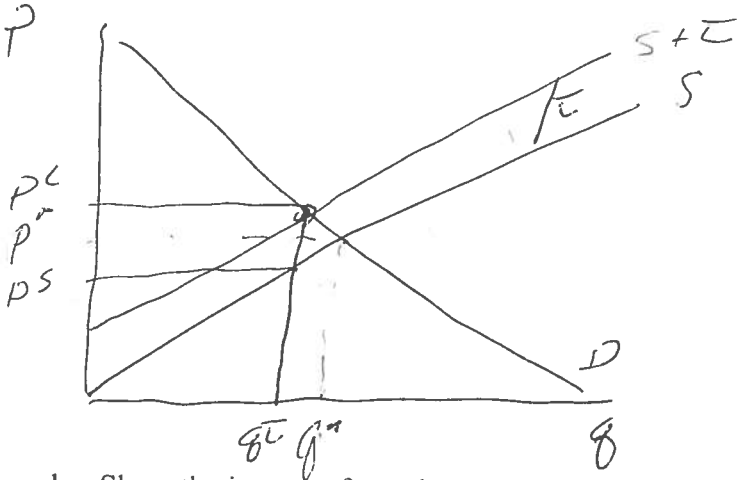
Final
PAI 897, Fall 2020
Professor John McPeak

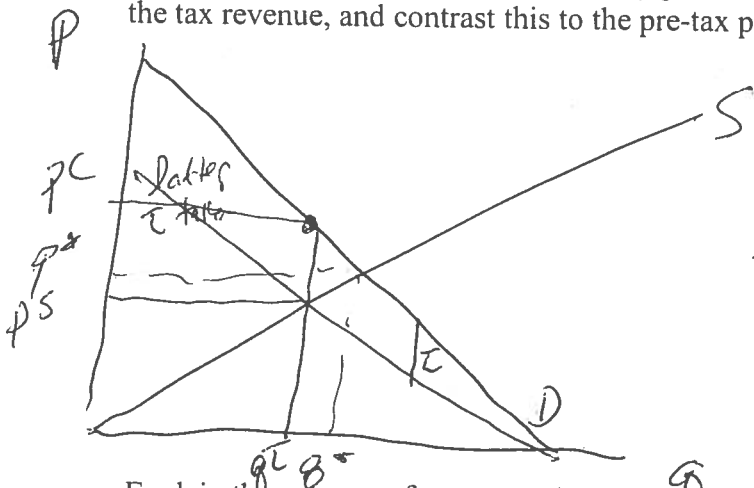
Name: KEY

The total exam is worth 30 points. Each numbered question is worth 2 points, and each sub question within a numbered question is worth an equal share of the 2 points.

1) Taxes.
   a. Show the impact of a specific tax of size τ placed on producers. Note the price paid by consumers, the price received by producers, the equilibrium quantity and the tax revenue, and contrast this to the pre-tax price quantity pair.



   b. Show the impact of an ad valorem tax rate α placed on consumers. Note the price paid by consumers, the price received by producers, the equilibrium quantity and the tax revenue, and contrast this to the pre-tax price quantity pair.



$T = \alpha \cdot P^C$

   c. Explain the concept of consumer incidence in reference to your answer to part b of this question

$\frac{P^C - P^*}{T}$ is the share of the tax burden on consumers

2) Monopoly. Inverse demand is p=36-2*q. The marginal cost of production is 2*q.

a. What is the equilibrium outcome if the producer is a monopolist?

$MR = 36 - 4q$

$36 - 4q = 2q$

$36 = 6q$ $\quad q = 6$

$P = 36 - 2(6)$
$= 36 - 12$
$= 24$

$(p^m, q^m) = (\$24, 6)$

b. What is the equilibrium outcome if the producers are in a perfectly competitive market?

$36 - 2q = 2q$

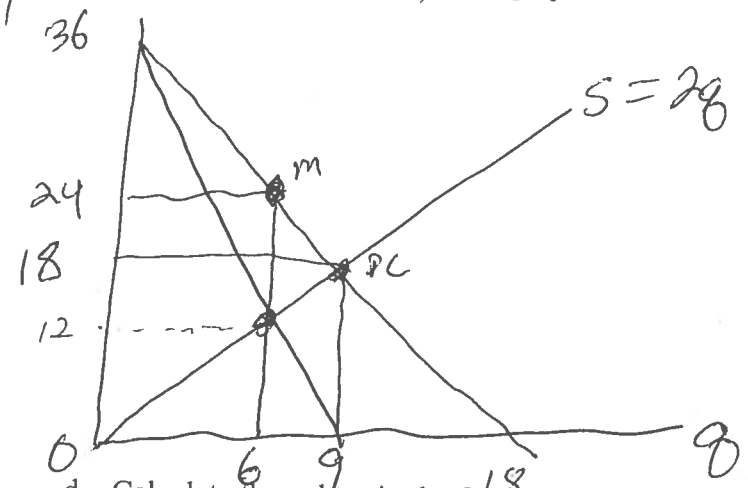
$36 = 4q$

$q = 9$

$P = 36 - 2(9)$
$= 36 - 18$
$= 18$

$(p^c, q^c) = (\$18, 9)$

c. Illustrate these two areas on a graph.



d. Calculate the values in the following table.

