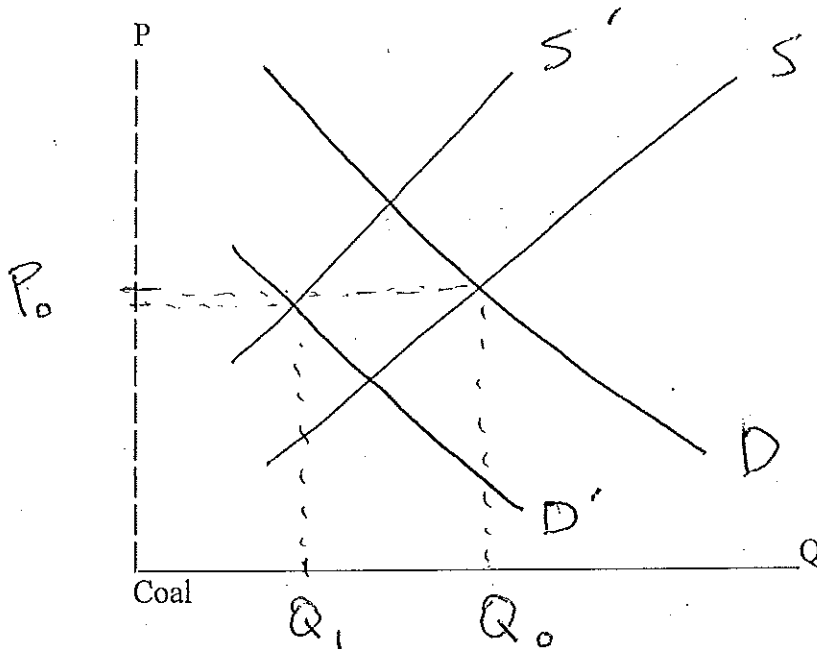


100 points total. Answer each question in the space provided. General advice: show your work, including any formulas or diagrams that you use in reasoning through your answers.

1. (10 pts.) Coal and natural gas are two primary sources of energy for generating electricity in the U.S. The past several years have been hard on the coal industry. The U.S. Environmental Protection Agency has imposed severe restrictions on coal mining, adding to the costs of extracting coal from the ground. Technological advancements in natural gas production have caused the price of natural gas to drop sharply. In the diagram below, illustrate the effects of these two changes on the market for coal. Explain briefly whether you can say with certainty what will happen to the equilibrium price of coal and the equilibrium quantity of coal.



EPA regulations cause the market supply curve to shift to the left. Fall in the price of a substitute, natural gas, shifts the market demand curve to the left.

Equilibrium quantity will definitely decline, but equilibrium price may increase, decrease, or stay relatively unchanged.

2. (10 pts.) You handle the advertising account for a large Ford dealer in a university town. Currently the car dealer rents ten billboards around town at a price of \$300 each per month. You have found that when you put generic displays from Ford's corporate marketing department on the billboards, the dealership typically sells 150 vehicles per month. You have an inspiration, and contact the agent who represents the local university basketball coach. They agree to let you use the coach's image and endorsement on the billboards for a fee of \$100 per billboard per month. The dealership sees an immediate and lasting increase in sales to 170 vehicles per month. Calculate the "advertising expenditure" elasticity of demand. How would you determine whether this would be a good move?

$$\text{Advertising expenditure elasticity} = \frac{\% \Delta Q_D(x)}{\% \Delta \text{Ad Exp}}$$

$$\% \Delta Q = \frac{20}{150} = 13.3\%$$

$$\% \Delta \text{Ad Exp} = \frac{1000}{3000} = 33.3\%$$

$$\epsilon_{x, \text{Ad Exp}} = \frac{13.3}{33.3} = \del{0.4} 0.4$$

Compare profits from sale of additional 20 cars per month to the cost of the additional advertising expenditures.

3. (5 pts.) The new owners of Kentucky Kingdom ask your advice on pricing. The former owners had operated the park well below capacity on typical summer weekdays, charging the same price that they charged on weekends. They had found own-price elasticity of demand to be in the region of 2.0 on weekdays, but much less elastic on weekends. What advice would you give them and why?

