

1) (5 pts.) True or False? Mark your answer.

- a) T\_\_\_ FX Wisconsin's processing vegetable industry (snap/green beans, sweet corn, peas, potatoes) is very small by Midwestern standards.
- b) T\_\_\_ FX Opportunity Cost is the cost of switching production practices to take advantage of a new opportunity.
- c) TX F\_\_\_ An example of a business strategy a farmer may choose is to be a low cost/high volume producer of a commodity such as milk.
- d) TX F\_\_\_ In Strategic Management, a goal must be specific, measurable, and have a deadline.
- e) T\_\_\_ FX According to "What it Takes to Be Great", it takes 3-5 years of deliberate practice for a person to become "great" at something like chess.

2) (10 pts.) You manage a chicken farm and hire labor. This table reports how many broilers can be butchered, cleaned, and prepared for sale in one hour with different numbers of laborers.

Laborers Hired	Chickens/Hour	Marginal Product	Value of Marginal Product
3	36	--	--
5	60	12	72.00
7	75	7.5	45.00
9	80	2.5	15.00

- a) Using numbers given in this table, show below how to calculate the Marginal Product for one example, and then fill in the Marginal Product column in the table above.

$$MP = \Delta Q / \Delta X = (60 - 36) / (5 - 3) = 24 / 2 = 12$$

- b) Chickens sell for \$6.00 each. Using numbers from this table, show below how to calculate the Value of Marginal Product for one example, and then fill in the Value of Marginal Product column in the table above.

$$VMP = price \times MP = 6.00 \times 12 = 72$$

- c) What optimality condition defines the profit maximizing amount of the input to use? (Be brief and to the point.)

$$VMP = r_x$$

- d) If wages, taxes, etc. cost you \$15.00/hour to hire a laborer, what is the profit maximizing number of laborers to hire? (You may need to interpolate between entries.)

$$X = 9$$

**3) (15 pts.)** Cabbage as a function of sulfur fertilizer is  $C = 10 + 1.1S - 0.01S^2$ , where yield C is cwt/ac of sauerkraut cabbage and the sulfur rate S is lbs/ac. The price of cabbage is \$50/cwt and the price of sulfur fertilizer is \$1.50/lbs.

a) What is the economically optimal sulfur rate? Set up and solve this economic problem using calculus and the given information. **Be sure to check the second order condition.**

$$\pi = 50(10 + 1.1S - 0.01S^2) - 1.5S$$

$$FOC: d\pi/dS = 50(1.1 - 0.02S) - 1.5 = 0$$

$$\text{Solve FOC: } 55 - 1S = 1.5 \quad S = 53.5$$

$$SOC: d^2\pi/dS^2 = 50(-0.02) = -1 < 0, \text{ satisfies SOC for maximum}$$

b) At the sulfur rate you derived in part a, what is yield (cwt/ac)?

$$C = 10 + 1.1S - 0.01S^2 = 10 + 1.1(53.5) - 0.01(53.5)^2 = 40.23 \text{ cwt/ac}$$

c) Besides the cost of sulfur, other fixed costs are \$1000/ac. What are net returns (\$/ac)?

$$\pi = pC(S) - r_sS - K = 50(40.23) - 1.5(53.5) - 1000 = \$931.13/ac$$

4) (10 pts.) Pullets starting at 0.5 lbs fed the following corn and wheat rations gain 2.5 lbs and are ready to butcher and sell as broilers in 14 weeks.

Corn (lbs)	Wheat (lbs)	Marginal Rate of Technical Substitution	
		If Corn = Y	If Corn = X
5.0	12.0		
6.2	9.4	0.4615	2.1667
8.2	7.6	1.111	0.9000
10.4	6.2	1.5714	0.6364

Assume either Corn = Y or Corn = X, but not both.

- a) Using numbers from this table, show below how to calculate the Marginal Rate of Technical Substitution between corn and wheat for the second row in the table and then fill in the missing entries in the table above.

$$MRTS = -\Delta Y / \Delta X = -(6.2 - 5.0) / (9.4 - 12.0) = -1.2 / -2.6 = 0.4615$$

$$\text{or} \quad = -\Delta Y / \Delta X = -(9.4 - 12.0) / (6.2 - 5.0) = -(-2.6) / 1.2 = 2.1667$$

- b) What optimality condition defines the profit maximizing amount of both inputs to use? (Be brief and to the point.)

