Problem Set #5 Solutions
ECON 2106H - J. Turner

1)

i) **Income Consumption Curve (ICC)**: Optimal combinations of X and Y (where Y usually represents "all other goods"), keeping prices fixed, and letting income vary.

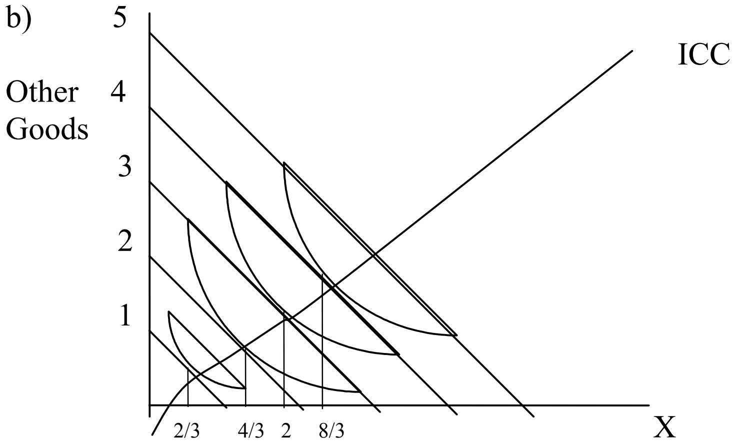
ii) **Engel Curve**: Relationship between the quantity of a good consumed and income.

a) Slope of budget constraint = $\frac{-P_x}{P_y}$

Examination of the graph shows the slope of the budget constraint to be -1, so...

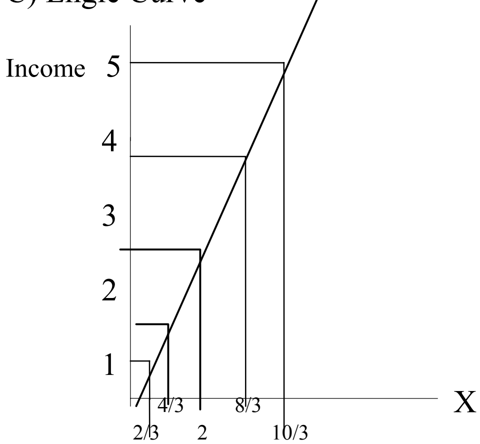
$-1 = \frac{-Px}{1}$ which can easily be solved for P_x=1.

b)

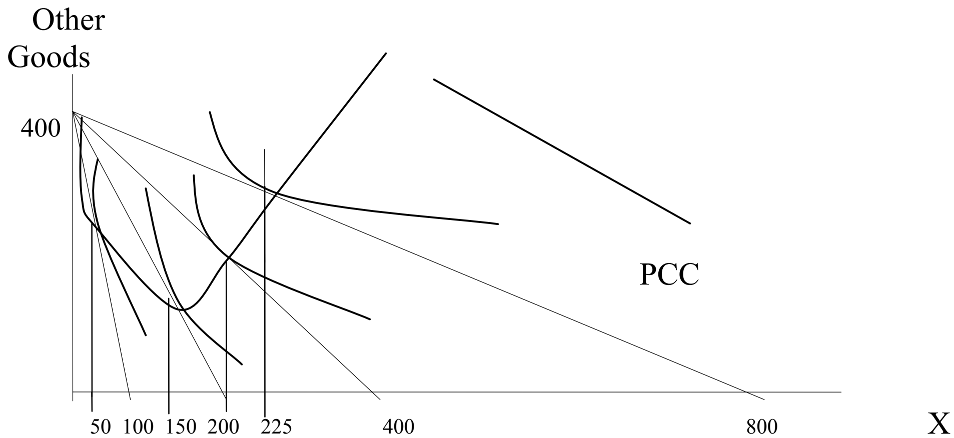


Note that all arcs should be tangent to the budget constraints.

