

Fall 2023

ECO2011 L07-10

BASIC MICROECONOMICS

Oct 24, 2023

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Written assignment #02

Instructions:

- 1) Submit by 15:59 p.m. on Nov. 03 (Friday), 2023 to the assignment drop box located on the 3rd floor of Zhiren building.
- 2) Late submission is not allowed. If there is reason that a late homework is accepted, at least 21 (out of 100) marks will be deducted.
- 3) Your answers must be in English.
- 4) Your answers must be in hand writing. Photocopy, computer printout or electronic submission will not be accepted.
- 5) Write down your name and student ID on the top of the front page of the answer sheets. Submission without a name or student ID will receive zero mark.
- 6) Once you have submitted your assignment work to the drop box, you cannot take it back or change any part of the answers.
- 7) If you submit more than one copy of the assignment work, the teaching assistants /or graders will randomly choose a copy to grade, and /or give you the lowest score among all your assignment work submissions.
- 8) Write on both sides of papers.
- 9) There is no need to copy the questions.
- 10) Use a pen /or a ball pen.
- 11) Staple your answer sheets if there is more than one sheet. If you do not staple your answer sheets, only the sheet that shows your name and student ID will be graded.
- 12) If you think there is chance of getting stuck, blocked, or locked down in your home town and cannot come back campus to submit your homework, work out your assignment work early and mail it to the teaching assistants' office (3rd floor, Zhiren building) by express delivery and make sure it arrives before the deadline.
- 13) If you have any question related to the submission of this written assignment, ask in Forum#2 on BB.
- 14) Read the University policy regarding academic honesty before doing this assignment.

Question 1

Suppose a technological advance reduces the cost of making computers.

- a) Draw a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for computers.

### Question 1

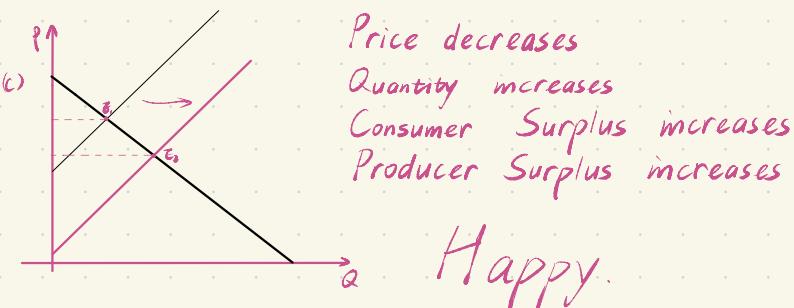
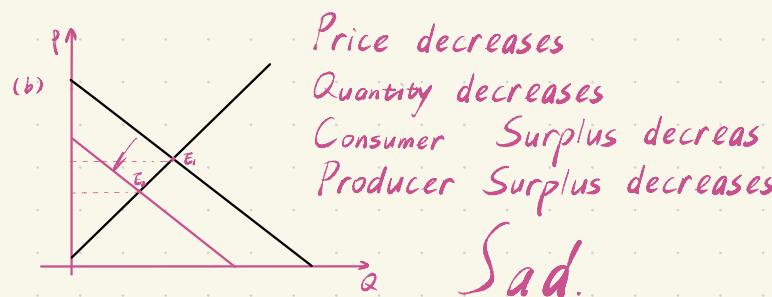
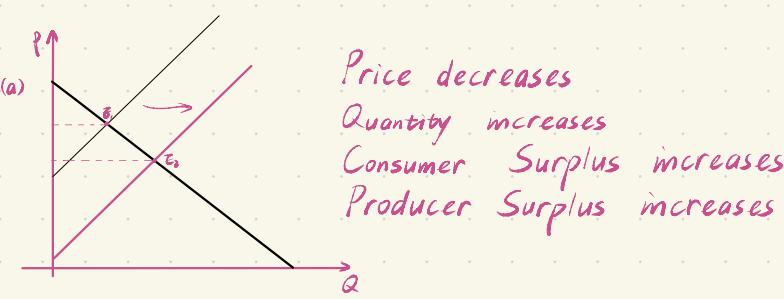
Suppose a technological advance reduces the cost of making computers.

a) Draw a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for computers.

b) Computers and adding machines (calculators) are substitutes. Use a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for adding machines. Should adding machine producers be happy or sad about the technological advance in computers?

c) Computers and software are complements. Draw a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for software. Should software producers be happy or sad about the technological advance in computers?

d) Does this analysis help explain why software producer Bill Gates is one of the world's richest men?



