



INTERMEDIATE
MICROECONOMICS

NINTH EDITION

HAL R. VARIAN

Chapter 25

Monopoly

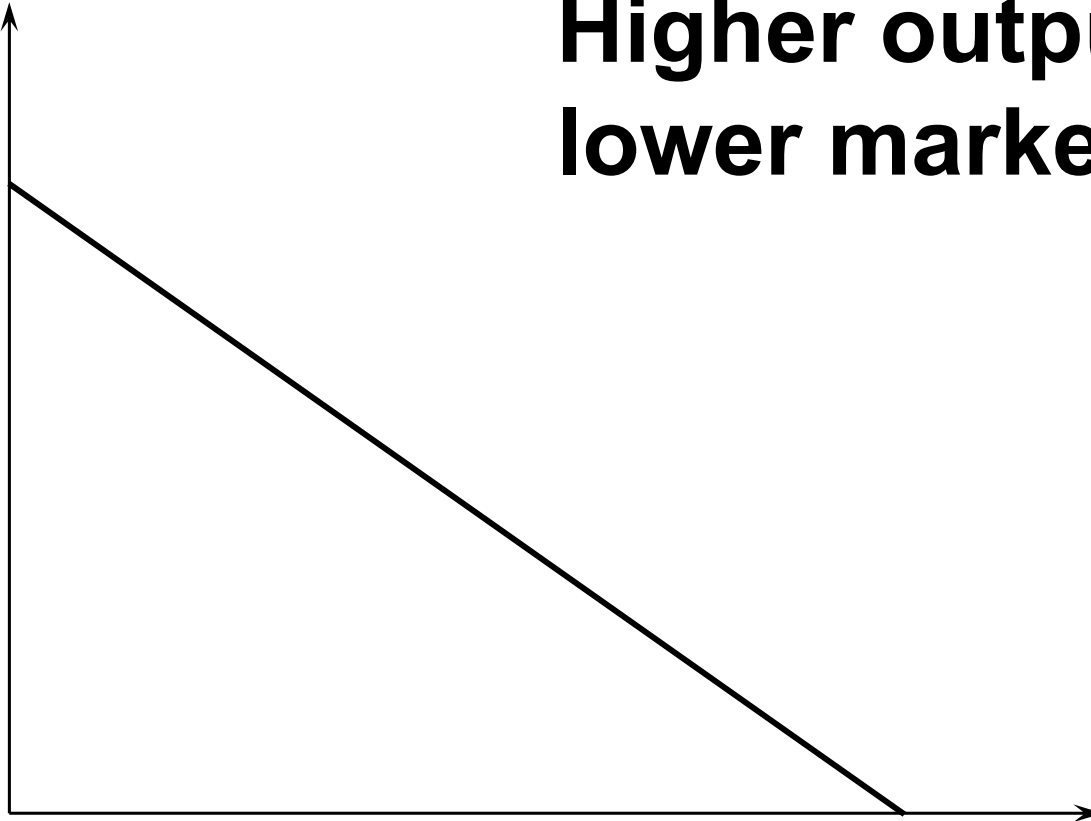
Pure Monopoly

- ◆ **A monopolized market has a single seller.**
- ◆ **The monopolist's demand curve is the (downward sloping) market demand curve.**
- ◆ **So the monopolist can alter the market price by adjusting its output level.**

Pure Monopoly

\$/output unit

$p(y)$



Higher output y causes a lower market price, $p(y)$.

Output Level, y

Why Monopolies?

