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13. (5 points) A firm has production function

$$F(x_1, x_2) = x_1^{1/2} x_2^{1/2}$$

(a) Write a general expression for the marginal product of factor 1 as a function of  $x_1$  and  $x_2$   $\frac{1}{2}x_1^{-1/2}x_2^{1/2}$

(b) If this firm is currently using the factor combination  $x_1 = 1$  and  $x_2 = 4$ , calculate the marginal product of factor 1? **MP=1**

14. (10 points) Flo Grow's production function is

$$F(x_1, x_2) = x_1 + 2x_2.$$

(c) If the price of factor 1 is 10 and the price of factor 2 is 25, what is the total cost to Flo of producing 20 units of output? **200**

(d) If the price of factor 1 is 10 and the price of factor 2 is 25, what is the total cost to Flo of producing  $y$  units of output? **10y**

(e) If the price of factor 1 is  $w_1$  and the price of factor 2 is  $w_2$ , what is the total cost to Flo of producing  $y$  units of output?  **$Min\{w_1, w_2/2\}y$**

15. (10 points) Mary Magnolia has opened a flower shop. Her fixed costs are  $\$F$ , where  $F$  is the number of square feet of floor space in her shop. Her variable costs are  $\$y^2/F$  where  $y$  is the number of bouquets that she sells per month. If she has 400 square feet,

a) write down her marginal cost as a function of  $y$   **$\$y/200$**

b) write down her average total cost as a function of  $y$ .  $\frac{400}{y} + \frac{y}{400}$

c) At what level of  $y$  is her average total cost minimized?  **$y=400$**

d) How much is her average total cost when it is minimized? **2**

16. (15 points) A firm produces bird houses with the production function

$$f(x_1, x_2) = (\min\{x_1, x_2\})^{1/2}$$

where  $x_1$  is the amount of wood used and  $x_2$  is the amount of labor.

a) In the graph below, draw a production isoquant representing input combinations that will produce 3 birdhouses. Draw another production isoquant representing input combinations that will produce 5 birdhouses.

Your graph will have two L-shaped isoquants, one with its corner at (9, 9) and the other with its corner at (25, 25).

b) Does this production function exhibit increasing, decreasing, or constant returns to scale? **Decreasing returns to scale.**

c) At the factor prices  $w_1 = 1$  and  $w_2 = 2$ , what is the cheapest way to produce 5 birdhouses? **Use 25 units of wood and 25 units of labor.** How much does this cost? **\$75.**

d) At the factor prices  $w_1 = 1$  and  $w_2 = 2$ , the cost of producing  $y$  birdhouses with this technology is  $c(1, 1, y) = 3y^2/2$ .

e) A general formula for the cost of producing  $y$  birdhouses when the factor prices are  $w_1 = 1$  and  $w_2 = 2$  is  $c(w_1, w_2, y) = (w_1 + 2w_2)y^2/2$ .