Happy.

(d) Software producers should generally be happy about the technological advance in computers. The decrease in computer costs leads to an increase in computer usage and, subsequently, a rise in the demand for software. This can result in increased sales and potentially higher profits for software producers. Bill Gates, as one of the pioneers in the software industry with Microsoft, has undoubtedly benefited from this increased demand for software, contributing to his wealth.

- b) Computers and adding machines (calculators) are substitutes. Use a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for adding machines. Should adding machine producers be happy or sad about the technological advance in computers?
- c) Computers and software are complements. Draw a supply-and-demand diagram to show what happens to price, quantity, consumer surplus, and producer surplus in the market for software. Should software producers be happy or sad about the technological advance in computers?
- d) Does this analysis help explain why software producer Bill Gates is one of the world's richest men?

	TC	TR	Profit	MP
1	1	3.5	2.5	3.5
2	3	7	4	2.5
3	6	10.5	4.5	1.5
4	10	14	4	0.5

Question 2

Mary enjoys baking cupcakes and selling them. Because her kitchen space is limited, making large numbers of cupcake is more costly than making small amounts. Here is the cost she incurs to produce each cupcake:

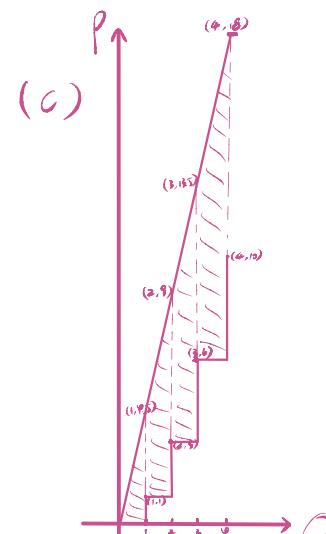
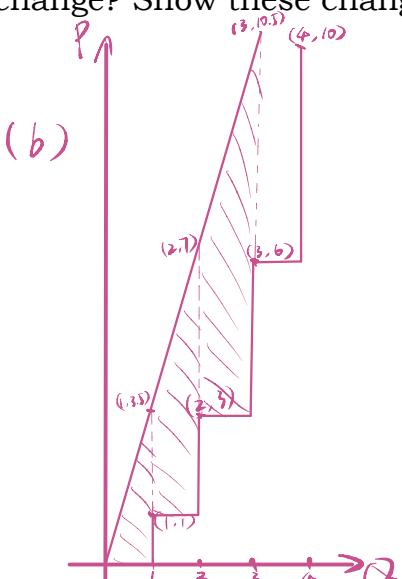
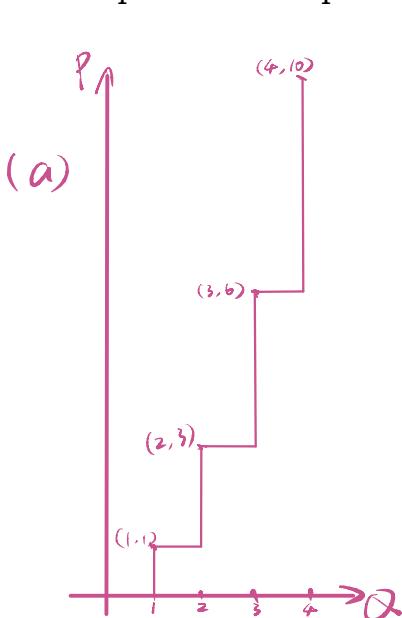
Cost of first cupcake	\$1
Cost of second cupcake	\$2
Cost of third cupcake	\$3
Cost of fourth cupcake	\$4

