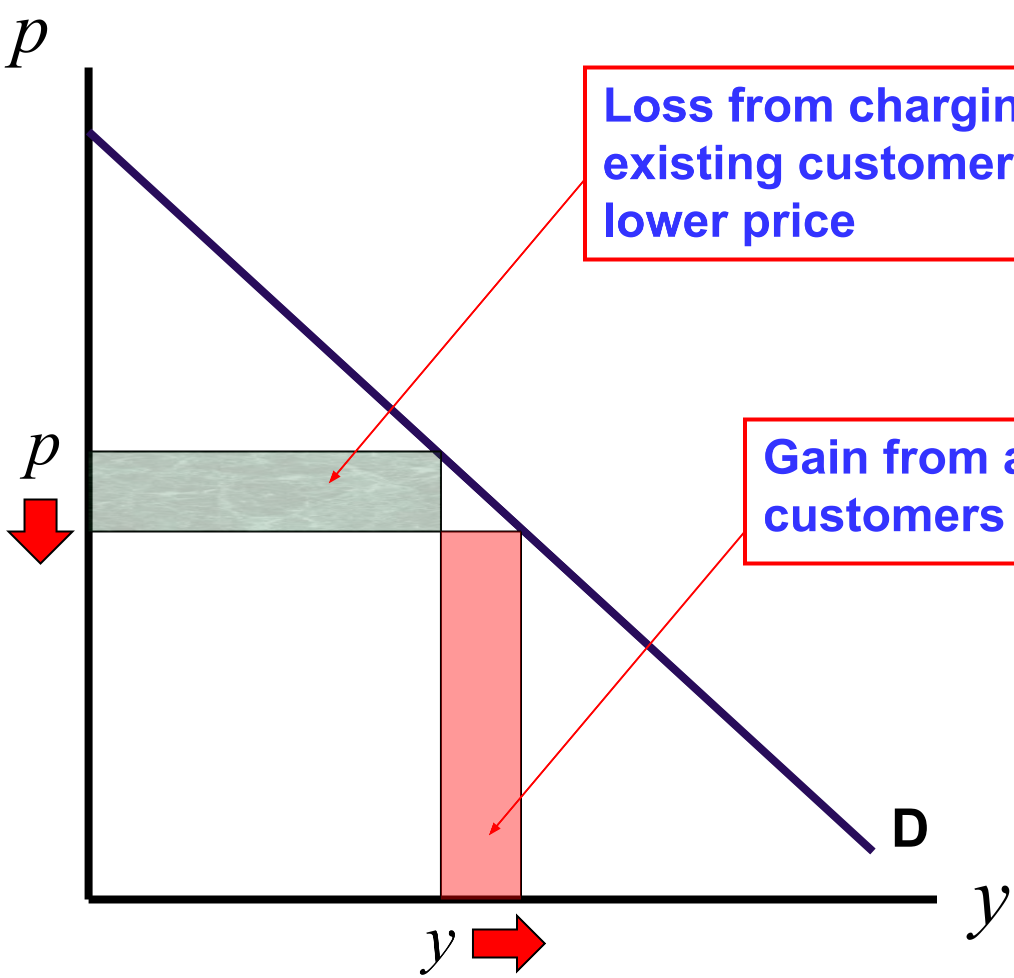
Finance 510: Microeconomic Analysis

Monopoly Pricing Techniques

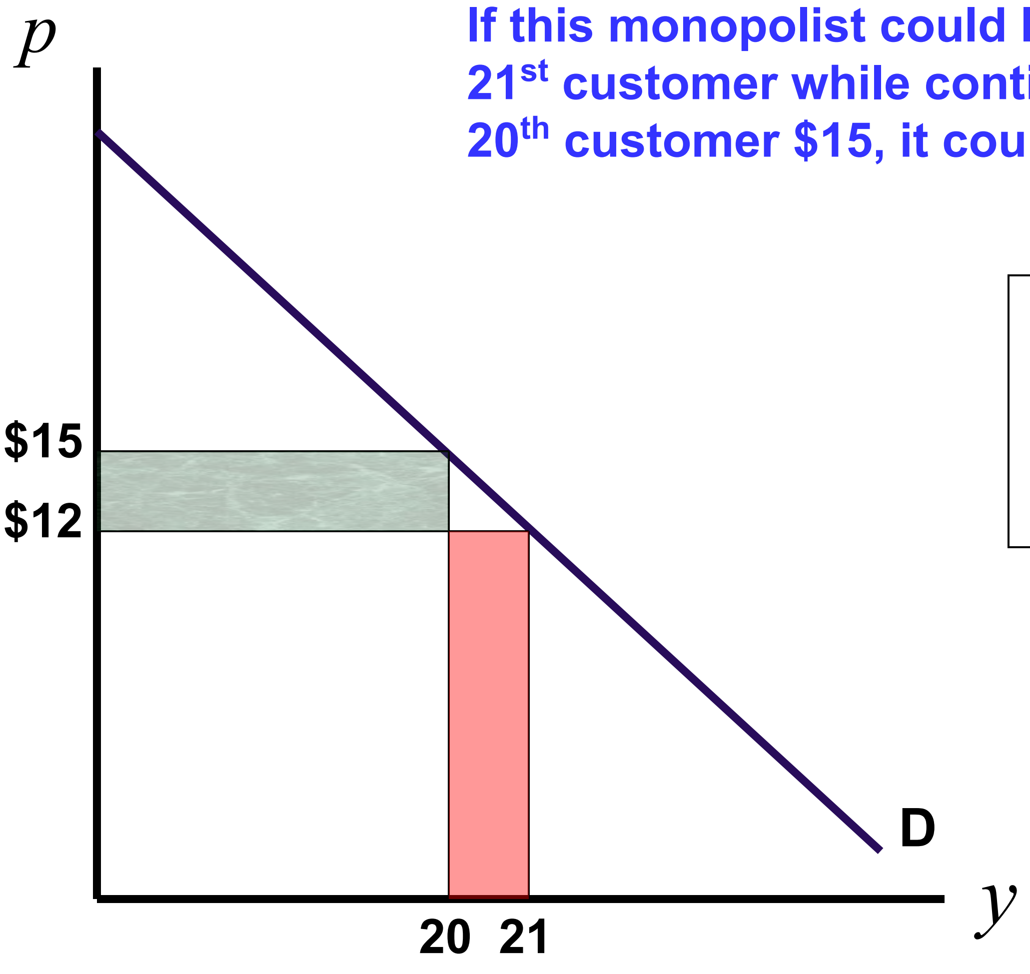
Monopolies face the entire (downward sloping) market demand and therefore must lower its price to increase sales.



Is it possible to attract new customers without lowering your price to everybody?

Price Discrimination

If this monopolist could lower its price to the 21st customer while continuing to charge the 20th customer $15, it could increase profits.

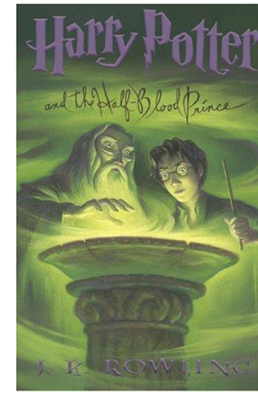


Problems:

- Identification
- Arbitrage

Price Discrimination (Group Pricing)

Suppose that you are the publisher for JK Rowling's newest book "Harry Potter and the Half Blood Prince"



Your marginal costs are constant at $4 per book and you have the following demand curves:

$$Q_{US} = 9 - .25P$$

US Sales

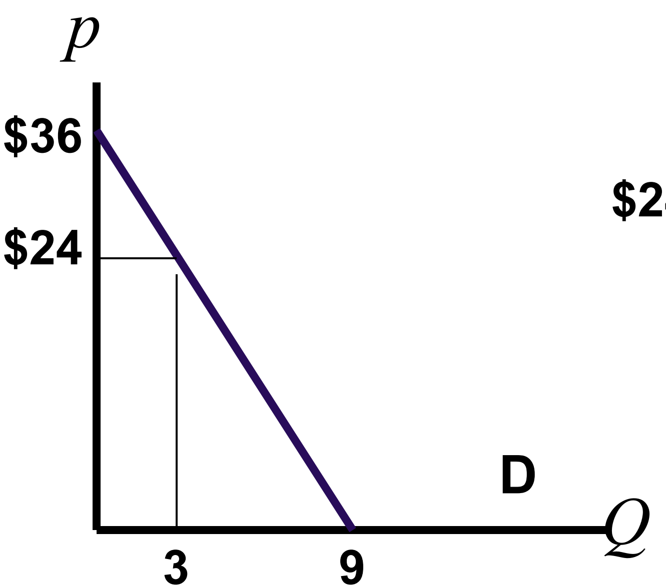
$$Q_E = 6 - .25P$$

European Sales

If you don’t have the ability to sell at different prices to the two markets, then we need to aggregate these demands into a world demand.

