Midterm 2

You have until 3pm to complete the exam, be certain to use your time wisely. For multiple choice questions, mark your answer on your scantron sheet. Choose only one answer for each multiple choice question; if more than one letter is filled in for a question it will be marked wrong. For the short answer questions, write your answers directly on the exam. Show your work clearly, place a box around final answers and be certain to label any graphs you draw. Final answers may be left as fractions. Non-graphing calculators may be used but they should not be necessary. Good luck!

Name: **ID Number:**   **Section:**

SECTION I: MULTIPLE CHOICE (60 points)

1. Suppose that a firm's production function exhibits increasing returns to scale. If it costs the firm \$100 to produce 20 units of output, then it will cost the firm:

   (a) Less than \$100 to produce 40 units of output.
   (b) Exactly \$200 to produce 40 units of output.
   (c) More than \$200 to produce 40 units of output.
   (d) Less than \$200 to produce 40 units of output.

2. Suppose that apples are a Giffen good. If the price of apples increases, then:

   (a) The income and substitution effects for apples will both be positive.
   (b) The income and substitution effects for apples will both be negative.
   (c) The income effect will be positive and the substitution effect will be negative for apples.
   (d) The income effect will be negative and the substitution effect will be positive for apples.

3. A firm that uses capital and labor is operating at its profit-maximizing input levels given the current prices of inputs and output. Which of the following price changes would not lead to an increase in labor hired in the short run? (Assume capital is fixed in the short run.)

   (a) An increase in the price of output and the price of capital.
   (b) An increase in the price of output and a decrease in the price of capital.
   (c) An increase in the price of labor and a decrease in the price of capital.
   (d) A decrease in the price of labor and an increase in the price of capital.

4. At the current price, the price elasticity of demand for comic books is equal to −2. If the only comic book store in town raises the price of comic books by a small amount, we would expect:

   (a) The number of comic books sold to increase and total revenues of the store to increase.
   (b) The number of comic books sold to decrease and total revenues of the store to increase.
   (c) The number of comic books sold to increase and total revenues of the store to decrease.
   (d) The number of comic books sold to decrease and total revenues of the store to decrease.
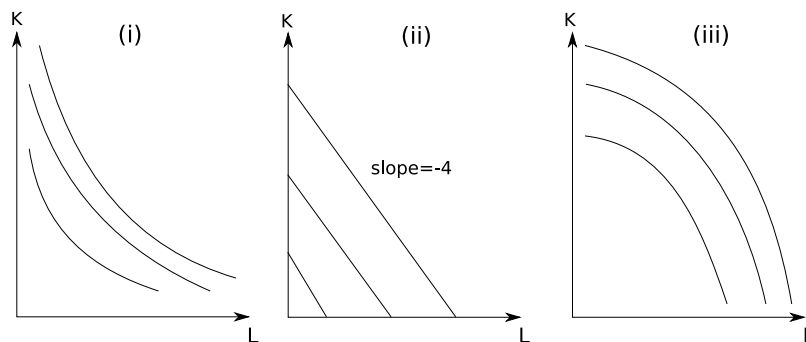
Refer to the figures above to answer questions 5 and 6. Each of the above graphs shows three isoquants for a particular production technology. You can assume that all three technologies are monotonic (increasing an input will increase output).

5. Which of the graphs could correspond to the isoquants for the production function: $f(K, L) = K^3 L^2$?

   (a) (i).
   (b) (ii).
   (c) (iii).
   (d) (i) and (iii).

6. Suppose that you are told that the wage is 5 times as large as the rental rate of capital. Which technologies could lead a firm to use positive amounts of both capital and labor in the long run under these prices?

   (a) (i).
   (b) (ii).
   (c) (i) and (iii).
   (d) (i) and (ii).

7. The deadweight loss generated by a quantity tax will be zero if:

   (a) Supply is perfectly elastic and demand is downward sloping.
   (b) Supply is perfectly inelastic and demand is downward sloping.
   (c) (a) and (b).
   (d) Neither (a) nor (b).

8. A firm with standard, convex isoquants is currently producing 50 cars using 10 machines and 10 workers. At this combination of inputs, the marginal product of labor is 5 and the marginal product of capital is 10. The wage is $10 and the rental rate of capital is $5. The firm can lower total costs and still produce 50 cars by:

   (a) Increasing the amount of labor and decreasing the amount of capital used.
   (b) Increasing the amount of capital and decreasing the amount of labor used.
   (c) Increasing the amount of capital and increasing the amount of labor used.
   (d) The firm is already minimizing costs.