Quantity Supplied	Cost	Price?
1	\$1	
2	\$3	
3	\$6	
4	\$10	

a) From this schedule, derive Mary's supply schedule. Graph her supply curve for cupcakes.

b) If the price of a cupcake is \$3.5, how many cupcakes does Mary produce and sell? How much producer surplus does she get from these sales? Show here producer surplus in your graph.

c) If the price rises to \$4.5, how does quantity supplied change? How does Mary's producer surplus change? Show these changes in your graph.



$$PS_2 = \frac{1}{2} \times 3.5 \times 1 + \frac{1}{2} \times (2.5+3) \times 1 + \frac{1}{2} \times (4+1.5) \times 1 = 9.25 (\$)$$

$$PS_3 = \frac{1}{2} \times 4.5 \times 1 + \frac{1}{2} \times (3.5+6) \times 1 + \frac{1}{2} \times (6+7.5) \times 1 + \frac{1}{2} \times (7.5+8) \times 1 = 21.5 (\$)$$

### Question 3

Four professors are willing to pay the following amounts for dormitory room cleaning service on campus:

Xu: \$7    Luo: \$2    Zhu: \$8    Cai: \$5

Four ladies (in Chinese, “A Yi”), S, T, U, V, can provide room cleaning service with the following costs:

S: \$3    T: \$6    U: \$4    V: \$2

Suppose that each lady has the capacity to produce only one room cleaning service.

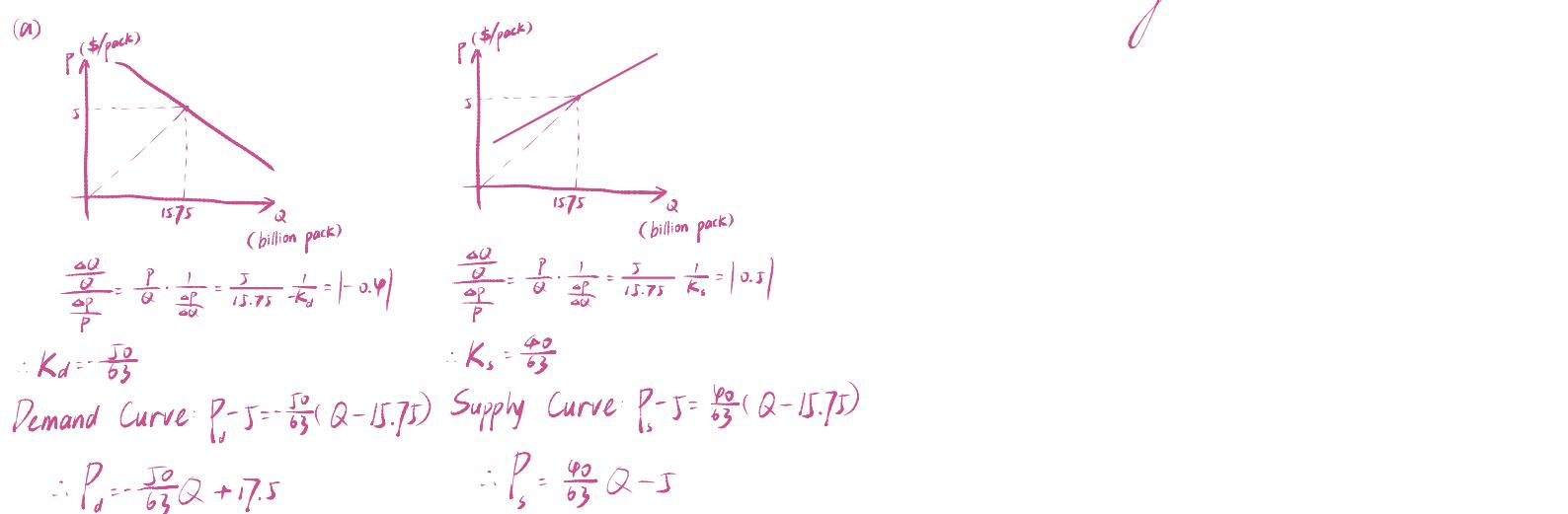
- For efficiency, how many units of room cleaning service should be taken and given?
- Which ladies should provide service and which professors should have their room cleaning services?
- How large is the maximum possible total surplus?

