25

Monopoly Behavior

How Should a Monopoly Price?

- So far a monopoly has been thought of as a firm which has to sell its product at the same price to every customer. This is uniform pricing.
- Can price-discrimination earn a monopoly higher profits?

Types of Price Discrimination

- 1st-degree: Each output unit is sold at a different price. Prices may differ across buyers.
- 2nd-degree: The price paid by a buyer can vary with the quantity demanded by the buyer. But all customers face the same price schedule. *E.g.,* bulk-buying discounts.

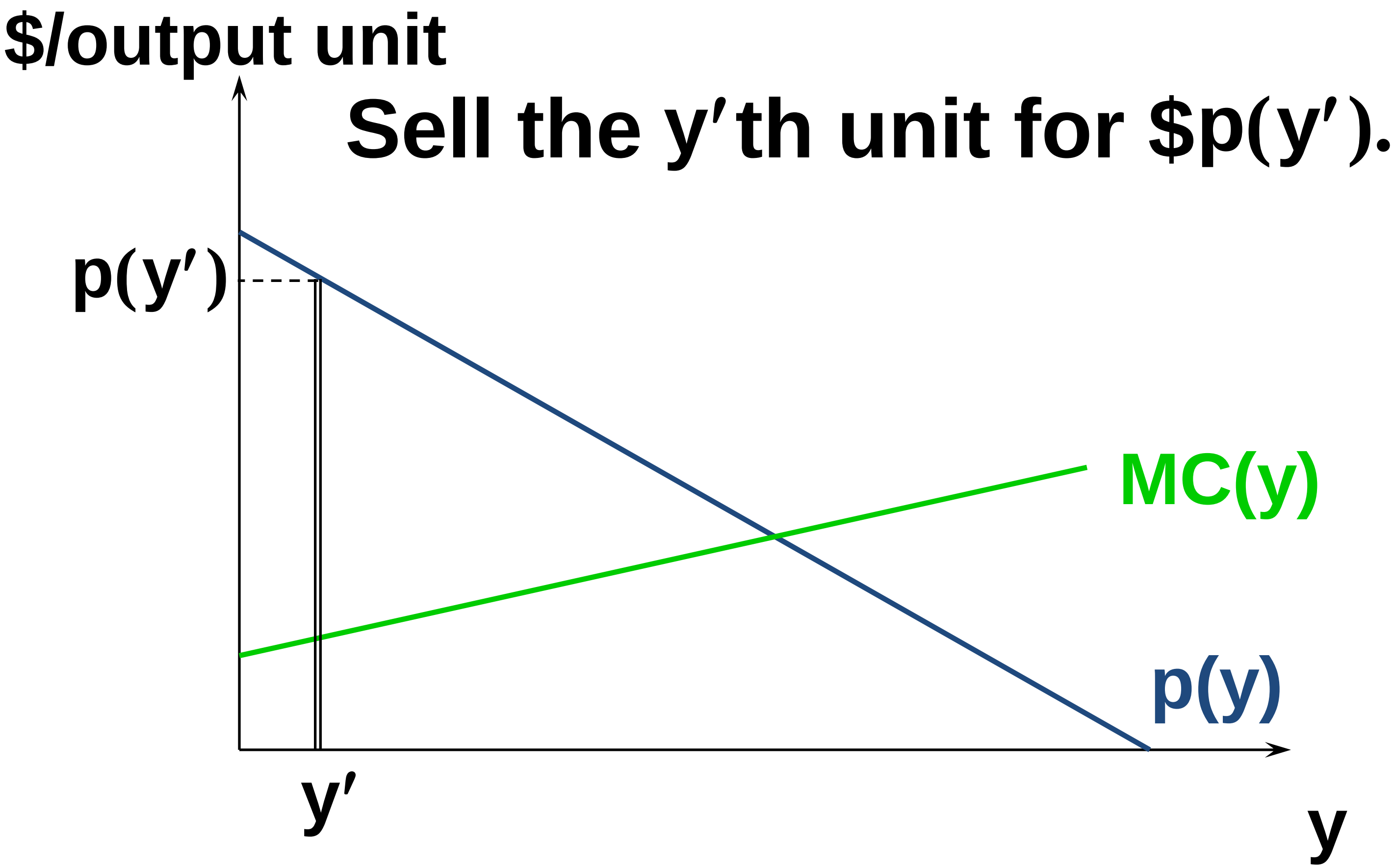
Types of Price Discrimination

- 3rd-degree: Price paid by buyers in a given group is the same for all units purchased. But price may differ across buyer groups. *E.g.*, senior citizen and student discounts *vs*. no discounts for middle-aged persons.

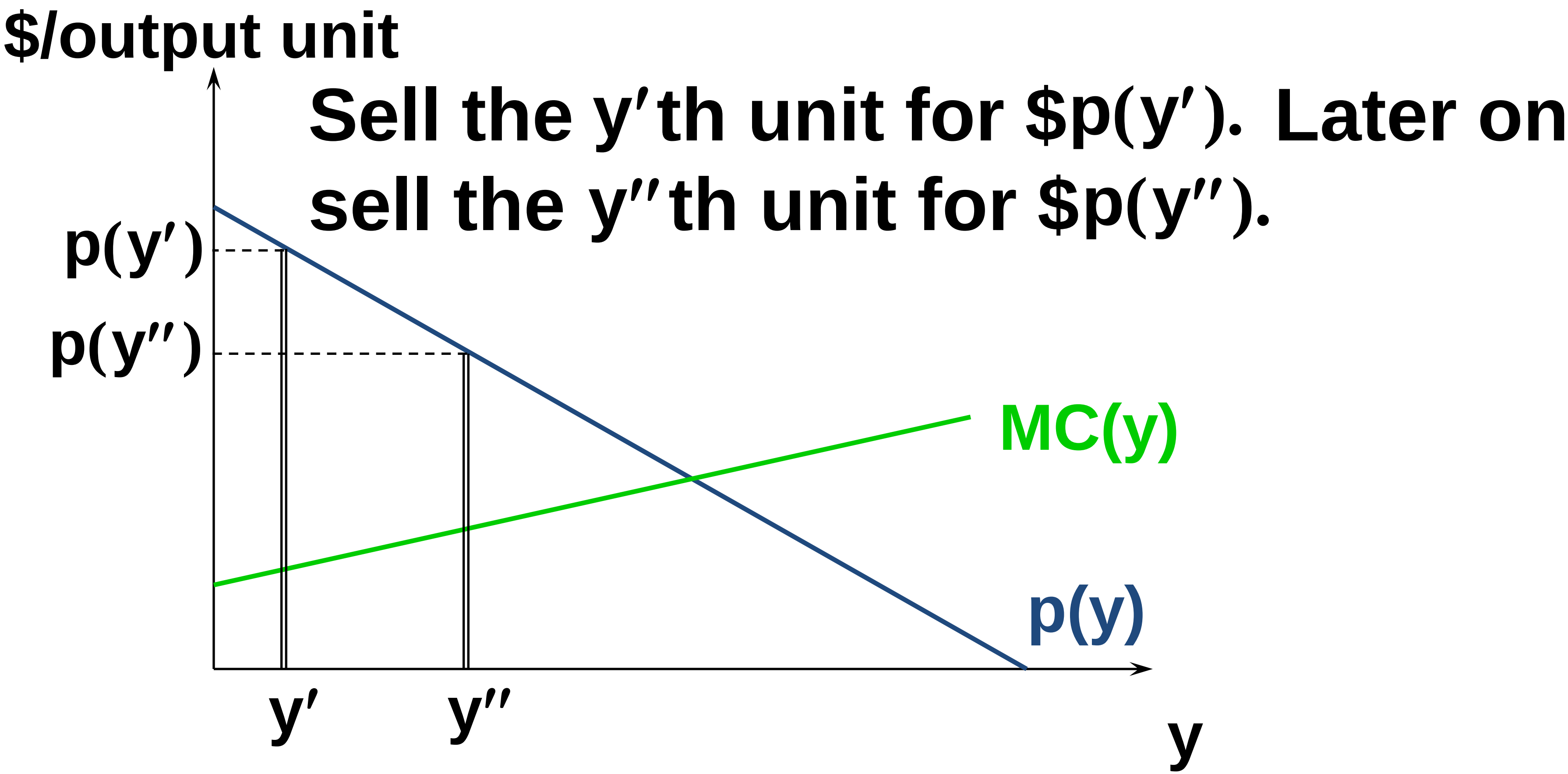
First-degree Price Discrimination

- Each output unit is sold at a different price. Price may differ across buyers.
- It requires that the monopolist can discover the buyer with the highest valuation of its product, the buyer with the next highest valuation, and so on.

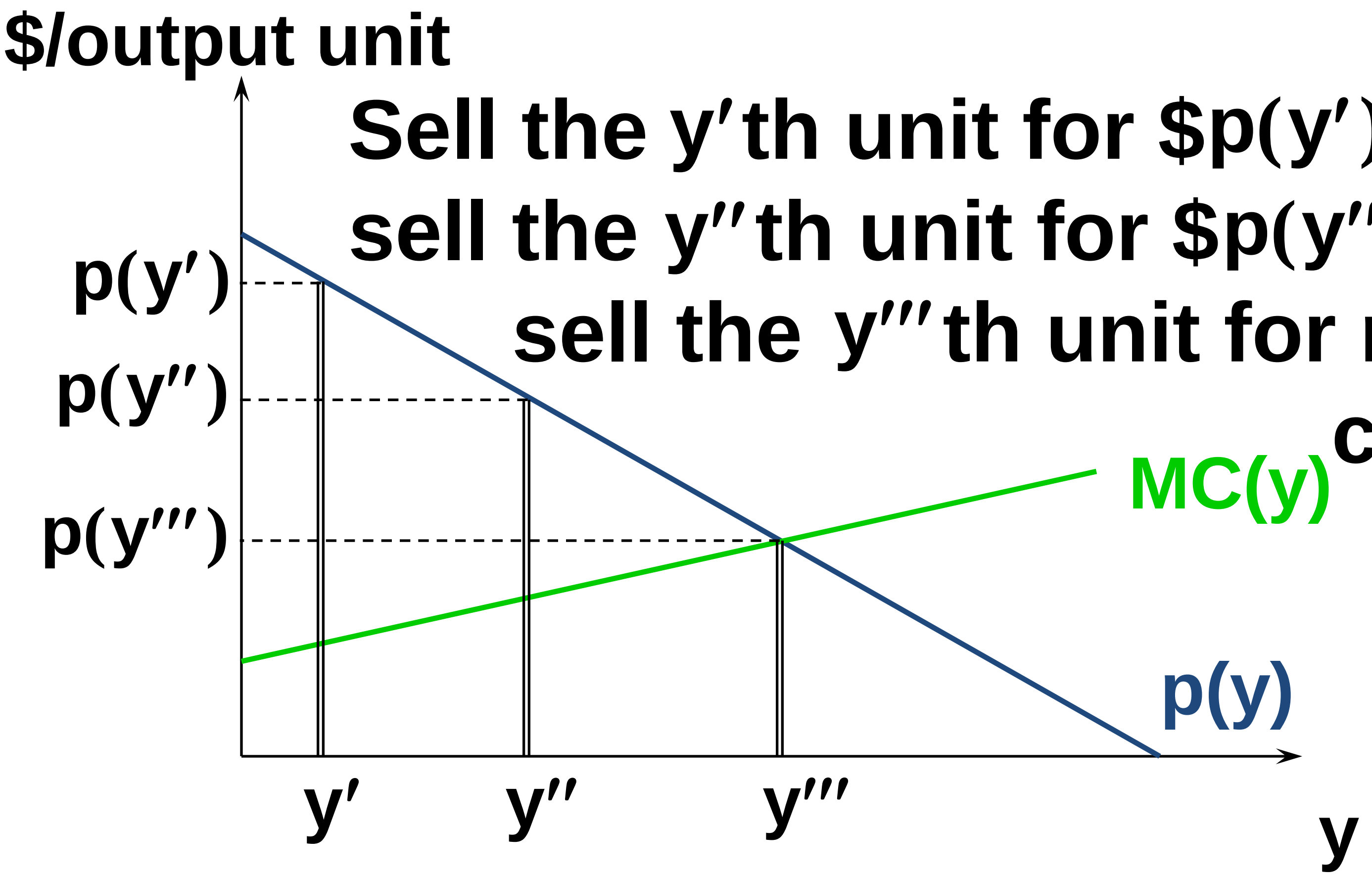
First-degree Price Discrimination



First-degree Price Discrimination



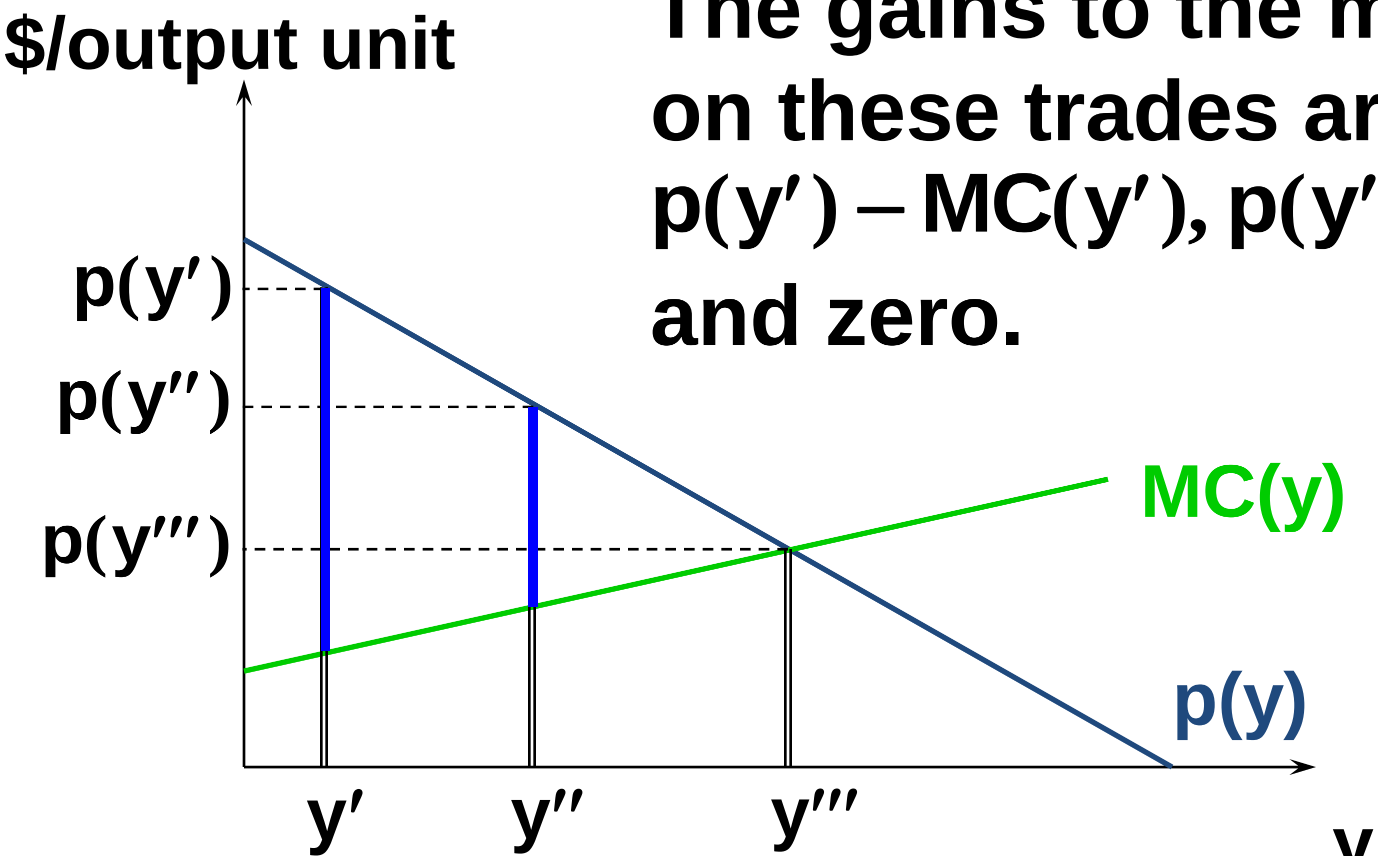
First-degree Price Discrimination



Sell the y'th unit for \$$p(y')$. Later on sell the y''th unit for \$$p(y'')$. Finally sell the y'''th unit for marginal cost, \$$p(y''')$.

