1. Fill in the missing blanks ("XXXXXXXXXXX" means that there is nothing to fill in this spot):

Quantity	Total utility	Marginal utility
0	0	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	*200 – 0 = 200*
1	200	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	150
2	*200 + 150 = 350*	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	125
3	*350 + 125 = 475*	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	*575 – 475 = 100*
4	575	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	*665 – 575 = 90*
5	665	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	*735 – 665 = 70*
6	735	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	50
7	*735 + 50 = 785*	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	40
8	*785 + 40 = 825*	XXXXXXXXXXX
XXXXXXXXXXX	XXXXXXXXXXX	*800 – 825 = –25*
9	800	XXXXXXXXXXX

2. Your willingness to pay for oranges is $5 per pound for the first pound, and decreases by $1 for each additional pound (i.e. $4 for the second pound). If you can purchase as many pounds of oranges you want at $1 per pound, what is your consumer surplus?

$CS_1 = \$5 - \$1 = \$4$
$CS_2 = \$4 - \$1 = \$3$
$CS_3 = \$3 - \$1 = \$2$
$CS_4 = \$2 - \$1 = \$1$
$CS_5 = \$1 - \$1 = \$0$
Total CS is the sum of the five pounds purchased, or $10.

3. In a given country, if supply is represented by the equation P = 2Q, and demand is represented by the equation P = 12 – Q, what are the equilibrium price and quantity? Determine the new price and quantity equilibrium when a $1 tax is imposed on sellers.

Without tax: Set $2Q = 12 - Q \Rightarrow Q = 4 \Rightarrow P = 8$
With tax: New supply is $P = 2Q + 1$. Set $2Q + 1 = 12 - Q \Rightarrow Q = 11/3 \Rightarrow P = 25/3$

4. Suppose that you plan on growing peas this summer in your back yard to supplement your income. Assume that you have already paid $20 to get the garden ready, that peas sell for $2 per pound, and that you can add fertilizer at a cost of $5 per pound. Based on the yield table below, how much fertilizer should you add to maximize your summer profit?

Pounds of fertilizer	Pounds of peas
0	20
1	30
2	35
3	38
4	39
5	39.5
6	39.75

To maximize, produce as long as $MB \geq MC$. (Note that the $20 sunk cost is irrelevant here.) MB of 1st pound of fertilizer is 10 pounds of peas, or $20; 2nd pound, $10 (from 5 add'l pounds); 3rd pound, $6 (from 3 add'l pounds); 4th pound, $2 (from 1 add'l pounds); 5th and 6th pounds, < $2. MC = $5 per pound of fertilizer. Thus, add 3 pounds of fertilizer to maximize profits. You will see that profits are positive, and so you will not need to check the shutdown condition here.

5. From the information in the previous problem, what are your total summer profits?

Total benefit, 38 pounds of peas, or $76
Total cost, $20 + 3 × $5 = $35
Total profit, $76 – $35 = $41

6. If supply shifts to the left and demand shifts to the right, what can you conclude about the new equilibrium price and quantity, relative to the old equilibrium?

Shift to the left in supply (keeping demand the same) increases P and reduces Q.
Shift to the right in demand (keeping supply the same) increases both P and Q.
Thus, P will definitely increase, but we cannot say anything conclusively about Q.

7. When the price of tennis balls increases, what would you expect to happen to the supply and demand of tennis rackets?

In this case, we can probably assume that tennis balls and tennis rackets are complements. Thus, when the price of tennis balls increases, the cost of playing tennis increases, and so the demand for tennis rackets will shift to the left. There is no indication about anything that changes the supply of tennis rackets, and so the supply does not change.

8. From the information in Problem 3, what would be the excess supply if a price floor is set at \$10? What happens if the price floor is set at \$4? In each case, compare consumer and producer surplus to equilibrium without price floors. (Assume no taxes.)