	Monopoly	Perfect Competition
Consumer Surplus	$\frac{1}{2}(36-24)\cdot 6$ $\frac{1}{2}(12)(6) = 36$	$\frac{1}{2}(36-18)\cdot 9$ $\frac{1}{2}(18)\cdot 9 = 81$
Producer Surplus	$12 \cdot 6$ $+\frac{1}{2}(12 \cdot 6) = 108$	$\frac{1}{2}(18 \cdot 9) = 81$
Dead Weight Loss	$\frac{1}{2}\,12 \cdot 3 = 18$	0
Total Social Welfare	144	162

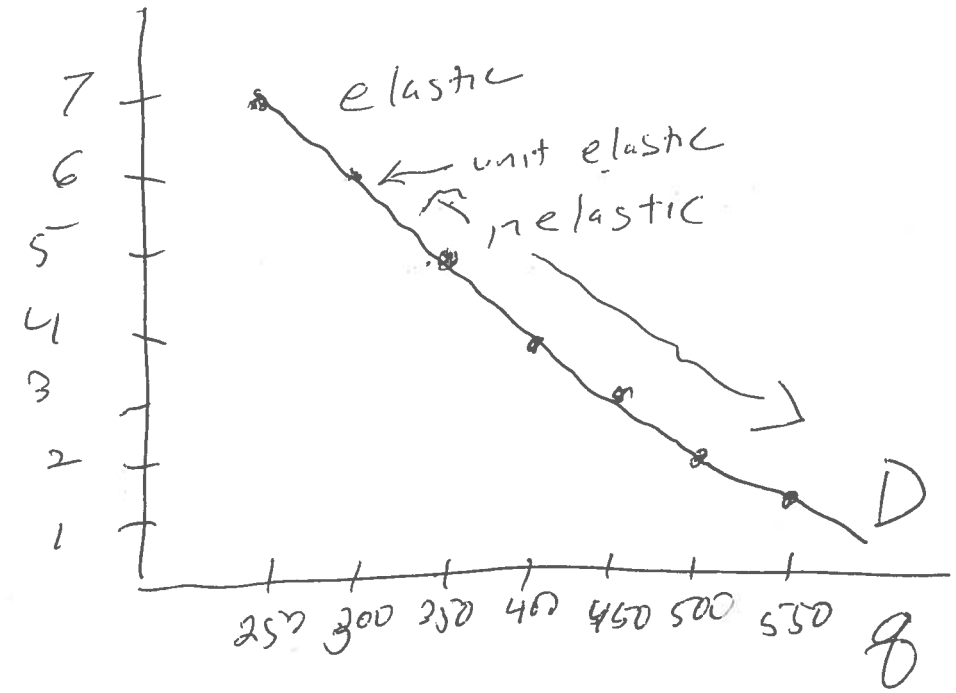
$$\varepsilon = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{\Delta Q}{\Delta P} \cdot \frac{P}{Q}$$

3) The demand curve is given to you as q=600-50*p.

a. Fill out the following table (use the relatively higher price / relatively lower quantity pair for the denominator in the elasticity calculation)

Price	Quantity	Elasticity
$1.00	550	----------
$2.00	500	$\frac{-50}{1} \cdot \frac{2}{500} = -\frac{1}{5}$
$3.00	450	$\frac{-50}{1} \cdot \frac{3}{450} = -\frac{3}{9}$
$4.00	400	$\frac{-50}{1} \cdot \frac{4}{400} = -\frac{1}{2}$
$5.00	350	$\frac{-50}{1} \cdot \frac{5}{350} = -\frac{5}{7}$
$6.00	300	$\frac{-50}{1} \cdot \frac{6}{300} = -1$
$7.00	250	$\frac{-50}{1} \cdot \frac{7}{250} = -\frac{350}{250} = -1\frac{3}{5}$

b. Draw this demand curve with price on the y-axis and quantity on the x – axis. Identify the range over which this curve is elastic or inelastic.