### Question 4

In 2010, Americans smoked 315 billion cigarettes, or 15.75 billion packs of cigarettes. The average retail price (including taxes) was about \$5.00 per pack. Statistical studies have shown that the price elasticity of demand is -0.4, and the price elasticity of supply is 0.5.

- Using this information, derive demand and supply curves for the cigarette market if demand and supply curves are both linear.
- In 1998, Americans smoked 23.5 billion packs cigarettes, and the retail price was about \$2.00 per pack. The decline in cigarette consumption from 1998 to 2010 was due in part to greater public awareness of the health hazards from smoking, but was also due in part to the increase in price. Suppose that the entire decline was due to the increase in price. What could you deduce from that about the price elasticity of demand (use mid-point method if applicable)?

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### Question 3

Four professors are willing to pay the following amounts for dormitory room cleaning service on campus:

Xu: \$7    Luo: \$2    Zhu: \$8    Cai: \$5

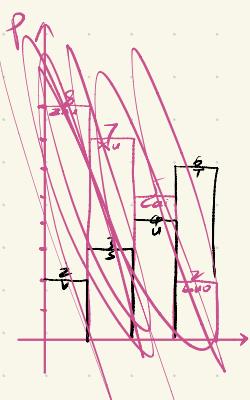
Four ladies (in Chinese, "A Yi"), S, T, U, V, can provide room cleaning service with the following costs:

S: \$3    T: \$6    U: \$4    V: \$2

Suppose that each lady has the capacity to produce only one room cleaning service.

- a) For efficiency, how many units of room cleaning service should be taken and given?  
b) Which ladies should provide service and which professors should have their room cleaning services?  
c) How large is the maximum possible total surplus?

3



Professors	Ladies
Zhu	U
Xu	S
Cai	V

$$(C) (8+7+5)-(4+3+2) = 11$$

Using the midpoint method, we can calculate the percentage change in quantity demanded and percentage change in price:

$$\text{Percentage change in quantity demanded} = [(15.75 - 23.5) / ((15.75 + 23.5)/2)] \times 100\% = -32.9\%$$

Q4 (b)

$$\text{Percentage change in price} = [(\$5 - \$2) / ((\$5 + \$2)/2)] \times 100\% = 85.7\%$$

We know that the price elasticity of demand is  $-0.4$ . Using this information, we can determine the approximate percentage change in quantity demanded due to a percentage change in price:

$$\% \text{ change in quantity demanded} = -0.4 \times \% \text{ change in price}$$

Since we know that the entire decline in cigarette consumption from 1998 to 2010 was due to the increase in price, we can equate the percentage change in quantity demanded due to the price increase ( $-32.9\%$ ) with the percentage change in quantity demanded predicted by the price elasticity of demand ( $-0.4 \times 85.7\% = -34.28\%$ ).

Therefore, the actual percentage change in quantity demanded ( $-32.9\%$ ) is close to the predicted percentage change in quantity demanded ( $-34.28\%$ ) using the price elasticity of demand of  $-0.4$ . This suggests that the price elasticity of demand for cigarettes is relatively inelastic (less than 1), which means that an increase in price leads to a proportionately smaller decrease in quantity demanded.

### Question 5

Fill in the blanks of the table below (use mid-point method to calculate price elasticity of demand, and express price elasticity of demand as a positive number).