C) Engle Curve



2) i) **Price Consumption Curve:** For a given (i.e. fixed) income and price of y (generally assumed to be all other goods), the PCC is the set of optimal bundles of x and y for different prices of good x.
   ii) **Demand Curve:** The amount that an individual or a market is willing to buy at different prices for the good.

a)


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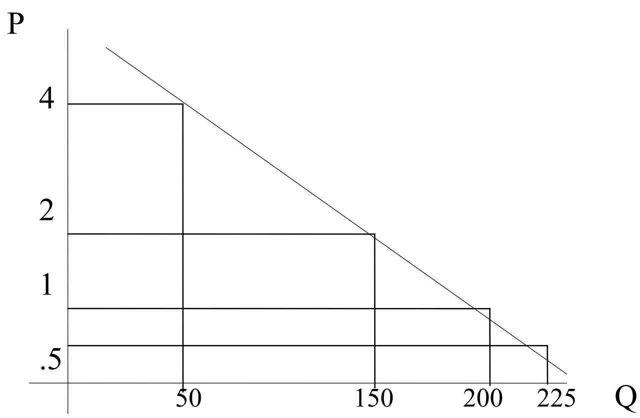
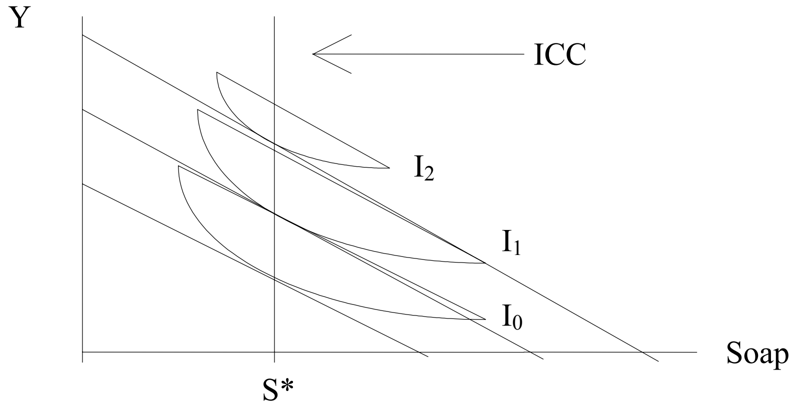
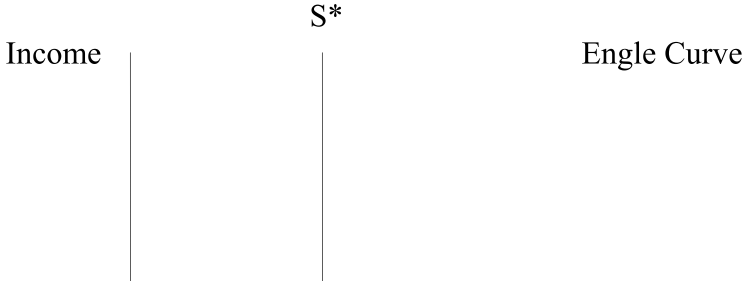
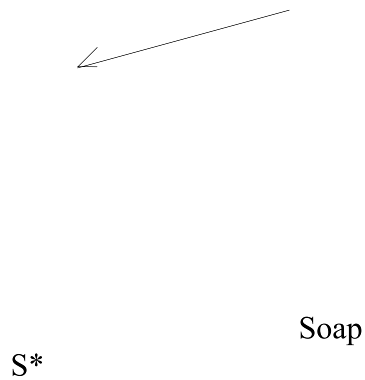


Note: Not all demand curves are straight lines, this example just happened to work out like this.

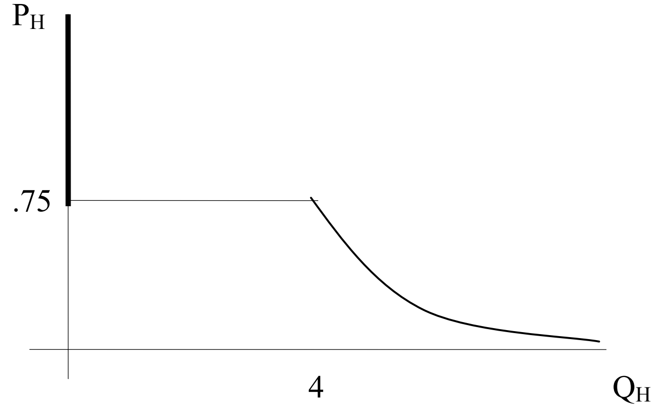
3)




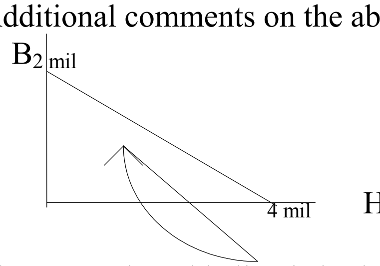


4)

