Problem A.

Metalicca Corp. shreds scrap steel and sells it in two markets, the domestic market and the Far East market. The demand functions for weekly sales quantity in the two markets are:

(domestic) \( Q_d = 9,500 - 50P_d \) \( P_d = 190 - 0.02Q_d \)

(Far East) \( Q_f = 10,200 - 40P_f \) \( P_f = 255 - 0.025Q_f \)

The above quantities are in tons, and prices do not include freight. The firm's total cost can be represented by the function:

\[ TC = 150,000 + 40Q, \text{ where } Q \text{ is the combined weekly tonnage sold in the two markets.} \]

\[ MC = 40 \]

1. What two economic conditions must hold for the firm to be able to gain from price discrimination?

a. Must keep markets separated.

b. \( 1P_d \neq 1P_f \) at the solution \( Q_d \).

2. Assuming the firm practices price discrimination, what will be its price per unit in each of the two markets, how many tons of product will it sell per week in each market, and what will be its total profit?

\[ 190 - 0.04Q_d = 40; \quad Q_d = \frac{3750}{115} = 32.95 \]

\[ P_d = \frac{115}{5} \]

\[ 255 - 0.05Q_f = 40; \quad Q_f = \frac{4300}{147.5} = 29.18 \]

\[ P_f = \frac{147.5}{5} \]

3. Calculate the firm's total profit.

\[ \Pi = 431,250 + 434,250 - 150,000 - 322,000 = 593,500 \]
Problem B.

Cowpoke Joe's, Inc. is a small firm in Houston that produces Rodeo T-shirts. Its wholly-owned subsidiary, Corona Graphics, is located in Crystal City and specializes in printing designs on T-shirts by the silk screen method. The market for this type of printing is perfectly competitive, and the going price for printing a shirt is $1.35. Corona Graphics is permitted to do subcontract work for other manufacturers of T-shirts.

Cowpoke Joe's estimates its monthly total cost of production of shirts (not including the printing) to be represented by the equation below:

\[ TC_s = 10,000 + 0.25Q_s + 0.0001Q_s^2, \]

where \( Q_s \) is the number of shirts produced.

Meanwhile, the monthly total cost function of Corona Graphics is:

\[ TC_g = 600 + 0.15Q_g + 0.0003Q_g^2, \]

where \( Q_g \) is the number of shirts printed.

If the demand curve facing Cowpoke Joe's for the T-shirts is

\[ q = 8,000 - 500p; \]

\[ p = 16 - 0.002q. \]

(a) How many shirts should Cowpoke Joe's sell?

\[ NMR_s = 16 - 0.004q - 25 - 0.002q_s \]

\[ = 15.75 - 0.006q_s \]

\[ .006q_s = 15.75 \]

\[ q_s = 2500 \]

(b) What price should they charge per shirt?

\[ p = 16 - 0.002(2500) = 11.20 \]

(c) How much silk-screen printing should Corona Graphics do?

\[ 15 + 0.006q_g = 1.35 \]

\[ q_g = 2000 \]

(d) Should Corona graphics do printing for other firms? If so, how much? If not, how much printing will Cowpoke Joe's have to buy elsewhere?

Joe will buy 2400 - 200 = 2000 elsewhere.

(e) What will be the total profit of the two-unit firm?

\[ \Pi_s = 24,880 - 16,000 - 600 - 5760 - 3240 = 7280 \]

\[ \Pi_g = 2700 - 400 - 300 - 1200 = 600 \]

\[ \Pi_s + \Pi_g = 7880 \]