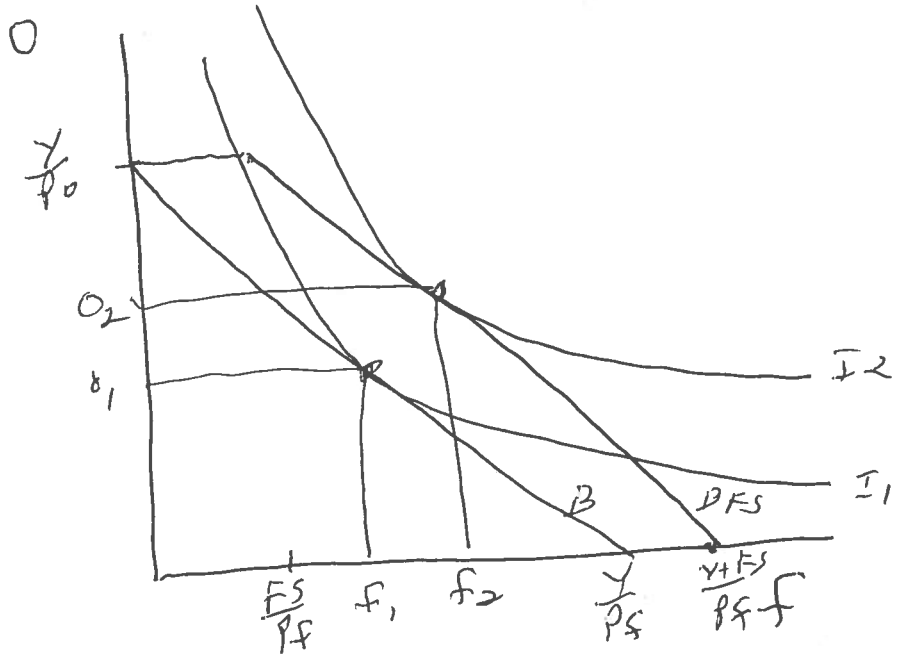


4) Circle the correct answer.

Statement	**The statement is (circle the correct answer)**
The expansion path traces out all points that are economically efficient.	(True) False
Producer surplus is calculated as the area below the demand curve and above the price line.	True (False)
The cross-price elasticity of a complement is a positive number.	True (False)
The income elasticity of demand for a normal good is a positive number.	(True) False
The internal rate of return is the value of r at which present value benefits equal present value costs for a project.	(True) False
The slope of an isoquant is called the Marginal Rate of Substitution (MRS)	True (False)
A club good is excludable and non-rival.	(True) False
The free rider problem leads to under provision of a public good.	(True) False
The Marginal Cost (MC) curve crosses the Average Fixed Cost (AFC) curve from below at the minimum value of AFC, after which AFC will begin to increase.	True (False)
Marginal Cost equals the wage rate over the marginal product of labor, $MC_Q=w/MP_L$	(True) False

5) Budget Constraints. There are two goods, food (f) and other (o). The price of food is p_f, the price of other is p_o. Income is Y. The budget constraint is $p_f*f+p_o*o=Y$.

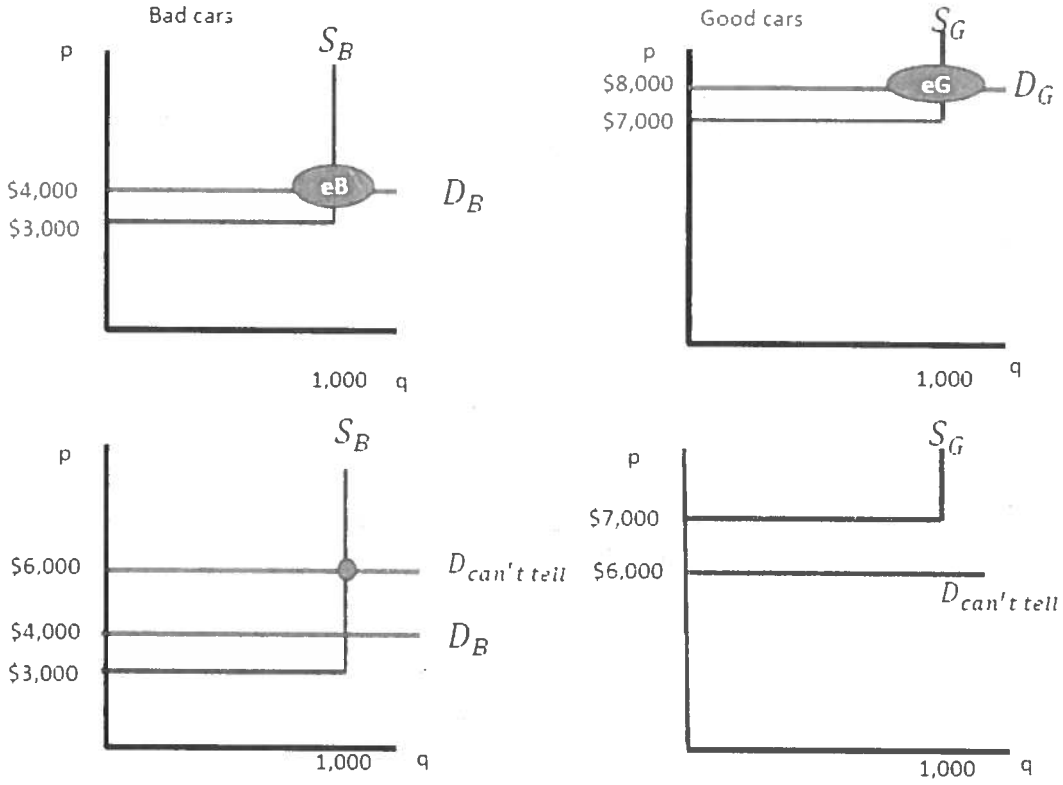
a. Draw the budget constraint and indifference curves for a consumer showing the optimal bundle with the original budget line and after the consumer has received food stamps of cash value FS.