First-degree Price Discrimination

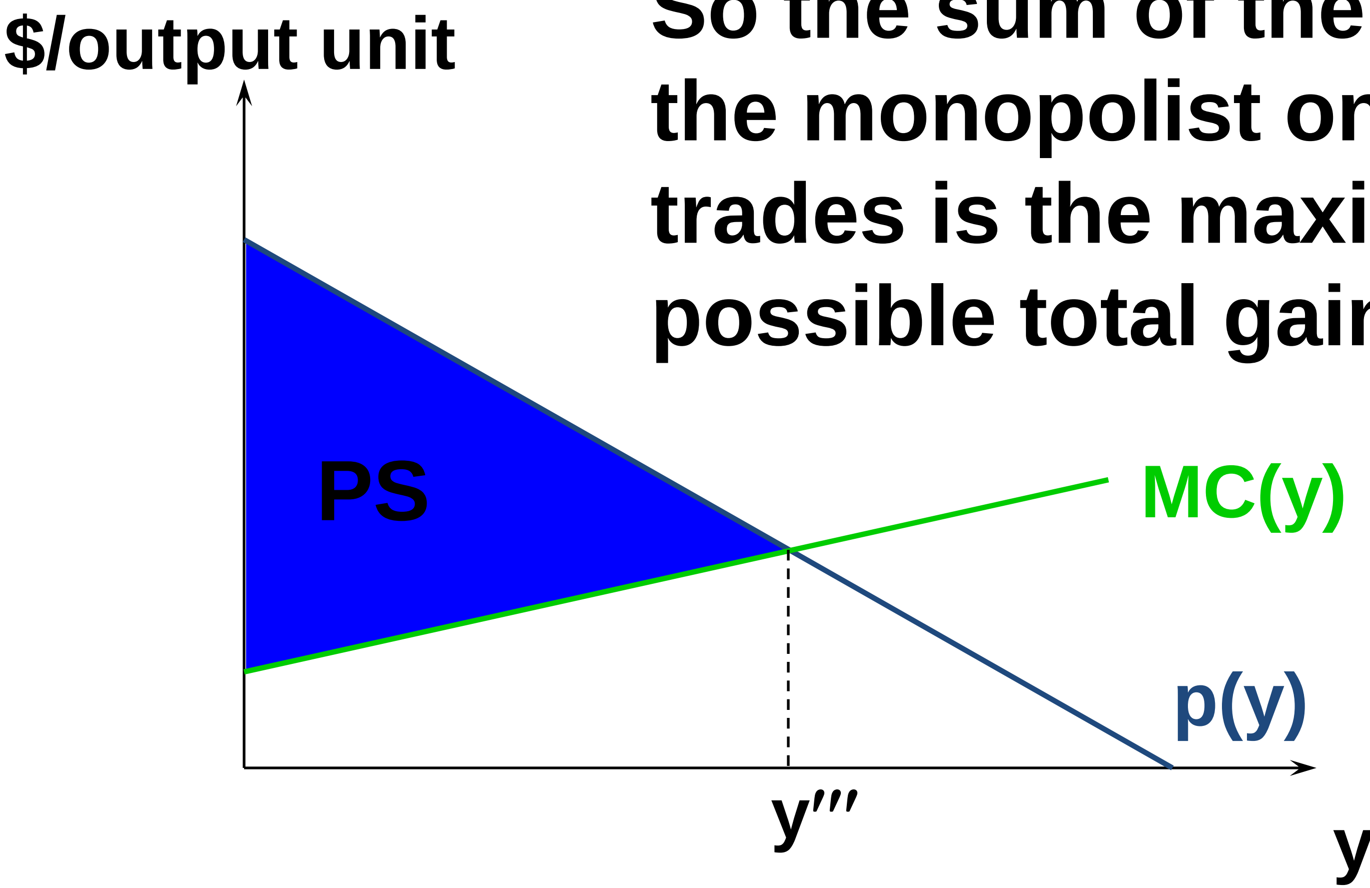
The gains to the monopolist on these trades are:
$p(y') - MC(y')$, $p(y'') - MC(y'')$ and zero.



The consumers' gains are zero.

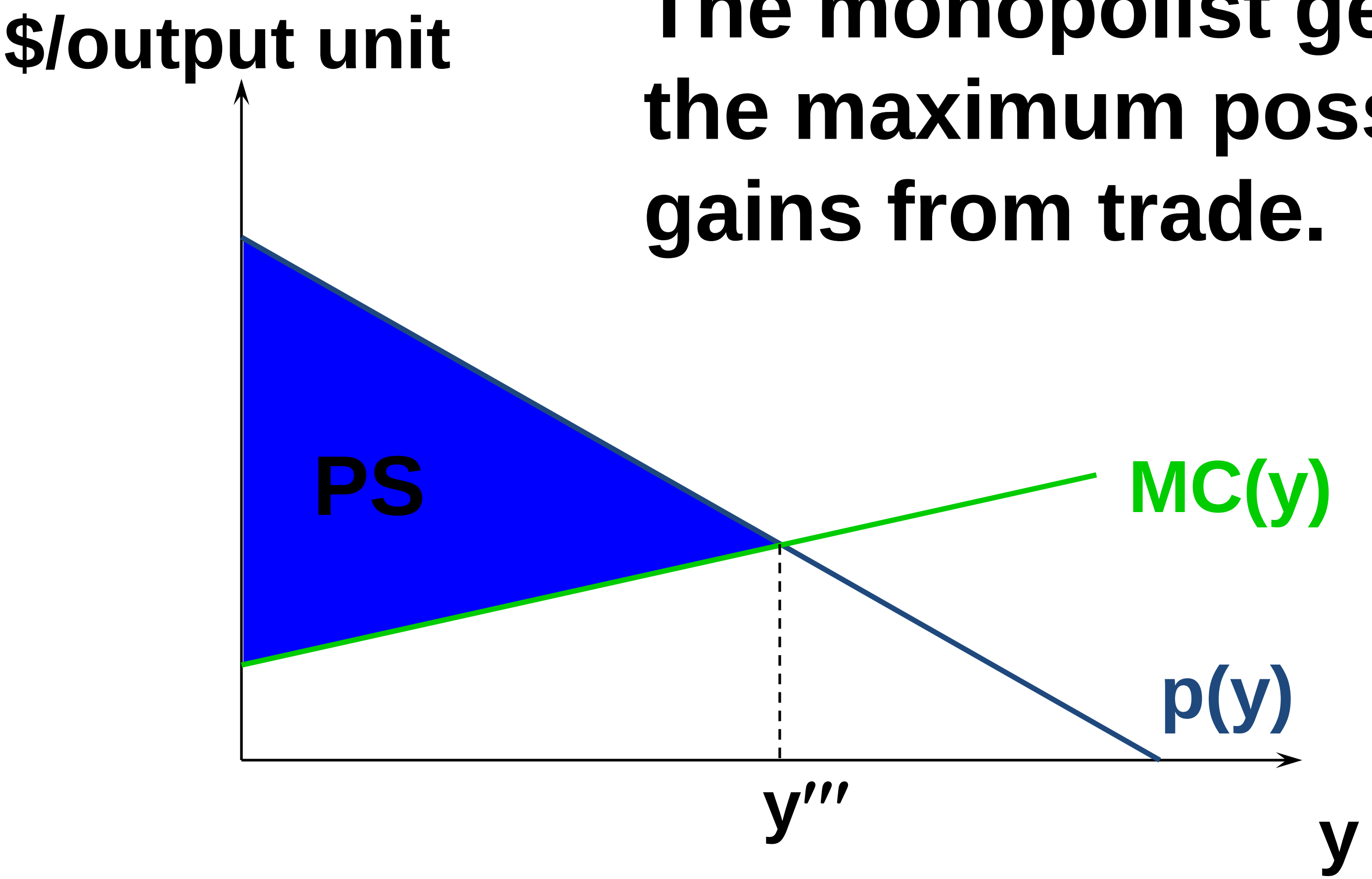
First-degree Price Discrimination

So the sum of the gains to the monopolist on all trades is the maximum possible total gains-to-trade.



First-degree Price Discrimination

The monopolist gets the maximum possible gains from trade.



First-degree price discrimination is Pareto-efficient.

First-degree Price Discrimination

- First-degree price discrimination gives a monopolist all of the possible gains-to-trade, leaves the buyers with zero surplus, and supplies the efficient amount of output.

Third-degree Price Discrimination

- Price paid by buyers in a given group is the same for all units purchased. But price may differ across buyer groups.

Third-degree Price Discrimination

- A monopolist manipulates market price by altering the quantity of product supplied to that market.
- So the question “What discriminatory prices will the monopolist set, one for each group?” is really the question “How many units of product will the monopolist supply to each group?”

Third-degree Price Discrimination

- Two markets, 1 and 2.
- y_1 is the quantity supplied to market 1. Market 1's inverse demand function is $p_1(y_1)$.
- y_2 is the quantity supplied to market 2. Market 2's inverse demand function is $p_2(y_2)$.

Third-degree Price Discrimination

- For given supply levels y_1 and y_2 the firm's profit is

$$\Pi(y_1, y_2) = p_1(y_1)y_1 + p_2(y_2)y_2 - c(y_1 + y_2).$$

- What values of y_1 and y_2 maximize profit?

Third-degree Price Discrimination

$$\Pi(y_1, y_2) = p_1(y_1)y_1 + p_2(y_2)y_2 - c(y_1 + y_2).$$

The profit-maximization conditions are

$$\frac{\partial \Pi}{\partial y_1} = \frac{\partial}{\partial y_1}\left(p_1(y_1)y_1\right) - \frac{\partial c(y_1 + y_2)}{\partial (y_1 + y_2)} \times \frac{\partial (y_1 + y_2)}{\partial y_1}$$

$$= 0$$

Third-degree Price Discrimination

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$$= 0$$

$$\frac{\partial \Pi}{\partial y_2} = \frac{\partial}{\partial y_2}\left(p_2(y_2)y_2\right) - \frac{\partial c(y_1 + y_2)}{\partial (y_1 + y_2)} \times \frac{\partial (y_1 + y_2)}{\partial y_2}$$
$$= 0$$

Third-degree Price Discrimination

$$\frac{\partial (y_1 + y_2)}{\partial y_1} = 1$$ **and** $$\frac{\partial (y_1 + y_2)}{\partial y_2} = 1$$ **so**

the profit-maximization conditions are

$$\frac{\partial}{\partial y_1}\left(p_1(y_1)y_1\right) = \frac{\partial c(y_1 + y_2)}{\partial (y_1 + y_2)}$$

and $$\frac{\partial}{\partial y_2}\left(p_2(y_2)y_2\right) = \frac{\partial c(y_1 + y_2)}{\partial (y_1 + y_2)}.$$

Third-degree Price Discrimination

$$\frac{\partial}{\partial\, \mathbf{y}_1}\left(\mathbf{p}_1(\mathbf{y}_1)\mathbf{y}_1\right) = \frac{\partial}{\partial\, \mathbf{y}_2}\left(\mathbf{p}_2(\mathbf{y}_2)\mathbf{y}_2\right) = \frac{\partial\, \mathbf{c}(\mathbf{y}_1 + \mathbf{y}_2)}{\partial\, (\mathbf{y}_1 + \mathbf{y}_2)}$$

Third-degree Price Discrimination

$$\underbrace{\frac{\partial}{\partial\,\mathbf{y_1}}\left(\mathbf{p_1(y_1)y_1}\right) = \frac{\partial}{\partial\,\mathbf{y_2}}\left(\mathbf{p_2(y_2)y_2}\right)} = \frac{\partial\,\mathbf{c(y_1+y_2)}}{\partial\,\mathbf{(y_1+y_2)}}$$

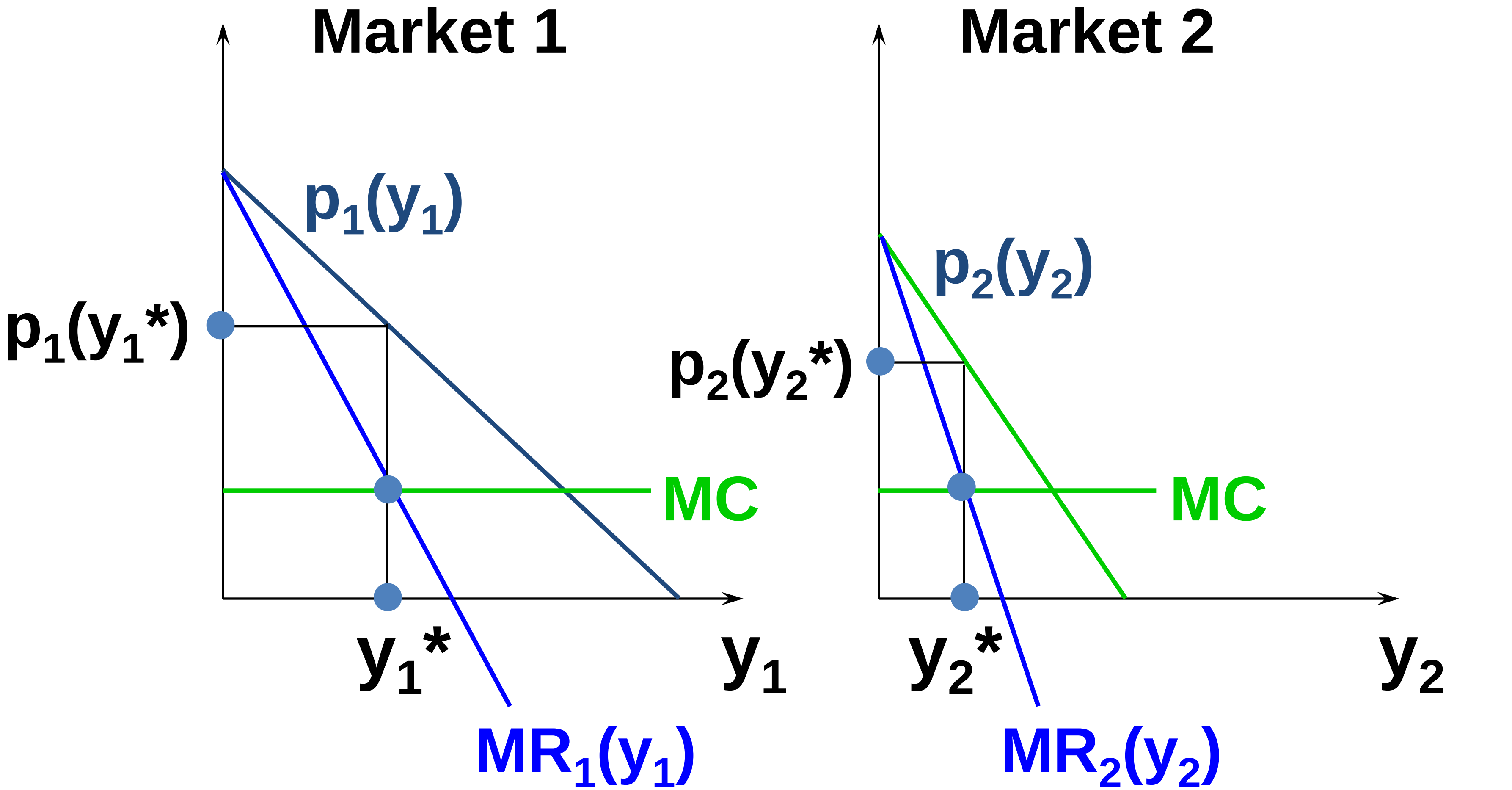
$MR_1(y_1) = MR_2(y_2)$ says that the allocation y_1, y_2 maximizes the revenue from selling $y_1 + y_2$ output units.
***E.g.*, if $MR_1(y_1) > MR_2(y_2)$ then an output unit should be moved from market 2 to market 1 to increase total revenue.**

Third-degree Price Discrimination

$$\underbrace{\frac{\partial}{\partial \mathbf{y}_1}\left(\mathbf{p}_1(\mathbf{y}_1)\mathbf{y}_1\right) = \frac{\partial}{\partial \mathbf{y}_2}\left(\mathbf{p}_2(\mathbf{y}_2)\mathbf{y}_2\right) = \frac{\partial\, \mathbf{c}(\mathbf{y}_1 + \mathbf{y}_2)}{\partial\, (\mathbf{y}_1 + \mathbf{y}_2)}}$$

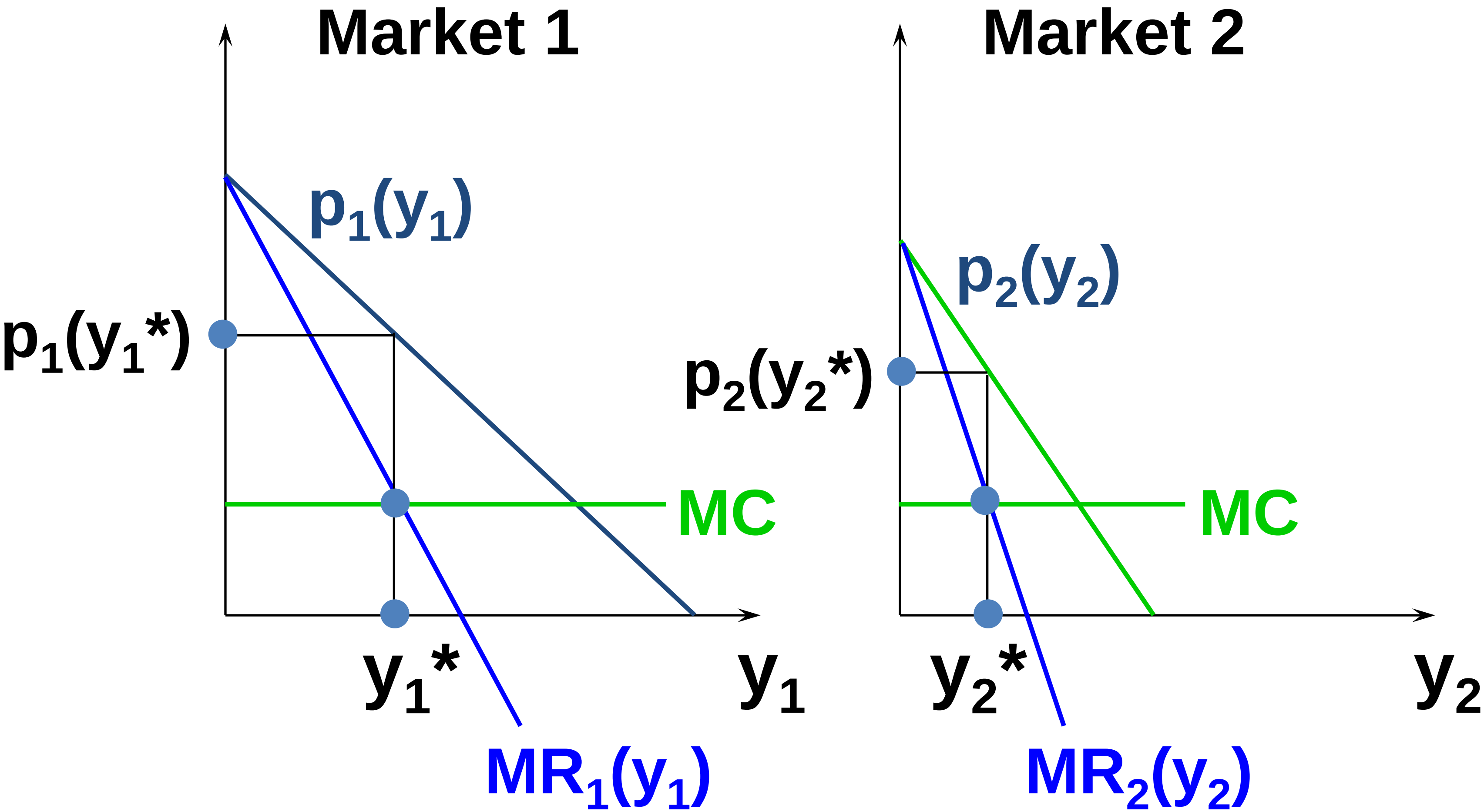
The marginal revenue common to both markets equals the marginal production cost if profit is to be maximized.

Third-degree Price Discrimination



$$MR_1(y_1^*) = MR_2(y_2^*) = MC$$

Third-degree Price Discrimination



$MR_1(y_1^*) = MR_2(y_2^*) = MC$ and $p_1(y_1^*) \neq p_2(y_2^*)$.