$$MRTS = \text{price of } X / \text{price of } Y \text{ or } r_x / r_y$$

- c) If corn cost \$0.10/lb and wheat costs \$0.11/lb, what is the profit maximizing level of each to feed? (Note: you may need to interpolate between entries.)

$$\text{If assume corn} = X, \text{ then price of } X / \text{price of } Y = 0.11 / 0.10 = 1.1$$

$$\text{If assume corn} = Y, \text{ then price of } X / \text{price of } Y = 0.10 / 0.11 = 0.9091$$

Both imply optimal is Corn of about 8.2 and Wheat of about 7.6

5) (20 pts.) Cabbage production is  $C = 25 + 3S - 0.4S^2 + 5N - 0.3N^2 + 0.1SN$ , where C is cabbage yield as cwt/ac, S is the sulfur fertilizer rate (lbs/ac) and N is the nitrogen fertilizer rate (lbs/ac). The cabbage price is \$50/cwt, the price of sulfur fertilizer is \$2.00/lb, and the price of nitrogen fertilizer is \$0.50/lb.

What is the profit maximizing amount of sulfur (S) and nitrogen (N) to use per acre to grow cabbage? (Note: you will not need to convert prices to set up the profit function.)

**Be sure to check the second order conditions.**

$$\pi = pC(S,N) - r_s S - r_n N$$

$$\pi = 50(25 + 3S - 0.4S^2 + 5N - 0.3N^2 + 0.1SN) - 2S - 0.5N$$

$$FOC: \quad d\pi/dS = 50(3 - 0.8S + 0.1N) - 2 = 0$$

$$d\pi/dN = 50(5 - 0.6N + 0.1S) - 0.5 = 0$$

Solve FOC to get  $S = 4.840$  and  $N = 9.123$

$$SOC \quad d^2 \pi/dS^2 = 50(-0.8) = -40 \quad d^2 \pi/dSdN = 50(0.1) = 5$$

$$d^2 \pi/dN^2 = 50(-0.6) = -30$$

Check SOC:  $d^2 \pi/dS^2 < 0$ ,  $d^2 \pi/dN^2 < 0$  (both pass)

$$d^2 \pi/dS^2 \times d^2 \pi/dN^2 - (d^2 \pi/dSdN)^2 = (-40)(-30) - 25 = 1175 > 0, \text{ passes}$$

**6) (10 pts.)** You own and manage a farm. Your typical annual farm revenue is \$250,000 and all annual costs are \$180,000. Your farm's market value is \$300,000, but you owe \$200,000 for the mortgage. You are thinking about alternatives to farming for a living. You think you could get a job earning \$65,000 nearby and could invest the farm equity and earn 5% annually.

a) Given these numbers, what is your economic profit for owning and operating the farm?

<i>Revenue</i>	<i>250,000</i>	<i>Equity = 300,000 – 200,000 = 100,000</i>
<i>Cost</i>	<i>180,000</i>	<i>100,000 at 5% = 5,000 in opportunity cost of capital</i>
<i>Opportunity Costs</i>		
	<i>Time 65,000</i>	
	<u><i>Capital 5,000</i></u>	
	<i>\$0</i>	

b) For this question, suppose you find that your economic profit as a farmer is zero. Explain what this means in terms of the income you earn. Specifically, how much money are you making? Does it mean you are not making any money?

*Means you are making a normal rate of return on your time and assets/capital, i.e., 65,000 is about your fair income and 5% is a fair rate of return (risk free).*

7) (15 pts.) The table below reports the cost of producing hogs for a farm.

Hogs (hogs/year)	Fixed Cost	Variable Cost	Total Cost	Marginal Cost	Average Variable Cost	Average Total Cost
3,400	50,000	310,000	360,000	---	105.88	91.18
4,000	50,000	370,000	420,000	100.00	105.00	92.50
4,400	50,000	430,000	480,000	150.00	109.09	97.73
4,700	50,000	490,000	540,000	200.00	114.89	104.76

- a) Using numbers from this table, show below how to calculate Total Cost, Marginal Cost, Average Variable Cost, and Average Total Cost for the second row and then fill in the missing values in the table.

$$TC = FC + VC = 50,000 + 310,000 = 360,000$$

$$MC = \Delta TC / \Delta Q = (420,000 - 360,000) / (4,000 - 3,400) = 60,000 / 600 = 100.00$$

$$AVC = VC / Q = 310,000 / 3,400 = 91.18$$

$$ATC = TC / Q = 360,000 / 3,400 = 105.88$$

- b) What optimality condition defines the profit maximizing amount to produce? (Be brief and to the point.)

$$P = MC$$

- c) At a hog price of \$150/hog (i.e., \$60/cwt and 250 lbs per hog), what is the profit maximizing amount of hogs to produce? (Note: you may need to interpolate between entries.)