b. Contrast the consumption level of food and other before the food stamps were given and after food stamps are given in the graph you drew for part a. using the concepts of normal and inferior goods.

When food stamps are given, money that was being used for food at (f_1, O_1) is freed up. That money can be used for more food and more other. Since $f_2 > f_1$ and $O_2 > O_1$ we see both food and other are normal goods for a consumer with these preferences.

6) Explain the following graphs.



a. For the pair of graphs on top, describe what the lines in each graph represent and explain the equilibrium outcomes.

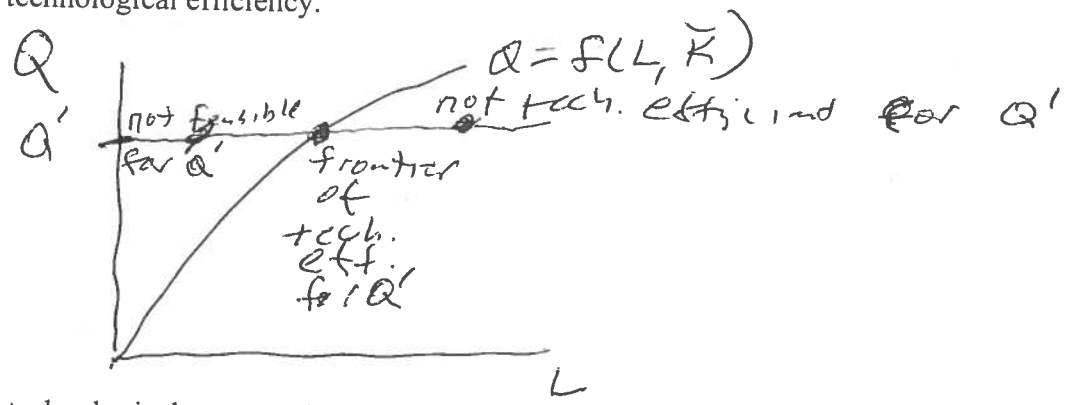
For the Bad Cars, the supply is horizontal at the reservation price per car at $3,000 up to 1000 cars, after which it not possible to find another bad car. The demand for bad used cars is horizontal at $4,000. The equilibrium is ($4,000, 1000). For the Good cars, it is the same idea but the reservation price per car is $7000 and the demand is at $8,000. The equilibrium is ($8,000, 1000)

b. For the pair of graphs on the bottom, explain what is different compared to the graphs on the top, and describe the difference in the equilibrium outcome.

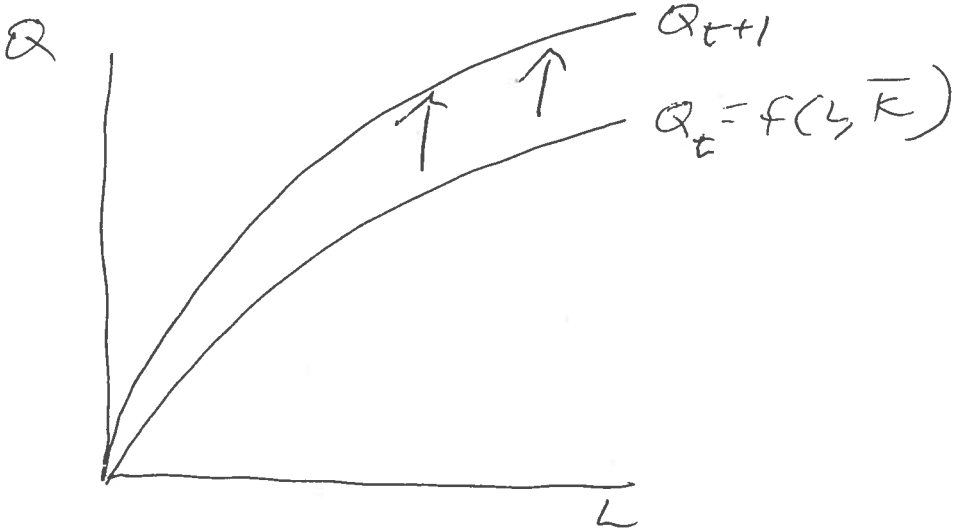
For the top two graphs, we have assumed that both buyers and sellers have the same information about whether a car is good or bad. If buyers can't tell a good car from a bad car, they take the average of the value for a good car and a bad car, so $\frac{8000 + 4000}{2} = 6000$. If they are willing to pay $6,000 for a used car no good cars will be sold and eventually

7) Production functions.