Third-degree Price Discrimination

- In which market will the monopolist cause the higher price?

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- Recall that

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and

$$MR_2(y_2) = p_2(y_2)\left[1 + \frac{1}{\varepsilon_2}\right].$$

Third-degree Price Discrimination

- In which market will the monopolist cause the higher price?
- Recall that
$$MR_1(y_1) = p_1(y_1)\left[1 + \frac{1}{\varepsilon_1}\right]$$
and
$$MR_2(y_2) = p_2(y_2)\left[1 + \frac{1}{\varepsilon_2}\right].$$
- But, $MR_1(y_1^*) = MR_2(y_2^*) = MC(y_1^* + y_2^*)$

Third-degree Price Discrimination

So $$p_1(y_1^*)\left[1+\frac{1}{\varepsilon_1}\right]=p_2(y_2^*)\left[1+\frac{1}{\varepsilon_2}\right].$$

Third-degree Price Discrimination

So $$p_1(y_1^*)\left[1+\frac{1}{\varepsilon_1}\right] = p_2(y_2^*)\left[1+\frac{1}{\varepsilon_2}\right].$$

Therefore, $p_1(y_1^*) > p_2(y_2^*)$ **if and only if**

$$1+\frac{1}{\varepsilon_1} < 1+\frac{1}{\varepsilon_2}$$

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The monopolist sets the higher price in the market where demand is least own-price elastic.

Two-Part Tariffs

- A two-part tariff is a lump-sum fee, p_1, plus a price p_2 for each unit of product purchased.
- Thus the cost of buying x units of product is

$$p_1 + p_2x.$$

Two-Part Tariffs

- Should a monopolist prefer a two-part tariff to uniform pricing, or to any of the price-discrimination schemes discussed so far?
- If so, how should the monopolist design its two-part tariff?

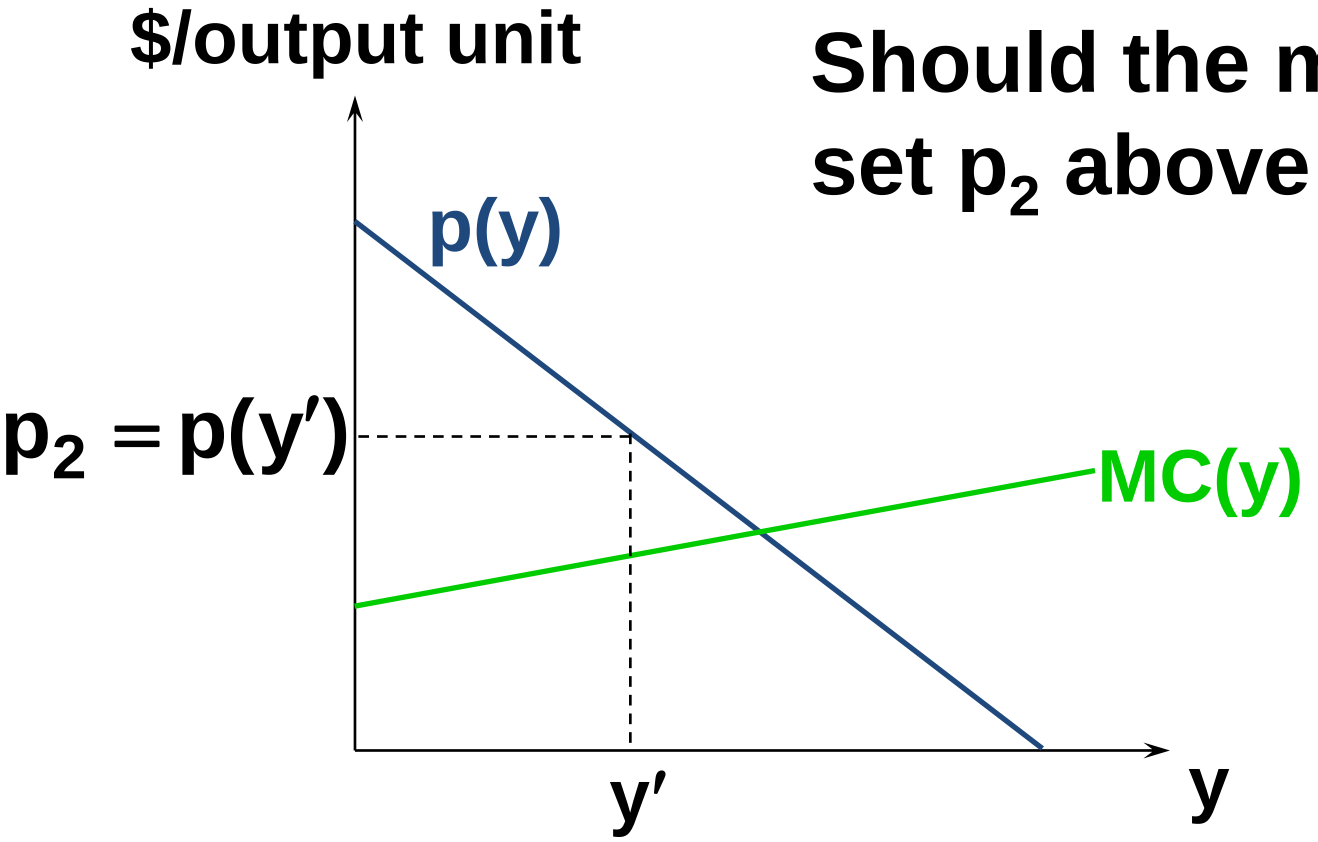
Two-Part Tariffs

- $p_1 + p_2x$
- Q: What is the largest that p_1 can be?

Two-Part Tariffs

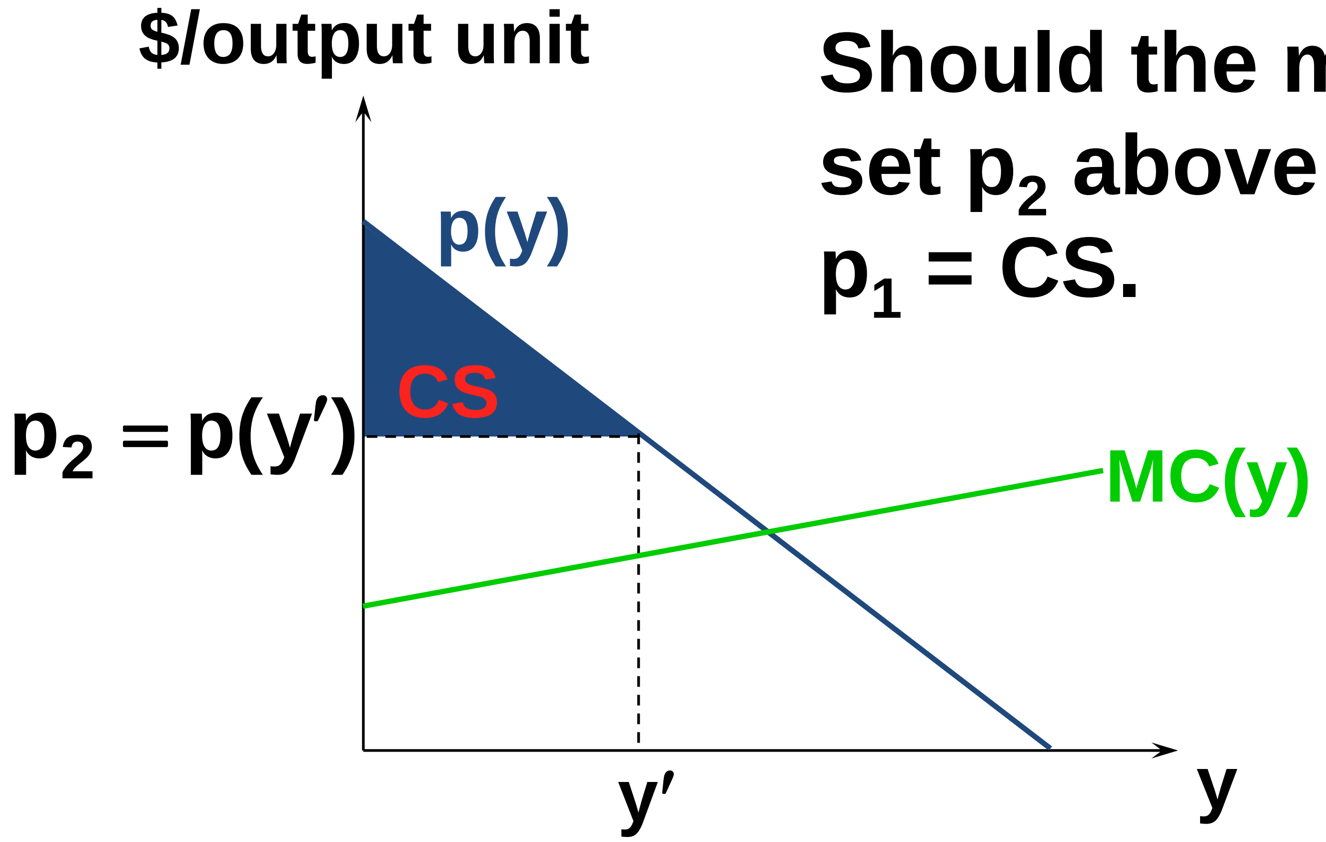
- $p_1 + p_2x$
- Q: What is the largest that p_1 can be?
- A: p_1 is the “market entrance fee” so the largest it can be is the surplus the buyer gains from entering the market.
- Set p_1 = CS and now ask what should be p_2?

Two-Part Tariffs



Should the monopolist set p_2 above MC?

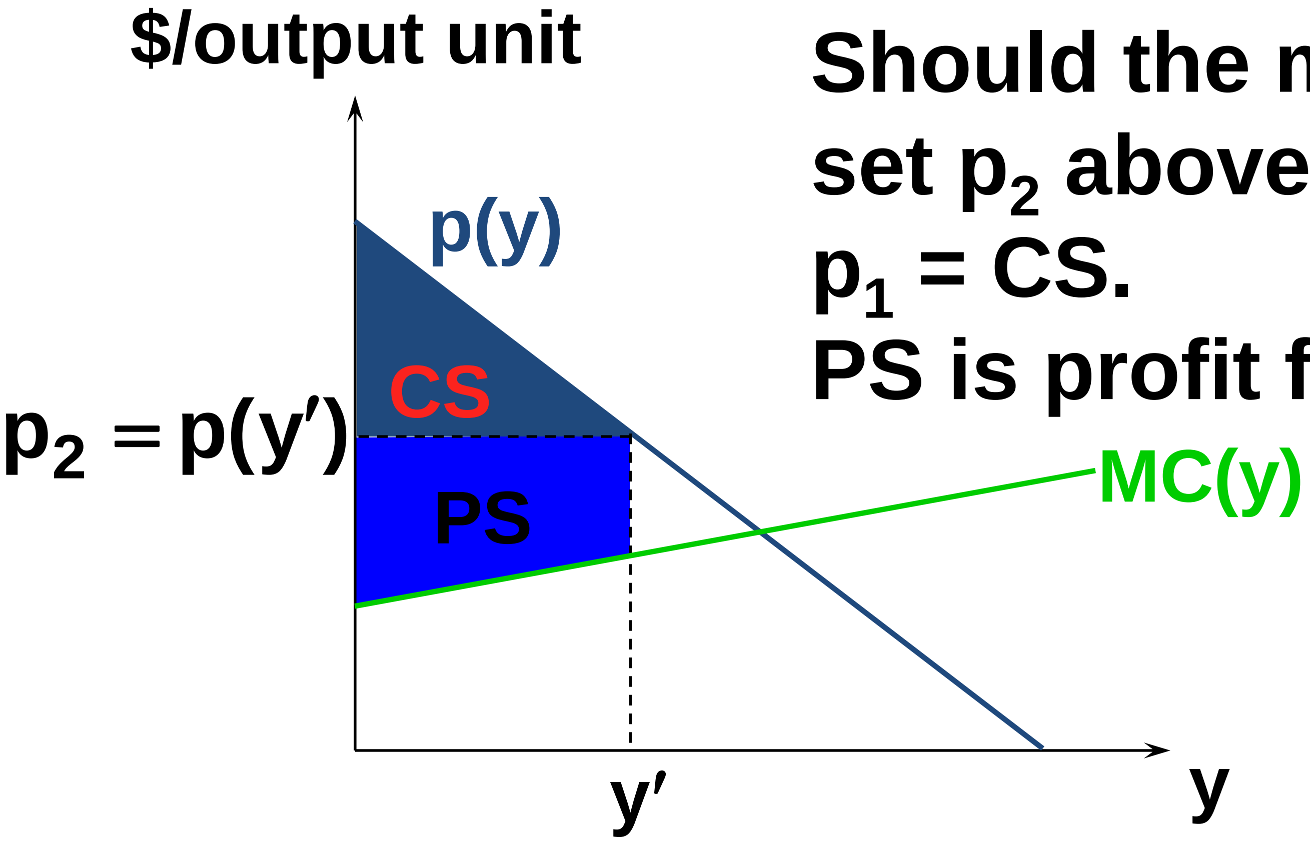
Two-Part Tariffs



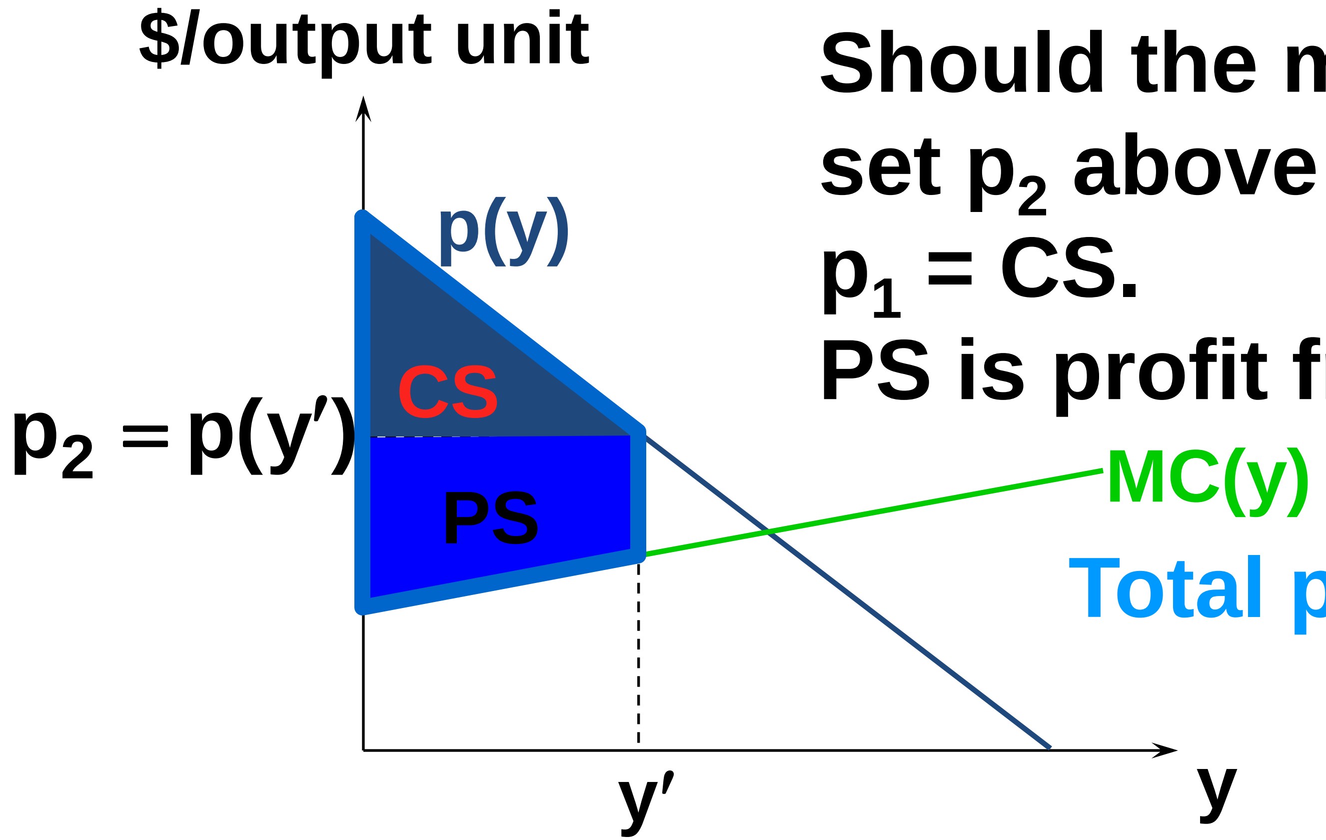
Should the monopolist set p_2 above MC?
p_1 = CS.

Two-Part Tariffs

Should the monopolist set p_2 above MC?
p_1 = CS.
PS is profit from sales.