In Problem 3, Q = 4 and P = \$8. In this case, PS is a triangle that is 4 units long and 8 units high, leading to PS of \$16. CS is a triangle that is 4 units long and 4 units high, leading to a CS of \$8. A price floor is a minimum price that has to be received. So when the price floor is \$4, the market still clears, since equilibrium is above the price floor. When the price floor is \$10, quantity supplied is 5, and quantity demanded is 2. So there is an excess supply of 3 units. In this case, PS is a trapezoid that is 2 units "high" and has bases of "length" 10 and 6.[1] Since the area of a trapezoid is the height times the average of the bases, PS is \$16 (at most, since there is no guarantee that low-cost suppliers will supply). CS is a triangle that is 2 units long and 2 units high, leading to a CS of \$2.

9. If price elasticity of demand for peanuts is 4 (in absolute value) and an increase in percentage change in quantity demanded is 5 percent, how much does price change?

Elasticity = %ΔQ / %ΔP ➔ 4 = 0.05 / %ΔP ➔ Price change is 1.25%.
Since quantity demanded goes up and slope is negative, the price drops 1.25%.

10. Assume that there is a linear demand curve with vertical intercept at price \$10 and horizontal intercept at quantity 20. What are the price elasticities of demand when price is \$8, \$6, \$4, and \$2?

Recall that elasticity can be expressed as P / (Q × slope). Based on the two intercepts, there is a rise of 10 and a run of 20, leading to a slope of 0.5. Thus, demand can be represented by P = 10 – 0.5 × Q.
P = \$8 ➔ Q = 4 ➔ elasticity is 4
P = \$6 ➔ Q = 8 ➔ elasticity is 1.5
P = \$4 ➔ Q = 12 ➔ elasticity is 2/3, or about 0.67
P = \$2 ➔ Q = 16 ➔ elasticity is 0.25

11. From the information in the previous question, at what price and quantity will total expenditures be maximized?

The midpoint between the intercepts is the point of elasticity equal to 1. This occurs when P is \$5 and Q is 10.

12. If two individuals have demand curves represented by P = 10 – Q and P = 20 – 2Q, what is the total demand? (Notes: Assume that quantity demanded is never negative. Graphing the total demand may be easier than representing it algebraically.)

To represent the demand algebraically, note that when P > 10, only the second individual has a positive demand. When P < 10, we add the quantities demanded. So P ≥ 10 ➔ Demand is a line segment connecting the points (5,10) & (0,20).
When P < 10 ➔ Demand is a line segment connecting the points (5,10) & (20,0).

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[1] I put quotes here, since "high" refers to horizontal distance in this case only, and "length" refers to horizontal distance in this case only.

13. Assume that picture frames sell for $10 each and that hiring an additional worker costs $200 per day. Given the production function below, how many workers should be hired to maximize profits?

Workers per day	Output (picture frames per day)			
0	0			
1	50			
2	150			
3	220			
4	250			
5	275			
6	290			
7	295			
8	298			

You need to sell at least 20 picture frames for each additional worker hired to increase profits. Thus, hiring each of the first 5 workers is profitable, but not for the 6th worker. So you should hire 5 workers.

14. Assume the same information as in the previous problem. If the only other cost is a $250 per day rent that has to be paid, how much are daily profits for this firm?

TR = $10 × 275 = $2,750
TC = $250 + $200 × 5 = $1,250
Profit = $2,750 - $1,250 = $1,500

15. Again, use the same information as in Problem 13. Find the FC, VC, AFC, and AVC for each possible number of employees hired. Determine the MC per picture frame for each worker hired.

I will continue to assume FC is $250 per day ➔ AFC is 250 / Q for any output Q.
Variable cost is 200 for one worker ➔ AVC for 50 frames is 200 / 50, or $4.
Variable cost is 400 for two workers ➔ AVC for 150 frames is $2.67.
Variable cost is 600 for three workers ➔ AVC for 220 frames is $2.73, etc.
MC is add'l cost per frame for each worker hired.
1st worker: MC for worker is $200 for 50 frames ➔ MC per frame is $4.
2nd worker: MC for worker is $200 for 100 frames ➔ MC per frame is $2.
3rd worker: MC for worker is $200 for 70 frames ➔ MC per frame is $2.86, etc.