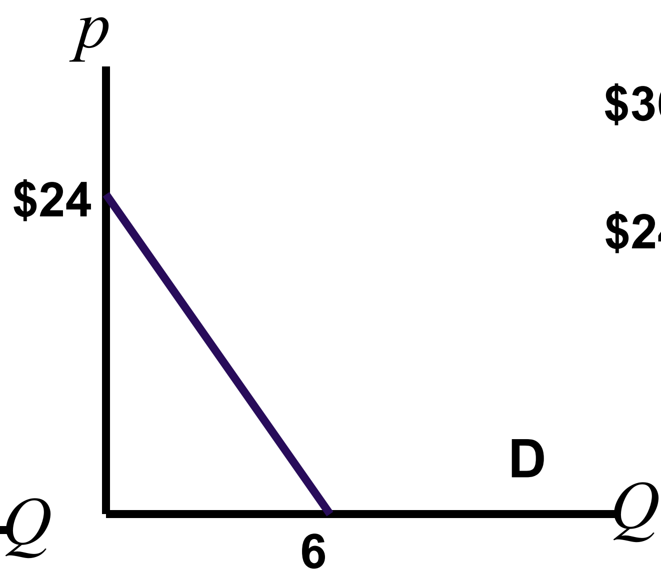
US Market

$$Q_{US} = 9 - .25P$$



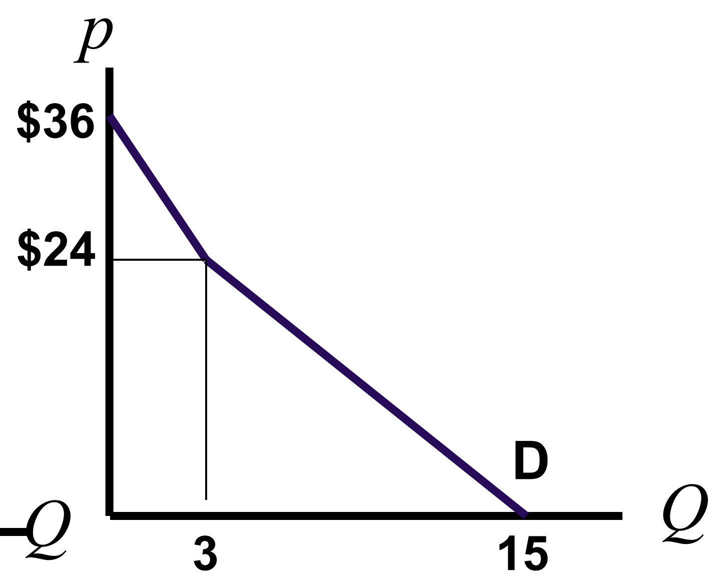
European Market

$$Q_E = 6 - .25P$$



Worldwide

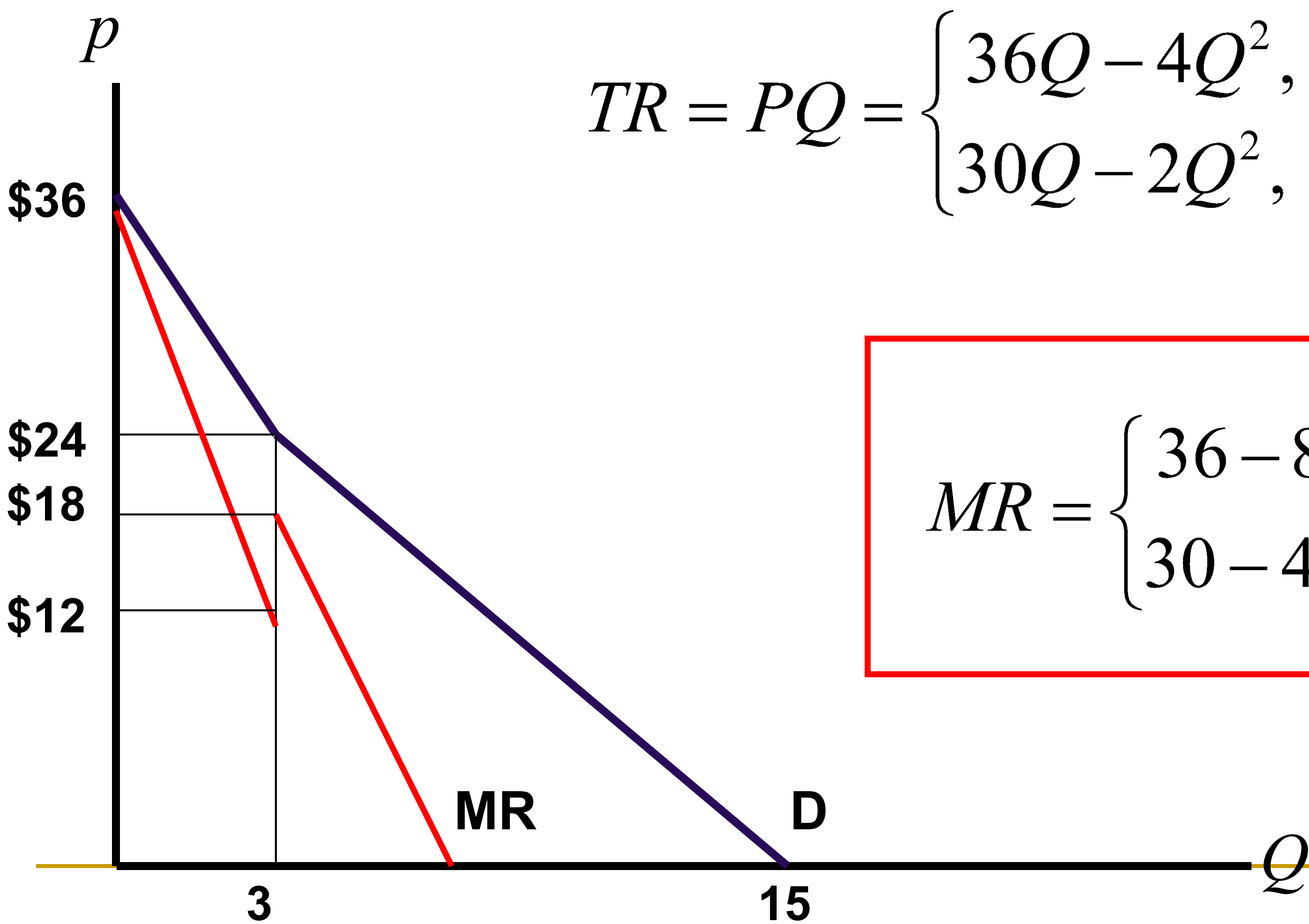
$$Q = \begin{cases} 9 - .25P, & \mathrm{Q} \leq 3 \\ 15 - .5P, & \mathrm{Q} > 3 \end{cases}$$



$$Q = \begin{cases} 9 - .25P, & Q \le 3 \\ 15 - .5P, & Q > 3 \end{cases} \Rightarrow P = \begin{cases} 36 - 4Q, & Q \le 3 \\ 30 - 2Q, & Q > 3 \end{cases}$$

$$TR = PQ = \begin{cases} 36Q - 4Q^2, & Q \le 3 \\ 30Q - 2Q^2, & Q > 3 \end{cases}$$

$$\boxed{MR = \begin{cases} 36 - 8Q, & Q \le 3 \\ 30 - 4Q, & Q > 3 \end{cases}}$$

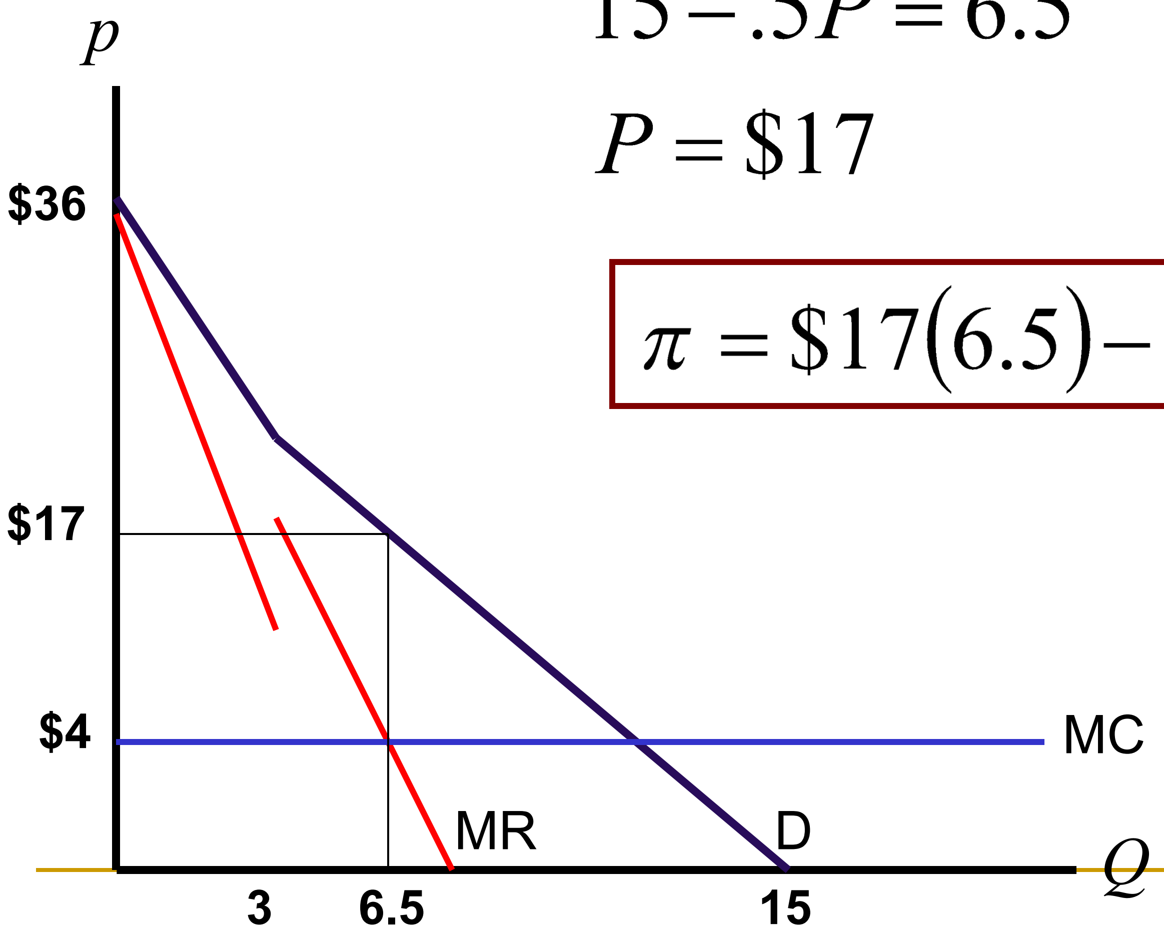


$$MR = \begin{cases} 36 - 8Q, & Q \le 3 \\ 30 - 4Q, & Q > 3 \end{cases} = MC = 4 \Rightarrow Q = 6.5$$

$$15 - .5P = 6.5$$

$$P = \$17$$

$$\boxed{\pi = \$17(6.5) - \$4(6.5) = \$84.5}$$

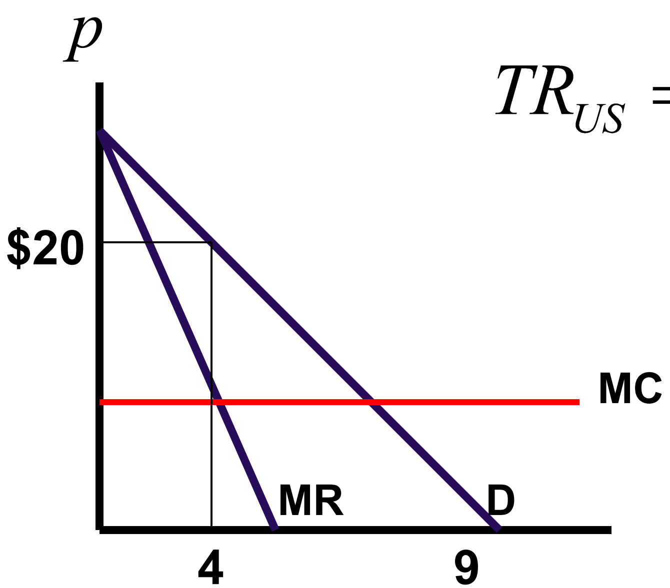


If you can distinguish between the two markets (and resale is not a problem), then you can treat them separately.

US Market

$$Q_{US} = 9 - .25P \Rightarrow P_{US} = 36 - 4Q_{US}$$

$$TR_{US} = 36Q - 4Q_{US}^2 \Rightarrow MR_{US} = 36 - 8Q_{US}$$

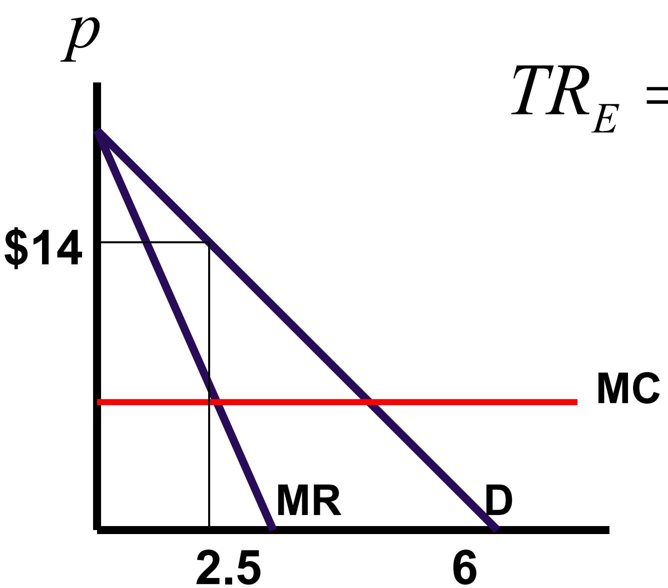


$$\boxed{\begin{aligned} 36 - 8Q_{US} &= 4 \\ Q &= 4 \\ P &= \$20 \end{aligned}}$$

If you can distinguish between the two markets (and resale is not a problem), then you can treat them separately.

European Market

$$Q_E = 6 - .25P_E \Rightarrow P_E = 24 - 4Q_E$$

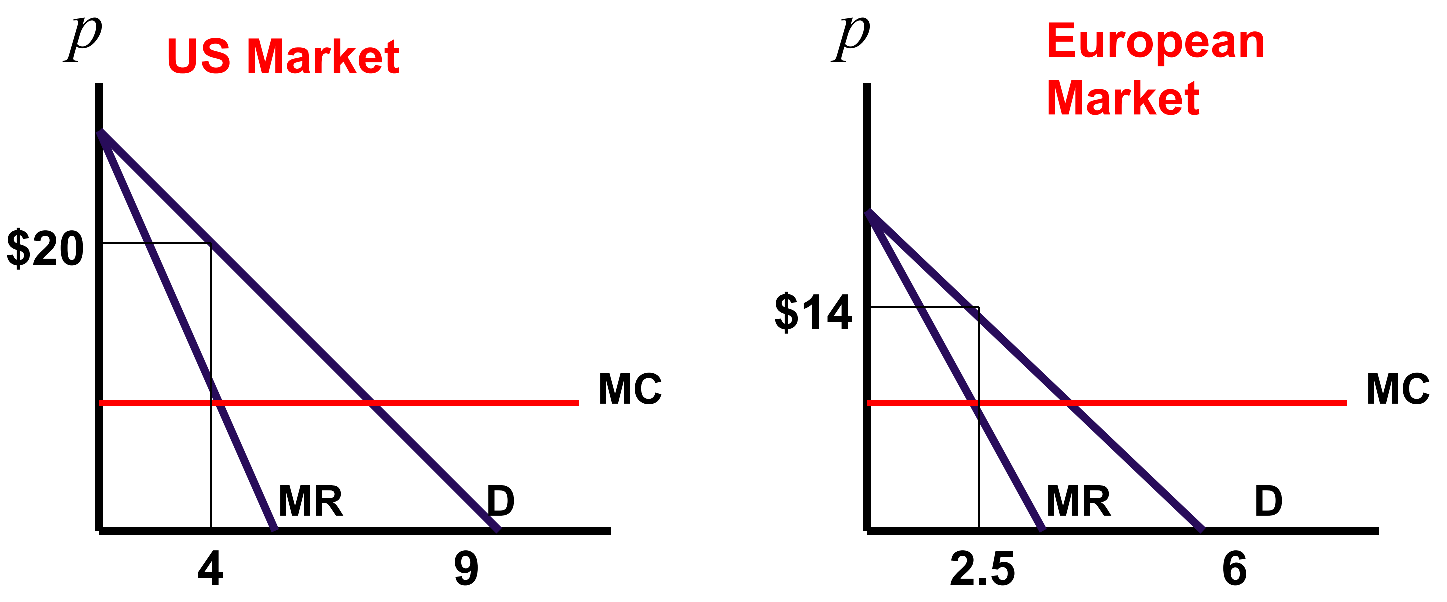


$$TR_E = 24Q - 4Q_E^2 \Rightarrow MR_E = 24 - 8QE$$

$$\boxed{\begin{aligned} 24 - 8Q_E &= 4 \\ Q &= 2.5 \\ P &= \$14 \end{aligned}}$$