Two-Part Tariffs



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Two-Part Tariffs

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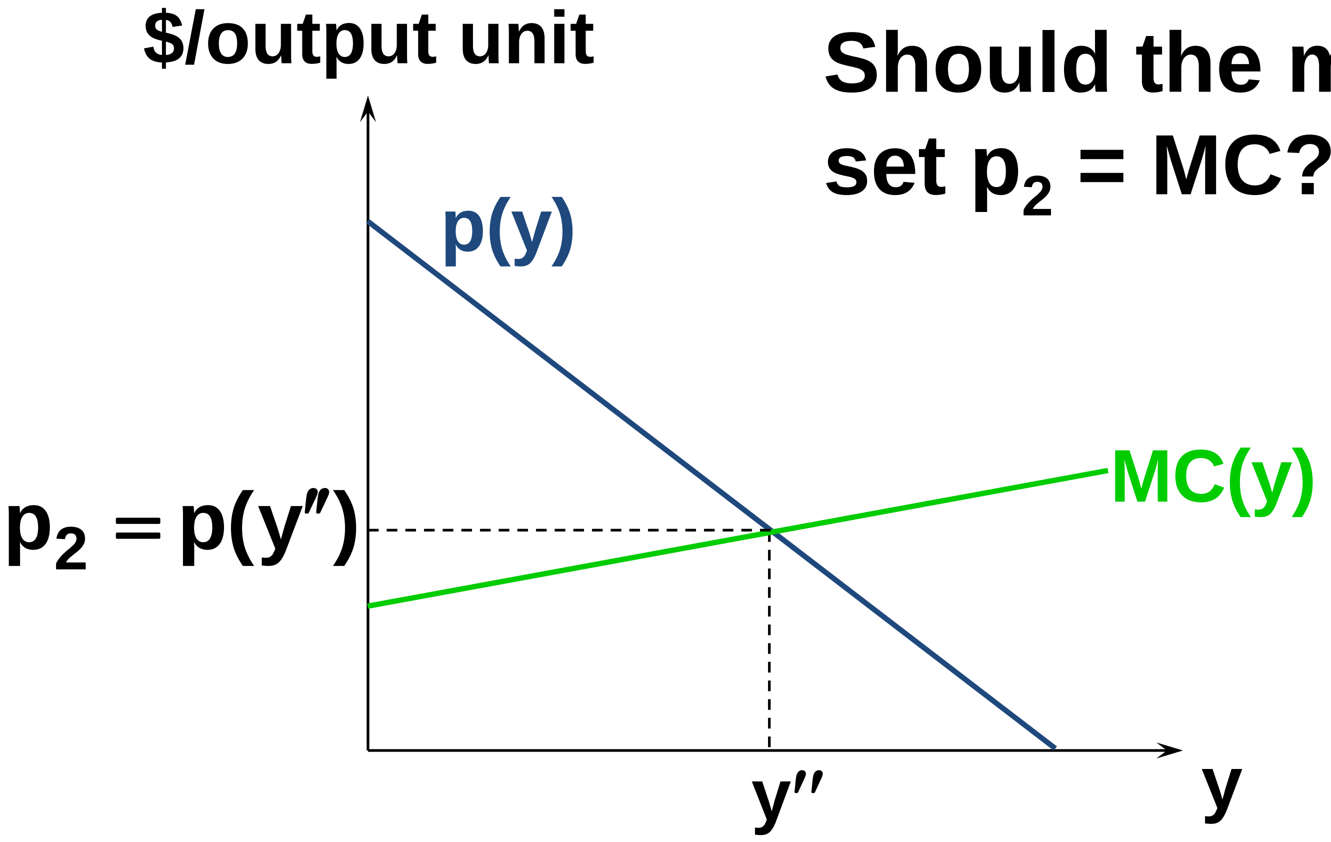

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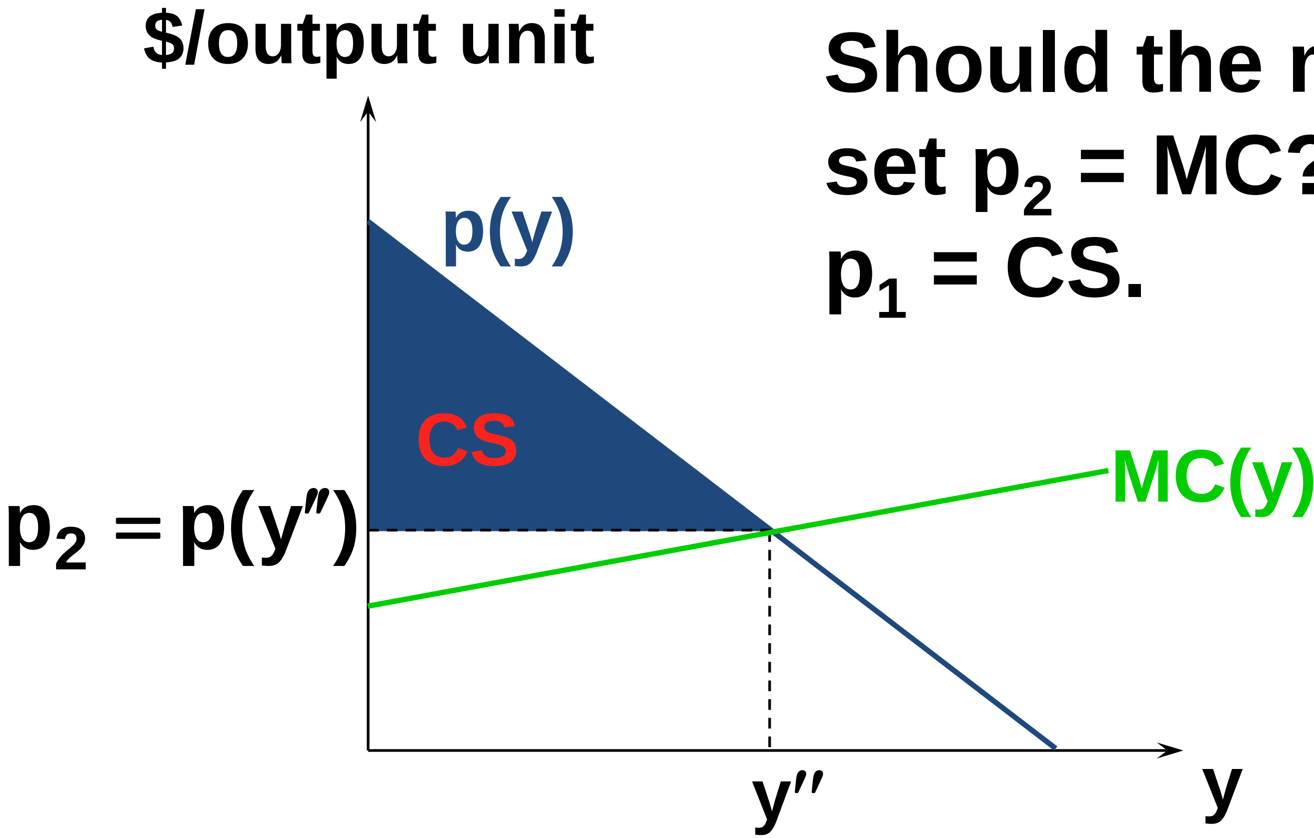

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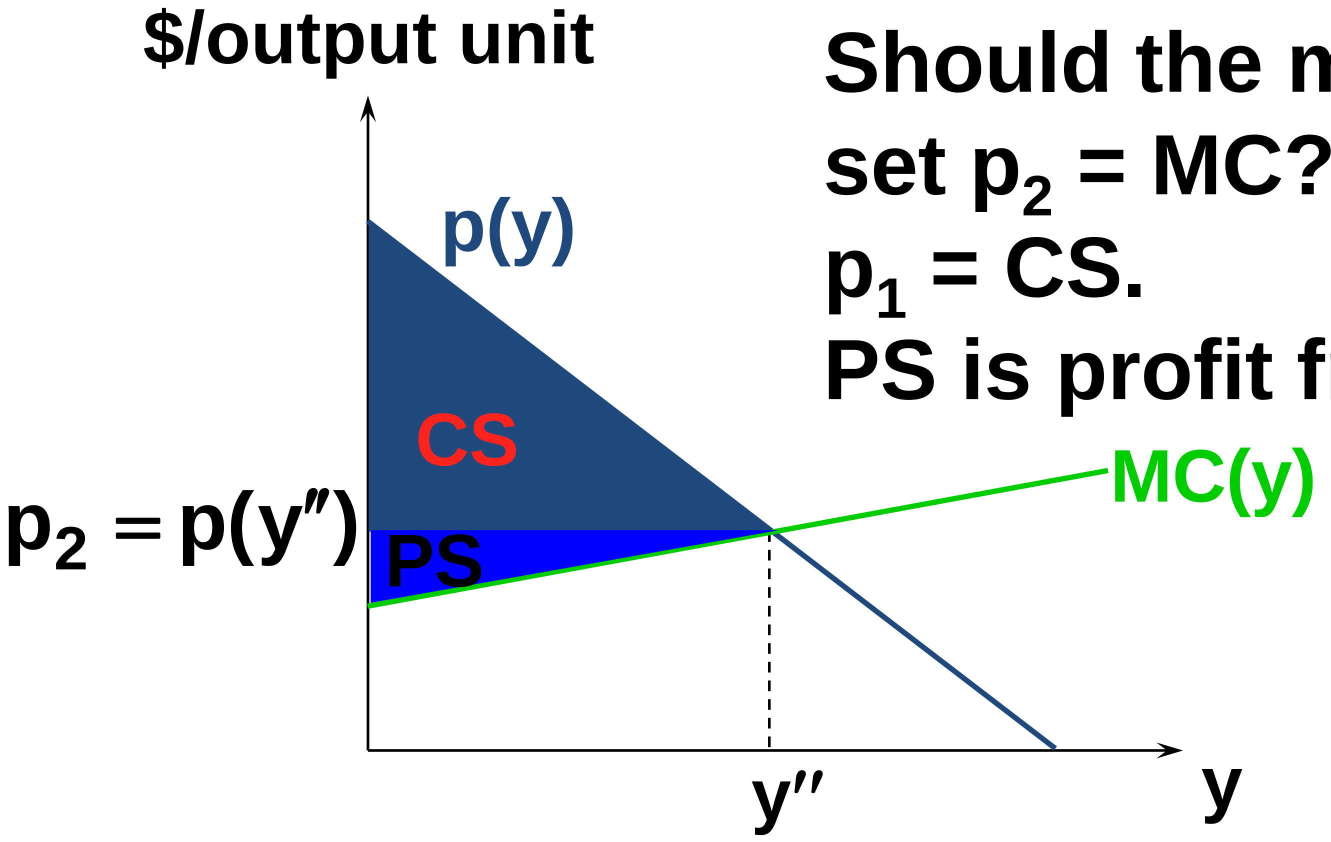

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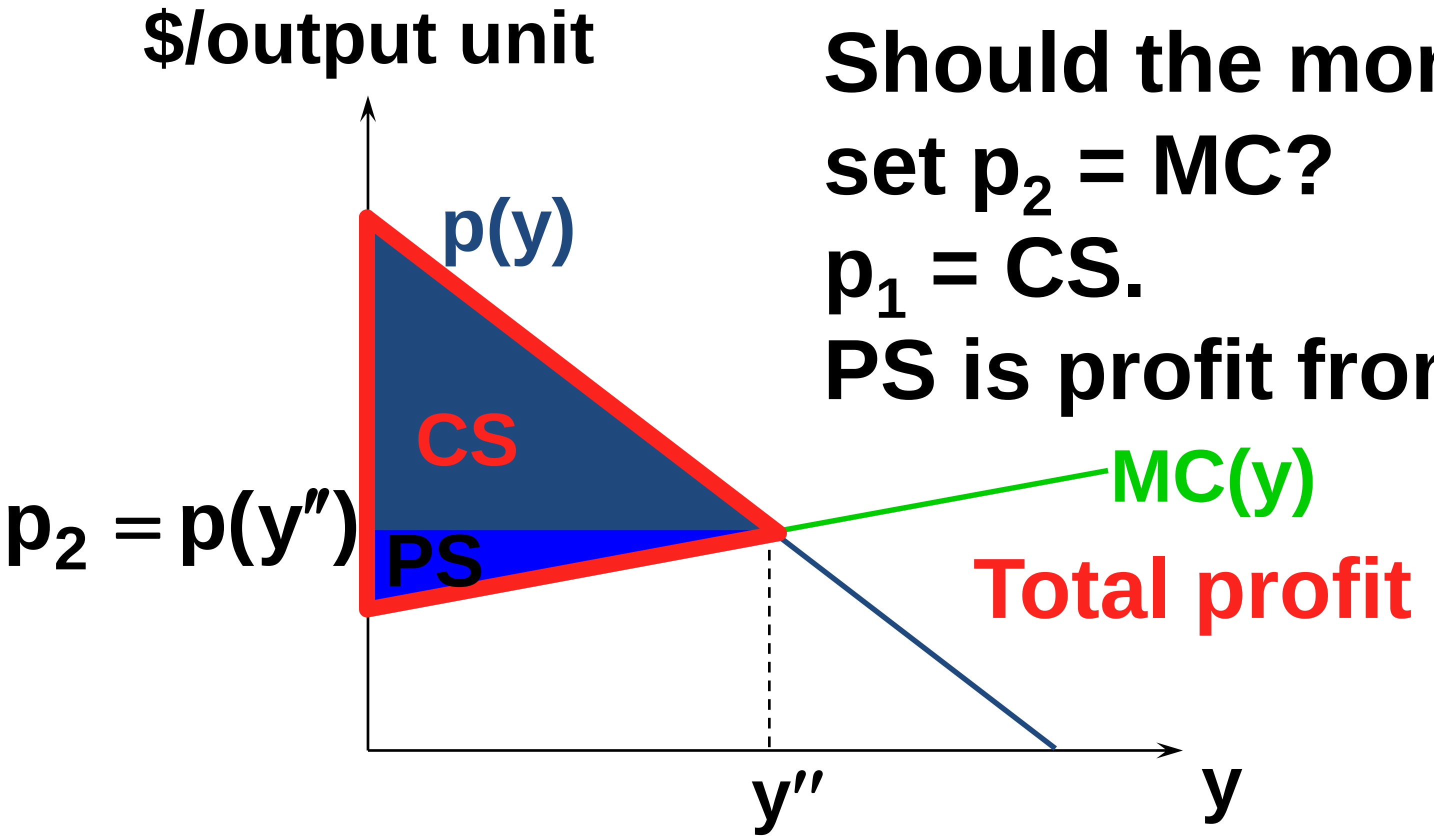

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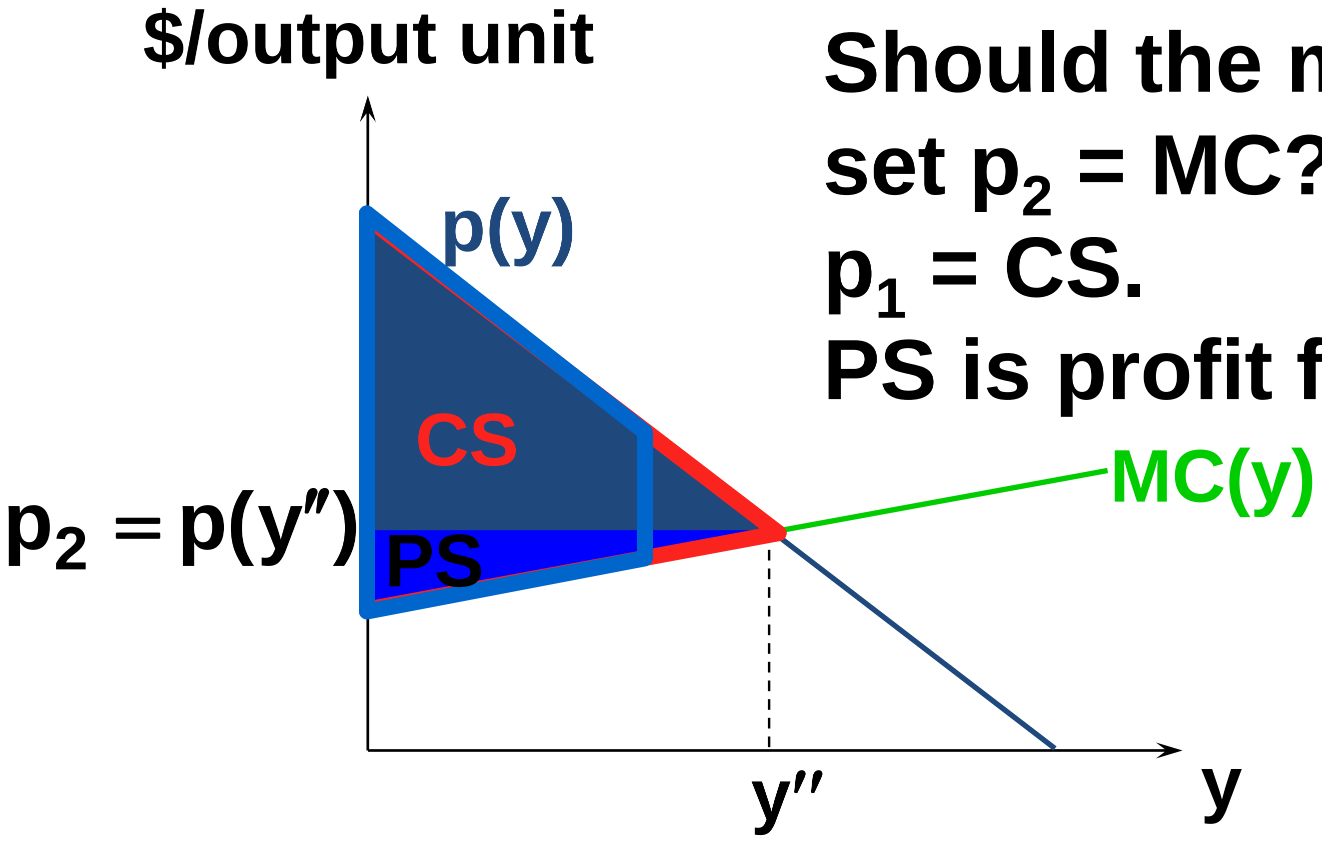

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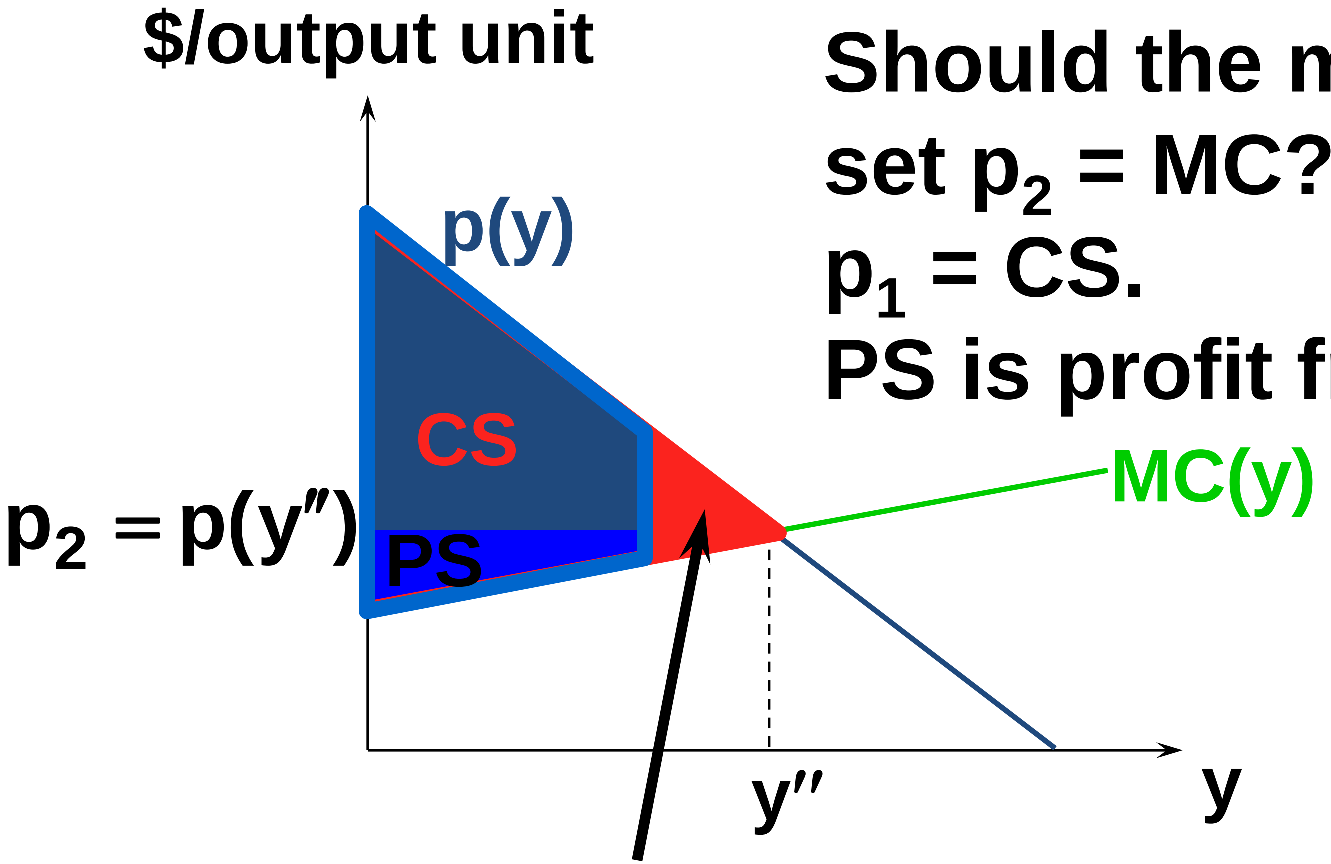

Should the monopolist set p_2 = MC?
p_1 = CS.
PS is profit from sales.