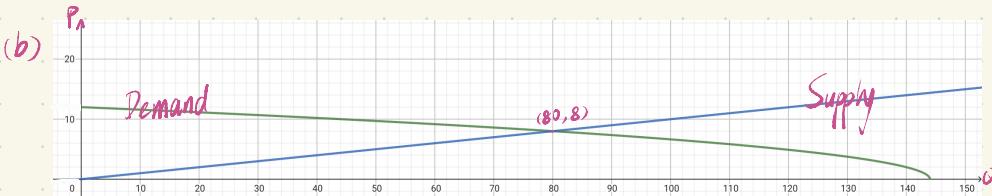
Q	P	TR	MR	%ΔP	%ΔQ	Price elasticity of demand	Description of demand
0	8	0	-	-	-	-	-
10	7	70	7	-0.133	2	15.54?	elastic
20	6	120	5	-0.154	1.5	9.74	elastic
30	5	150	3	-0.182	0.9	2.20	elastic
40	4	160	1	-0.222	0.286	1.29	elastic
50	3	150	-1	-0.286	0.222	0.78	inelastic
60	2	120	-3	-0.4	0.182	0.46	inelastic
70	1	70	-5	-0.666	0.154	0.23	inelastic
80	0	0	-7	-0.8	0.133	0.07	inelastic

### Question 6

The demand and supply curves are:

$\{ Q_d = 144 - P^2 ; Q_s = 10 \times P \}$ , where P is the price, and  $Q_d$  and  $Q_s$  are quantity demanded and quantity supplied (See Notes:- Differentiation of polynomials at the end of this assignment).  $P = \sqrt{144 - Q}$

- Find the inverse demand curve (Price as a function of quantity demanded).
- Plot the demand and supply curve. → 8
- Find the equilibrium price and equilibrium quantity. 80
- Express the price elasticity of demand as a function of the price.
- Find the point along the demand at which demand is unit elastic.
- Find the price elasticity of demand at the market equilibrium.
- Is demand elasticity, unit elastic or inelastic at the market equilibrium?



$$(d) E = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta P}{P}} = \frac{P}{Q} \cdot \frac{\Delta Q}{\Delta P} = \frac{P}{140P - P^2} \cdot (-2P) = \frac{-2P^2}{140P - P^2}$$

(e)  $|E| = 1$   $P = 4\sqrt{3} \approx 6.93$   $Q_d = 96 \therefore$  The point: (96, 6.93)

$$(f) E = \frac{-2(8)^2}{140P - 8^2} = -\frac{32}{15} \approx -2.13$$

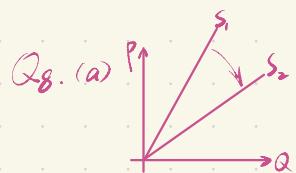
(g)  $|E| > 1 \therefore$  elastic

Set  $(P_1, Q_1), (P_2, Q_2)$  2 points on the demand curve

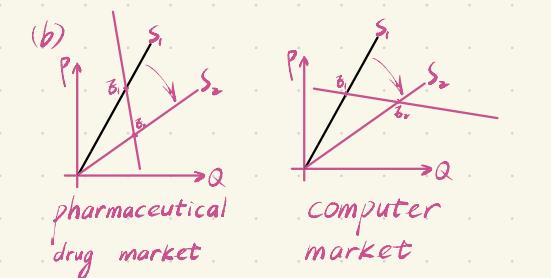
Q7. (a)  $E_I = \frac{\frac{\Delta Q}{Q}}{\frac{\Delta I}{I}} = \frac{1}{3}$  The price of food is constant  $\therefore Q$  is proportional to  $I \therefore E_I = 1$

(b) Assume her income is constant, the total amount of money she spends on food is fixed set to  $I$ ,

$$I_1 = P_1 Q_1 = P_2 Q_2 \quad E_p = \frac{\frac{Q_2 - Q_1}{Q_1}}{\frac{P_2 - P_1}{P_1}} = \frac{\frac{I_1 - I_2}{I_1}}{\frac{P_2 - P_1}{P_1}} = \frac{\frac{1}{P_1} - \frac{1}{P_2}}{\frac{P_2 - P_1}{P_1}} = -\frac{P_1}{P_2} \quad \text{Ep isn't a constant}$$