Price Discrimination (Group Pricing)

$$\pi = \$20(4) + \$14(2.5) - \$4(6.5) = \$89$$



Price Discrimination (Two Part Pricing)

Suppose you operate an amusement park. You know that you face two types of customers (Young and Old). You have estimates their (inverse) demands as follows:

$$Q_o = 80 - P_O$$ **Old**

$$Q_Y = 100 - P_Y$$ **Young**

You have a a constant marginal cost of $2 per ride

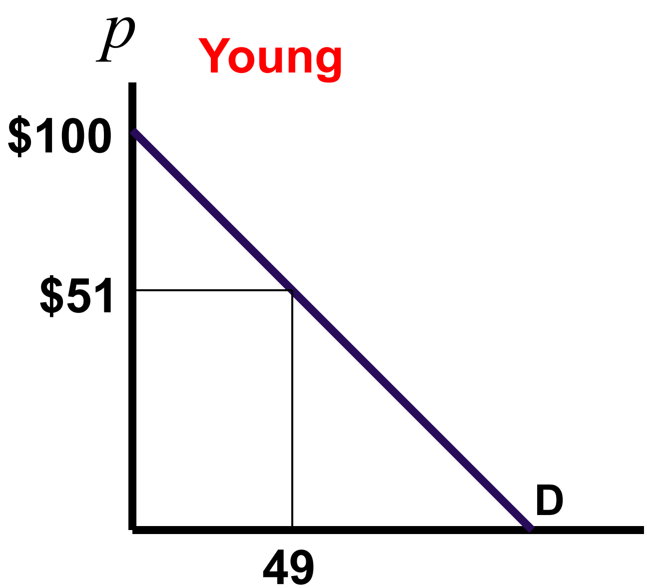
Can you distinguish low demanders from high demanders?

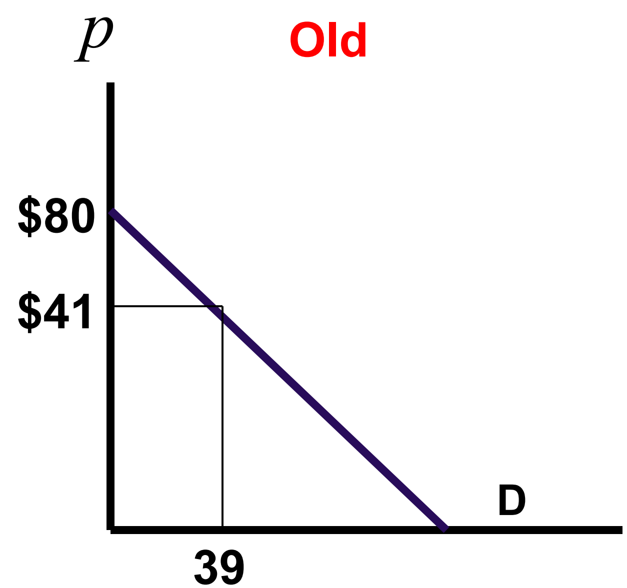
Can you prevent resale?

Group Pricing

If you could distinguish each group and prevent resale, you could charge different prices

$$Q_Y = 100 - P_Y \qquad\qquad Q_o = 80 - P_O$$



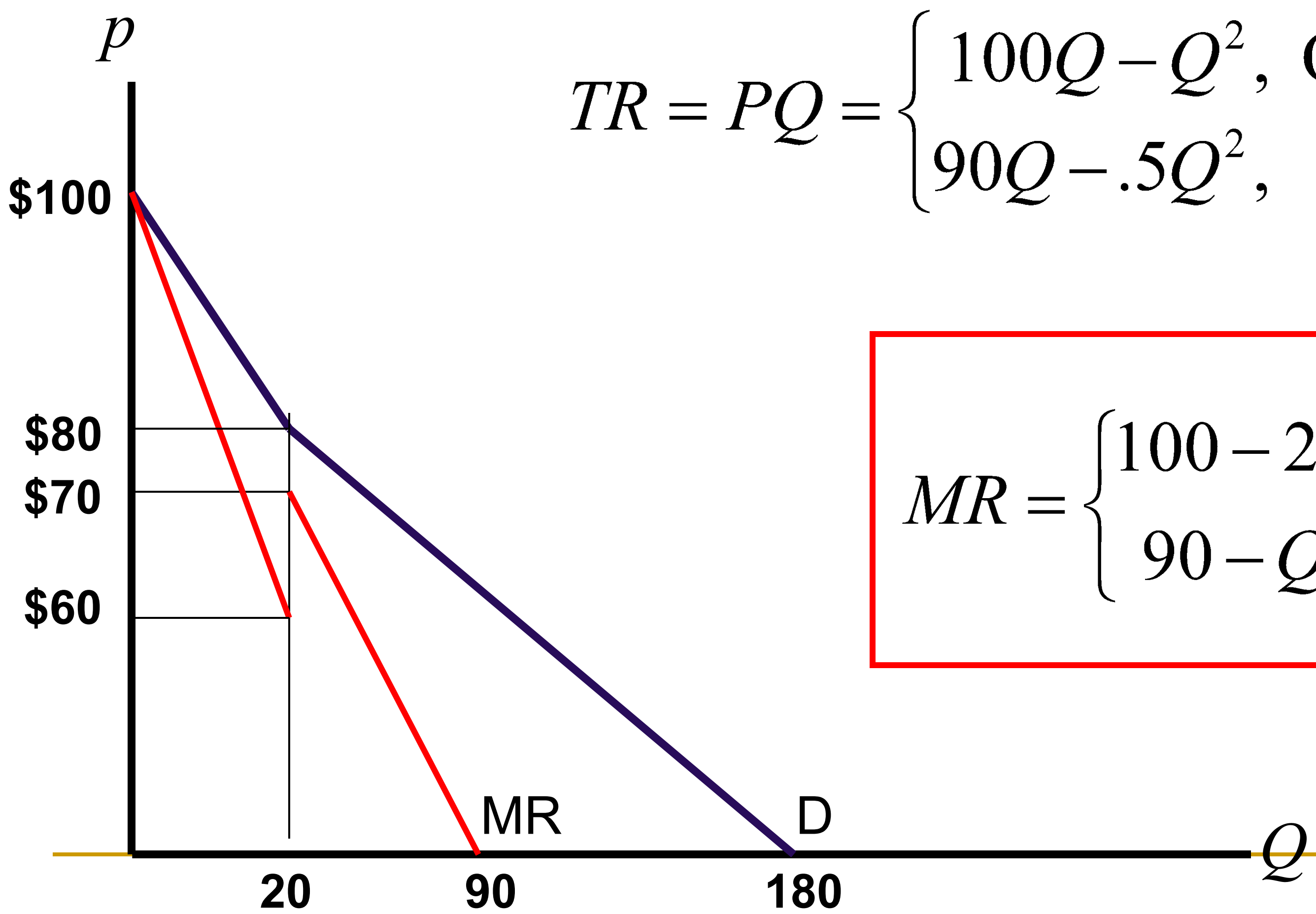


Two Part Pricing

$$P = \begin{cases} 100 - Q, & Q \le 20 \\ 90 - .5Q, & Q > 20 \end{cases}$$

First, lets calculate a uniform price for both consumers

$$TR = PQ = \begin{cases} 100Q - Q^2, & Q \le 20 \\ 90Q - .5Q^2, & Q > 20 \end{cases}$$

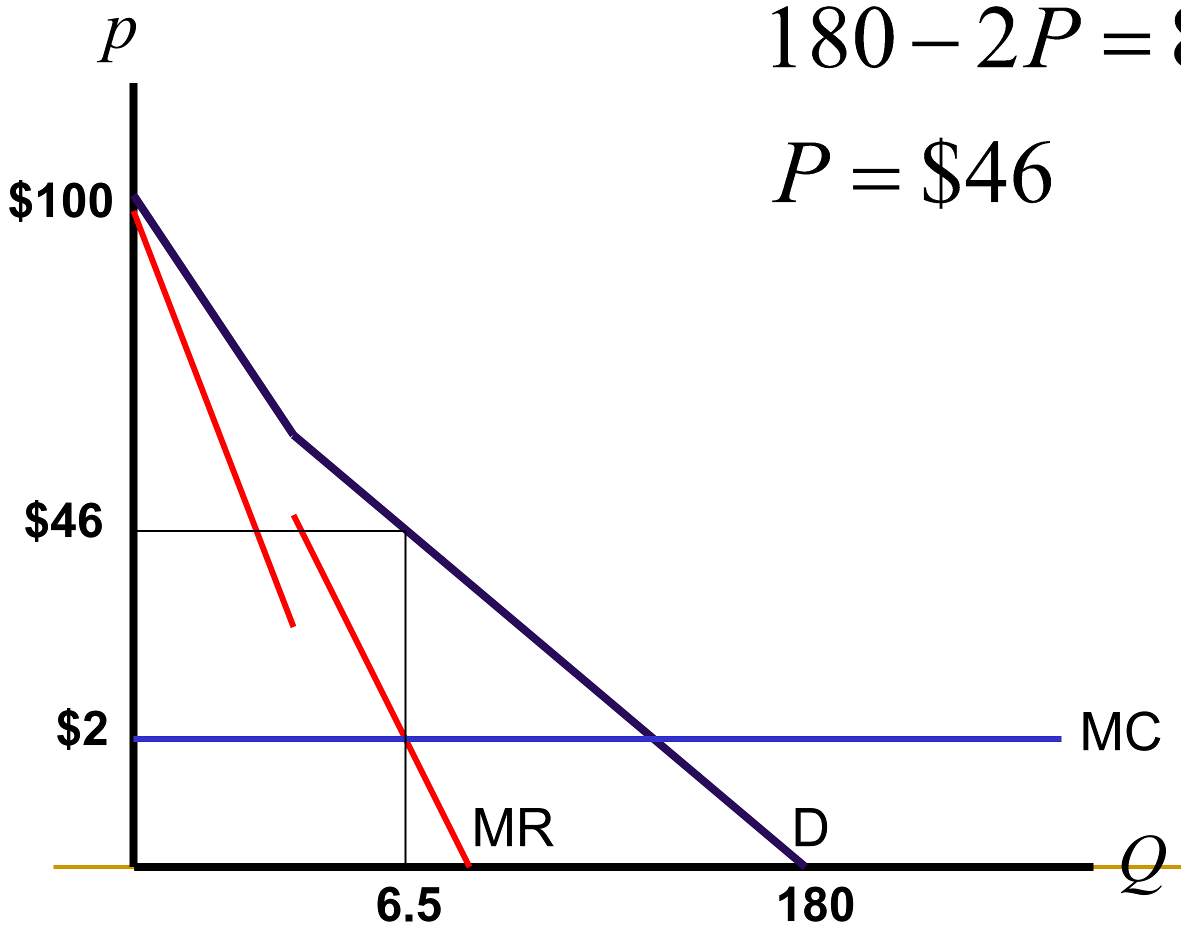


$$MR = \begin{cases} 100 - 2Q, & Q \le 20 \\ 90 - Q, & Q > 20 \end{cases}$$

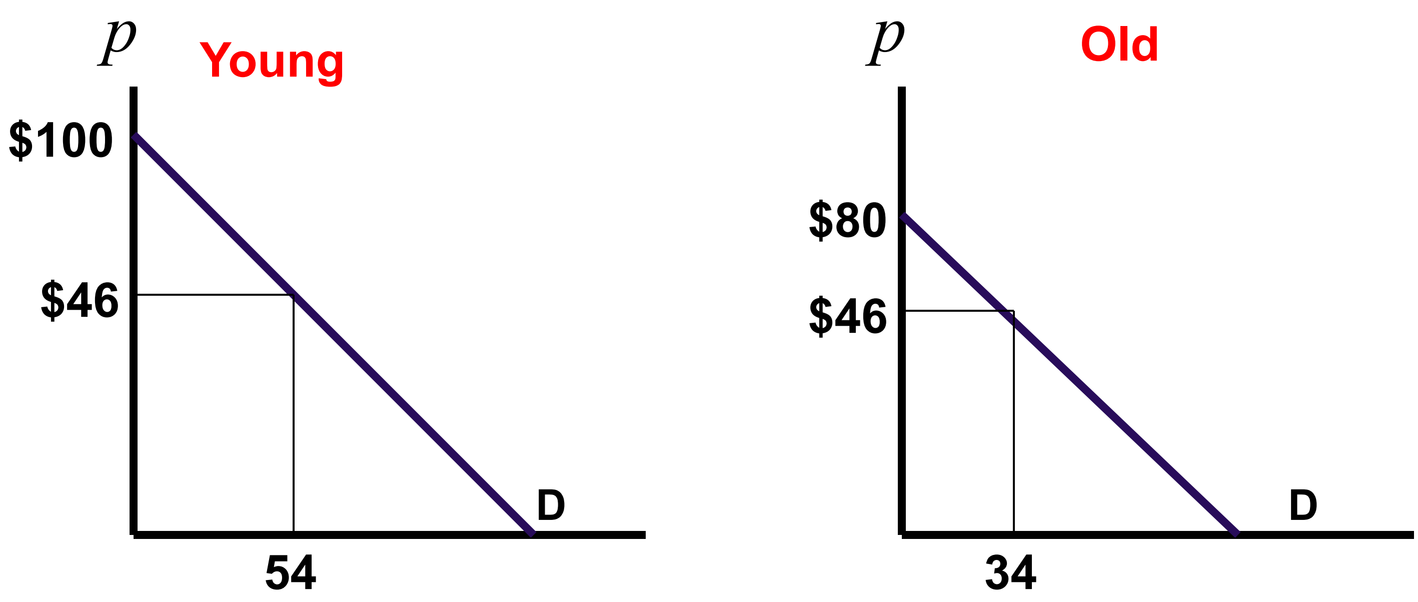
$$MR = \begin{Bmatrix} 100 - 2Q, & Q \le 20 \\ 90 - Q, & Q > 20 \end{Bmatrix} = MC = 2 \Rightarrow Q = 88$$