Additional profit from setting p_2 = MC.

Two-Part Tariffs

- The monopolist maximizes its profit when using a two-part tariff by setting its per unit price p_2 at marginal cost and setting its lump-sum fee p_1 equal to Consumers' Surplus.

Two-Part Tariffs

- A profit-maximizing two-part tariff gives an efficient market outcome in which the monopolist obtains as profit the total of all gains-to-trade.

Differentiating Products

- In many markets the commodities traded are very close, but not perfect, substitutes.
- *E.g.,* the markets for T-shirts, watches, cars, and cookies.
- Each individual supplier thus has some slight “monopoly power.”
- What does an equilibrium look like for such a market?

Differentiating Products

- Free entry $\Rightarrow$ zero profits for each seller.

Differentiating Products

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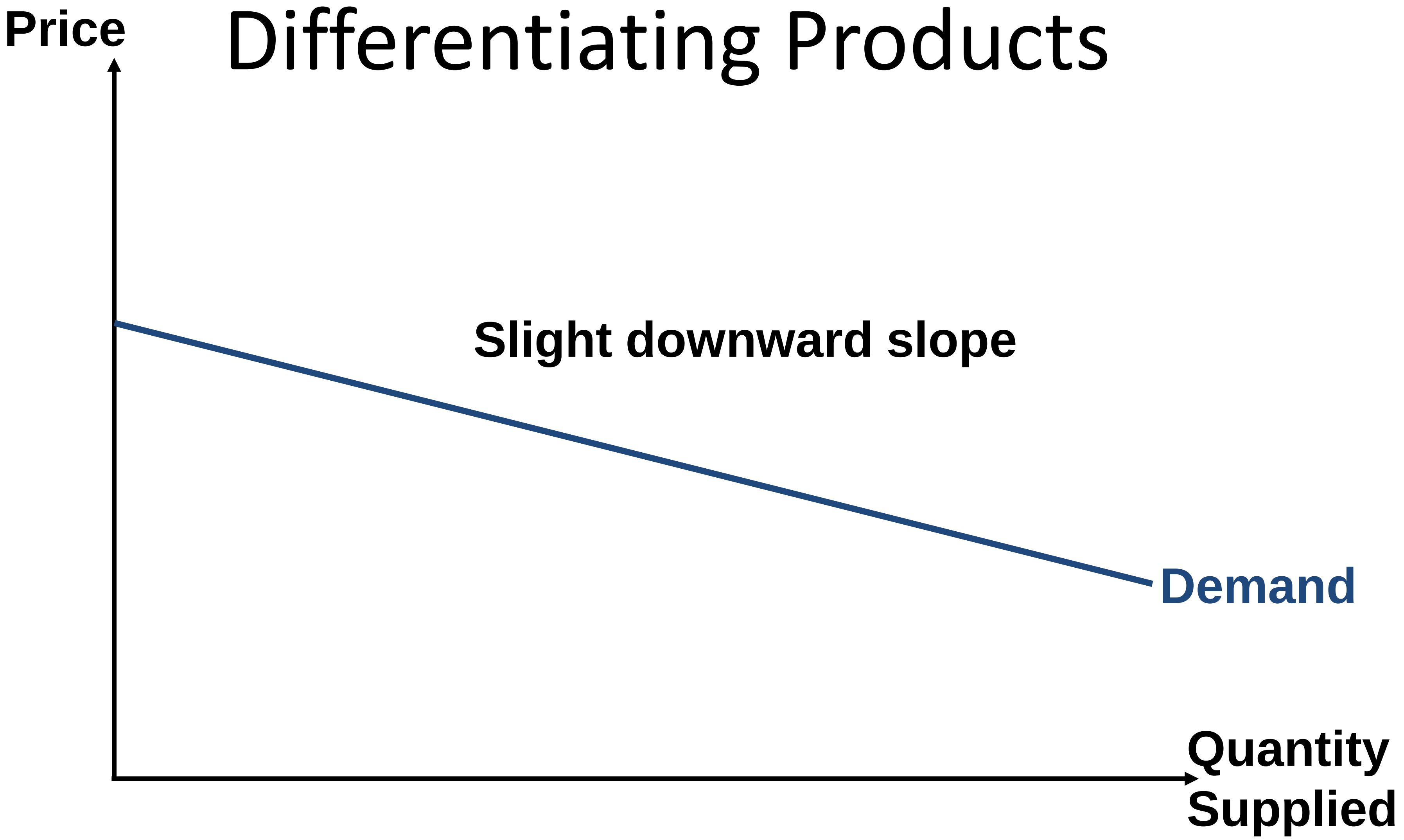
- Profit-maximization $\Rightarrow$ MR = MC for each seller.

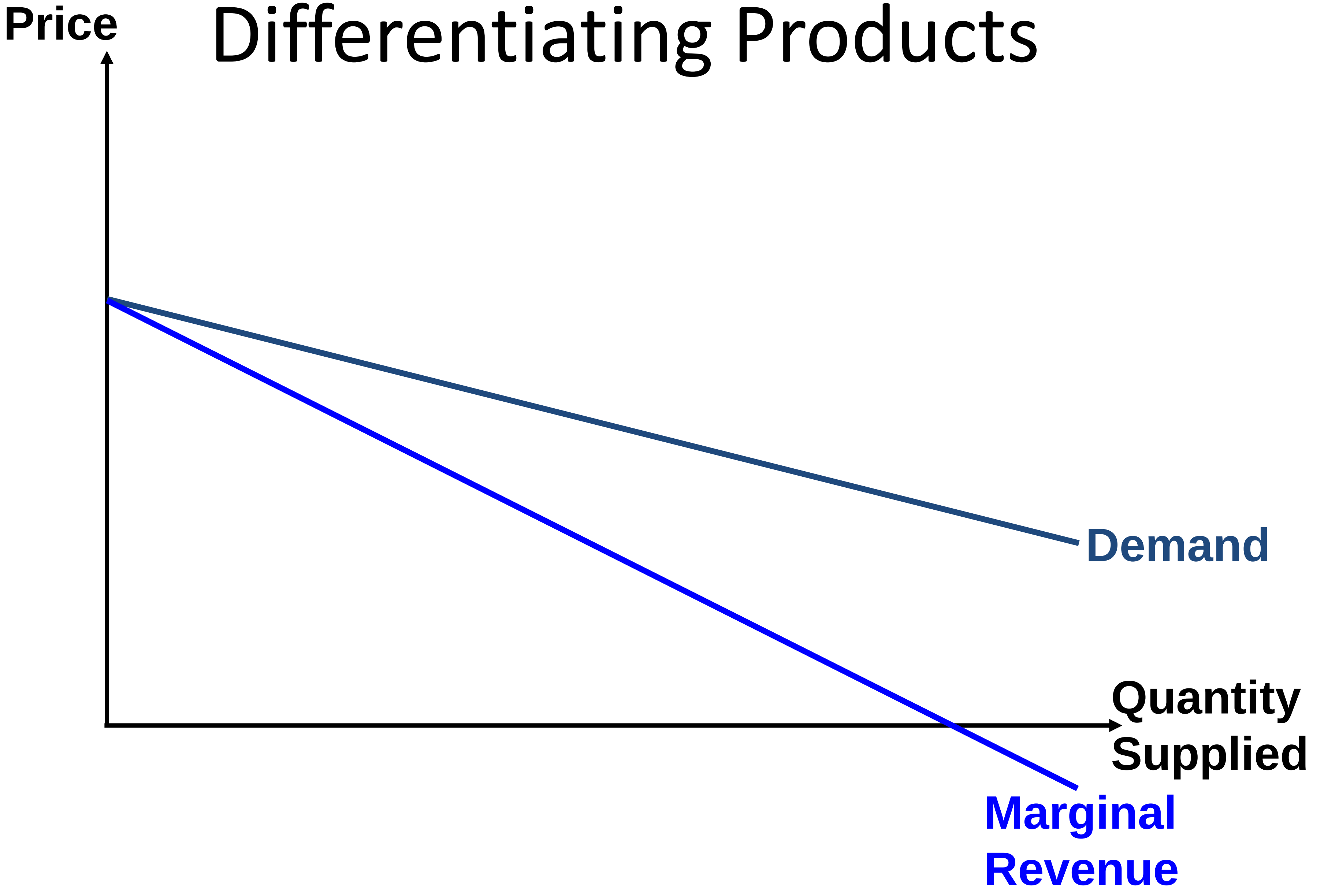
Differentiating Products

- Free entry $\Rightarrow$ zero profits for each seller.
- Profit-maximization $\Rightarrow$ MR = MC for each seller.
- Less than perfect substitution between commodities $\Rightarrow$ slight downward slope for the demand curve for each commodity.

Differentiating Products



Differentiating Products



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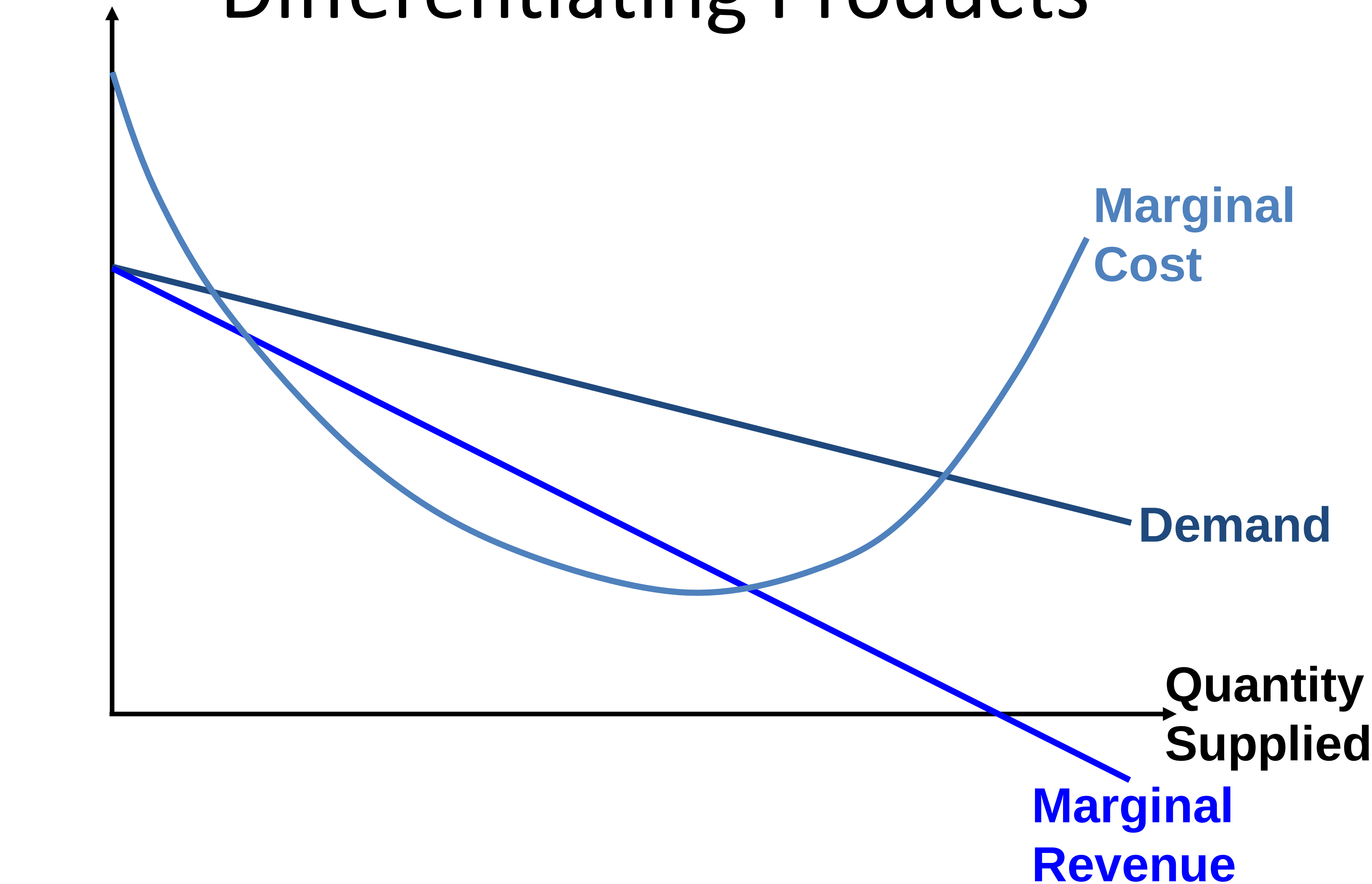

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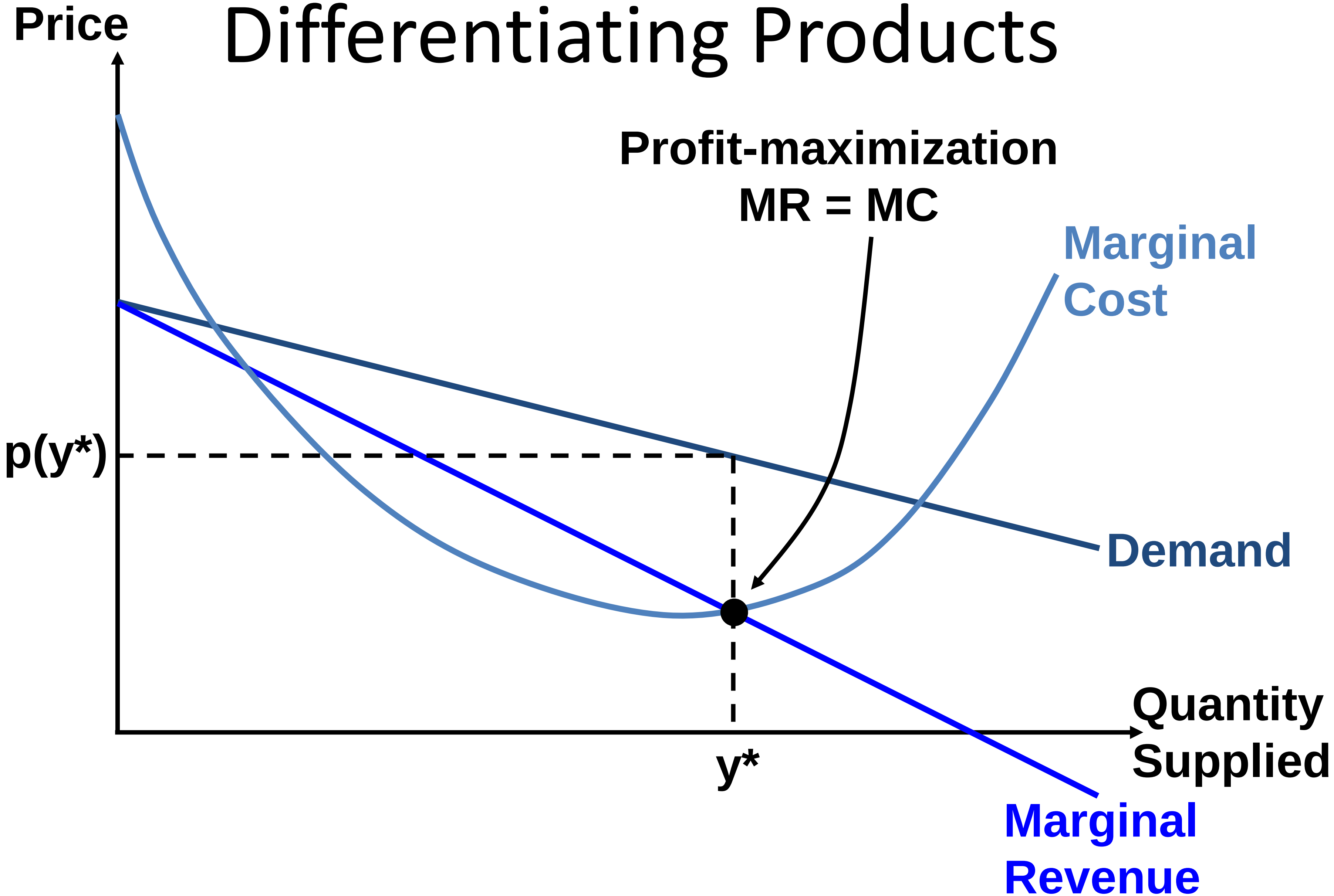