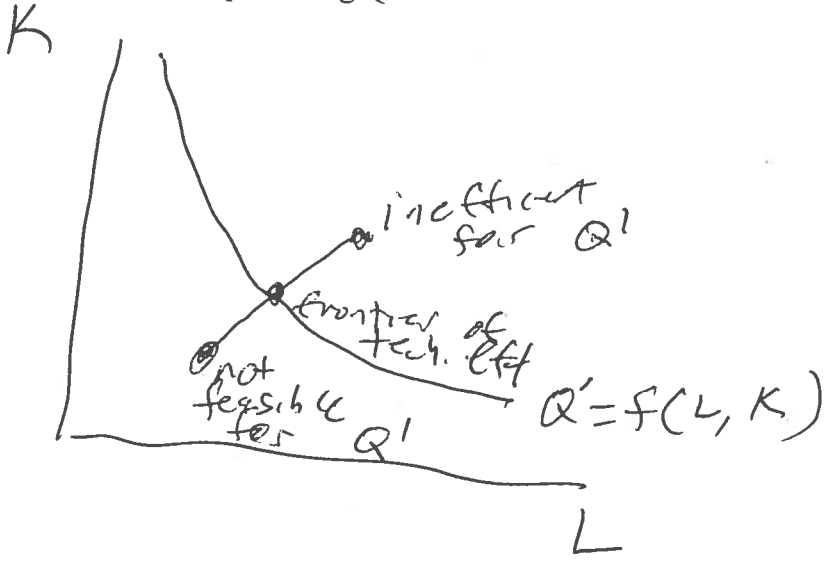
a) Draw the production function $Q=f(L, \bar{K})$ noting areas that are not feasible, not efficient and at the frontier of technological efficiency.



b) Show what technological progress looks like on a production function such as the one you drew for (a)



c) Draw an isoquant of the production function $Q=f(L, K)$ and label it Q', noting areas that contain combinations of inputs that are: not feasible; not efficient; and at the frontier of technological efficiency for producing Q'.



8) Market structure and externalities. The inverse demand curve is given as p=58-3*q. The inverse supply curve is p=10+q.

a. What is the equilibrium price quantity pair if the market structure is perfectly competitive?

$58-3q = 10+q$

$48 = 4q$

$q = 12$

$P = 58-3(12)$

$= 54 - 36$

$= 22$

$(P^{PC}, Q^{PC}) = (\$22, 12)$

b. If there is a marginal externality generated by production of the good equal to 2*q ($MC^E=2*q$), what is the socially optimal price quantity pair?

$58-3q = (10+q)+2q$

$48 = 6q$

$q = 8$

$P = 58 - 3(8)$

$= 58 - 24$

$= 34$

$(P^{SO}, Q^{SO}) = (\$34, 8)$

c. What size specific tax τ placed on producers can be used to replicate the socially optimal outcome?