9. Suppose that books are an inferior, ordinary good. When the price of books goes up, the magnitude of the income effect for books will be _____ the magnitude of the substitution effect for books.

   (a) Greater than.
   (b) Less than.
   (c) Equal to.
   (d) Not enough information.

10. When the demand curve is a downward sloping line and the supply curve is an upward sloping line, which of the following will be true as the magnitude of a quantity tax increases?

    (a) Tax revenues will first increase and then decrease, deadweight loss will increase.
    (b) Deadweight loss will first increase and then decrease, tax revenues will increase.
    (c) Both tax revenues and deadweight loss will first increase and then decrease.
    (d) Both tax revenues and deadweight loss will increase.

11. Suppose that in the short run, capital is a fixed input, labor is a variable input and electricity is a quasi-fixed input. Which of the following is not true?

    (a) Changes in the price of labor may affect the optimal level of labor hired in the short run.
    (b) Changes in the price of capital may affect the optimal level of labor hired in the short run.
    (c) Changes in the price of electricity may affect the decision to shut down in the short run.
    (d) Firm profits will depend on the price of capital in the short run.

12. Suppose there are three consumers in the market for ice cream and all three have identical, downward sloping linear demand curves with a slope of -3 (note that this is the slope of the demand curve on a graph with price on the vertical axis and quantity on the horizontal axis). The magnitude of the slope of the market demand curve will be:

    (a) Less than 3.
    (b) Equal to 3.
    (c) Equal to 9.
    (d) Greater than 9.

13. Suppose a firm's production technology is given by $f(K, L) = 10K^2 + 5L^{\frac{1}{2}}$. Which of the following statements is true?

    (a) The technology exhibits diminishing marginal product of capital and diminishing marginal product of labor.
    (b) The technology exhibits increasing marginal product of capital and diminishing marginal product of labor.
    (c) The technology exhibits diminishing marginal product of capital and increasing marginal product of labor.
    (d) The technology exhibits increasing marginal product of capital and increasing marginal product of labor.

14. What must be true about a firm's short run and long run profits (assuming that the firm is maximizing profits and that all prices of inputs and outputs are fixed)?

    (a) Profits will be the same in the short run and long run.
    (b) Profits will always be larger in the long run than in the short run.
    (c) Profits will always be larger in the short run than in the long run.
    (d) Long run profits will be greater than or equal to short run profits.

15. Suppose that output as a function of capital (holding other inputs fixed) is graphed with output on the vertical axis and capital on the horizontal axis. The slope of this curve will be equal to:

    (a) The marginal product of capital.
    (b) The marginal product of labor.
    (c) The technical rate of substitution.
    (d) The wage divided by the rental rate of capital.

SECTION II: SHORT ANSWER (40 points)

For this section, be certain to show your work and clearly label any graphs you draw. Give complete answers but keep them concise. Please place a box around final answers where appropriate.

1. Brendan consumes only apples (A) and bananas (B). His demand functions for apples and bananas in terms of the income (I), the price of apples (p_A) and the price of bananas (p_B) are given below:

$$A(I, p_A, p_B) = \frac{I}{p_A + \frac{p_A^2}{p_B}} \tag{1}$$

$$B(I, p_A, p_B) = \frac{I}{p_B + \frac{p_B^2}{p_A}} \tag{2}$$

   (a) Supppose that Brendan's income is \$120, the price of apples is \$1 and the price of bananas is \$1. How many apples and bananas does Brendan consume? (3 points)
   (b) Suppose that the price of apples increases to \$2. How many apples and bananas does Brendan consume after the price change? (3 points)
   (c) Calculate the change in Brendan's demand for bananas due to the income effect and the change in Brendan's demand for bananas due to the substitution effect. (10 points)

2. A firm uses nuts (N) and bolts (B) to produce widgets (w). The production function for the firm is the following:

$$f(N, B) = 10N^{\frac{1}{2}}B^{\frac{1}{2}} \tag{3}$$

(a) Derive expressions for the marginal product of nuts, the marginal product of bolts, and the technical rate of substitution. (4 points)

(b) In the short run, the number of nuts is fixed at 100 but the firm can choose any number of bolts to use. If the price of nuts is \$20, the price of bolts is \$5, and the price of output is \$1, how many bolts does the firm use and how many widgets does it produce in the short run? (10 points)

(c) In the long run, the firm decides to produce 100 widgets. Prices are all the same as in part (b). What combination of nuts and bolts will the firm use to minimize costs? (10 points)