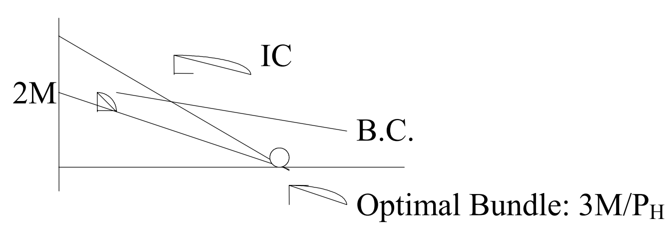
a) In part (a) , we showed that if bacon costs \$1.50 per pound, and hamburger costs \$1.00 per pound, that *no* hamburger was purchased. This is one point on a demand curve for hamburger (i.e. P=\$1.50 Q=0). In fact, for any price less than \$.75/pound, Q_D=0, using the same analysis as we did in problem 3a). At a price of \$.75/pound, Elvis is indifferent between any point on his budget constraint, and thus the demand curve is flat at \$.75 from Q_H=0 to Q_h=4M. (Note: This analysis assumes the price of bacon is constant).



Additional comments on the above demand curve derivation:

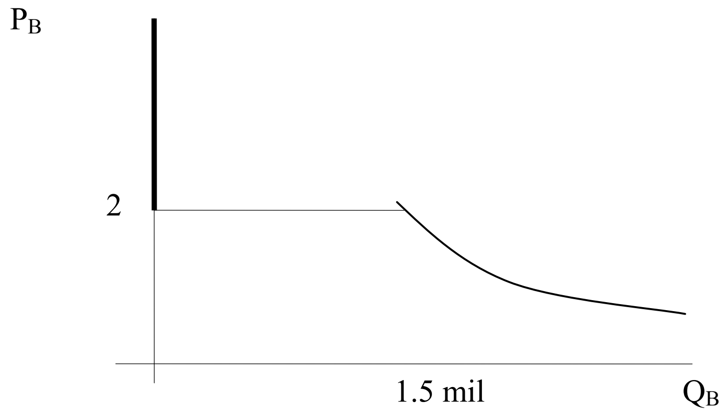


If P_H =.75 then this line is both the budget constraint and Elvis' highest indifference curve.



If P_H=.75, then we can see above that Elvis consumes only hamburger Q_H= 3 mil/P_H. This is the part of Elvis' Demand curve with Q higher than 4 mil.

The same analysis as above can give us Elvis' Demand Curve for Bacon (assumes price of hamburger fixed at \$1).

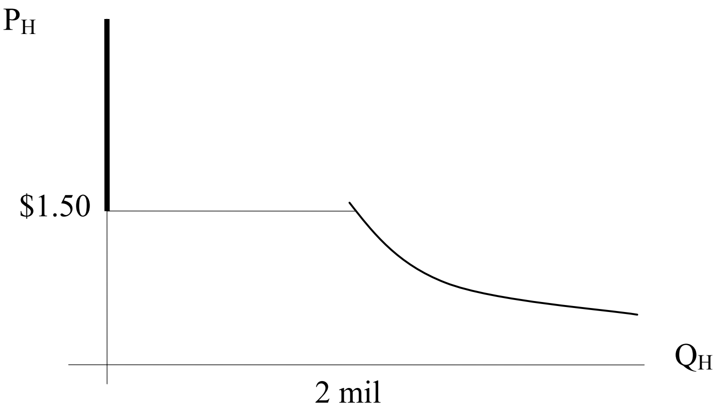


4 b)

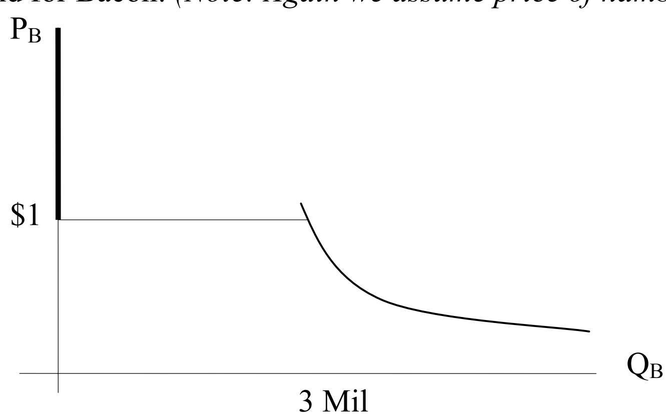
In part b) we assume Elvis' preferences change so that now the slope of his indifference curve is -1 (vs. Previously -2 .... if you are confused see the answer sheet to problem set #3...problem #3, parts a & b)