16. Assume that you can run your own business and earn $50,000 per year. If you could instead be hired by a private company and earn $30 per hour to work at home 40 hours per week, 50 weeks per year, which would you choose?

Earnings from private company are $30 × 40 × 50 = $60,000. Assuming that working hours and conditions are comparable in both jobs, you should work for the private company.

17. Given the information in the previous problem, assume instead that you must commute if you are hired by the private company. Assume that each one-way commute costs you $60. Which option would you choose?

> *You must commute 250 days per year, at a round-trip cost of $120 per day. Total cost is $30,000 per year. Your net earnings in the private company job are now $30,000, which means that you should now run your own business.*

18. If you won a contest that pays you $100,000 per year forever, how much is its present value if the interest rate is always at 10 percent?

> *The present value of a perpetual annual payment of $100,000 is $100,000 / 0.1, or $1,000,000.*

19. If each person in an economy has a comparative advantage in producing some good or service, why is trade beneficial?

> *With trade, the "economic pie" can be made bigger. See Figures 9.3 and 9.5 for examples in which consumption possibilities increase. From a supply/demand framework, see Figures 9.6 and 9.7 to see that total surplus increases when trade is open.*

20. Assume that Brett can build 3 computers per day or 6 computer printers per day. Assume also that Shannon can build 9 computers per day or 12 computer printers per day. Who has absolute advantage in production of each item? Who has comparative advantage in production of each item?

> *Shannon can build more computers per day → Shannon has absolute advantage in computer production. Shannon can build more computer printers per day → Shannon has absolute advantage in computer printer production.*
>
> *Brett gives up 2 computer printers per computer, or ½ computer per computer printer. Shannon gives up 4/3 computer printers per computer, or ¾ computer per computer printer. Find the lowest opportunity cost to find comparative advantage → Brett has comparative advantage in computer printers and Shannon has comparative advantage in computers.*

21. Joe can produce a total of 100 pounds per day of corn, peas, or a combination of the two. If the world price of corn is $1/pound and the world price of peas is $2/pound, what should Joe produce when costless trade is possible?

> *Since the opportunity cost of a pound of corn is a pound of peas (and vice versa), Joe should produce each pound that gives him the most money → Produce only peas.*

22. Using the information in the previous problem, assume that Joe produces to maximize his total revenue. If he decides to consume 80 pounds of corn, how much peas can he consume?

> *Note that even if Joe wants to consume corn, he should produce peas and sell them in exchange for corn. In this case, he will make $200 from the 100 pounds of corn. He can buy 80 pounds of corn for $80, leaving $120 for 60 pounds of peas.*

23. Assume the information in Problem 3 without a tax. Determine consumer surplus and producer surplus if no trade is possible. Do the same for this country if the world price is \$2 and costless trade can occur. How much is imported or exported by this country?

Recall P = 2Q and P = 12 – Q are the supply and demand, respectively. Q = 4 and P = 8 with no taxes and no trade. CS is a triangle with height 4 and length 4, leading to a CS of 8. PS is a triangle with height 8 and length 4, leading to a PS of 16. (Note total surplus w/o trade is 24.)

With trade leading to a price of \$2, one unit is supplied, and 10 units are demanded. This leads to 9 units being imported. CS is now a triangle with height 10 and length 10, leading to a CS of 50. PS is now a triangle with height 2 and length 1, leading to a PS of 1. (Note total surplus w/trade is 51.)

24. Assume the same as in the previous problem, except a \$1 tariff is imposed on all imports. What are consumer and producer surplus if trade is possible?