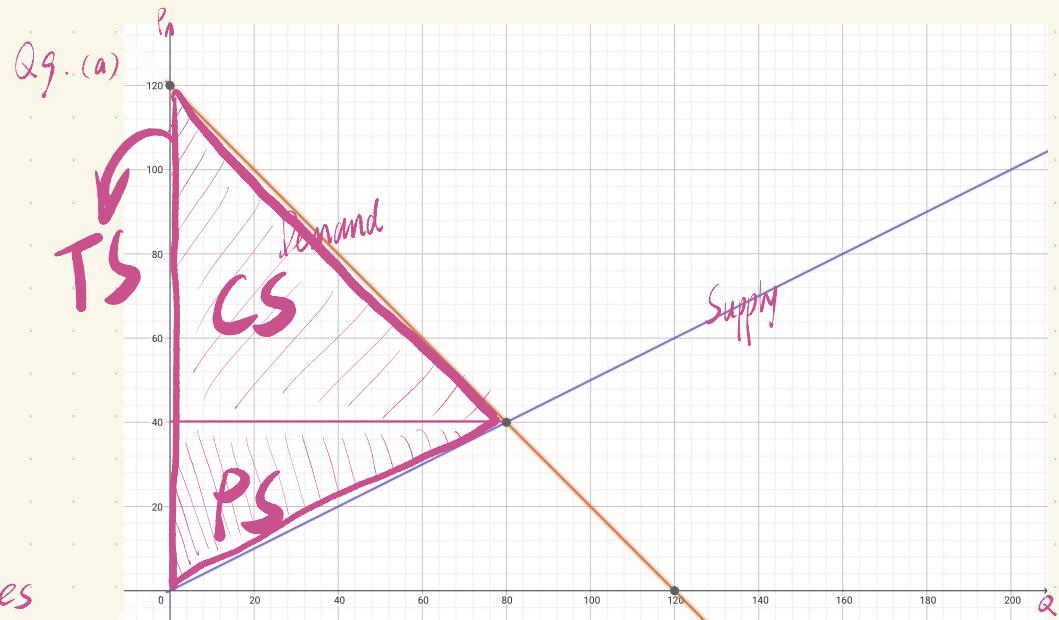


Assume the slope of  $S_1$  is  $K$ , then the slope of  $S_2$  is  $\frac{1}{2}K$ .



equilibrium price decreases

equilibrium quantity increases



(b) point of equilibrium: (80, 40)

price: \$40  $Q_d = Q_s = 80$  kg

$$(c) CS = \frac{1}{2} \times 80 \times (120 - 40) = 3200 \text{ (\$)}$$

$$PS = \frac{1}{2} \times 80 \times 40 = 1600 \text{ (\$)}$$

$$TS = CS + PS = 4800 \text{ (\$)}$$

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## Question 7

Susan has decided always to spend one-third of her income on food.

- What is her income elasticity of demand for food?
- What is her price elasticity of demand for food?

## Question 8

We consider the pharmaceutical drugs market and computer market. Suppose that pharmaceutical drugs have an inelastic demand, and computers have an elastic demand. Suppose that technological advance doubles the supply of both products (that is, the quantity supplied at each price is twice what it was).

- Draw the old and the new supply curves (assume they are straight lines).
- What happens to the equilibrium price and quantity in each market (what are the directions of changes of equilibrium price and quantity)?
- Which product experiences a larger change in price? ... drug
- Which product experiences a larger change in quantity? computer
- What happens to total consumer spending on each product? increases

## Question 9

$$P_{100} \quad P = \frac{1}{2}Q$$

Suppose demand and supply functions in a market are:

$\{ Q_d = 120 - P ; Q_s = 2 \times P \}$ , where P is the price (measured in \$), and  $Q_d$  and  $Q_s$  are quantity demanded and quantity supplied, respectively, (measured in kg).