Now his demand curves are:

Demand for **Hamburger:** *(Note: Again we assume the price of bacon fixed at $1.50*)



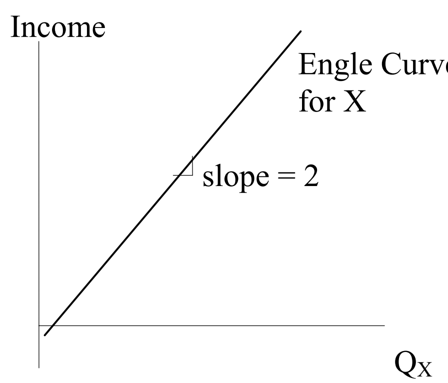
Demand for Bacon: *(Note: Again we assume price of hamburger is fixed at $1.)*

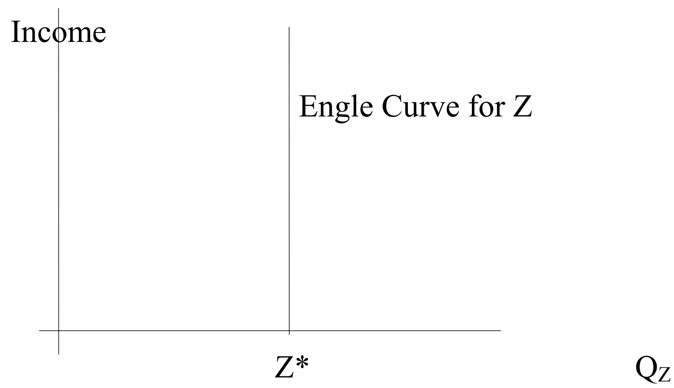


5)

a) i) Perfect Compliments (e.g. left and right shoes)

ii) Some good like salt. It doesn't matter what your income is, you will always consume about the same amount of salt.