With a \$1 tariff, the price in this country will be \$3, leading to 1.5 units supplied and 9 units demanded. Here, the PS is a triangle with height 9 and length 9, leading to PS of 40.5. CS is a triangle with height 3 and length 1.5, leading to PS of 2.25. (Note total surplus here is 42.75. Total tariff revenue is 7.5 times 1, or \$7.50.)

25. Do #2 of the Chapter 11 problems (p. 341).

a. No, since each player's best response depends on what the other person does.
b. Use the underlining technique to see that (movie, movie) and (baseball, baseball) are both NE.
c. This cannot be a PD, since neither player has a dominant strategy.
d. Use a game tree, going backwards, to see that they will both buy baseball tickets.
e. Similar to (d), except that they will both buy movie tickets.

26. Bill and Doris are asked to say "yes" or "no." They make their decisions simultaneously. If both say yes, then Bill gets a payout of 5 and Doris gets a payout of 10. If both say no, then Bill gets a payout of 20 and Doris gets a payout of 3. If one person says yes and the other says no, then they both get a payout of 12. Answer the following:

- Draw the payoff matrix.
- Find all NE, if any.
- Determine if any person has a dominant strategy.
- Is this a prisoner's dilemma? Explain.
- Suppose that Doris gets to decide first, and Bill will see Doris' choice before he makes his decision. What should Doris choose? What will Bill choose? Why?
  You should draw a payoff matrix, similar to what was done in class or Ch. 11. Use the underlining technique to find that Bill saying no and Doris saying yes is a NE. Bill has a dominant strategy (no), while Doris does not have a dominant strategy. This is not a prisoner's dilemma, since Doris does not have a dominant strategy. To answer the last bullet point, note that you need to draw a game tree and work backwards. In this case, both players will make the same choice as in NE.

27. Assume that there are 10 people that have positive reservation prices for Darby's Donuts, as listed in the following table. (Assume nobody wants more than one donut.)

Person	A	B	C	D	E	F	G	H	I	J
Reservation price	\$5	\$4	\$3	\$2.50	\$2.25	\$2	\$1.75	\$1.50	\$1.25	\$1

If Darby's MC per donut is \$0.40, how many donuts will she sell? What price will she charge if she must charge the same price to everyone? What will her profit be if she has fixed costs of \$2? If she can perfectly price discriminate, how much will her profit be?

If Darby must charge the same price to everyone, her MB for the first donut is \$5; 2nd donut, \$3; 3rd donut, \$1; 4th donut, \$1; 5th donut, \$1.25; 6th donut, \$0.75; 7th donut, \$0.25; 8th-10th donuts, negative ➔ sell 6 donuts at a price of \$2 each ➔ TR = \$12.
TC = 2 + 0.4 × 6 = \$4.40
Profit = 12 – 4.40 = \$7.60
If Darby can perfectly price discriminate, she can charge \$5 to Person A, \$4 to person B, etc. This leads to a total profit of \$18.25, since she sells to all 10 people.

28. Using an efficiency argument, explain why monopolies should be controlled.
Monopolies should be controlled since they produce a level of output that is lower than what would be produced in a competitive environment. In a competitive environment w/o externalities, the outcome is usually efficient.

29. If you owned the only grocery store in the town of Los Olivos, do you have complete monopoly power over everything you sell?
No. Although you have some market power over the area, people could still go to nearby towns that have grocery stores to buy your food.

30. Suppose you are a monopoly firm with MC curve of MC = Q, and the demand for your product is denoted by P = 200 – 3Q. Determine the price and quantity that will maximize your profit. Is this outcome efficient? Why/why not?

From demand curve, MR = 200 – 6Q. Set MR = MC ➔ Q = 200 – 6Q ➔ Q = 200/7. Find price off of the demand curve → P = 200 – 3 × (200/7) = 800/7.

This outcome is not efficient, since producing an additional unit will lead to a net gain in total surplus. This is a problem in general with monopolies.

31. Assume the following: Private MC is P = Q + 100; demand is P = 500 – Q; there is an external cost of 50 for each unit produced. What is the equilibrium if there are no market interventions? What is the deadweight loss in this equilibrium? What is the efficient outcome?