- Draw the demand and supply curves. Label the axes and the curves.
- Find P,  $Q_d$  and  $Q_s$  in equilibrium.
- Calculate the consumer, producer and total surpluses in equilibrium, and indicate the surpluses in your diagram in part (a).
- Suppose that the government now imposes a tax, which is a per-unit tax and the rate is \$30 /kg, on sellers. Draw a new diagram showing the demand curve, the old and the new supply curves, label the axes and the curves, and indicate the new consumer, producer and total surpluses.
- Calculate the new consumer, producer and total surpluses with the government tax, and indicate the surpluses in your diagram in part (d). Calculate also the government tax revenue and deadweight loss, and indicate them in your diagram in part (d).

$$(e) NCS = \frac{1}{2} \times 60 \times (120 - 60) = 1800 (\$)$$

$$NPS = \frac{1}{2} \times 60 \times (60 - 30) = 900 (\$)$$

$$NTS = NCS + NPS = 2700 (\$)$$

$$Tax = 30 \times 60 = 1800 (\$)$$

$$DWL = \frac{1}{2} \times 30 \times 20 = 300 (\$)$$

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\*\*\*\*\* End \*\*\*\*\*

Notes: Differentiation of polynomials

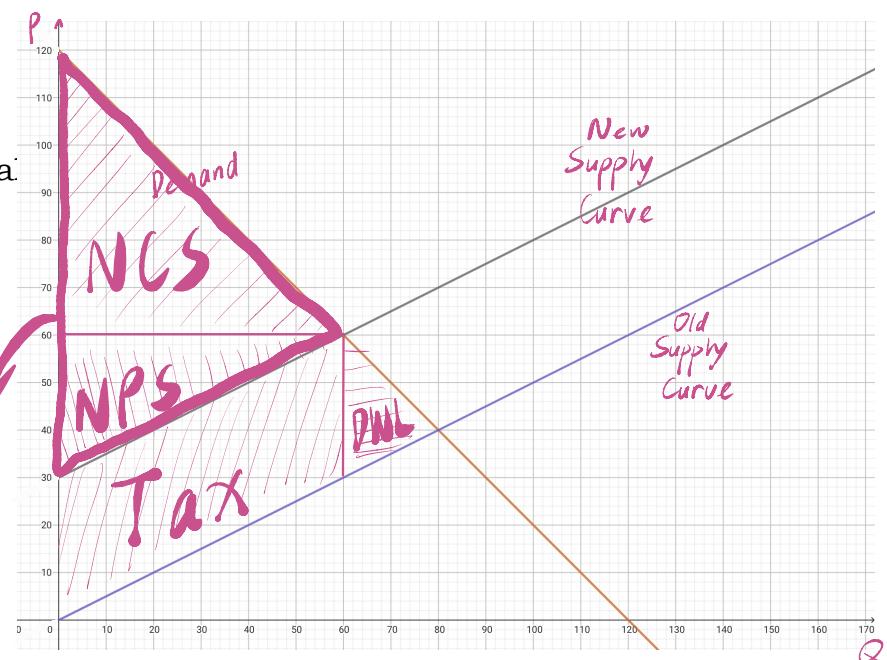
$$\frac{d}{dx}(a) = 0$$

$$\frac{d}{dx}(a \cdot x) = a$$

$$\frac{d}{dx}(x^n) = n \cdot x^{n-1}$$

$$\frac{d}{dx}(a \cdot x^n) = a \cdot n \cdot x^{n-1}$$

NTS

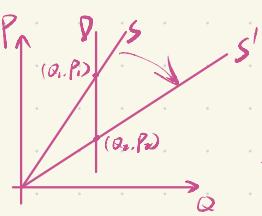


$$\text{If } y(x) = a + b \cdot x + c \cdot x^2 + d \cdot x^3 + \dots$$

$$\frac{dy(x)}{dx} = 0 + b \cdot 1 \cdot x^{1-1} + c \cdot 2 \cdot x^{2-1} + d \cdot 3 \cdot x^{3-1} + \dots = b + 2c \cdot x + 3d \cdot x^2 + \dots$$

我迷惑了 但是我光承认之前是混成 CS3 我是SB  
药，需求受价格的影响很小  $\Rightarrow$  无论价格怎么变，人们只需要基本上  
一定的量

夸张一点：



"Customer Spending" 是不是应该是  $Q \times P$ ?

那我假设  $Q$  不变  $\cancel{Q}P > \cancel{Q}P_2$ ? drug 是  
 $decrease$ ??

Computer 因理? increase?