If demand is elastic ($\epsilon_{x, P_x} > 1$), then a reduction in price will lead to an increase in total revenue. This may be a good move, given the excess capacity on weekdays.

4. (10 pts.) One of your classmates has moved to the U.S. from abroad to enroll in the one-year MBA program. She discovers that public transportation in Lexington makes it difficult to get around, and so she decides to use some of her savings and buy a car. She plans to return to her native country at the end of the program, and would sell the car at that point. She has calculated the following costs of owning and operating a car in Lexington for the year:

Purchase price of a new compact sedan:	\$20,000
License, tags, registration, taxes:	\$1,500
Gas, oil, other routine maintenance	<u>\$2,000</u>
Total costs	\$23,500

She turns to you and asks you what you think of her reasoning. Has she calculated the economic costs of owning and operating a car for the year correctly?

She has made three mistakes.

- ① She does not lose her \$20,000, she has an asset that she can sell and recoup her money. So the \$20,000 purchase price is not a cost.
- ② She does lose the use of her \$20,000 for the year while she owns the car. So the interest earnings foregone are a cost of owning and operating the car for the year. If she previously had \$20,000 in a mutual fund where it earned 5%, she would give up \$1,000 in interest earnings.
- ③ The car will wear out or depreciate some during the year. This economic depreciation is measured by the decline in the market value in the car over the course of the year. If she can only sell the car for \$17,000 at the end of the year, she ^{will} have incurred depreciation costs of \$3,000.

5. (10 pts.) You use a mix of human and robotic pickers to fill orders in your warehouse distribution center. You rent (employ) humans at a daily wage rate of \$100. You lease robots from an equipment leasing company at a daily rental rate of \$250. You have experimented with changing the mix of humans and robots and find that, at your current employment of men/women and machines, adding or subtracting a worker causes output to change by 60 orders per day. If instead you add or subtract a robot, your output changes by 200 orders per day. Are you employing humans and robots in the cost-minimizing way? Explain why or why not, including any formula you use in your reasoning.

$$MP_L = 60$$

$$w = \$100$$

$$MP_K = 200$$

$$r = \$250$$

Cost-minimizing combination of labor and capital requires that

$$\frac{MP_L}{w} = \frac{MP_K}{r}$$

$$\frac{60}{100} = \frac{?}{250}$$

$.6 \neq .8$, so you are not

using an efficient mix of L and K.

You could increase output and not increase total cost by using less L and more K.

6. (10 pts.) Use the expertise that you have developed from taking video tours of Toyota's Georgetown plant, General Motors' 1936 Chevrolet plant, and Ford's Model T plant to answer the following question about Make or Buy. In the early days of General Motors, GM bought body parts from a separate company, the Fisher Body Company. Fisher made dies that were specifically designed for each GM car, and stamped out fenders and hoods using hydraulic presses. They then sold the parts to GM, which used them to assemble Chevrolets, Buicks, and Cadillacs. Without knowing the history of GM, can you see any problems that might arise with this method of sourcing body parts? Explain, using the concepts of asset specificity and hold-up that we have developed in this course. How does Toyota source body parts for its Camrys?

The dies are specific assets, and require Fisher or GM to make an irreversible investment, i.e. to incur a sunk cost. Once the initial investment is made, additional body parts can be stamped out at relatively low marginal cost. If Fisher Body Co. makes the dies, it leaves itself vulnerable to being held up by GM. Both parties have an interest in a formal vertical connection — either long-term contracting or vertical integration.

Toyota makes its own dies and stamps out its own body parts.

7. (5 pts.) Large-scale chicken farmers have a disposal problem—how to get rid of the dozens and sometimes hundreds of chickens that die daily in the normal course of production. Some farmers in the southeast have started raising alligators on the side, because alligators consider dead chickens a delicacy and are happy to dispose of as many chicken carcasses as farmers will feed them. Write an algebraic expression that expresses the synergies between raising chickens and alligators simultaneously, and briefly explain it.