$$180 - 2P = 88$$

$$P = \$46$$



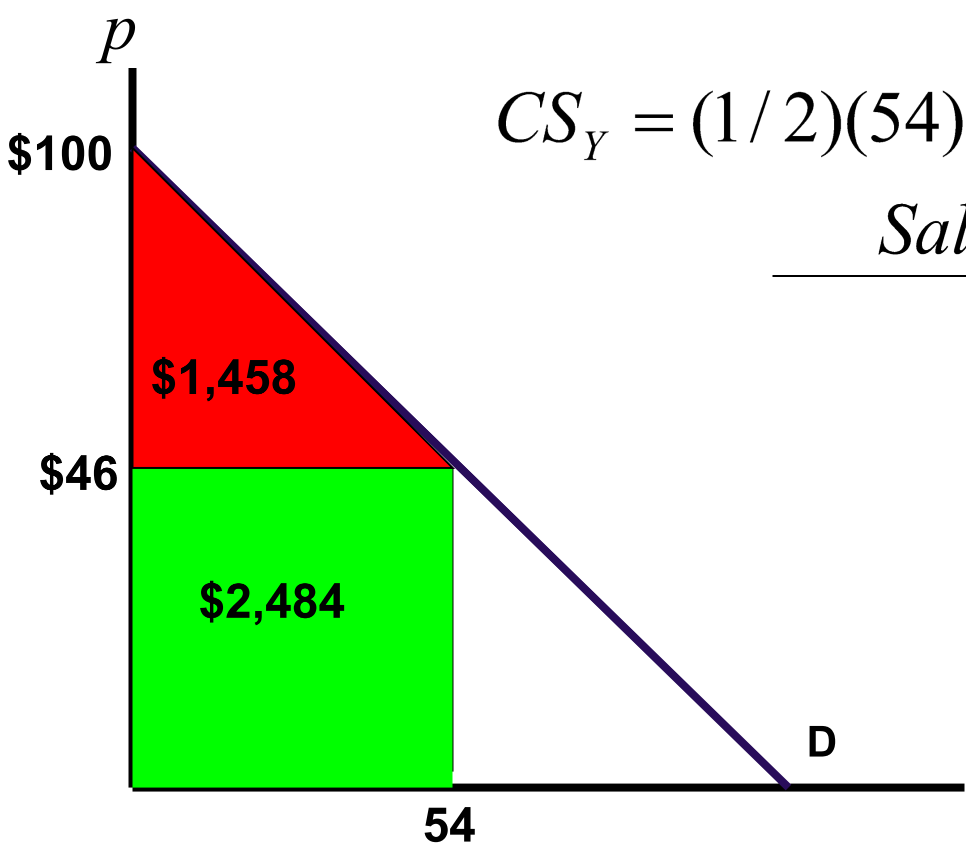
First, you set a price for everyone equal to $46. Young people choose 54 rides while old people choose 34 rides.



Can we do better than this?

The young person paid a total of \$2,484 for the 54 rides. However, this consumer was willing to pay \$3942.

$$Q_Y = 100 - P_Y$$



$$CS_Y = (1/2)(54)(\$100 - \$46) = \$1{,}458$$

$$Sales = \$46(54) = \$2{,}484$$

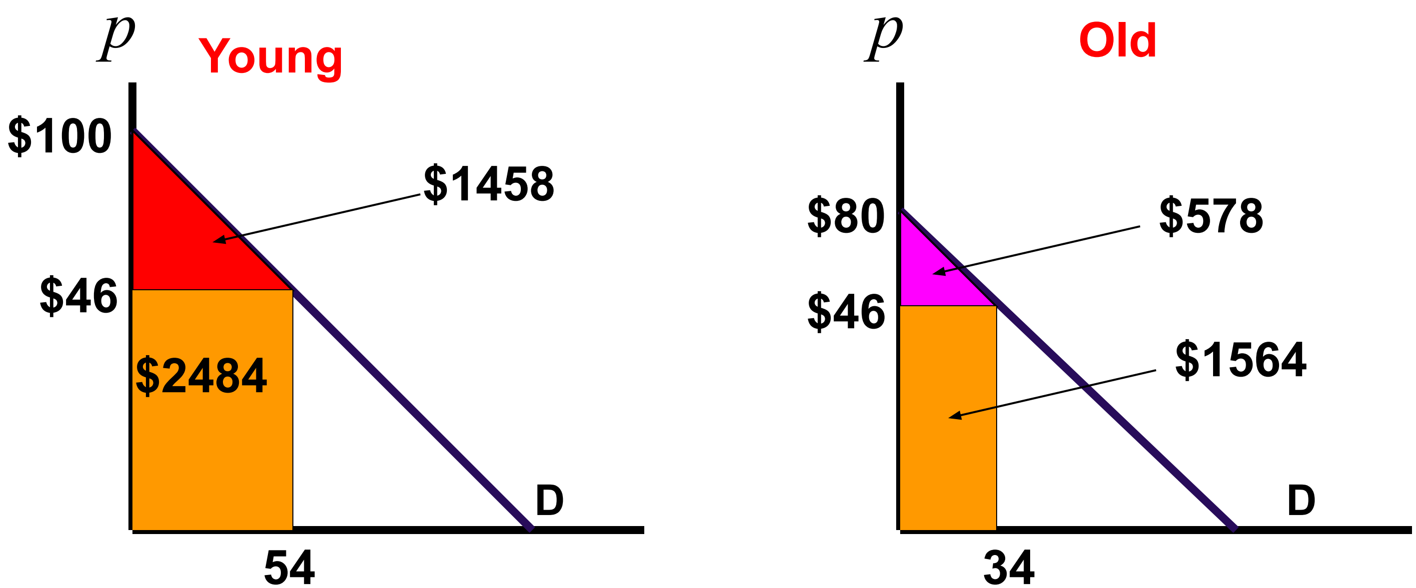
$$\$3{,}942$$

How can we extract this extra money?

Two Part pricing involves setting an "entry fee" as well as a per unit price. In this case, you could set a common per ride fee of $46, but then extract any remaining surplus from the consumers by setting the following entry fees.

P = $46/Ride

Entry Fee = $1458 Young; $578 Old

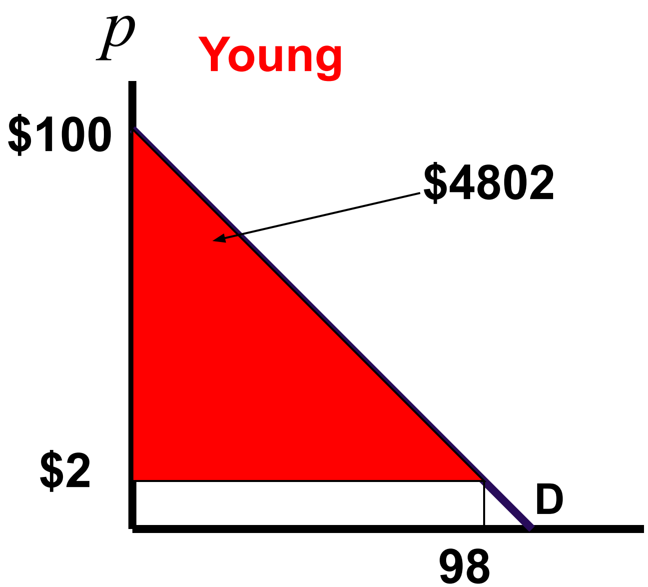


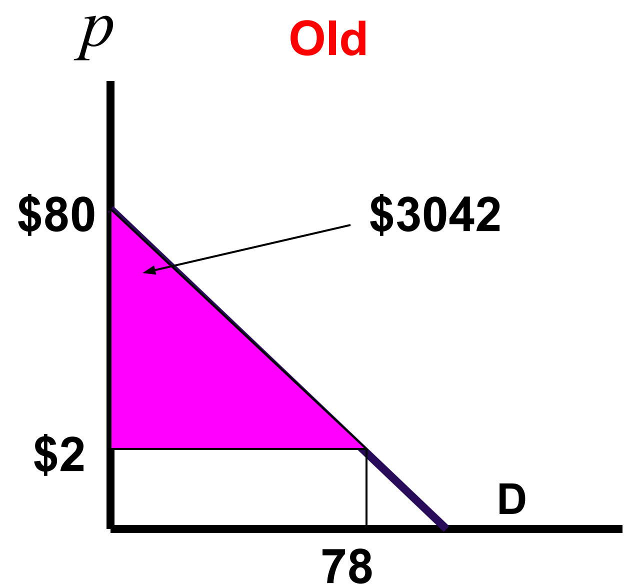
Could you do better than this?

Suppose that you set the cost of the rides at their marginal cost ($2). Both old and young people would use more rides and, hence, have even more surplus to extract via the fee.

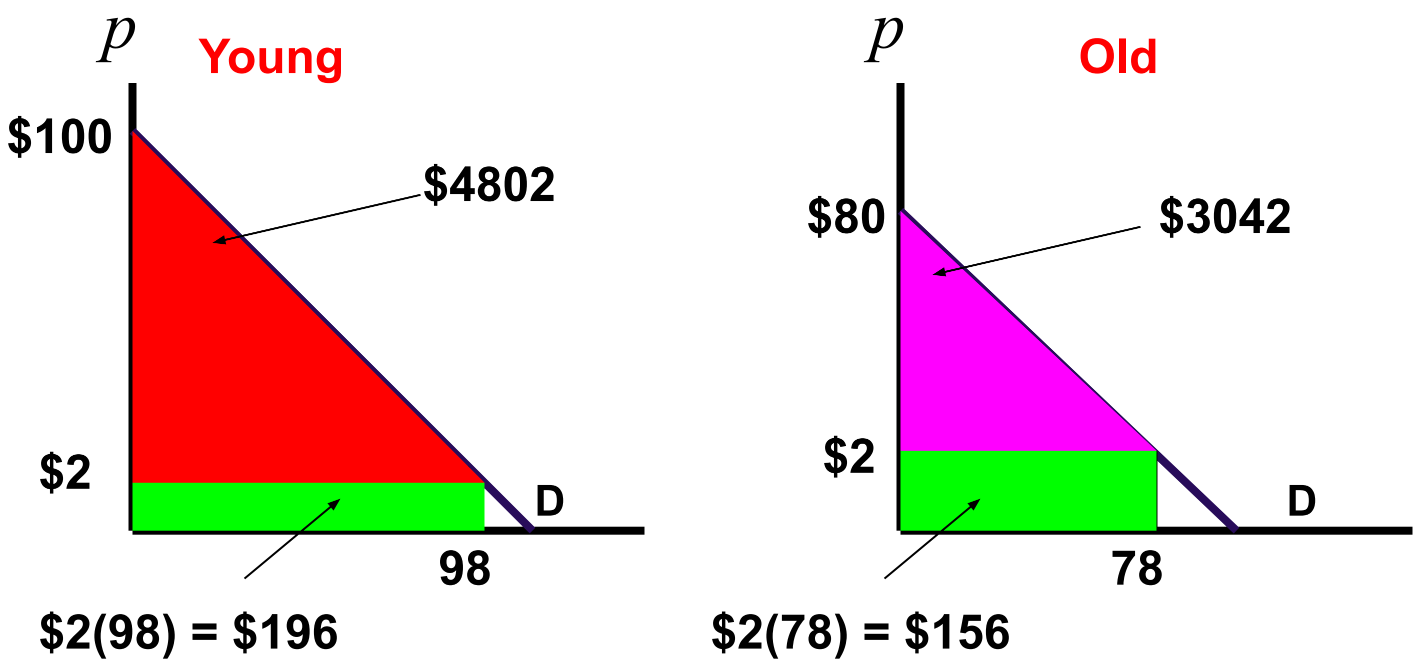
P = $2/Ride

Entry Fee = { $4802 Young, $3042 Old }





Block Pricing involves offering "packages". For example:



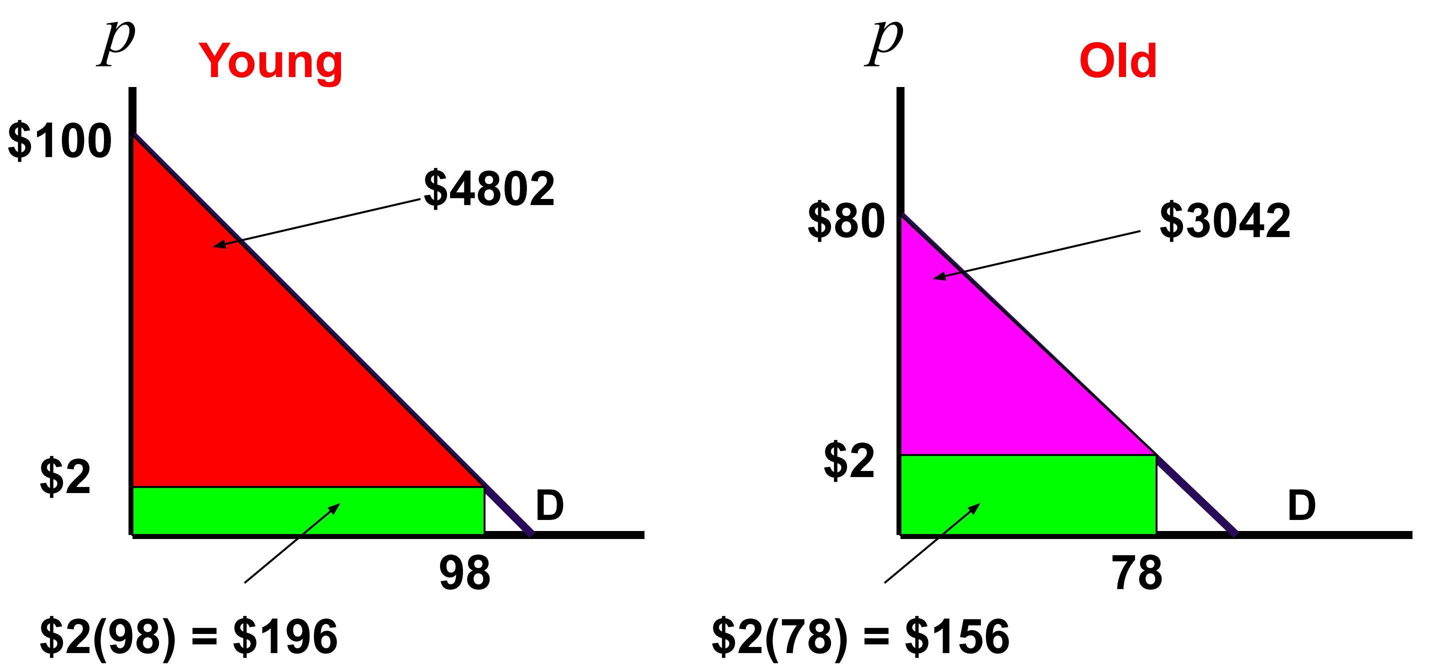
"Geezer Pleaser": Entry + 78 Ride Coupons (1 coupon per ride): $3198

($3042 +$156)

"Standard" Admission: Entry + 98 Ride Coupons (1 coupon per ride): $4998

($4802 +$196)

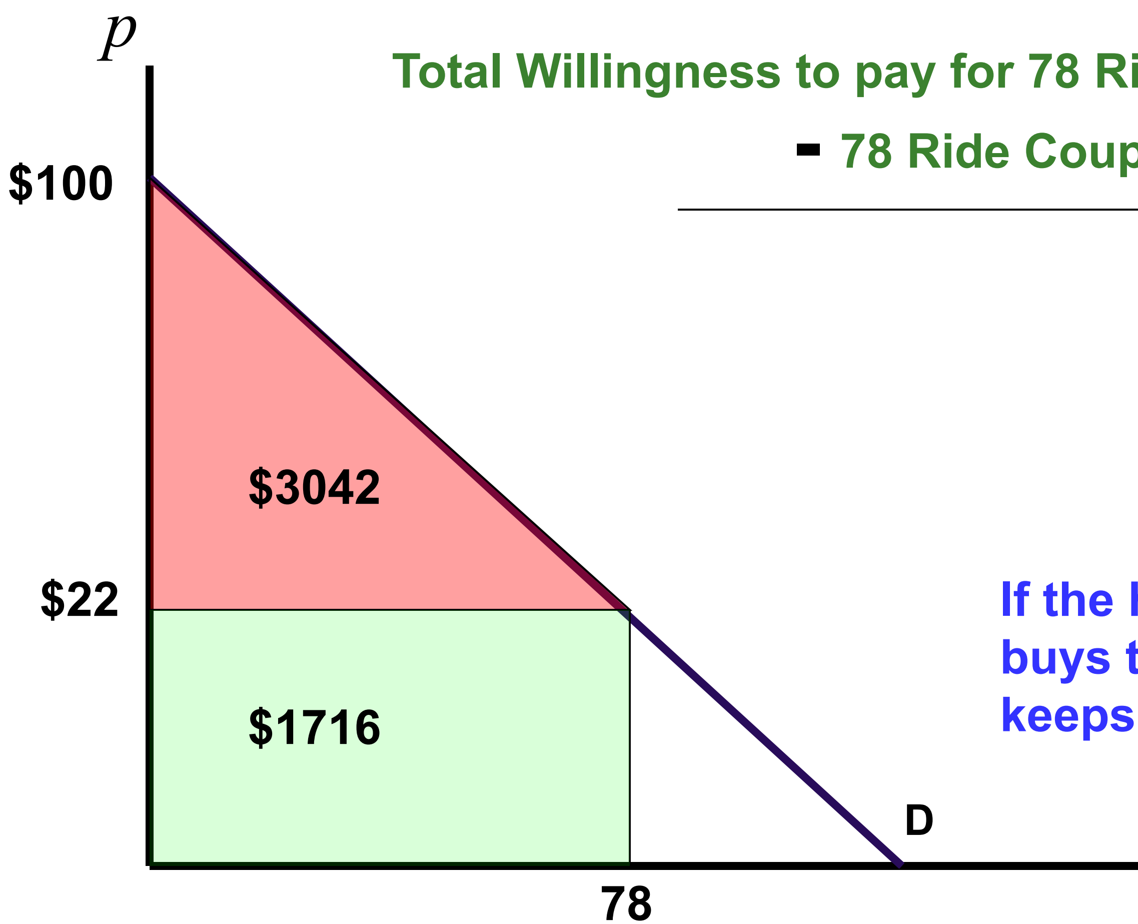
Suppose that you couldn't distinguish High value customers from low value customers: Would this work?



1 Ticket Per Ride

- 78 Ride Coupons: $3198
- 98 Ride Coupons: $4998

We know that is the high value consumer buys 98 ticket package, all her surplus is extracted by the amusement park. How about if she buys the 78 Ride package?



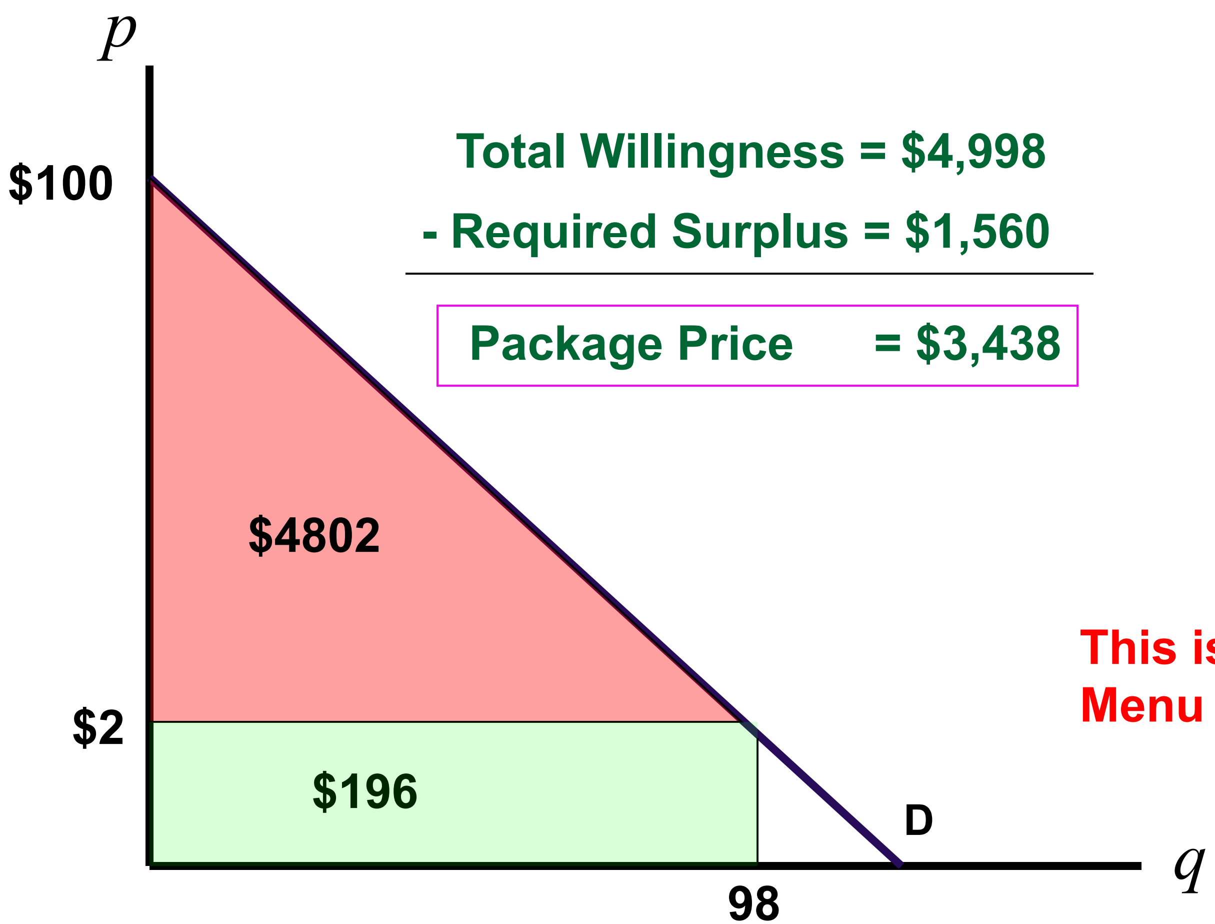
Total Willingness to pay for 78 Rides: $4758

\- 78 Ride Coupons: $3198

$1560

If the high value customer buys the 78 ride package, she keeps $1560 of her surplus!

You need to set a price for the 98 ride package that is *incentive compatible*. That is, you need to set a price that the high value customer will self select. (i.e., a package that generates $1560 of surplus)



This is known as Menu Pricing

Block Pricing: You can distinguish high demand and low demand (First Degree Price Discrimination)

1 Ticket Per Ride
- 78 Ride: $3198 ($41/Ride)
- 98 Rides: $4998 ($51/Ride)

Menu Pricing: You can't distinguish high demand from low demand (2^{nd} Degree Price Discrimination)

1 Ticket Per Ride
- 78 Ride: $3198 ($41/Ride)
- 98 Rides: $3438 ($35/Ride)

Group Pricing: You can distinguish high demand from low demand (3^{rd} Degree Price Discrimination)

No Entry Fee
- Low Demanders: $41/Ride
- High Demanders: $51/Ride

Bundling

Suppose that you are selling two products. Marginal costs for these products are \$100 (Product 1) and \$150 (Product 2). You have 4 potential consumers that will either buy one unit or none of each product (they buy if the price is below their reservation value)

Consumer	Product 1	Product 2	Sum
A	\$50	\$450	\$500
B	\$250	\$275	\$525
C	\$300	\$220	\$520
D	\$450	\$50	\$500

If you sold each of these products separately, you would choose prices as follows

Product 1 (MC = $100)

P	Q	TR	Profit
$450	1	$450	$350
$300	2	$600	$400
$250	3	$750	$450
$50	4	$200	-$200

Product 2 (MC = $150)

P	Q	TR	Profit
$450	1	$450	$300
$275	2	$550	$250
$220	3	$660	$210
$50	4	$200	-$400

Profits = $450 + $300 = $750

Pure Bundling does not allow the products to be sold separately

Product 1 (MC = $100)

Product 2 (MC = $150)

Consumer	Product 1	Product 2	Sum
A	$50	$450	$500
B	$250	$275	$525
C	$300	$220	$520
D	$450	$50	$500

With a bundled price of $500, all four consumers buy both goods:

Profits = 4($500 -$100 - $150) = $1,000

Mixed Bundling allows the products to be sold separately

Product 1 (MC = $100)

Product 2 (MC = $150)

Consumer	Product 1	Product 2	Sum
A	$50	$450	$500
B	$250	$275	$525
C	$300	$220	$520
D	$450	$50	$500

Price 1 = $250

Price 2 = $450

Bundle = $500

Consumer A: Buys Product 2 (Profit = $300) or Bundle (Profit = $250)

Consumer B: Buys Bundle (Profit = $250)

Consumer C: Buys Product 1 (Profit = $150)

Consumer D: Buys Only Product 1 (Profit = $150)

Profit = $850

or $800

Mixed Bundling allows the products to be sold separately

Product 1 (MC = $100)

Product 2 (MC = $150)

Consumer	Product 1	Product 2	Sum
A	$50	$450	$500
B	$250	$275	$525
C	$300	$220	$520
D	$450	$50	$500

Price 1 = $450

Price 2 = $450

Bundle = $520

Consumer A: Buys Only Product 2 (Profit = $300)

Consumer B: Buys Bundle (Profit = $270)

Consumer C: Buys Bundle (Profit = $270)

Consumer D: Buys Only Product 1 (Profit = $350)

Profit = $1,190

Bundling is only Useful When there is variation over individual consumers with respect to the individual goods, but little variation with respect to the sum!?

