

**Quiz #1**

Points for each problem are shown out of 100 points. Each subsection in a problem is weighted equally. Try to allocate your time accordingly.

A. (20 pts) Answer True, False, or Uncertain, and briefly explain your answer.

- (1) Income elasticities are always negative.
- (2) Points on the budget constraint are always preferred to points off the budget constraint.
- (3) The consumer is better off in period  $s$  than in period  $t$  if the Laspeyres quantity index,

$$L_q = \frac{P_1^s X_1^t + P_2^s X_2^t}{P_1^s X_1^s + P_2^s X_2^s}, \text{ is less than 1.}$$

- (4) With increasing returns to scale, isoquants for unit increases in output become farther and farther apart.

B. (20 pts) Short answers.

- (1) Given a demand curve  $Q_d = 20 - 2P$ , when the price changes from 3 to 2, what is the associated change in consumer surplus?
- (2) A person has the utility function  $U = \sqrt{X} + \sqrt{Y}$ . What is the marginal rate of substitution between  $X$  and  $Y$ ?
- (3) Draw two isoquants for a production function in which the inputs are used in fixed proportions.
- (4) Describe two sets of parallel concepts between consumer theory and firm theory.

For the following problems, please show the calculations used to arrive at your answers. Draw graphs neatly and label axes and points clearly. Round answers to the first decimal place if necessary.

C. (10 pts)

A risk-averse person with utility function  $U = \sqrt{Y}$ , where  $Y = \text{income}$ , is offered the choice of receiving his income of \$900 or participating in a gamble that pays \$144 with a probability of 25% and \$1500 with a probability of 75%. Which will he choose?

D. (30 pts) Christine consumes two goods, X and Y. Christine's utility function is

$$U = \ln X + Y$$

- (1) What is the marginal rate of substitution between X and Y?
- (2) What is the demand function for X?
- (3) What is the demand function for Y?
- (4) Given  $P_X = 5$ ,  $P_Y = 10$ , and  $M = 50$ , graph Christine's budget constraint.
- (5) Calculate the optimal quantities of X and Y that Christine should choose, given her budget constraint. Show this point on your graph.
- (6) Is X a substitute, complement, or unrelated good for Y? Is Y a substitute, complement, or unrelated good for X?

E. (20 pts) Webb Corp. produces egg cartons that are sold to egg distributors. Webb has the production function:

$$Q = 25L^{0.6}K^{0.4}$$

where  $Q = \text{output measured in one thousand carton lots}$ ,  
 $L = \text{labor hours}$ ,  $K = \text{machine hours}$ . Webb currently pays a wage of \$10/hr, and the rental rate for capital is \$25/hr.

- (1) Does this function exhibit increasing, constant, or decreasing returns to scale?
- (2) What is the marginal product of labor?
- (3) What is the marginal product of capital?
- (4) Determine the optimal ratio of capital to labor that Webb should use in manufacturing egg cartons.