$T = MC^E(Q^{SO})$

$= 2 \cdot 8$

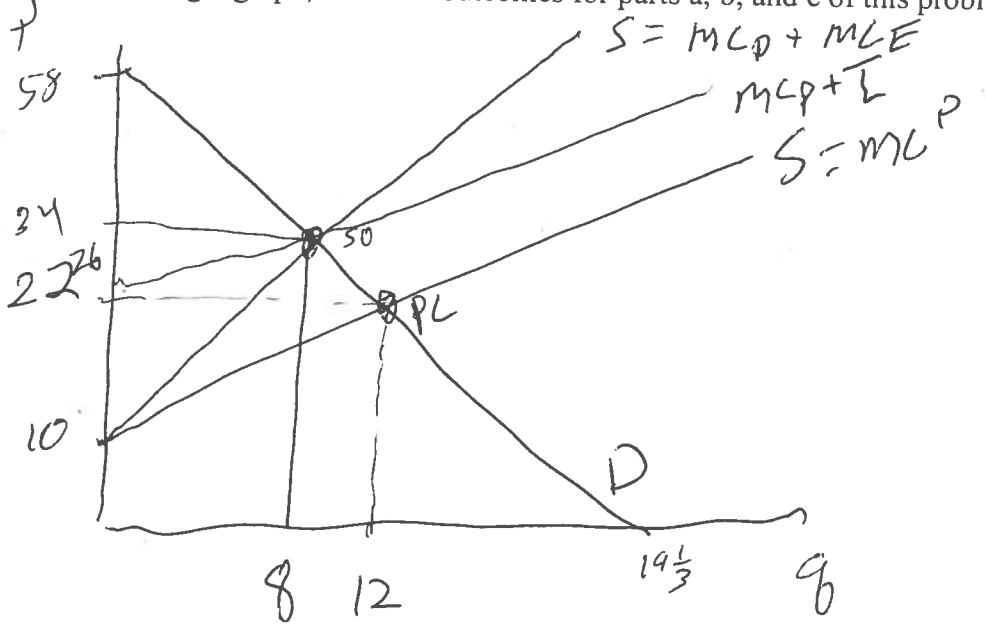
$= 16$

$34 = 10 + 8 + T$

$34 - 18 = T$

$16 = T$

d. On a single graph, draw the outcomes for parts a, b, and c of this problem.



9) Public goods, Pandemic edition.
There are three students left who are currently attending classes in the classrooms of the Maxwell School. They each have an inverse demand curve for the number of Purell freestanding hand sanitizing stations (stations) to put in the hallways that all three students can use (q is the # of stations). David's demand is \$550-\$10*q. Mary Pat's demand is \$320-\$40*q. Carol's is \$330-\$15*q. 22 $q = 55$ $q = 8$

a. If the marginal cost of stations is constant at \$480.00 per station and no effort is made to avoid the free rider problem, what number of stations will be provided and who will provide them?

David.

$550 - 10q = 480$

$70 = 10q$

$q = 7$

b. What is the socially optimal number of stations that should be provided?

0 to 8 $(550 + 320 + 330) - (10 + 40 + 15)q$

$1200 - 65q$

$1200 - 65(8) = 680$

$= 1200 - 520$

8 to 22 $(550 + 330) - (10 + 15)q$

$880 - 25q$

$550 - 10(22)$

$= 330$

22 to 55 $550 - 10q$

$480 = 880 - 25q$

$25q = 400$

$q^{SO} = 16$

10) Cost.

a. Complete the following table.

Total Output	Fixed Cost	Total Cost	Variable Cost	Average Variable Cost	Average Fixed Cost	Average Cost	Marginal Cost
0	12	12	-------	------	-----	------	---------
1	12	27	15	15	12	27	15
2	12	39	27	13.5	6	19.5	12
3	12	52	40	13.3	4	17.3	13
4	12	67	55	13.75	3	~~16~~ 16.75	15
5	12	85	73	14.6	2.4	17	18

16.75

b. Is this short run or long run cost information? Why?

Short run because there is fixed cost. In the long run all cost is variable cost

c. If market price for the output produced is 13, what level of output is profit maximizing for a firm if the market structure is perfectly competitive?

1) $MR = MC$ at $P = 13$ so $q = 3$

2) $P \geq AVC(q=3)$? $13 \geq 13.3$? no, shut down $q = 0$

-or-

$\pi(q=3) = 13.3 - 52 = 39 - 52 = -13$ (R, C)

$\pi(q=0) = 0 - 12 = -12$. shut down, $q = 0$

11) Game Theory.

Target and Old Navy have entry points that are side by side in a strip mall. A guard costs $4 to hire and will sit between the two doors. The benefit of a guard at the main door that they will not suffer losses from theft (0 is the payoff). The baseline is no guard for either, each suffers theft losses of -3. If one hires and the other does not, each store will benefit from the avoided losses because of the guard but the store who hired has to pay the guard. If both hire, they pay both, but two guards are no more effective than one.

		Old Navy	
		Hire	Don't hire
Target	Hire	-4, -4	-4, 0
	Don't Hire	0, -4	-3, -3

a) Describe the full set of best responses and identify the Nash Equilibrium.

If ON Hire, Target Don't Hire
If ON Don't Hire, Target Don't Hire
If Target Hire, ON Don't Hire
If Target Don't Hire, ON Don't Hire

NE
Target Don't Hire, get -3
ON Don't Hire, get -3

Can they arrive at a Pareto improving outcome if Old Navy and Target come to an agreement to split the cost of one guard ($2 each)? Here if they honor the agreement, they get the benefits of the guard (0 losses) but pay 2 each (-2, -2). A store can also renege (refuse to honor the agreement). If one store honors and the other reneges, the store that honors pays the full cost of the guard while the other gets the full benefits (-4, 0) or (0, -4). If they both renege no guard is hired and they continue to suffer losses (-3, -3). The payoffs are as follows.

		Old Navy	
		Honor	Renege
Target	Honor	-2, -2	-4, 0
	Renege	0, -4	-3, -3

b) Describe the full set of best responses and identify the Nash Equilibrium.