With no market interventions, solve by setting Q + 100 = 500 – Q ➔ Q = 200 ➔ P = 300. The Public MC is P = Q + 150. To find the efficient outcome, set Q + 150 = 500 – Q. The efficient Q = 175. To get the price that leads to efficiency, we need to go off of the Public MC or demand curve → P = 500 – 175 = 325. If you draw your graph of this situation, you will see that the DWL triangle has length 25 (the difference in quantity) and height 50 (the marginal external cost). This triangle has area 625.

32. Use the same information as in the previous problem, except assume that there is an external benefit of 50 for each unit produced. Solve the same questions.

The equilibrium w/o market interventions is the same as before.

As for solving the efficient solution, I will alter the MC curve, giving the external benefit to the producer. You can do a similar solution by giving the external benefit to the consumer. In this case, the quantity comes out to be the same, but price is 50 higher.

Here, the Public MC is P = Q + 50. To get the efficient outcome, set Q + 50 = 500 – Q. The efficient Q = 225. Price is 500 – 225, or 275. From a graph, you will also get a triangle with length 25 and height 50 (although this is a different triangle than in the previous problem). This area is also 625.

33. Assume that you can invest as much money as you want at an interest rate of 10% per year. You can also invest in one-year-old calves, paying $1,000 for each calf today. Each calf will eat grass in a common field over the next year to become fatter. The price that you can sell your cow at age two depends on the number of calves purchased today. If one calf is purchased today, she can be sold a year from now for $1,400; 2 calves today, $1,300; 3 calves today, $1,235; 4 calves today; $1,200; 5 calves today, $1,175; 6 calves today, $1,155; 7 calves today, $1,135; 8 calves today, $1,115; 9 calves today, $1,100; 10 calves today, $1,090. How many calves will be purchased today if there are no property rights on the grassy field?

If there are no property rights, then the equilibrium occurs when the rate of return is the same as the interest rate. This occurs with 9 calves on the field, when the rate of return is 10%.

34. Using the information from the previous problem, how many calves will be purchased today if there are property rights on the grassy field? What is your willingness to pay for the grassy field? If you plan on purchasing the grassy field in a perfectly competitive market, how will you allocate your investments if you have $20,000 to invest in total?

If there are property rights on the grassy field, then the private investor wants to add another calf as long as the marginal return is at least $100 for an additional calf invested (10% return on $1,000). The marginal return on the first calf is $400, $200 for the second, $105 for the third, $95 for the fourth, and less than $95 for each calf thereafter. So the optimal investment is 3 calves. The $3,000 invested leads to a return of $705, or $405 more than what the same amount of money would return if invested at 10%. This leads to a willingness to pay of $405 / 0.1, or $4,050, for the grassy field. So a perfectly competitive market would price the grassy field at $4,050. This would lead to the buyer investing $4,050 in the grassy field, $3,000 in calves, and the remaining amount ($12,950) at the guaranteed 10%-return investment.

35. If MC of information is equal to the quantity (Q), and MB = 60 – 2Q, how many units of information will be gathered, and at what price?

Here, the marginal cost function is denoted by MC = Q. To find the optimal number of units of information, set MC = MB ➔ Q = 60 – 2Q ➔ Q = 20. The demand curve comes from MB ➔ P = 60 – 2(20) = 20.

36. Assume that there are "lemons" and "plums" in the private car market. Current owners of cars value lemons at $300 each for their cars, while plum owners value their car at $1,000 each for their cars. A local dealership is willing to offer a single price for all cars. The local dealership knows the following:

- The value of a lemon to the dealership is $600.
- The value of a plum to the dealership is $1,600.
- Half of all cars privately owned are plums, while the other half are plums.

What price should the local dealership offer? How much profit will the dealership make?

Three prices could be offered: $1,001, $301, $0. For ease of calculation, I will assume that there are only two cars in this market, one lemon and one plum. (Notice at a price of $0, the profit is $0.)

