3 of his income on good X
      iv. The consumer will spend all his income on good Y

5. (20 points). Suppose that a firm has technology given by $Y = F(K, L)$, the price of the final good (Y) is P, and the prices of inputs are R, W. The firm is a price taker in market for final good as well as the markets for inputs.
    a. Write the firm's optimization problem.

$$\max_{K,L} P \cdot F(K, L) - RK - WL$$

    b. Derive the first order conditions for your problem in a, and provide a verbal interpretation of it.

$$\frac{\partial \pi}{\partial K} = PF_K(K, L) - R = 0$$
$$\frac{\partial \pi}{\partial L} = PF_L(K, L) - W = 0$$

Competitive (price taking firm) will hire inputs up to the point when their marginal product equals their prices.