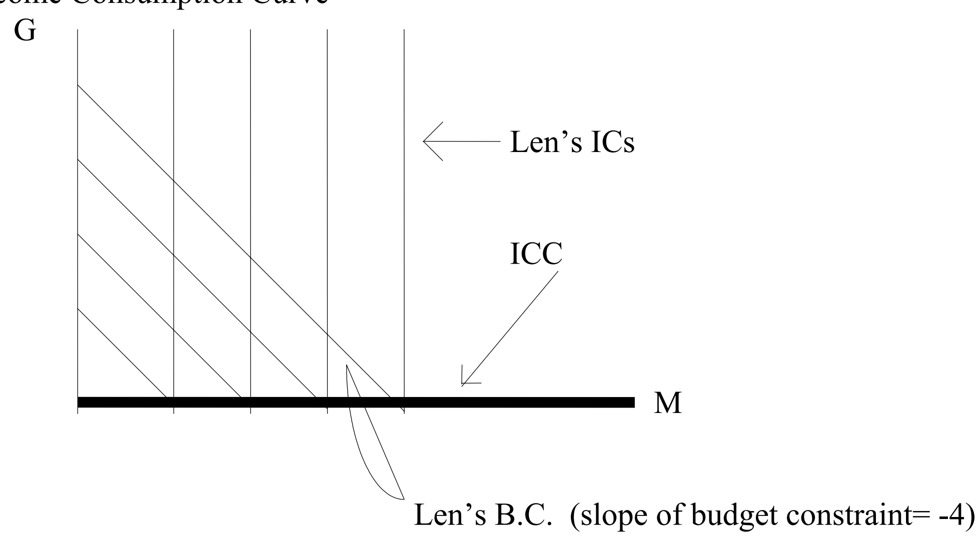




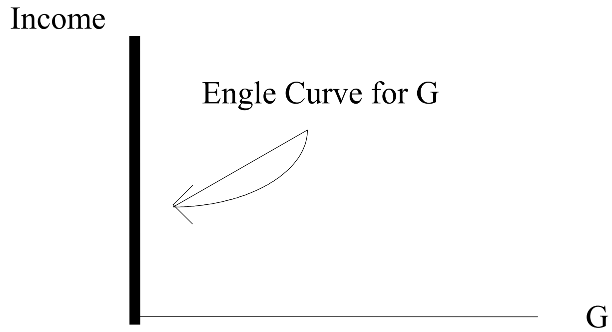
c) Yes

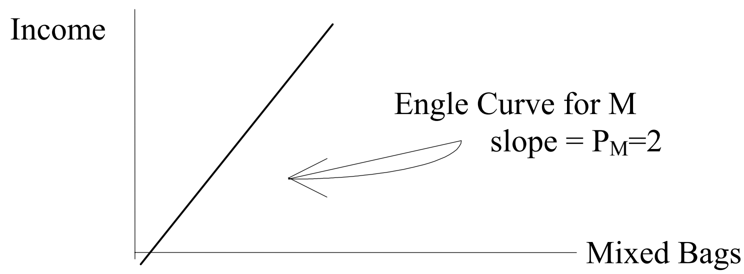
6)

a) Income Consumption Curve



b) Engle Curve





Engle Curve for M: Since Len spends all of his income on M, his Engle Curve is:

$$P_M Q_M = \text{Income}$$
$$2Q_M = \text{Income}$$

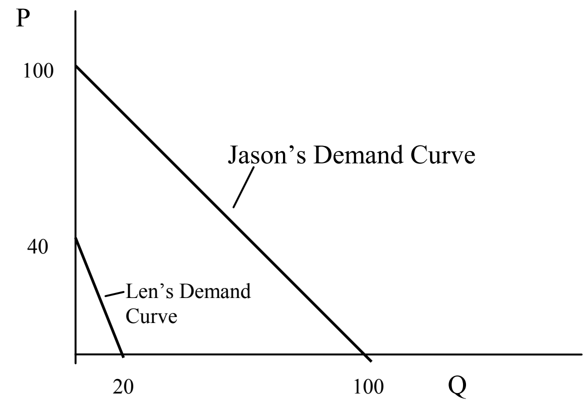
7.

The crucial assumption that is being made when indifference curves are "infinitely close together" is that individuals have preferences over goods that are defined even to fractions of goods. This means that I can evaluate, for example, my value of 1.34 M&M's, and compare that to my value of 1.35 M&M's. Clearly, this assumption makes more sense for some goods (like coke) than for others (like compact disks). Nonetheless, it is an assumption that is always implicit in the definition of indifference curves.

So what is the rationale for doing this? The simplest answer is mathematical and graphical simplicity. Perfect divisibility is what allows us to draw smooth demand curves, Indifference curves, and virtually all other curves we draw. Other than allowing us to solve for fractional values, however, the assumption of divisibility of goods does not change the outcome of the analysis.

It is for this reason, that some answers you may get in economics will be fractional.

8. a)



b) Demand curve is a crooked line as shown below. This is how you do it.

Step 1. Convert equations for individual demand curves to:
Q=100-P and Q=20-.5P

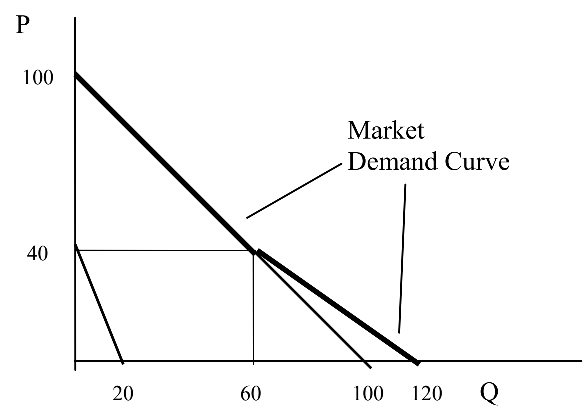
Step 2. The horizontal sum of these two lines is Q=120-1.5P, (which is the same as P=80 - (2/3)Q after doing a little algebra)

Step 3. This is not the market demand yet since for prices greater than **40 Len's quantity demanded of coffee is zero** and not a negative amount. When the price is greater than 40, the market demand curve is the same as that part of Jason's demand curve since Jason is the only individual willing to purchase any of X when the price is above 40.