If $1,001 is offered, then both of the cars will be purchased by the dealer. The dealer then spends $2,002, and the value of the cars to the dealer is $2,200, leading to a $198 profit.

If $301 is offered, only the lemon will be purchased by the dealer. Since this car has a $600 value to the dealer, the profit is $299.

The dealer's best choice is to offer $301. This earns a profit of $299 for every two cars available on the market (one lemon purchased, one plum not purchased).

37. Solve Problem 13 using a value of marginal product of labor approach.

MC of each worker is $200. VMP of the first worker is $500, $1,000 for the second worker, $700 for the third worker, $300 for the fourth worker, $250 for the fifth worker, and $150 for the sixth worker. VMP is higher than $200 for the first five workers, and so five workers should be hired.

38. Joseph can build pots with his bare hands, but he must rent a cubicle in a nearby office building to build his pots. Rental of the cubicle is $12 per hour, and Joseph needs $5 in clay costs for each pot he builds. If Joseph can build 3 pots per hour, and there are many competitive firms that Joseph can sell pots to for $25 each, how much money will Joseph expect to earn per hour if he builds pots?

For each hour of labor, Joseph's costs are $12 (cubicle) and $15 (material for 3 pots), or $27 total. For the three pots sold, he receives $75. He can expect to make $75 – $27, or $48, per hour.

39. If a day in the hospital costs $10,000 per day, and you demand hospital care based on the demand P = $20,000 – 2,000 Q, how many days will you stay in the hospital under each of the following situations:

- Full insurance with no co-payment
- A co-payment of 20% of your bill
- No insurance

With full insurance, the patient will stay in the hospital until MB = 0. To find the number of days in the hospital under these conditions, set 0 = 20,000 – 2,000Q ➔ Q = 10.

With a 20% co-payment, the patient will stay in the hospital until MB is 20% of the daily cost, or $2,000 ➔ set 2,000 = 20,000 – 2,000Q ➔ Q = 9.

With no insurance, set MC = MB ➔ 10,000 = 20,000 – 2,000Q ➔ Q = 5.

40. What is the lost surplus (if any) of the three situations above, relative to the efficient outcome?

Lost surplus with full insurance: Triangle with 5 days more than efficient, with height 10,000 ➔ Lost surplus is $25,000.

Lost surplus with 20% co-payment: Triangle with 4 more days than efficient, with height 8,000 (derived from 10,000 – 2,000) ➔ Lost surplus is $16,000.

No lost surplus when there is no insurance, since the patient will stay in the hospital until MC = MB.

41.

Tons of smoke emitted per day	4	3	2	1	0
Total abatement cost, firm A	$0	$20	$50	$150	$300
Total abatement cost, firm B	$0	$15	$35	$60	$90
Total abatement cost, firm C	$0	$5	$100	$300	$600

Use the table above to determine an optimal way to reduce 5 tons of smoke per day.

Find the lowest MC of abatement for each ton of smoke:

- *Firm C has lowest cost of abating its first ton, at a MC of $5*
- *Firm B is next, at $15*
- *Firm A has MC of $20 to abate its 1st ton, while firm B has MC of $20 to abate its 2nd ton ➔ both will be abated*
- *For the 5th ton to abate, firm B's MC of abating the 3rd ton is $25. This is less than the MC of the other firms for its next ton of abatement.*

So firms A and C will abate one ton, while firm B abates 3 tons.

42. One hundred people demand a public good privately based on the following equation: P = 1 – 0.02 Q. Marginal cost of the public good is 20. How much of the good will be provided if people need to privately purchase the good? How much of the good will be provided in an efficient outcome?

No individual has a WTP that is more than 1. So in the private market, nobody will purchase this good.

As a public good, we can vertically sum the 100 demand curves to get the public demand ➔ P = 100 – 2Q. Since MC is 20, we set 100 – 2Q = 20 to get the efficient outcome ➔ Q = 40.