If ON Honor, Target Renege
If ON Renege, Target Renege
If Target Honor, ON renege
If Target Renege, ON renege

NE
Target Renege, get -3
ON Renege, get -3

c) In what sense is the (Honor, Honor) outcome potentially Pareto improving on the (Renege, Renege) outcome?

If we could move to (Honor, Honor) both will be made better off at (-2, -2) than they are at the NE of (renege, renege) with a payoff of (-3, -3)

12 Benefit cost.

We are evaluating proposals for use of decentralized climate funds in Mali. These are funds available to help local communities fund public goods that will help them adapt to anticipated climate change. The time horizon and our planning horizon is four years: t=0,1,2,3. One community has the following proposal.

Irrigated rice zone where rain-fed cultivation currently takes place. The fences, retaining walls, and canals of the irrigated zone will cost $150,000 to construct in year zero. During the construction year t=0 no cultivation will take place in this field. Once construction is finished, maintenance and repair of the zone are expected to cost $19,000 in years 1, 2, and 3. The benefit of building this zone is that it will allow two harvests from this irrigated area in years 1,2, and 3 where currently they are able to have one rain-fed harvest per year. Each rice harvest is worth $69,000, so if we have 2 harvests per year that is $138,000 per year. Input costs for a single growing season are $12,000 per season under both rain fed and irrigated cultivation, so $12,000 per year rain-fed and $24,000 per year under irrigation with two crops per year.
The discount rate is 5%.

a) What is the NPV of the 'without' (rain fed) scenario over years 0,1,2,3?

	Benefit	Cost	Benefit-Cost
T=0	69	12	57
T=1	$69/1.05$	$12/1.05$	$57/1.05$
T=2	$69/1.05^2$	$12/1.05^2$	$57/1.05^2$
T=3	$69/1.05^3$	$12/1.05^3$	$57/1.05^3$
Present Value	256.9	44.7	212

b) What is the NPV of the 'with' (irrigated) scenario over years 0,1,2,3

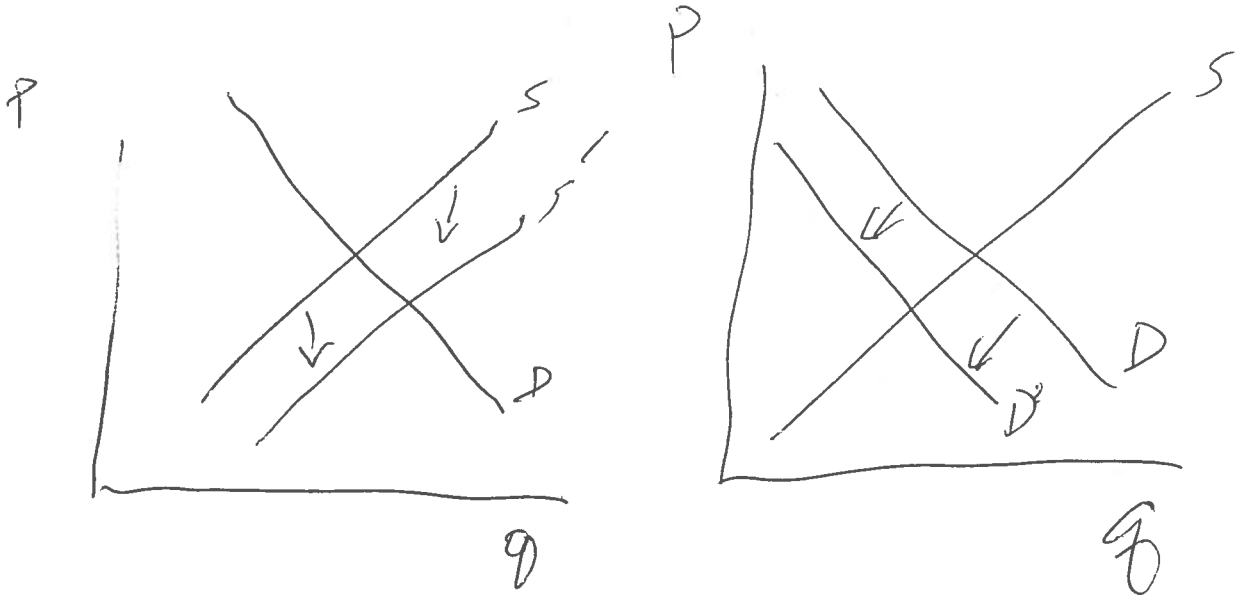
	Benefit	Cost	Benefit-Cost
T=0	0	150	-150
T=1	$138/1.05$	$19+24=43/1.05$	$95/1.05$
T=2	$138/1.05^2$	$19+24=43/1.05^2$	$95/1.05^2$
T=3	$138/1.05^3$	$19+24=43/1.05^3$	$95/1.05^3$
Present Value	375.8	267.1	109

c) Would my evaluation of which is better, 'with' or 'without' change if the irrigated system allowed for 3 harvests per year rather than 2? Why or why not?