Consumer	Product 1	Product 2	Sum
A	$300	$200	$500
B	$300	$200	$500
C	$300	$200	$500
D	$300	$200	$500

Product 1 (MC = $100)

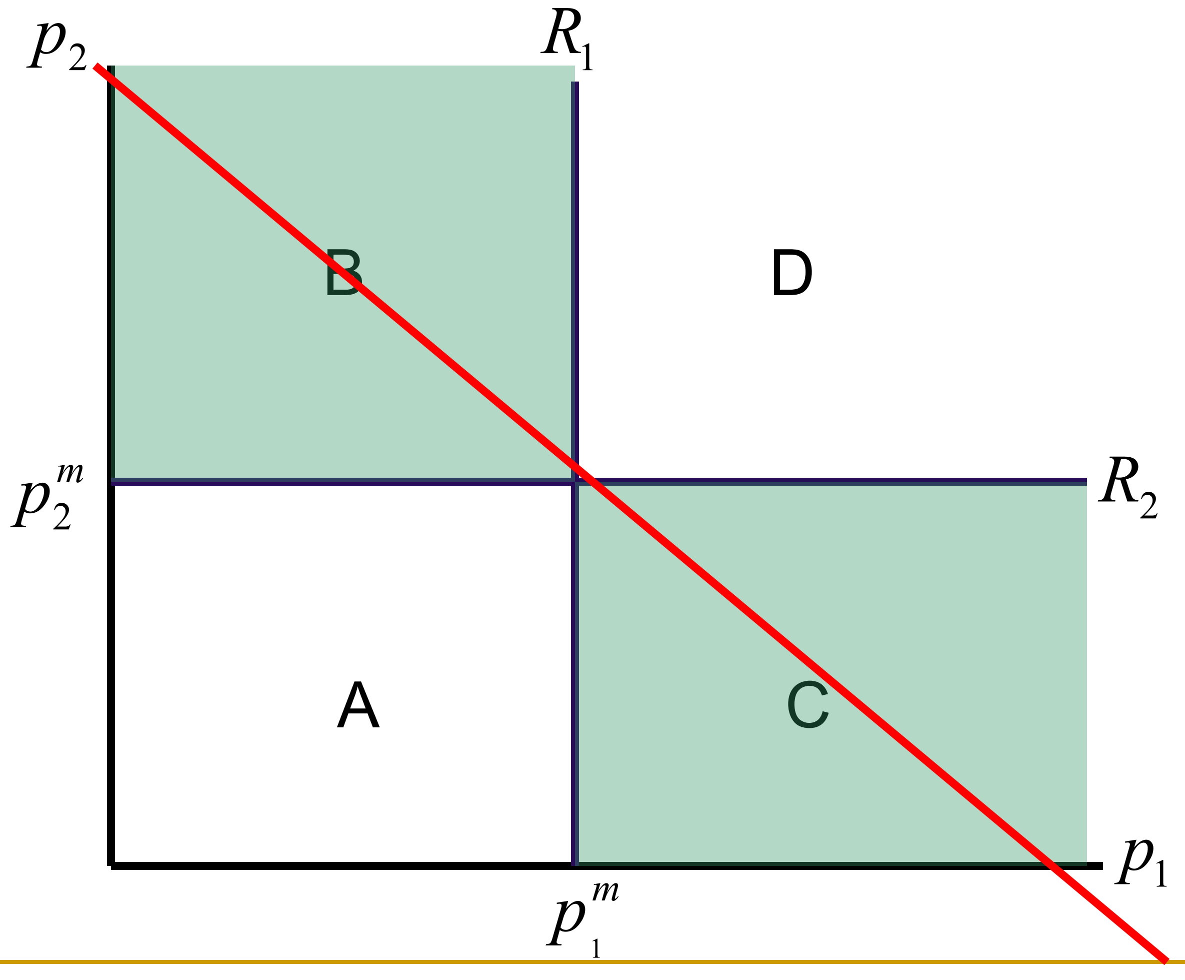
Product 2 (MC = $150)

Individually Priced: P1 = $300, P2 = $200, Profit = $1,000

Pure Bundling: PB = $500, Profit = $1,000

Mixed Bundling: P1 = $300, P2 = $200, PB = $500, Profit = $1,000

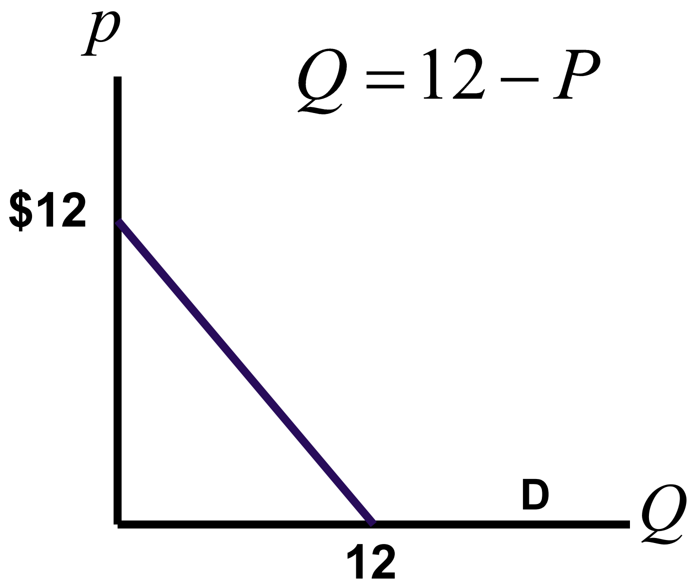
Bundling is only Useful When there is variation over individual consumers with respect to the individual goods, but little variation with respect to the sum!?

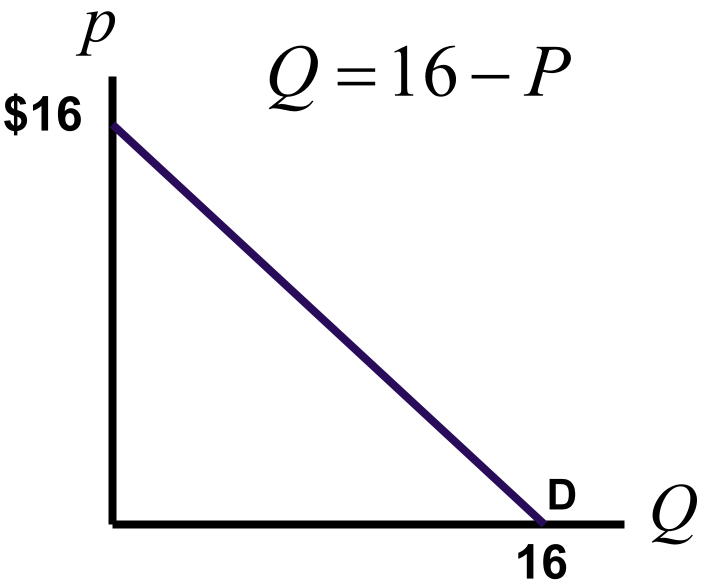


$$p_b \leq p_1^m + p_2^m$$

Tie-in Sales

Suppose that you are the producer of laser printers. You face two types of demanders (high and low). You can't distinguish high from low.

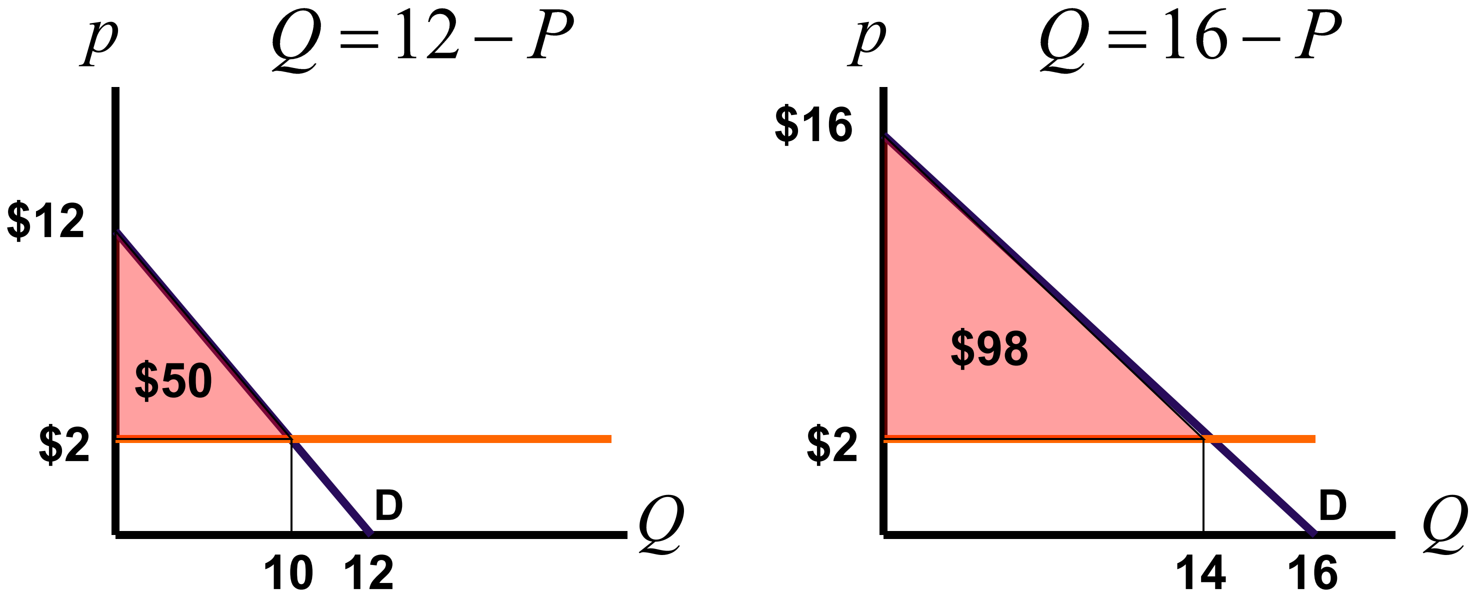




You have a monopoly in the printer market, but the toner cartridge market is perfectly competitive. The price of cartridges is $2 (equal to MC).

Tie-in Sales

You have already built 1,000 printers (the production cost is sunk and can be ignored). You are planning on leasing the printers. What price should you charge?

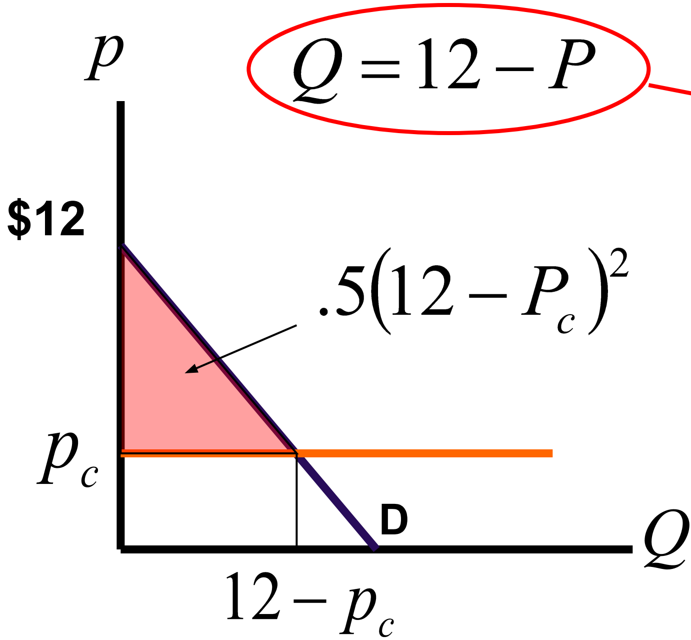


A monthly fee of $50 will allow you to sell to both consumers. Can you do better than this? Profit = $50*1000 = $50,000

Tie-in Sales

Suppose that you started producing toner cartridges and insisted that your lessees used your cartridges. Your marginal cost for the cartridges is also $2. How would you set up your pricing schedule?