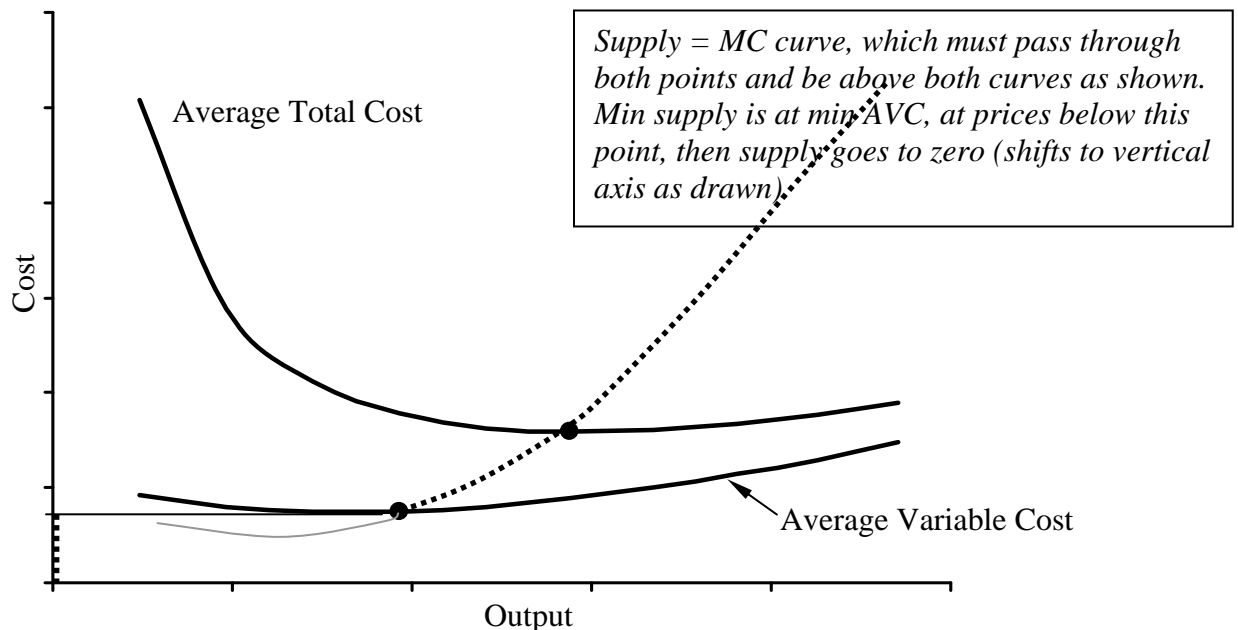
$$P = MC \text{ at } 4,400 \text{ hogs}$$

- d) If the hog price is \$125/hog (i.e., \$50/cwt and 250 lbs/hog), what is the profit maximizing number of hogs to produce? (Note: you may need to interpolate between entries.)

$$P = MC \text{ at } 4,200 \text{ hogs}$$

**8) (10 pts.)** The figure below illustrates Average Total Cost and Average Variable Cost for a hypothetical farm, where the two dots represent the minimum of each curve.

a) On the figure below, draw in a hypothetical marginal cost curve and clearly mark the profit maximizing supply curve—the quantity the profit maximizing farm will produce at any given price. Clearly indicate the bottom end of the supply curve—the lowest price a profit maximizing farm will operate at and the quantity it will supply.



b) Why would a profit maximizing farm choose to operate in the short run at a price below Average Total Cost and above Average Variable Cost? (Be brief and to the point.)

*Because though you lose money, you cover part of FC, though not all of it. If shut down, would cover none of FC, so are better off minimizing your losses.*

**9) (5 pts)** According to the Flat Objective Problem discussed in class, for many agricultural production cases, output is a) relatively non-responsive to input use at near optimal use levels and b) quite variable from factors such as weather. As a result, determining the effect of inputs on returns is difficult, so that overuse of inputs can be a hidden cost for many growers, implying inefficiency in input use. As discussed in class, what are some of the characteristics associated with farmers who more efficiently use inputs?

*Specialized in production of specific commodities, workers/they have incentives to work hard, work to improve their management, such as on-farm experiments*