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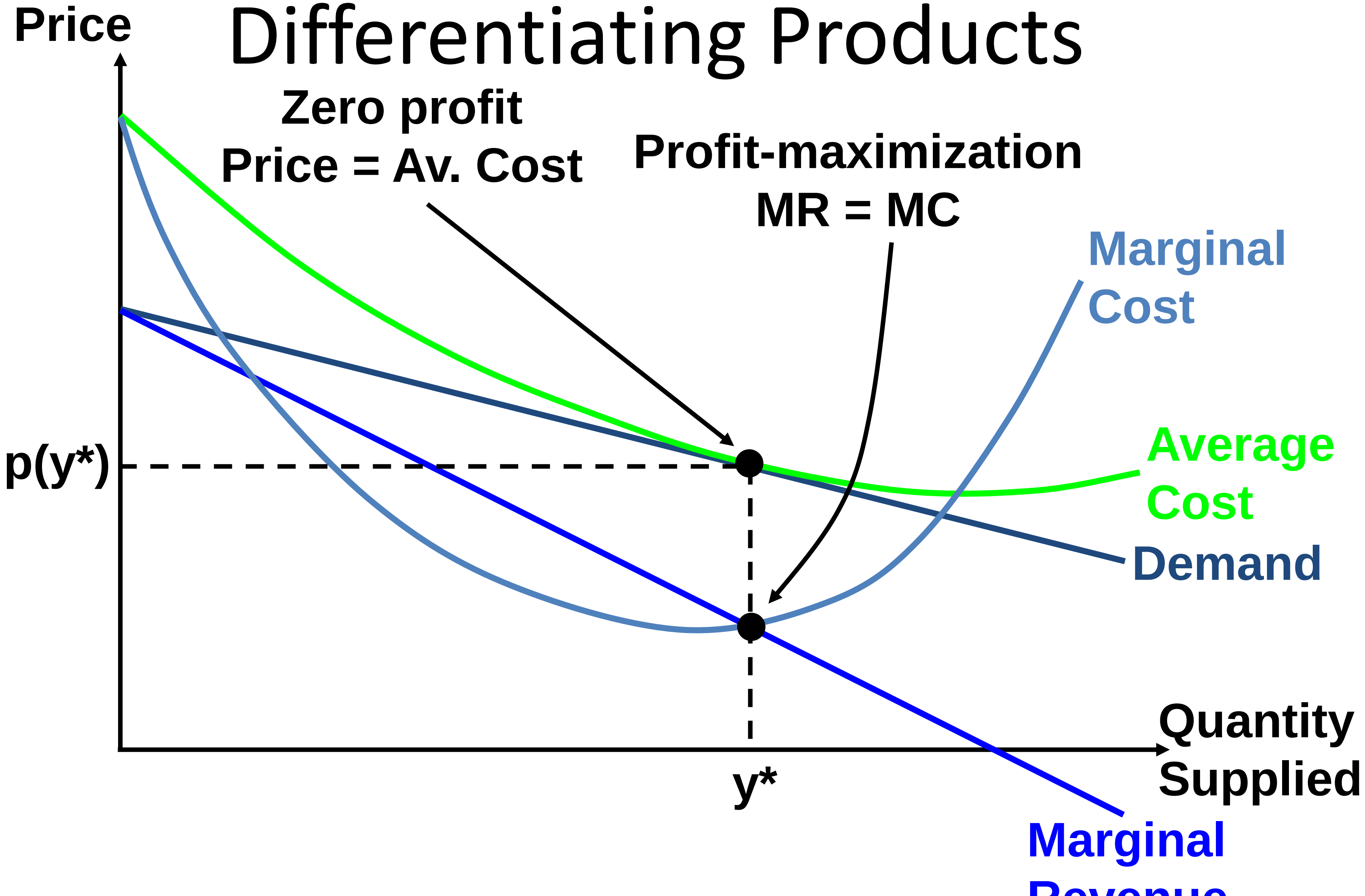
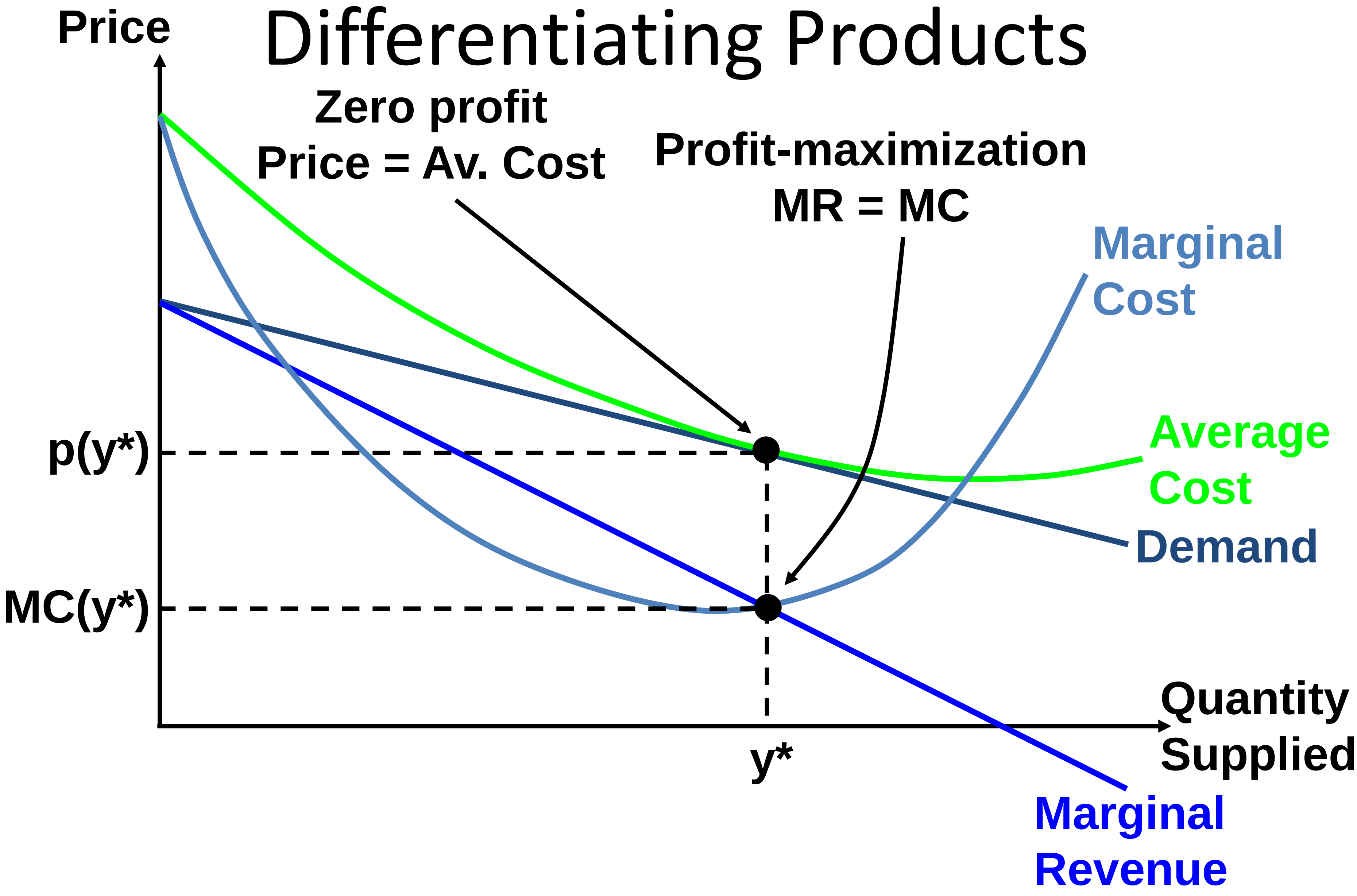


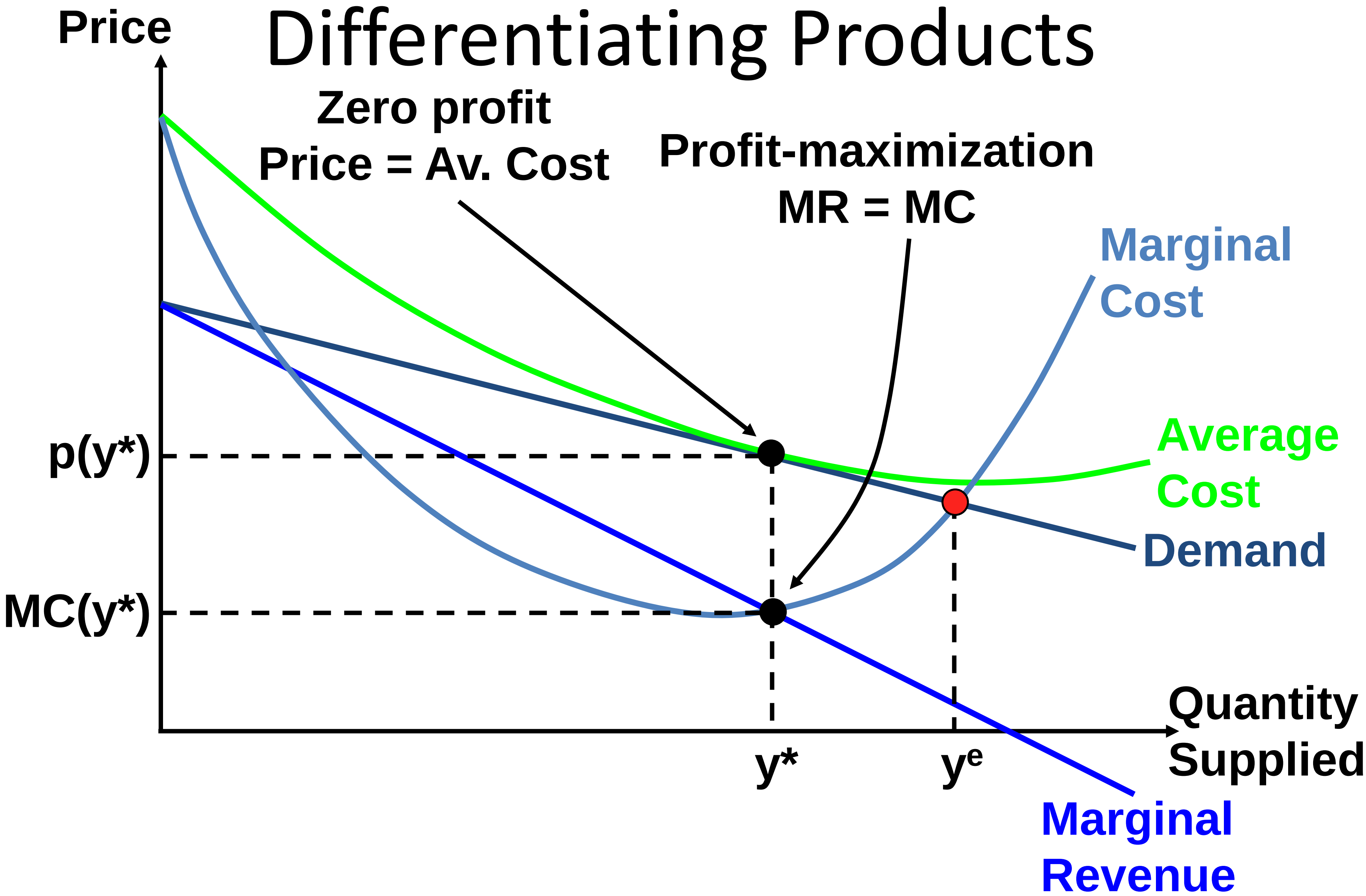
Differentiating Products

- Such markets are monopolistically competitive.
- Are these markets efficient?
- No, because for each commodity the equilibrium price $p(y^*) > MC(y^*)$.

Differentiating Products



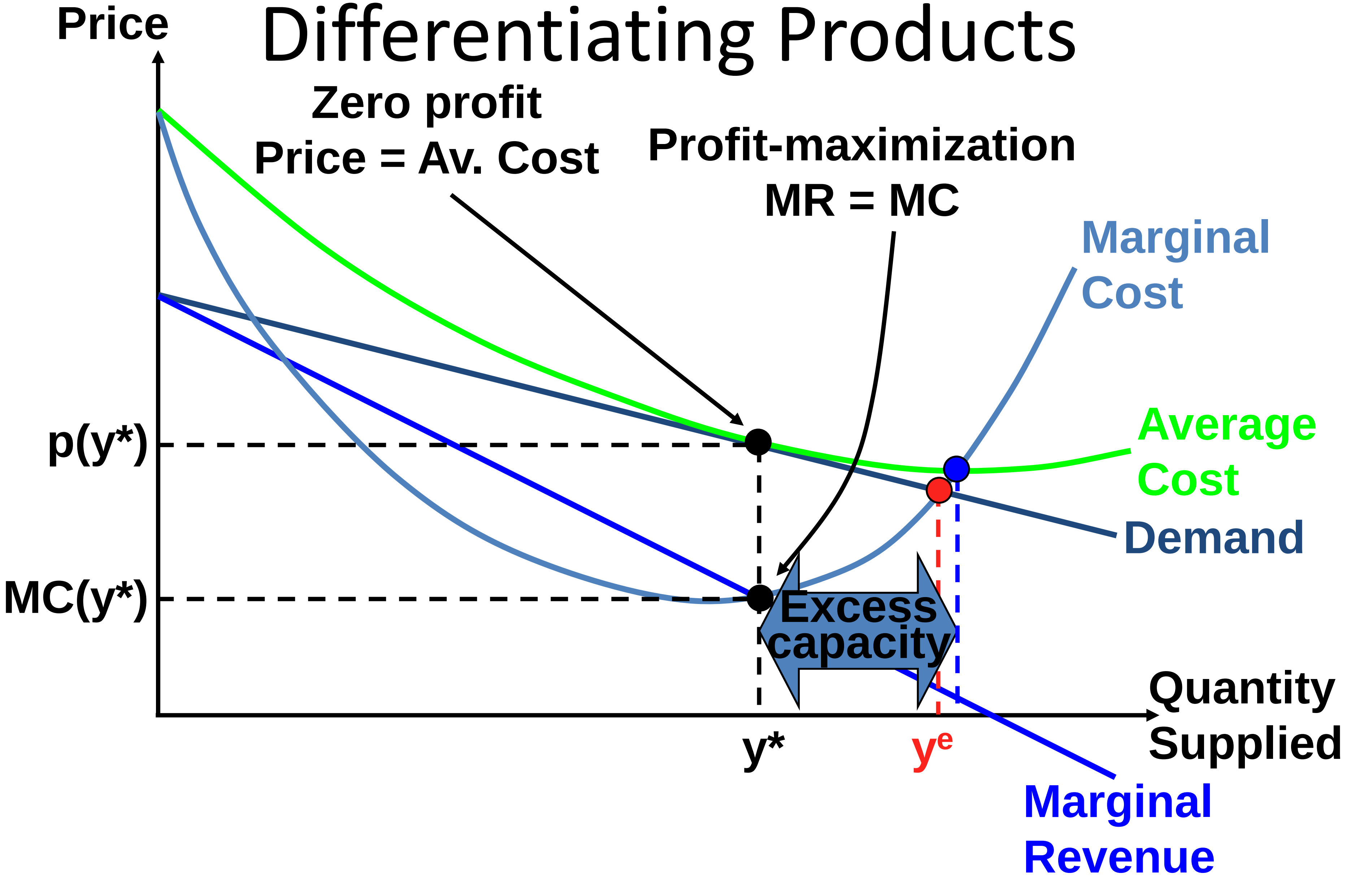
Differentiating Products



Differentiating Products

- Each seller supplies less than the efficient quantity of its product.
- Also, each seller supplies less than the quantity that minimizes its average cost and so, in this sense, each supplier has “excess capacity.”

Differentiating Products



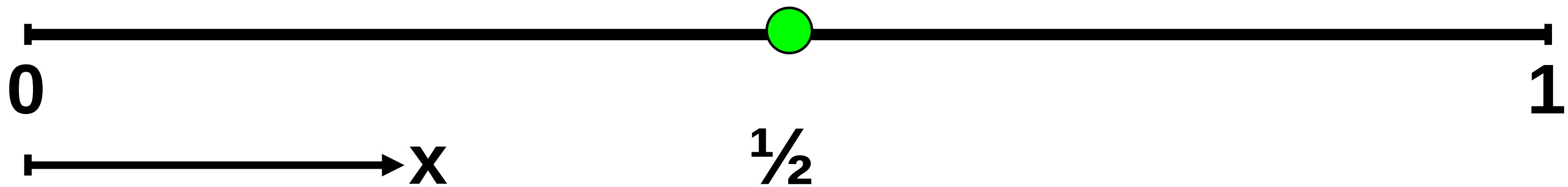
Differentiating Products by Location

- Think a region in which consumers are uniformly located along a line.
- Each consumer prefers to travel a shorter distance to a seller.
- There are $n \geq 1$ sellers.
- Where would we expect these sellers to choose their locations?

Differentiating Products by Location

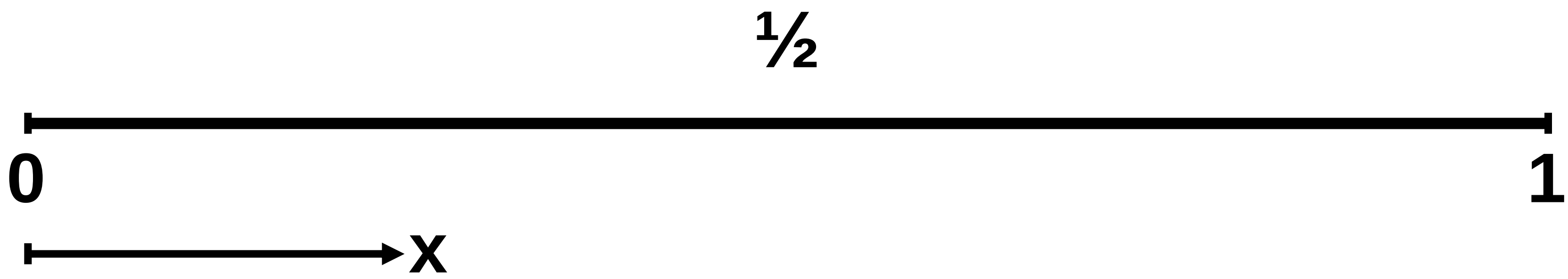
- If n = 1 (monopoly) then the seller maximizes its profit at x = ??