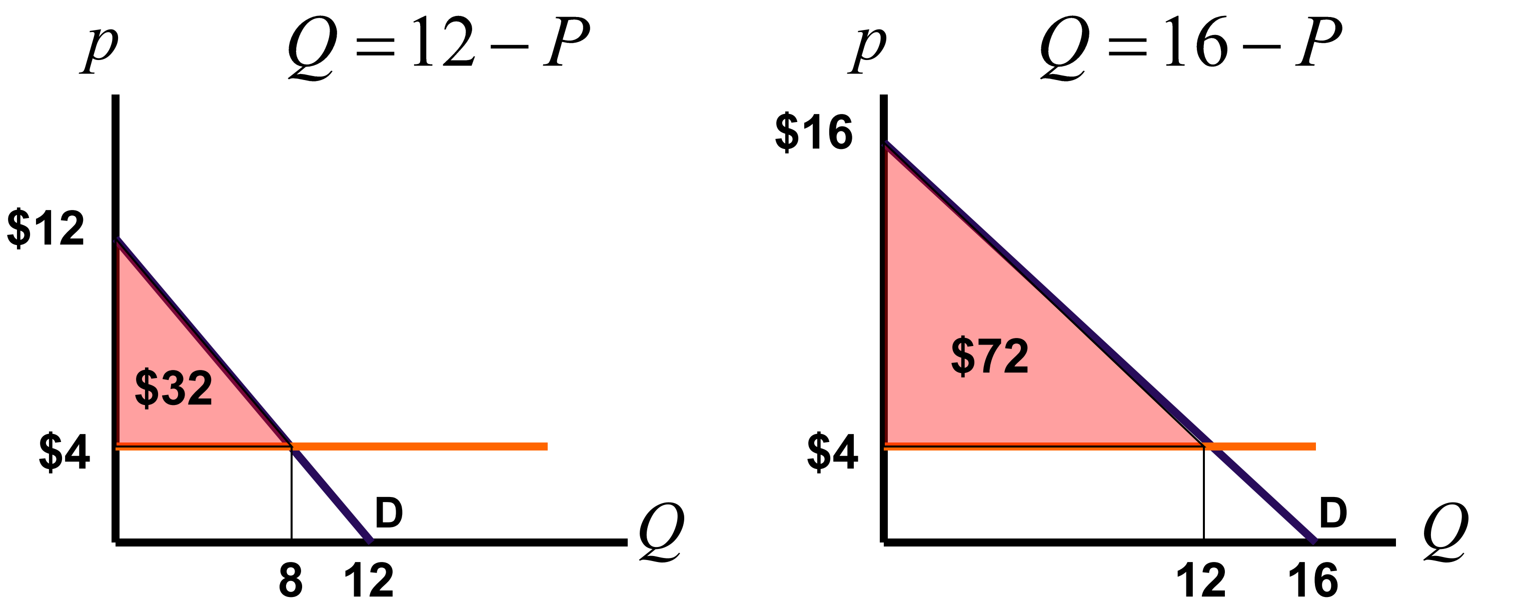
$$Q = 12 - P$$



$$\pi = (p_c - 2)Q + .5(12 - p_c)^2$$

$$p_c = \$4$$

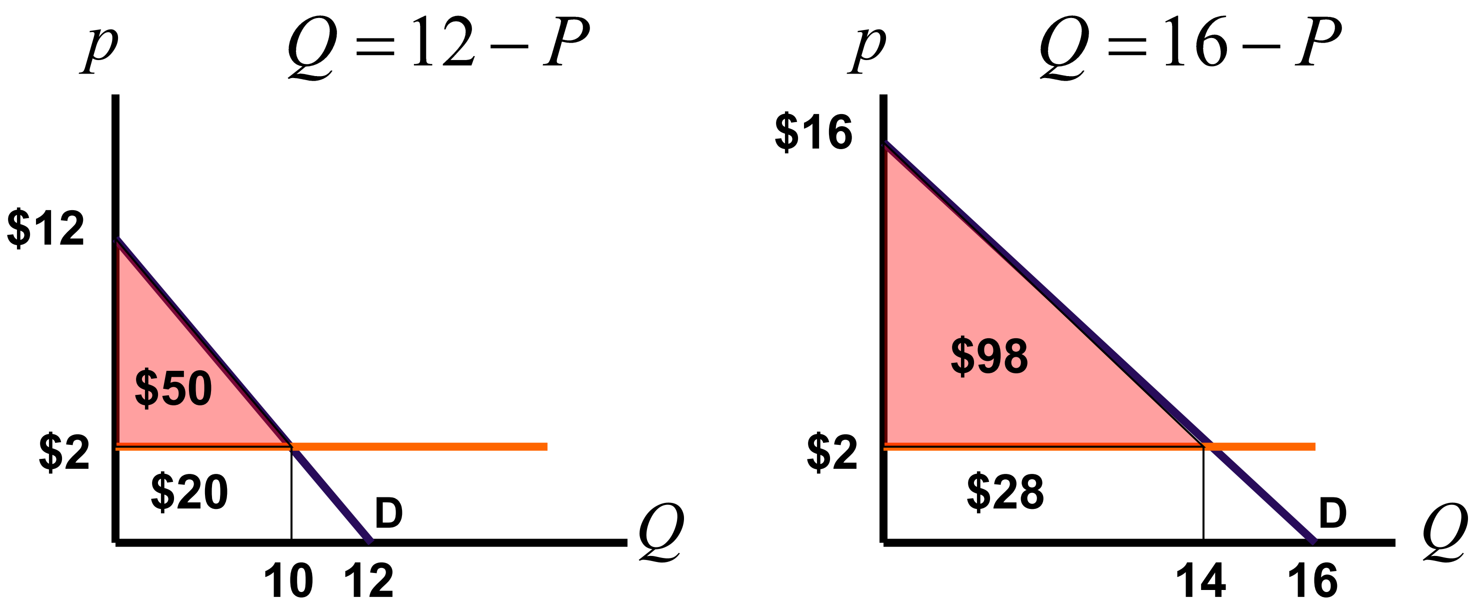
Tie-in Sales



By forcing tie-in sales. You can charge $4 per cartridge and then a monthly fee of $32?

Profit = ($4 - $2)*(8 + 12) + 2($32) = $104*500 = $52,000

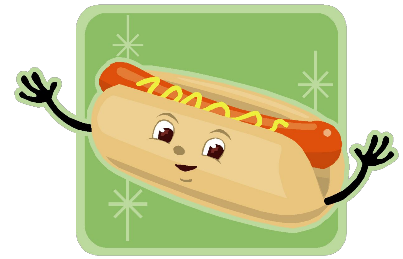
Could you do even better?



If you could design the ink cartridges in such a way that the consumer could not change them, you could . Charge $126 ($98 +$28) per month for a printer with a capacity of 14 and $70 ($50 +$20) for a printer with a capacity of 10

Profit = $70(500) + $126(500) = $98,000

Can a monopoly be a good thing?



Suppose that the demand for Hot Dogs is given as follows:

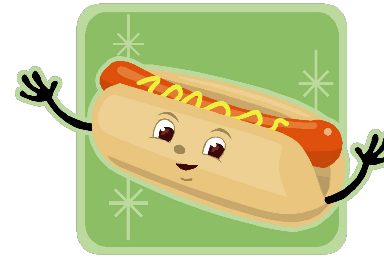
$$Q = 12 - (P_H + P_B)$$

Price of a Hot Dog

Price of a Hot Dog Bun

Hot Dogs and Buns are made by separate companies – each has a monopoly in its own industry. For simplicity, assume that the marginal cost of production for each equals zero.

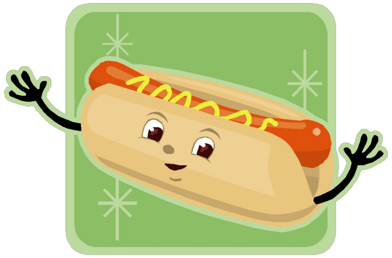
Can a monopoly be a good thing?



Each firm must price their own product based on their expectation of the other firm

Bun Company	Hot Dog Company
$P_B = (12 - P_H) - Q_B$	$P_H = (12 - P_B) - Q_H$
$TR = (12 - P_H)Q_B - Q_B^2$	$TR = (12 - P_B)Q_H - Q_H^2$
$MR = (12 - P_H) - 2Q_B = 0$	$MR = (12 - P_B) - 2Q_H = 0$
$Q_B = \frac{(12 - P_H)}{2}$	$Q_H = \frac{(12 - P_B)}{2}$

Can a monopoly be a good thing?



Each firm must price their own product based on their expectation of the other firm

Bun Company

$$Q_B = \frac{(12 - P_H)}{2}$$

Hot Dog Company

$$Q_H = \frac{(12 - P_B)}{2}$$

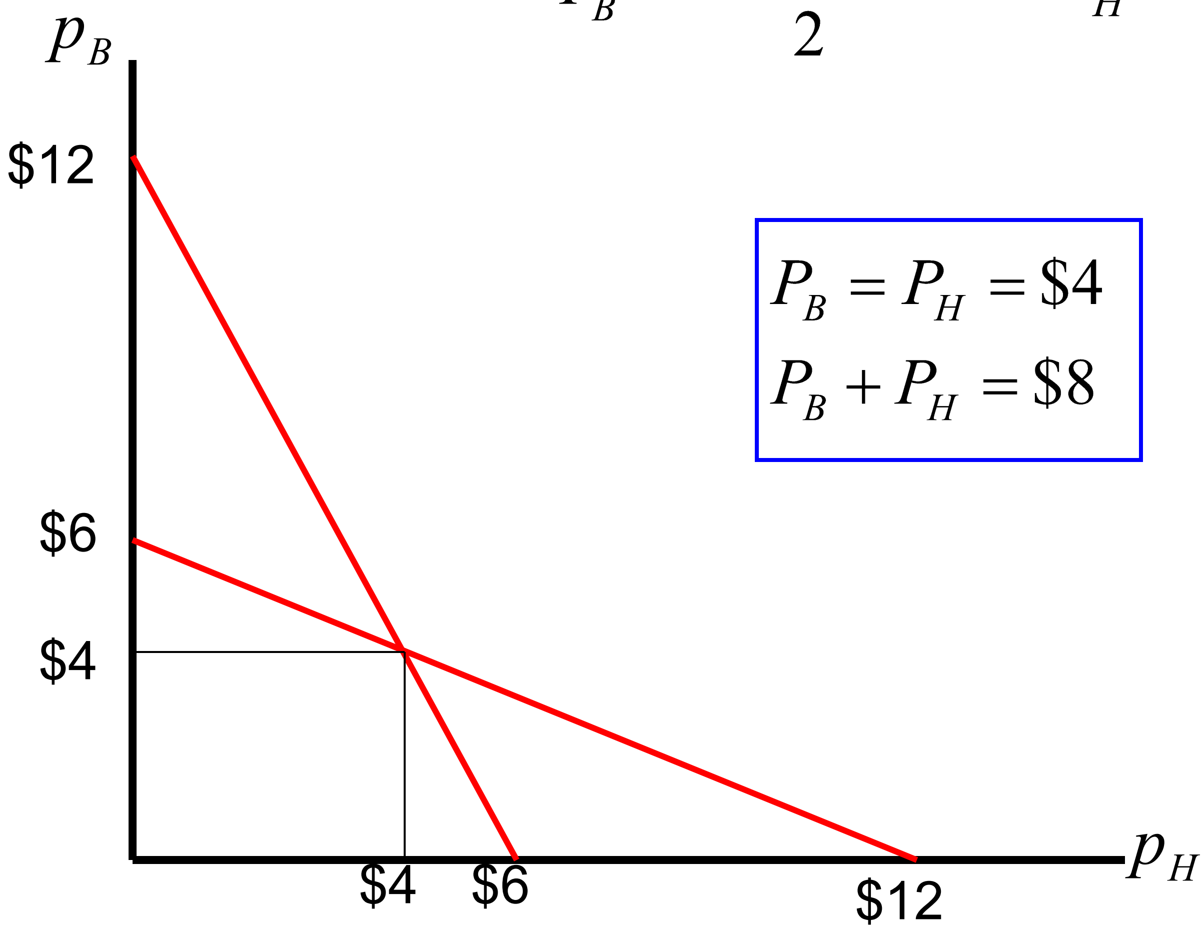
Substitute these quantities back into the demand curve to get the associated prices. This gives us each firm's reaction function.

$$P_B = \frac{(12 - P_H)}{2}$$

$$P_H = \frac{(12 - P_B)}{2}$$

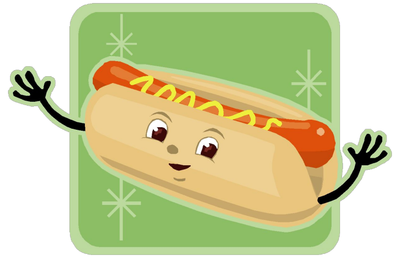
Any equilibrium with the two firms must have each of them acting optimally in response to the other.

$$P_B = \frac{(12 - P_H)}{2} \qquad P_H = \frac{(12 - P_B)}{2}$$



$$P_B = P_H = \$4$$
$$P_B + P_H = \$8$$

Can a monopoly be a good thing?