	Benefit	Cost	Benefit-Cost
T=0	0	150	-150
T=1	$207/1.05$	$19+36/1.05$	$152/1.05$
T=2	$207/1.05^2$	$19+36/1.05^2$	$152/1.05^2$
T=3	$207/1.05^3$	$19+36/1.05^3$	$152/1.05^3$
Present Value	563.7	299.8	263.9

13) The average price of processed pork has gone down in Central New York since this time last year. Assume each explanation listed below is hypothesized to be the sole cause of this price decrease. Which of the following explanations can you rule out, and which can you not rule out.

Explanation	Rule out	Not Rule Out (circle)
Incomes in Central New York have increased since last year.	Rule out	Not Rule Out
Consumer preferences have shifted away from processed pork to impossible burgers	Rule out	Not Rule Out
The world market price of hogs used to make processed pork has decreased due to decreased demand from China as a result of the trade war.	Rule out	Not Rule Out
The USDA guidelines for sanitary standards at meat processing plants have been made less costly to meet as part of the current wave of deregulation.	Rule out	Not Rule Out
Wilbur the adorable pig is a star of a new Disney + movie so that children cry when they find out their parents are feeding them pork from ground up pigs.	Rule out	Not Rule Out
Avian flu killed a large portion of the chicken population so that price of chicken meat increased dramatically.	Rule out	Not Rule Out



14) Syracuse University is raising the price for a 2021 season's ticket for all men's home football games to $280. In 2019, at a price of $225, they sold 21,000 season's tickets. In 2020 they did not sell any football tickets. The best available information from the past three years suggests that the price elasticity of demand for season's tickets is -0.75.

a. What is the predicted number of season's tickets sold in 2021 if the price is raised?

$-0.75 = \frac{\%\Delta Q}{\%\Delta P}$ $\quad \frac{280 - 225}{225} = 0.182 \approx .24$ $\quad Q_{2019} = 21,000$

$\%\Delta Q = -3850$

$Q = 17,150$

b. Compare total revenue in 2019 and 2021. Which is higher?

$225(21,000) = 4,725,000$

$280(17,150) = 4,802,000$

c. How many season tickets will be sold in 2021 if the elasticity is not -0.75 as assumed above, but is in fact -1.25 due to disappointment among fans with the outcomes of the 2019 and 2020 seasons? How will this predicted 2021 revenue compare to the 2019 revenue?

$-1.25 = \frac{\%\Delta Q}{\%\Delta P}$

$-1.25 = \frac{\%\Delta Q}{.244}$

$\%\Delta Q = -.305$

$\Delta Q = -6417$

$Q_{2021} = 14583$

$R_{2021} = 4,083,334$

15) Public goods, voting, and benefit cost.
A community of five people is voting to decide on public good provision. There are three proposals:
Proposal A: Install a N95 mask dispenser in front of town hall where residents can obtain a new mask whenever they want one. Total cost is $5,000 ($1000 each).

Proposal B: Assemble a box filled with personal protective equipment, hand sanitizer, take-out menus, and gift cards that can be used to order take-out meals and leave it at each household. Total cost is $7,500 ($1,500 each).

Proposal C: Build a vaccination clinic in front of the town with freezers that can keep things cold as low as negative eighty degrees Celsius that will deliver free Covid vaccines when they are distributed. Total cost is $10,000 (2,000 each)

1000 1500 2000

This table records each household's WTP for each proposal.

	Proposal A- mask	Proposal B-box	Proposal C-clinic
Atlas	$10	$100	$5
Fauci	$2,000	$2,200	$3,900
Birx	$1,900	$2,400	$4,500
Adams	$900	$1,600	$1,900
Azar	$190	$100	$295

a) How will they vote for each proposal and which proposal or proposals will pass with a majority? (circle)

	Proposal A		Proposal B		Proposal C	
Atlas	Yes	(No)	Yes	(No)	Yes	(No)
Fauci	(Yes)	No	(Yes)	No	(Yes)	No
Birx	(Yes)	No	(Yes)	No	(Yes)	No
Adams	Yes	(No)	(Yes)	No	Yes	(No)
Azar	Yes	(No)	Yes	(No)	Yes	(No)
Pass or not?	not		PASS		not	

b) If the costs are present value costs, and the willingness to pay figures are present value benefits, what is the net present value of each proposal?

Proposal A- mask	Proposal B - box	Proposal C – clinic
5000 - 5000 = 0	6400 - 7500 = -1100	+ 600

c) Did voting lead us to select the proposal that had the highest net present value? Explain why or why not.

no. Yes - no voting ignores intensity of preferences.