Step 4. Therefore, the demand curve is a kinked line like below, where:

$$P = \begin{cases} 100-Q & \text{if } Q<=60 \text{ (i.e., } P>=40) \\ 80-(2/3)Q & \text{if } Q>=60 \text{ (i.e., } P<=40) \end{cases}$$

c)



d) Best way to do this is to horizontally sum the demand curves that look like Jason's and then horizontally sum the demand curves that look like Len's.

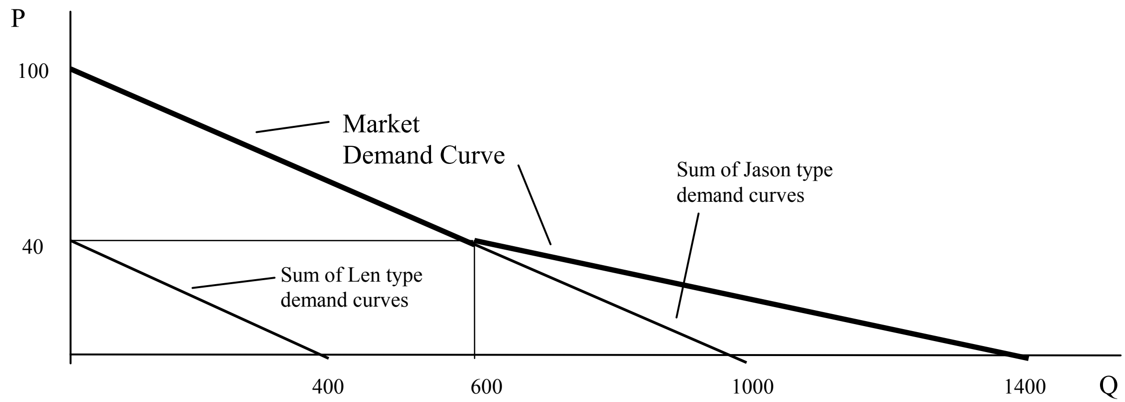
Step 1. Again, convert equations for individual demand curves to:
Q=100-P for Jason and Q=20-.5P for Len.

Step 2. The horizontal sum of 10 of Jason's demand curves gives us Q=10(100-P)=1000-10P,

(which is the same as P=100 - .1Q after doing a little algebra)

Step 3. The horizontal sum of 20 of Len's demand curves gives us Q=20(20-.5P)=400-10P, (which is the same as P=40 - .1Q after doing a little algebra)

Step 4. Graph the sums of the two types of demand curves to see what is happening:



Step 5. Now horizontally sum Q=1000-10P and Q=400-10P, which gives us:
Q = 1400 - 20P (which is the same as P=70 - .05Q after doing a little algebra)

Step 6. Again, this is not the market demand yet since for prices greater than **40 people with Len's type of demand curve have a quantity demanded of coffee that is zero** and not a negative amount. Therefore, when the price is greater than 40, the market demand curve is the same as that part of the sum of 10 Jason type demand curves since these 10 individuals are the only people willing to purchase any of X when the price is above 40.

Step 7. Therefore, the demand curve is a kinked line like the graph above shows, where:

$$P = \begin{cases} 100-.1Q & \text{if } Q<=600 \text{ (i.e., } P>=40) \\ 70-.05Q & \text{if } Q>=600 \text{ (i.e., } P<=40) \end{cases}$$

9. (Note when you see X in the demand curve it is the same thing as Q (i.e., the quantity of X)

a) **PX + Y = 100**

b) First, recognize that for any price of X, the optimal combination of the two goods results in the amount of X being equal to the amount of Y, or mathematically X=Y (due to the shape of the indifference curves – these are perfect complements – like shoes). Now, substitute X=Y into the budget constraint to get: PX + X =100. After a little algebra we get **P = -1 + 100/X**, which is the demand curve for X. As you can see this is not a straight line, but is curved (although it still has the required property that the quantity of X demanded decreases as P increases.)

c) Remember, to get a market demand curve first get the demand curve in the following form:

X = 100/(1+P)

Then, if we want to horizontally sum 50 of these identical demand curves together, multiply the right hand side by 50 to get X = 5000/(1+P). Last do some algebra to get the demand curve in the form **P = -1 + 5000/X**, which is the market demand curve.