Now, suppose that these companies merged into one monopoly

$$\left(P_H + P_B\right) = 12 - Q$$

$$TR = 12Q - Q^2$$

$$MR = 12 - 2Q = 0$$

$$\boxed{\begin{array}{l} Q = 6 \\ \left(P_H + P_B\right) = \$6 \end{array}}$$

Case Study: Microsoft vs. Netscape

The argument against Microsoft was using its monopoly power in the operating system market to force its way into the browser market by “bundling” Internet Explorer with Windows 95.

To prove its claim, the government needed to show:

- Microsoft did, in fact, possess monopoly power
- The browser and the operating system were, in fact, two distinct products that did not need to be integrated
- Microsoft’s behavior was an abuse of power that hurt consumers

What should Microsoft’s defense be?

Case Study: Microsoft vs. Netscape

Suppose that the demand for browsers/operating systems is as follows (look familiar?). Again, Assume MC=0

$$Q = 12 - \left(P_{OS} + P_B\right)$$

Case #1: Suppose that Microsoft never entered the browser market – leaving Netscape as a monopolist.

$$P_{OS} = P_B = \$4$$

$$\left(P_{OS} + P_B\right) = \$8$$

Case Study: Microsoft vs. Netscape

Case #2: Now, suppose that Microsoft competes in the Browser market

With competition (and no collusion) in the browser market, Microsoft and Netscape continue to undercut one another until the price of the browser equals MC (=$0)

Given the browser's price of zero, Microsoft will sell its operating system for $6

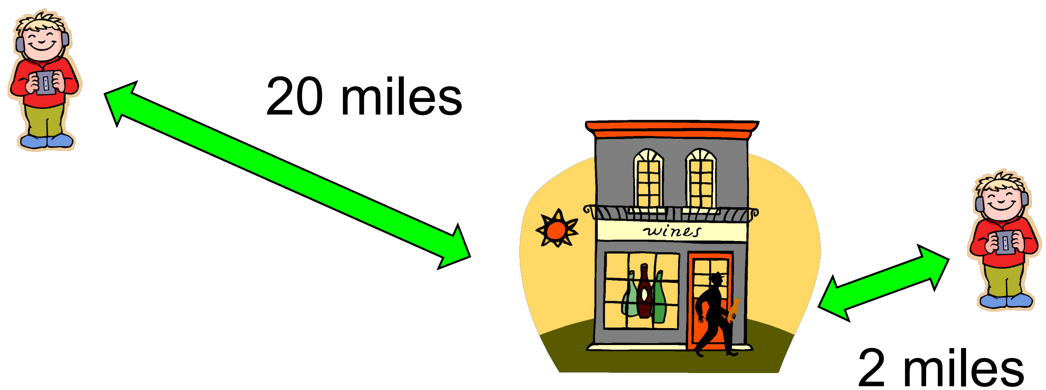
$$\left(P_{OS}+0\right)=12-Q$$

$$MR=12-2Q=0$$

$$\boxed{\begin{aligned} Q &= 6 \\ P_{OS} &= \$6 \end{aligned}}$$

Spatial Competition – Location Preferences

When you purchase a product, you pay more than just the dollar cost. The total purchase cost is called your *opportunity cost*



Consider two customers shopping for wine. One lives close to the store while the other lives far away.

The opportunity cost is higher for the consumer that is further away. Therefore, if both customers have the same demand for wine, the distant customer would require a lower price.

Spatial Competition – Location Preferences

Gucci currently has 31 locations in the US

Starbucks currently has 5,200 locations in the US

How can we explain this difference?

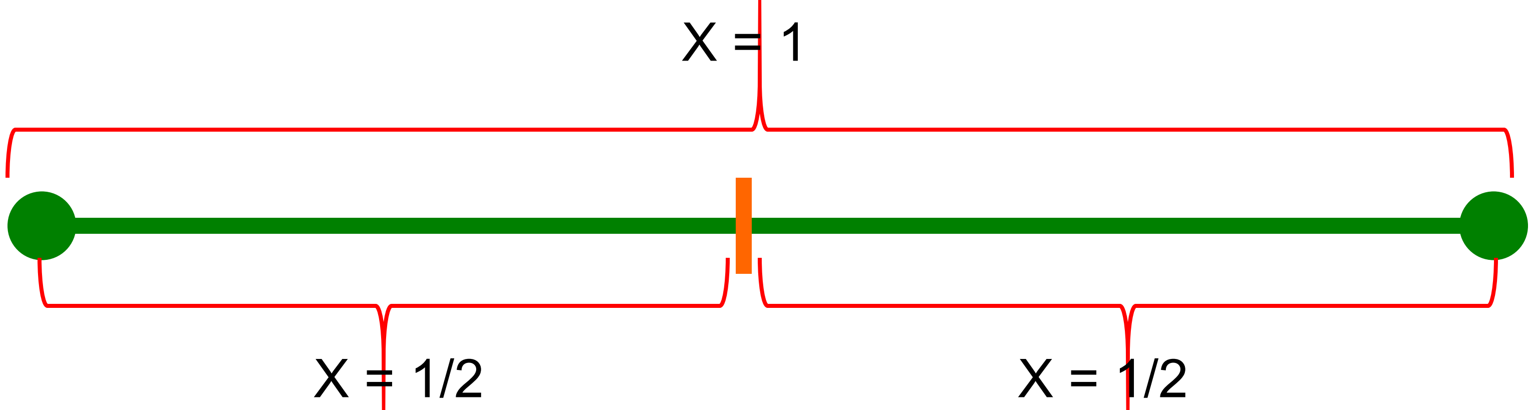
Consider a market with N identical consumers. Each has a demand given by

$$\boxed{D = \begin{cases} 1, & \text{if } p < V \\ 0, & otherwise \end{cases}}$$

We must include their travel time in the total price they pay for the product. The firm can't distinguish consumers and, hence, can't price discriminate.

$$p = \underbrace{\widetilde{p}}_{\textbf{Dollar Price}} + \underbrace{t}_{\textbf{Travel Costs}}\overbrace{x}^{\textbf{Distance to Store}}$$

There is one street of length one. Suppose that you build one store in the middle. For simplicity, assume that MC = 0



With a price $\widetilde{p}$ What fraction of the market will you capture?

$$\widetilde{p} + tx = V$$

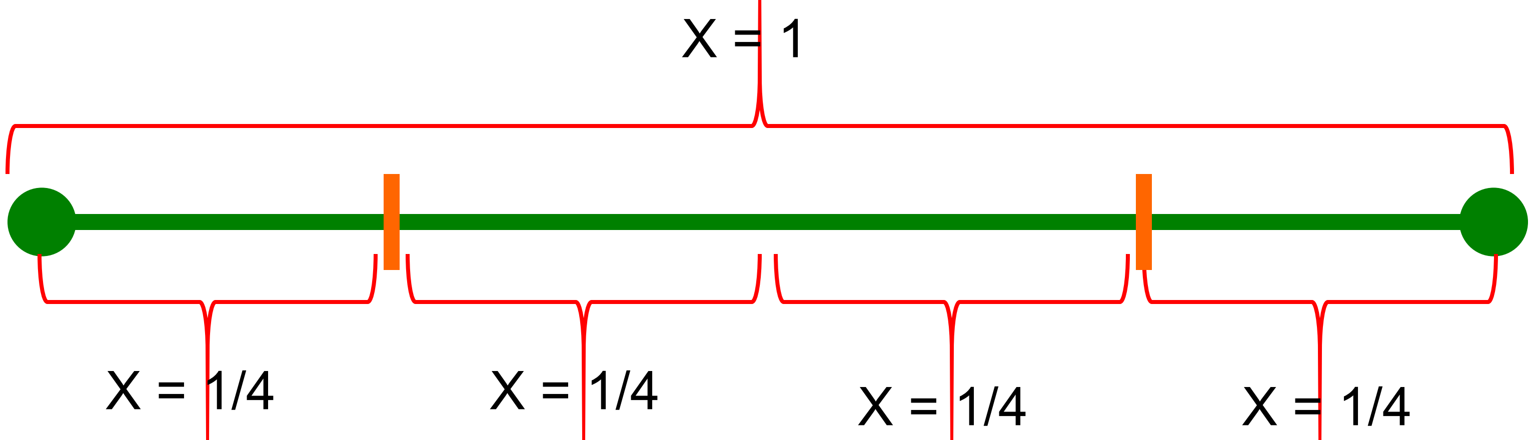
This is the "marginal customer"

$$x = \frac{V - \widetilde{p}}{t}$$

To capture the whole market, set x = 1/2

$$\widetilde{p} = V - \frac{t}{2}$$

Now, suppose you build two stores…



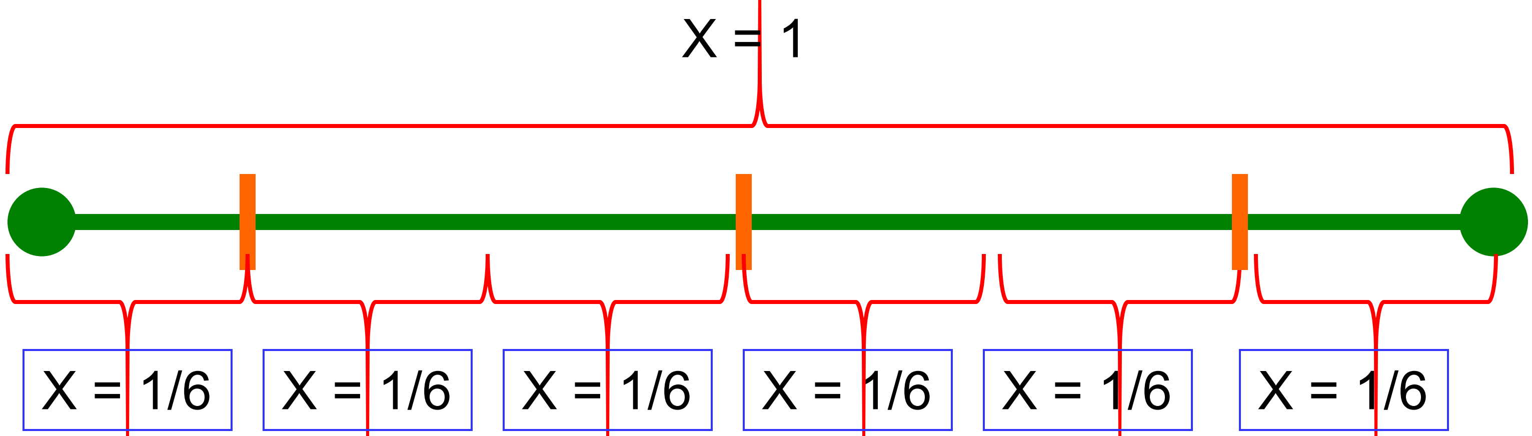
With a price $\tilde{p}$ What fraction of the market will you capture?

$$x = \frac{V - \tilde{p}}{t}$$

To capture the whole market, set x = 1/4

$$\tilde{p} = V - \frac{t}{4}$$

Now, suppose you build three stores…



With a price $\widetilde{p}$ What fraction of the market will you capture?

$$x = \frac{V - \widetilde{p}}{t} \Longrightarrow \text{To capture the whole market, set } x = 1/6 \Longrightarrow \widetilde{p} = V - \frac{t}{6}$$

Do you see the pattern??

With ‘n’ stores, the price you can charge is

$$\tilde{p} = V - \frac{t}{2n}$$

As n gets arbitrarily large, p approaches V

Further, profits are equal to

$$\pi = N\underbrace{\left(V - \frac{t}{2n}\right)}_{\text{Price}} - nF$$

Total Sales

Total Costs

Maximizing Profits

$$\max_{n}\left\{N\left(V-\frac{t}{2n}\right)-nF\right\}$$

$$\boxed{n=\sqrt{\frac{tN}{2F}}}$$

Number of locations is based on:

- Size of the market (N)
- Fixed costs of establishing a new location (F)
- "Moving Costs" (t)

Horizontal Differentiation

Baskin Robbins has 31 Flavors…how did they decide on 31?

$$n = \sqrt{\frac{tN}{2F}}$$

t = Consumer "Pickiness"

N = Market size

F = R&D costs of finding a new flavor