This describes economies of scope:

$$C(x, y) < C(x, 0) + C(0, y)$$

where x = chickens and y = alligators

8. (5 pts.) Sharp recently opened a large new production facility for making LCD televisions. One innovation is that Sharp "has decided to try and cut costs by moving suppliers on site, a kind of hyper-'just-in-time' delivery system." Suppliers have built and paid for their own facilities, and are renting the land from Sharp. Explain any advantages or disadvantages you see from this approach.

advantage - production efficiencies, from saving on transportation and coordination costs.

disadvantage - suppliers invest in site specific assets, and are vulnerable to hold up.

9. (10 pts.) Based on research conducted by various economics and marketing professors, you find that the following products have income elasticities as indicated:

Honda Accords	Household income < \$100,000	0.7
	Household income > \$200,000	-0.3
Milk	All income levels	0.1
Lotto tickets	Jackpot < \$5 million	-1.5
	Jackpot > \$100 million	0.8

Briefly explain how you would use this information in formulating a marketing strategy for each product.

Honda Accords - target middle income households; avoid media aimed at wealthier households.

Milk - target everyone, at least in terms of income categories.

Lotto - when jackpot is low, target low income households. When jackpot gets very large, advertise more broadly and reach middle and upper income households.

10. You finally agree to terms with Yum Brands and are awarded a Taco Bell franchise located near the UK campus. You are trying to decide how big to build your restaurant, and are provided with the following information about building size and equipment (K), workers (L, where L represents worker-hours), and meals per hour output (Q) by Yum headquarters:

	L=1	2	3	4	5	6	7	8	9	10	11
K=1	Q=10	22	36	48	58	66	74	80	84	86	86
2	14	30	48	64	78	90	100	108	114	118	120
3	16	36	58	78	96	112	124	134	142	148	152

- a. (5 pts.) Does this production relationship exhibit short-run diminishing returns? Explain using the above production function table.

Assume $K=1$. As L increases, output at first increases by larger and larger amounts ($0 \rightarrow 10 \rightarrow 22 \rightarrow 36 \rightarrow 48$) but eventually increases by smaller and smaller amounts ($48 \rightarrow 58 \rightarrow 66 \rightarrow 74 \rightarrow 80 \rightarrow 84 \rightarrow 86$). Diminishing returns.