Differentiating Products by Location



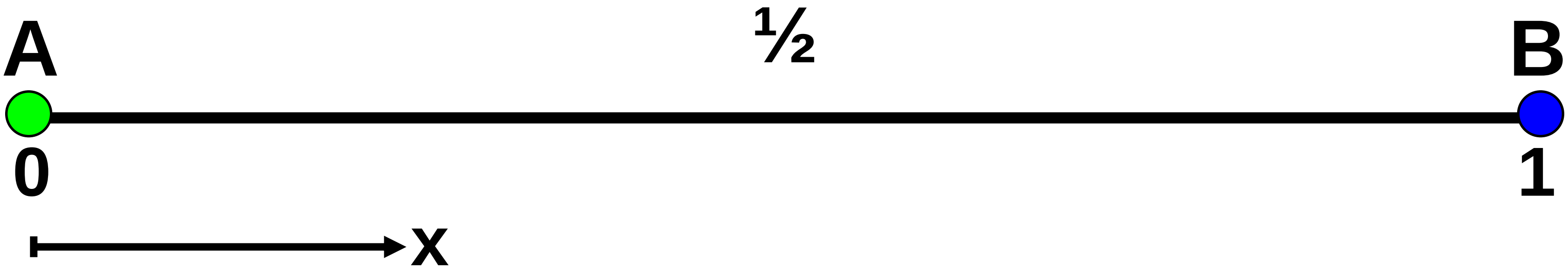
- If n = 1 (monopoly) then the seller maximizes its profit at x = ½ and minimizes the consumers’ travel cost.

Differentiating Products by Location



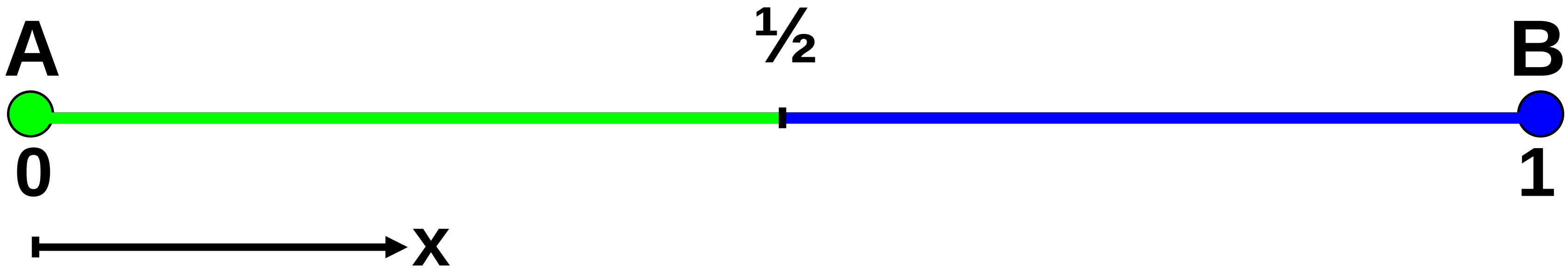
- If n = 2 (duopoly) then the equilibrium locations of the sellers, A and B, are x_A = ?? and x_B = ??

Differentiating Products by Location



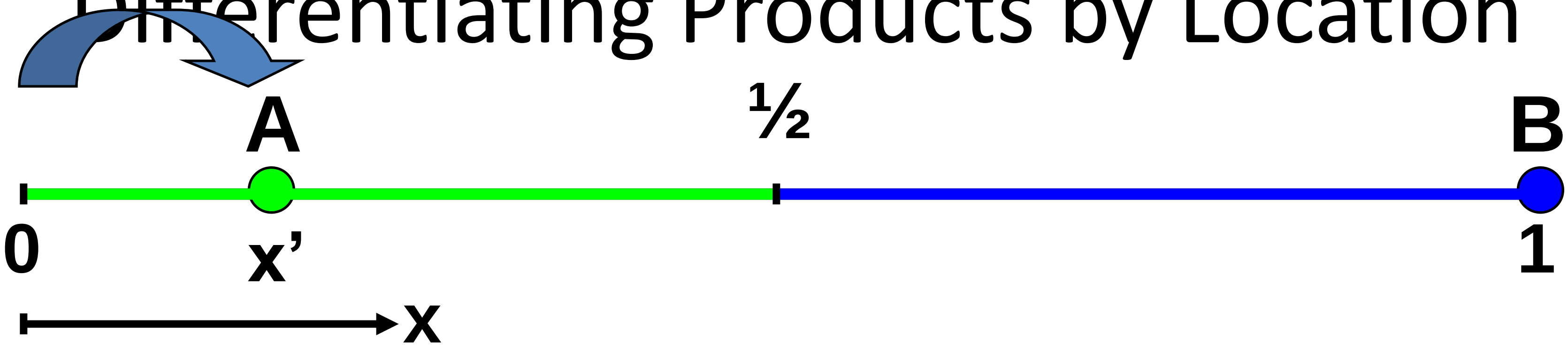
- If n = 2 (duopoly) then the equilibrium locations of the sellers, A and B, are x_A = ?? and x_B = ??
- How about $x_A = 0$ and $x_B = 1$; *i.e.* the sellers separate themselves as much as is possible?

Differentiating Products by Location



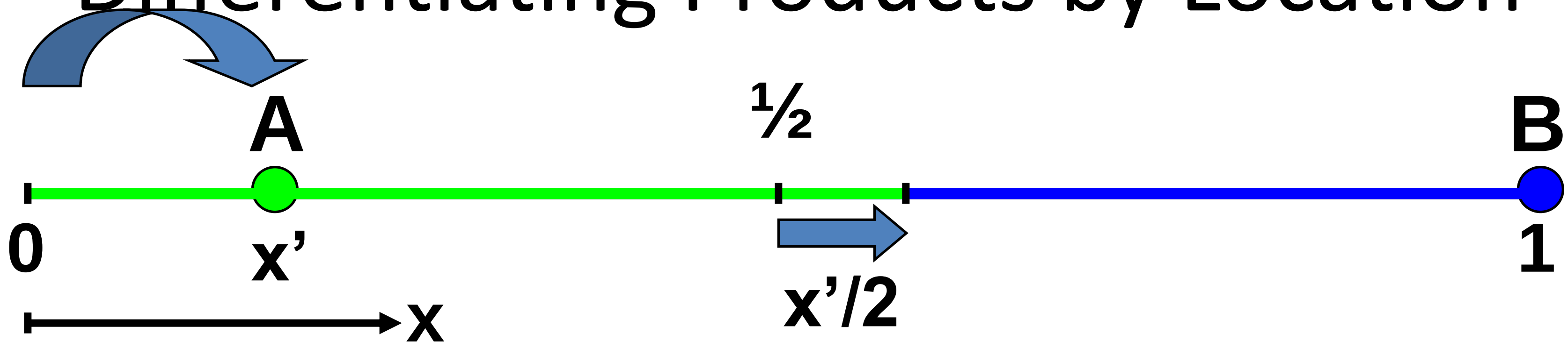
- If $x_A = 0$ and $x_B = 1$ then A sells to all consumers in $[0,½)$ and B sells to all consumers in $(½,1]$.
- Given B's location at $x_B = 1$, can A increase its profit?

Differentiating Products by Location



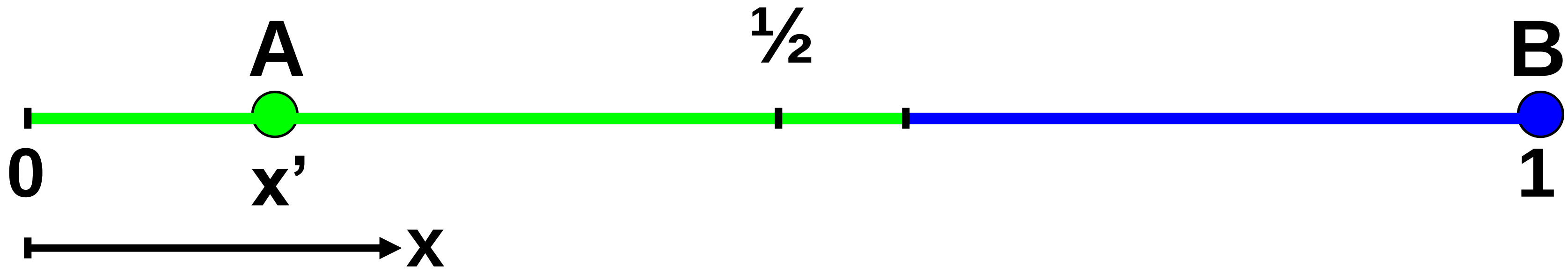
- If x_A = 0 and x_B = 1 then A sells to all consumers in [0,½) and B sells to all consumers in (½,1].
- Given B's location at x_B = 1, can A increase its profit? What if A moves to x'?

Differentiating Products by Location



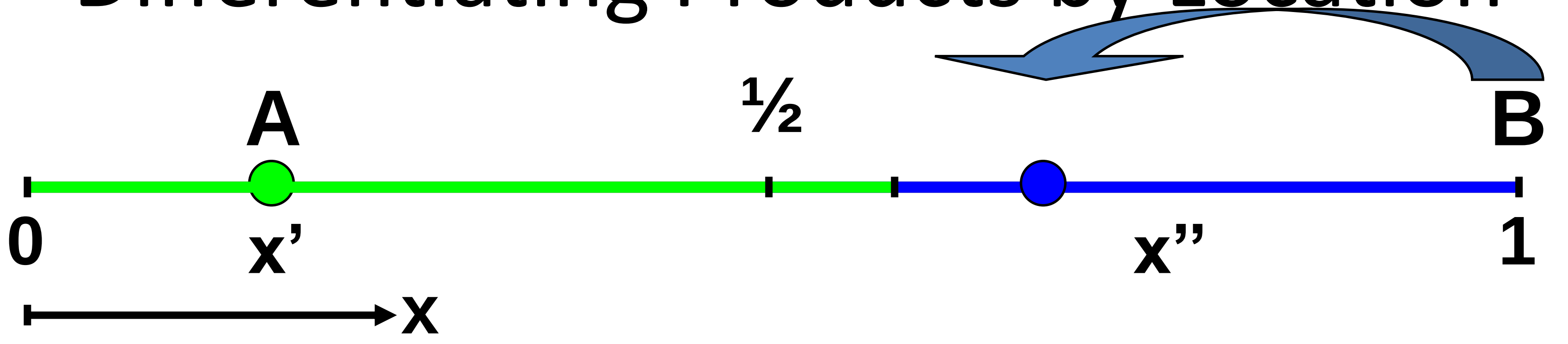
- If $x_A = 0$ and $x_B = 1$ then A sells to all consumers in [0,½) and B sells to all consumers in (½,1].
- Given B's location at $x_B = 1$, can A increase its profit? What if A moves to x'? Then A sells to all customers in [0,½+½ x') and increases its profit.

Differentiating Products by Location



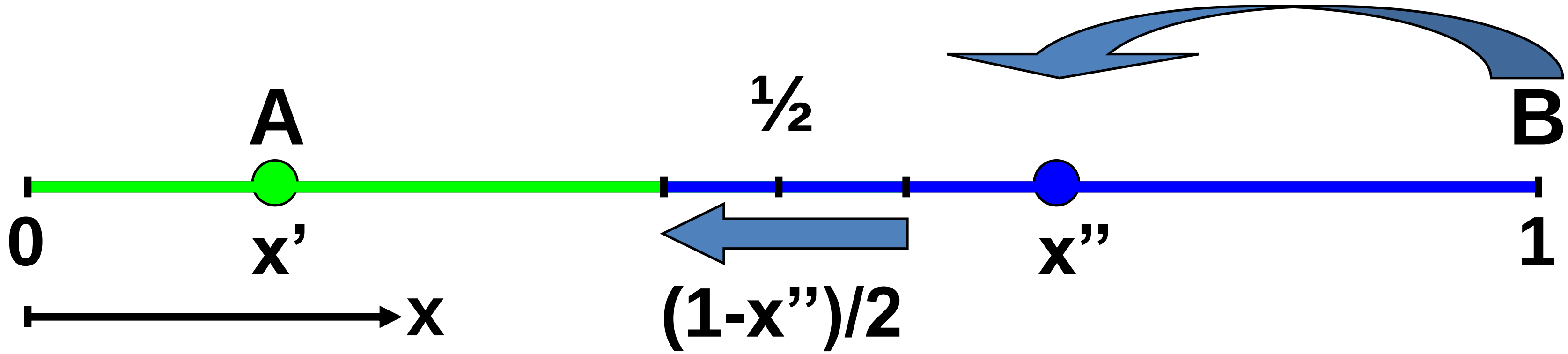
- Given $x_A = x'$, can B improve its profit by moving from $x_B = 1$?

Differentiating Products by Location



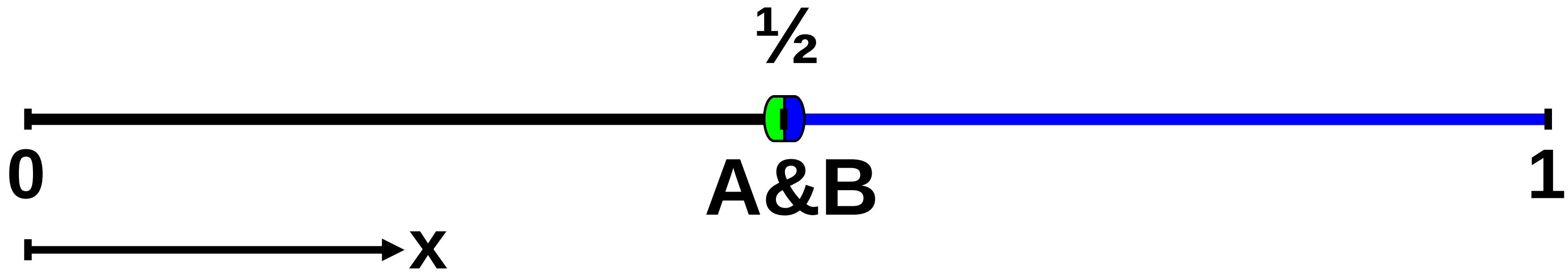
- Given $x_A = x'$, can B improve its profit by moving from $x_B = 1$? What if B moves to $x_B = x''$?

Differentiating Products by Location



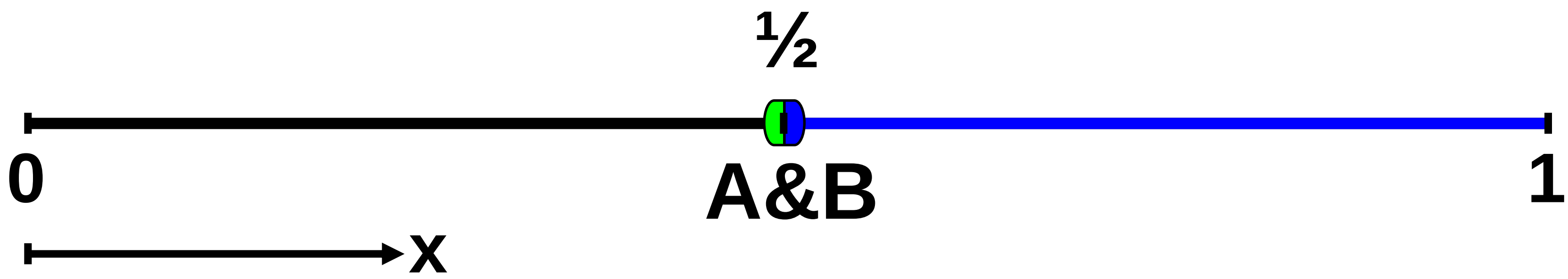
- Given $x_A = x'$, can B improve its profit by moving from $x_B = 1$? What if B moves to $x_B = x''$? Then B sells to all customers in $((x'+x'')/2,1]$ and increases its profit.
- So what is the NE?

Differentiating Products by Location



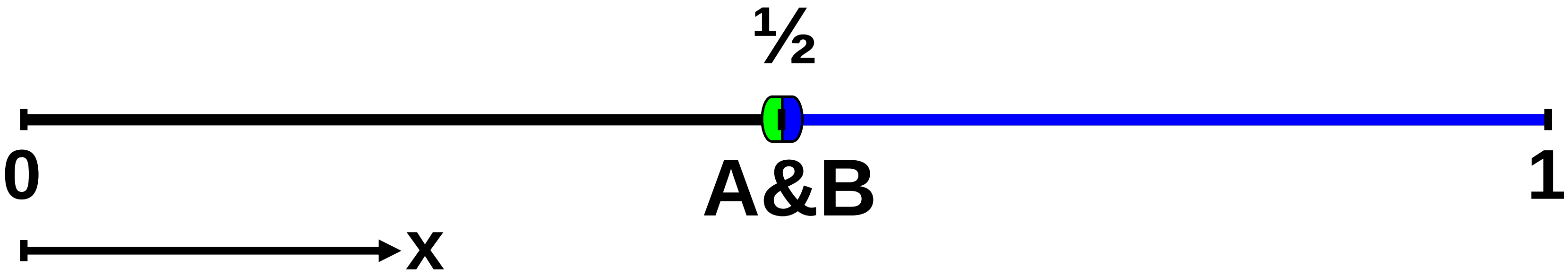
- Given x_A = x’, can B improve its profit by moving from x_B = 1? What if B moves to x_B = x’’? Then B sells to all customers in ((x’+x’’)/2,1] and increases its profit.
- So what is the NE? $x_A = x_B = ½$.

Differentiating Products by Location



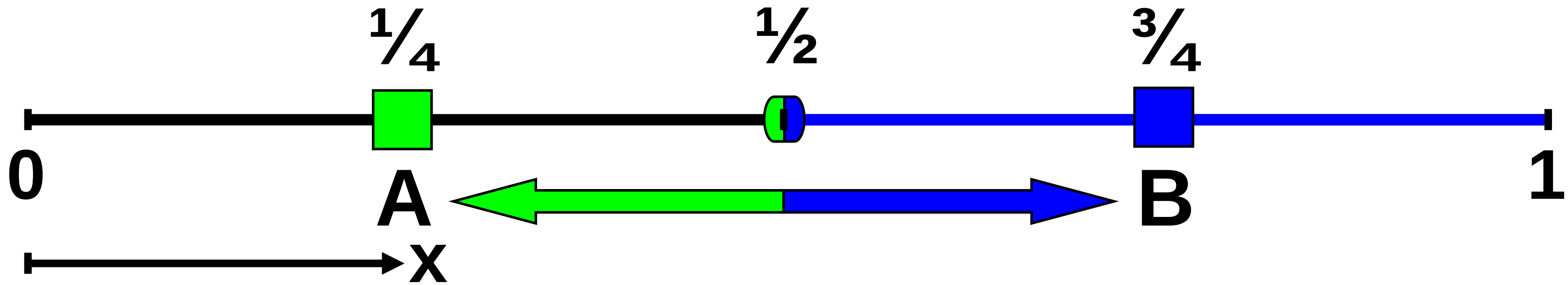
- The only NE is $x_A = x_B = ½$.
- Is the NE efficient?

Differentiating Products by Location



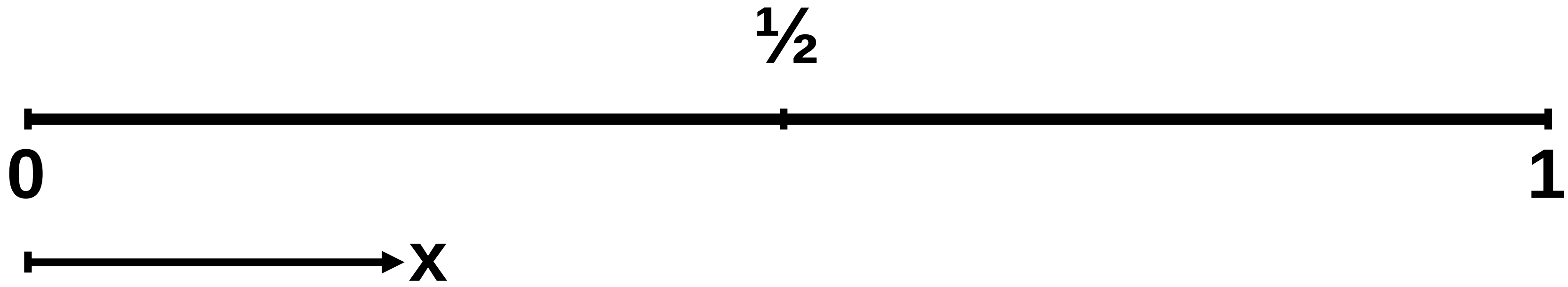
- The only NE is $x_A = x_B = ½$.
- Is the NE efficient? No.
- What is the efficient location of A and B?

Differentiating Products by Location



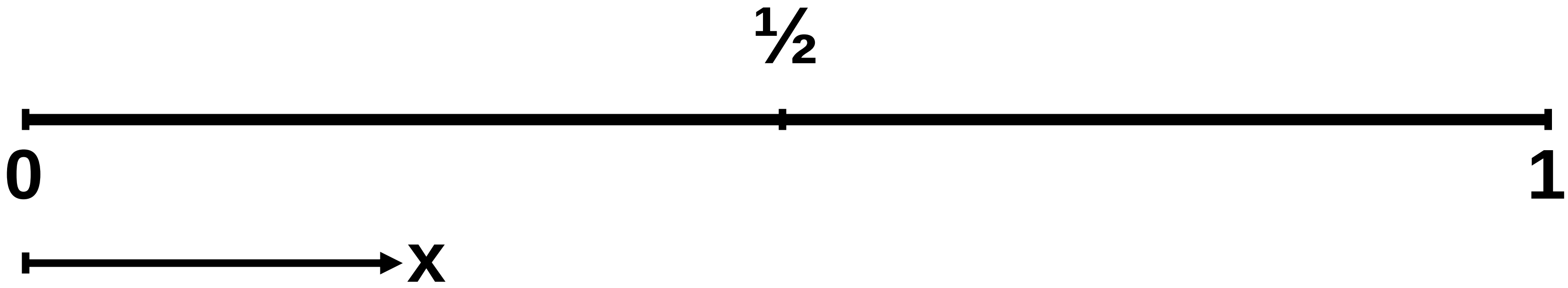
- The only NE is $x_A = x_B = ½$.
- Is the NE efficient? No.
- What is the efficient location of A and B? $x_A = ¼$ and $x_B = ¾$ since this minimizes the consumers' travel costs.

Differentiating Products by Location



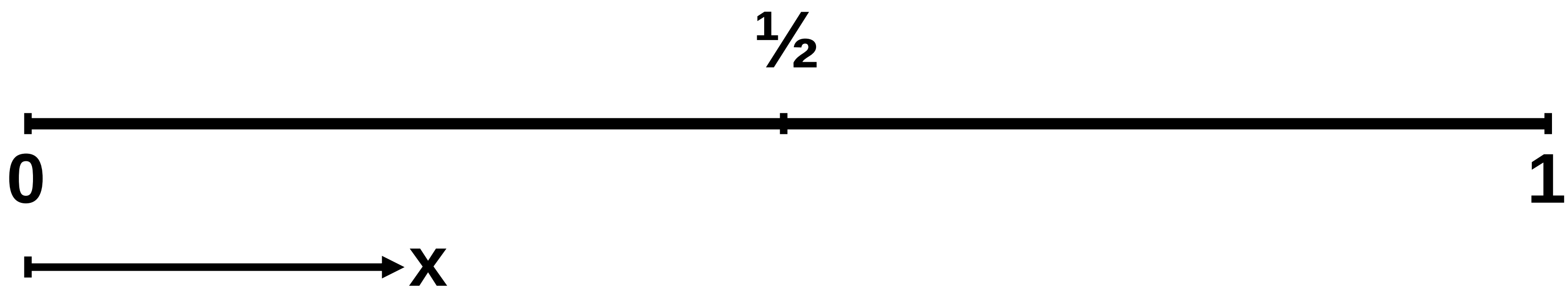
- What if n = 3; sellers A, B and C?

Differentiating Products by Location



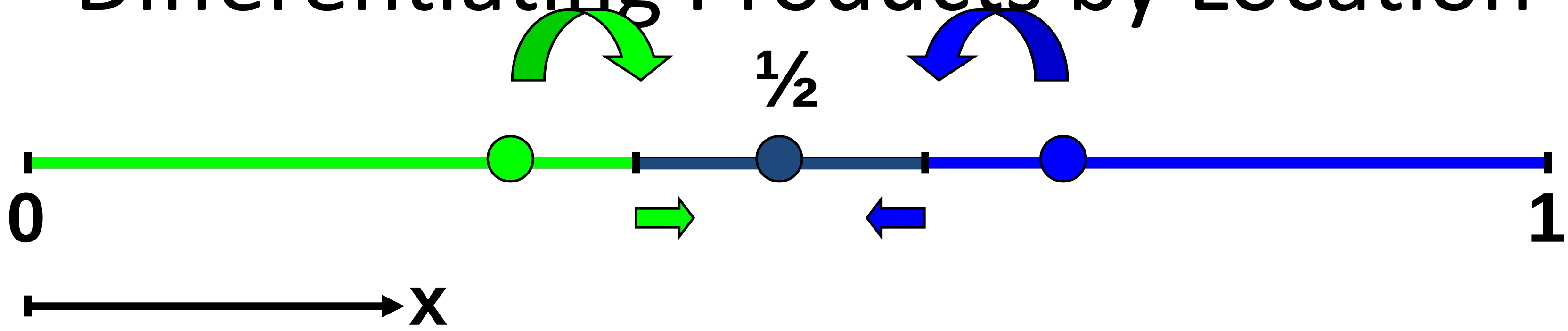
- What if n = 3; sellers A, B and C?
- Then there is no NE at all! Why?

Differentiating Products by Location



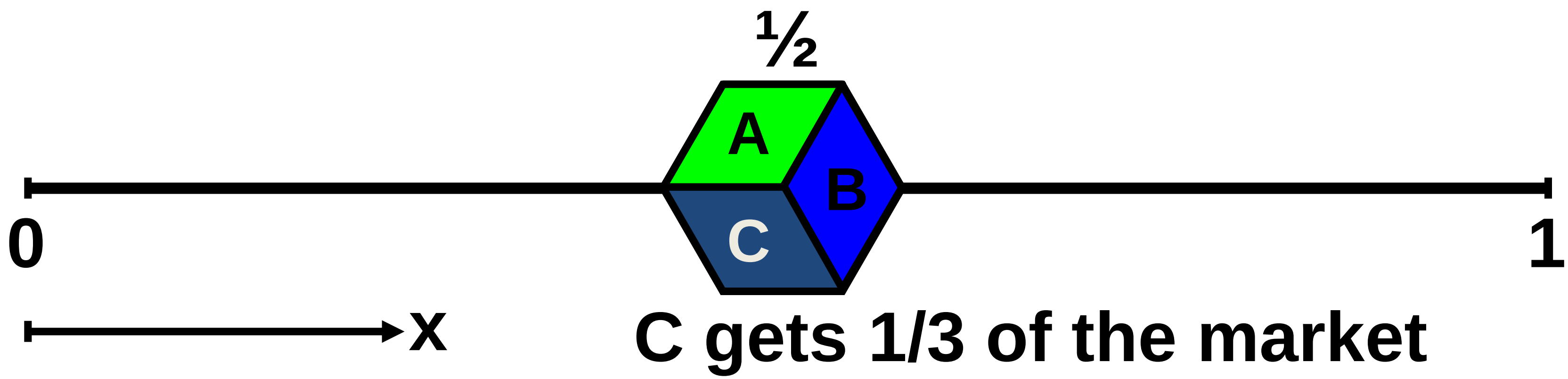
- What if n = 3; sellers A, B and C?
- Then there is no NE at all! Why?
- The possibilities are:
  – (i) All 3 sellers locate at the same point.
  – (ii) 2 sellers locate at the same point.
  – (iii) Every seller locates at a different point.

Differentiating Products by Location



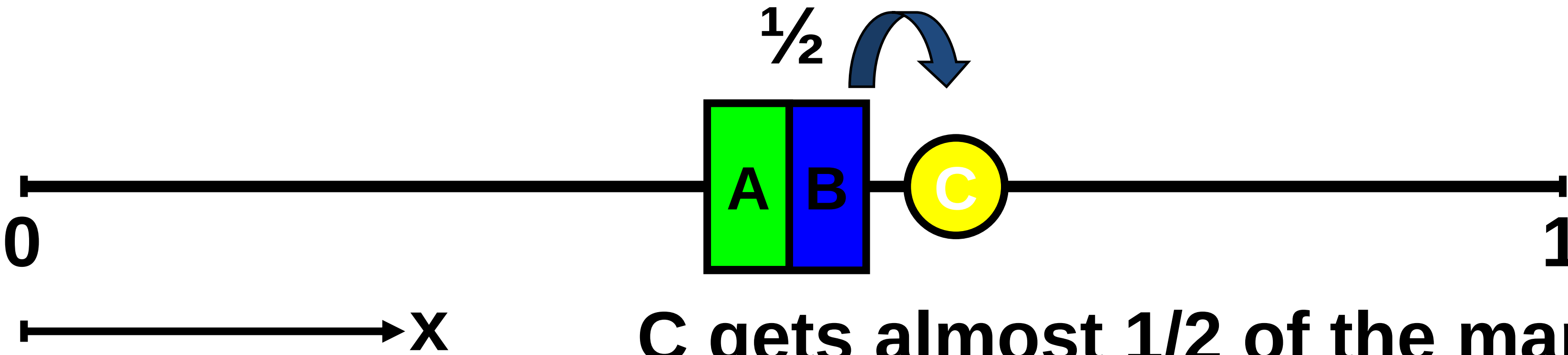
- (iii) Every seller locates at a different point.
- Cannot be a NE since, as for n = 2, the two outside sellers get higher profits by moving closer to the middle seller.

Differentiating Products by Location



- (i) All 3 sellers locate at the same point.
- Cannot be an NE since it pays one of the sellers to move just a little bit left or right of the other two to get all of the market on that side, instead of having to share those customers.

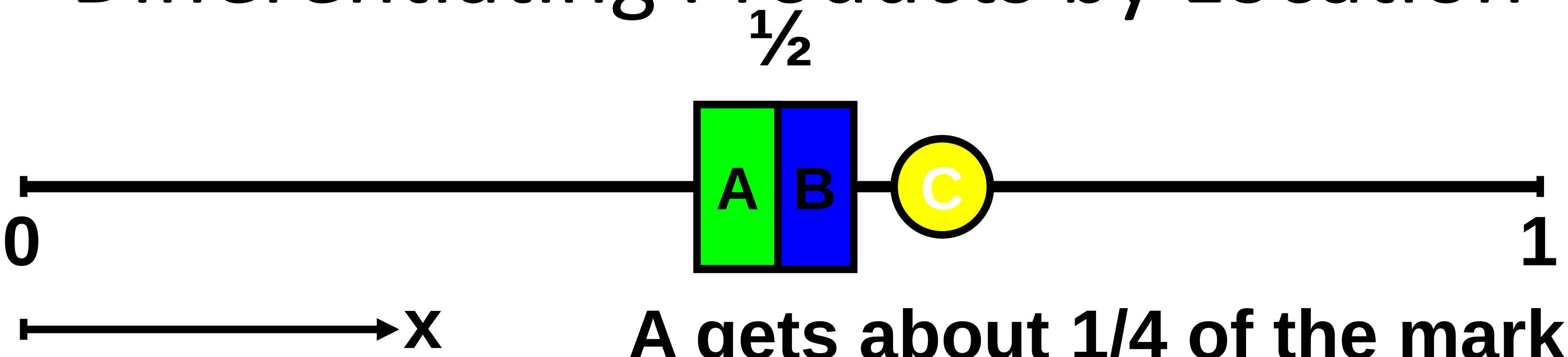
Differentiating Products by Location



C gets almost 1/2 of the market

- (i) All 3 sellers locate at the same point.
- Cannot be an NE since it pays one of the sellers to move just a little bit left or right of the other two to get all of the market on that side, instead of having to share those customers.

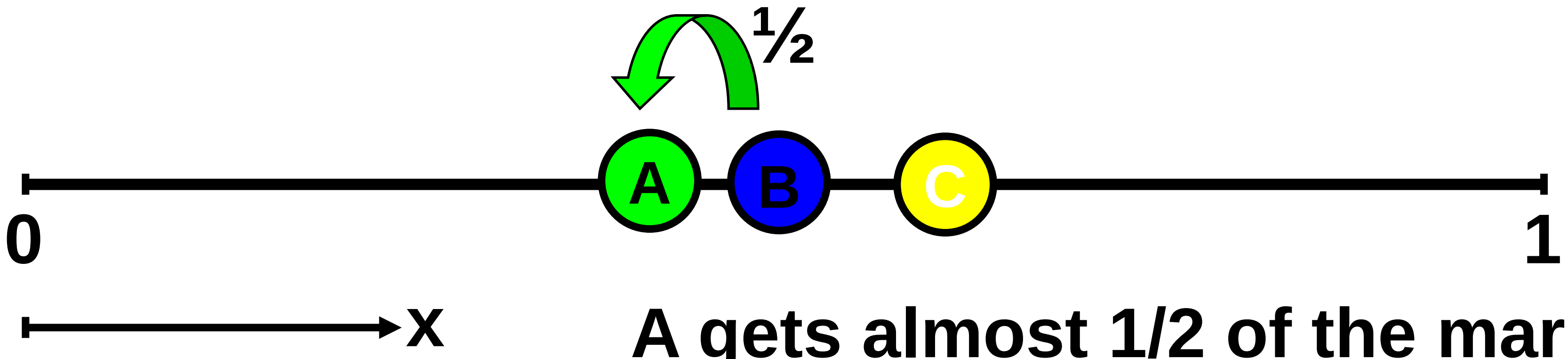
Differentiating Products by Location



A gets about 1/4 of the market

- 2 sellers locate at the same point.
- Cannot be an NE since it pays one of the two sellers to move just a little away from the other.

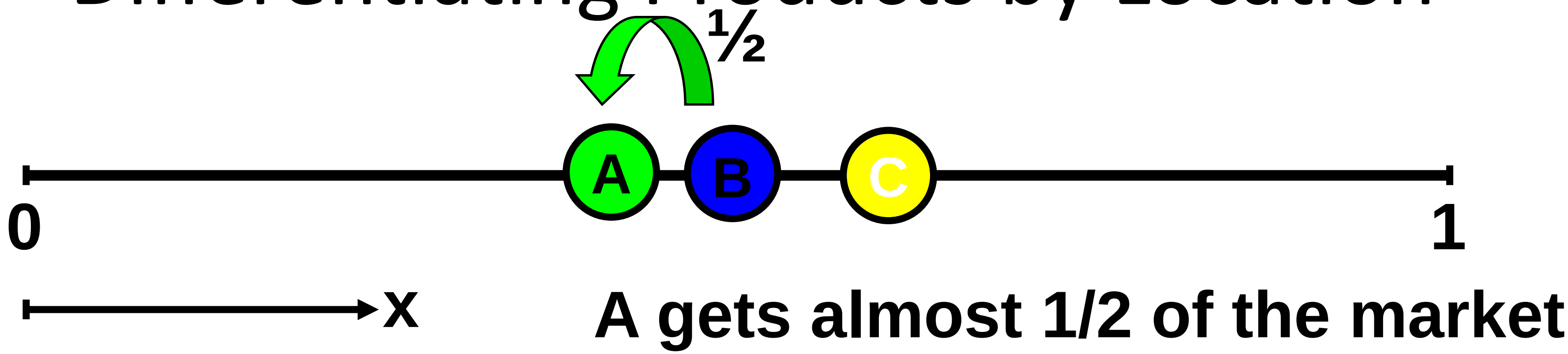
Differentiating Products by Location



A gets almost 1/2 of the market

- 2 sellers locate at the same point.
- Cannot be an NE since it pays one of the two sellers to move just a little away from the other.

Differentiating Products by Location



- 2 sellers locate at the same point.
- Cannot be an NE since it pays one of the two sellers to move just a little away from the other.

Differentiating Products by Location

- If n = 3 the possibilities are:
  - ~~(i) All 3 sellers locate at the same point.~~
  - ~~(ii) 2 sellers locate at the same point.~~
  - ~~(iii) Every seller locates at a different poi~~nt.
- There is no NE for n = 3.

Differentiating Products by Location

- If n = 3 the possibilities are:
  - ~~(i) All 3 sellers locate at the same point.~~
  - ~~(ii) 2 sellers locate at the same point.~~
  - ~~(iii) Every seller locates at a different point.~~
- There is no NE for n = 3.
- However, this is a NE for every n ≥ 4.