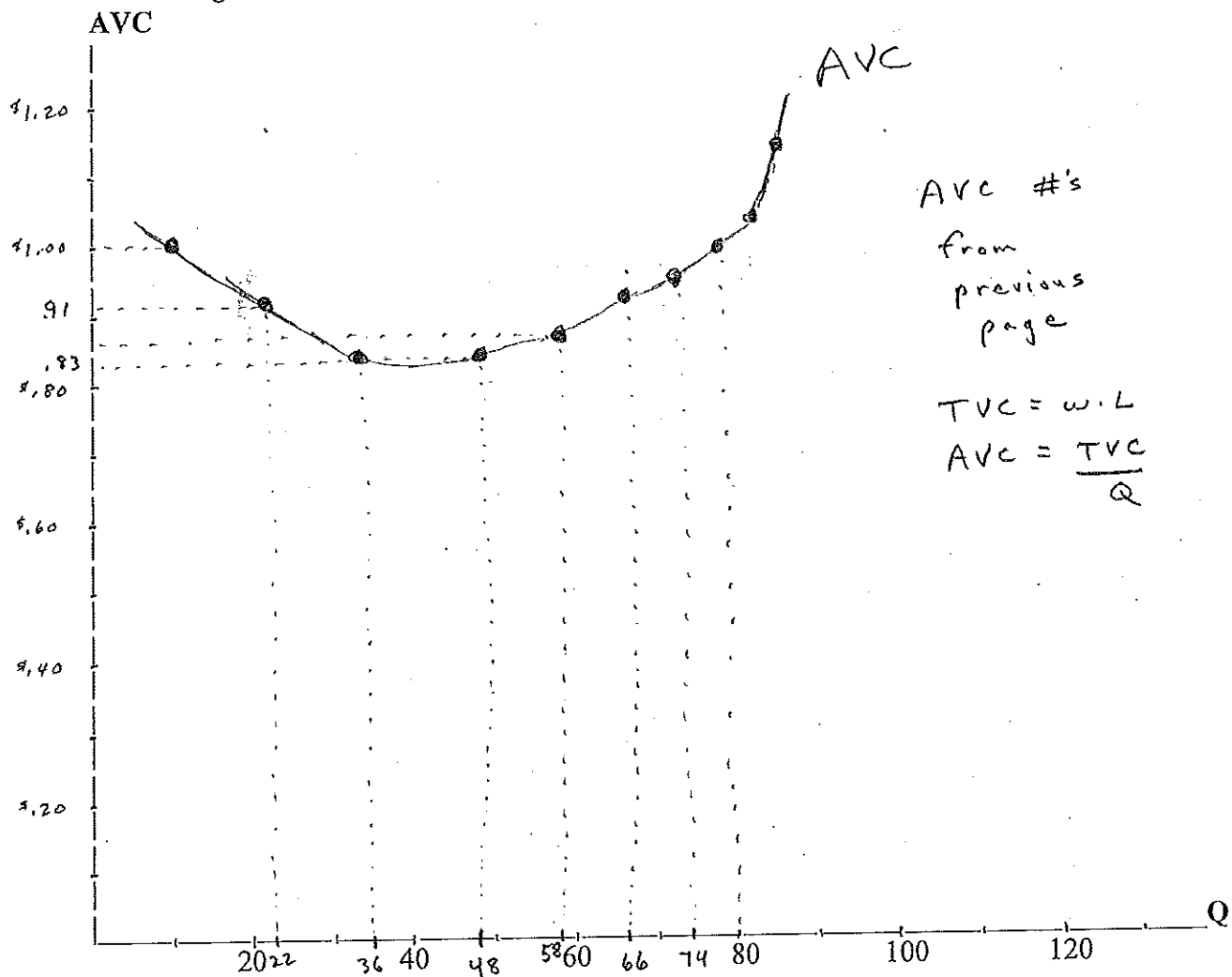
- b. (5 pts.) Does this production relationship exhibit decreasing returns to scale, constant returns to scale, or increasing returns to scale? Explain, again using information in the above table.

If $K=1$ and $L=1$, $Q=10$. Double all inputs ($K=2$ and $L=2$) and output more than doubles ($Q=30$). Increase all inputs by a factor of 1.5 ($K=3$ and $L=3$) and output increases by more than a factor of 1.5 ($Q=58$). Increasing returns to scale.

$$K=1 \quad w = \$10 \quad TVC = \$10 \cdot L$$

L =	1	2	3	4	5	6	7	8	9	10
TVC =	\$10	\$20	\$30	\$40	\$50	\$60	\$70	\$80	\$90	\$100
Q =	10	22	36	48	58	66	74	80	84	86
AVC =	\$1.00	\$.91	\$.83	\$.83	\$.86	\$.91	\$.95	\$1.00	1.07	\$1.16

- c. (10 pts.) Suppose you choose to build the smallest restaurant, i.e. $K=1$. Suppose also that your labor costs are \$10 per hour. Plot your short-run average variable cost curve in the diagram below.



- d. (5 pts.) If your anticipated long-run output rate is 75-80 meals per hour, compare your variable costs per meal if you build the small restaurant ($K=1$) with those of the medium-sized ($K=2$) and large-sized ($K=3$) restaurants. What additional information would you want to have before deciding which restaurant size to build?

- $K=2, L=5, Q=78, TVC=50, AVC = \0.64
 - $K=3, L=4, Q=78, TVC=40, AVC = \0.51
- compared with $K=1, L=8, AVC = \$1.00$

But we need to know how much capital - building and equipment cost in order to know average total cost.