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 - **a patent; e.g. a new drug**
 - **sole ownership of a resource; e.g. a toll highway**
 - **formation of a cartel; e.g. OPEC**
 - **large economies of scale; e.g. local utility companies.**

Pure Monopoly

- ◆ **Suppose that the monopolist seeks to maximize its economic profit,**

$$\Pi(y) = p(y)y - c(y).$$

- ◆ **What output level y^* maximizes profit?**

Profit-Maximization

$$\Pi(y) = p(y)y - c(y).$$

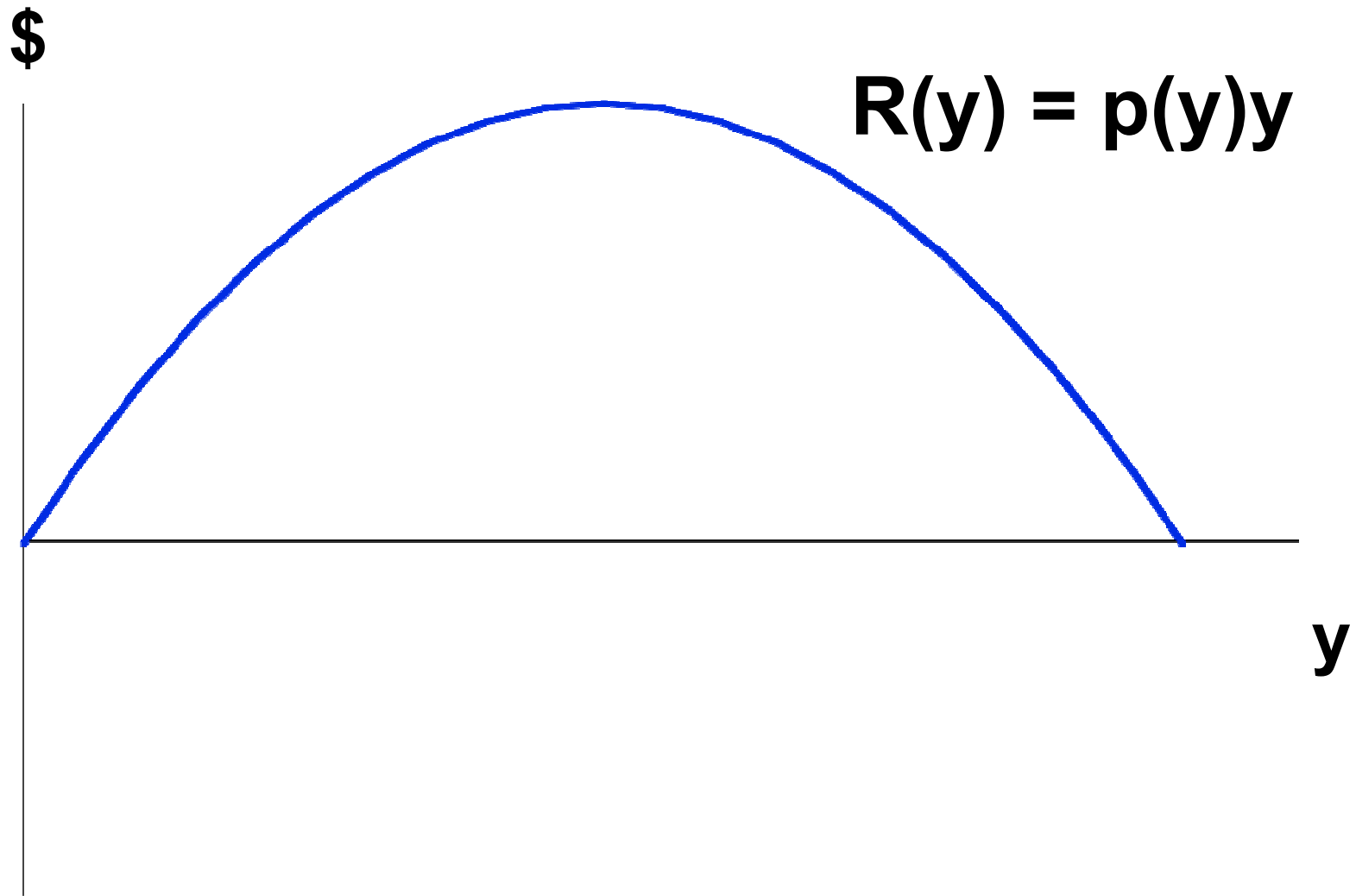
At the profit-maximizing output level y^*

$$\frac{d\Pi(y)}{dy} = \frac{d}{dy}(p(y)y) - \frac{dc(y)}{dy} = 0$$

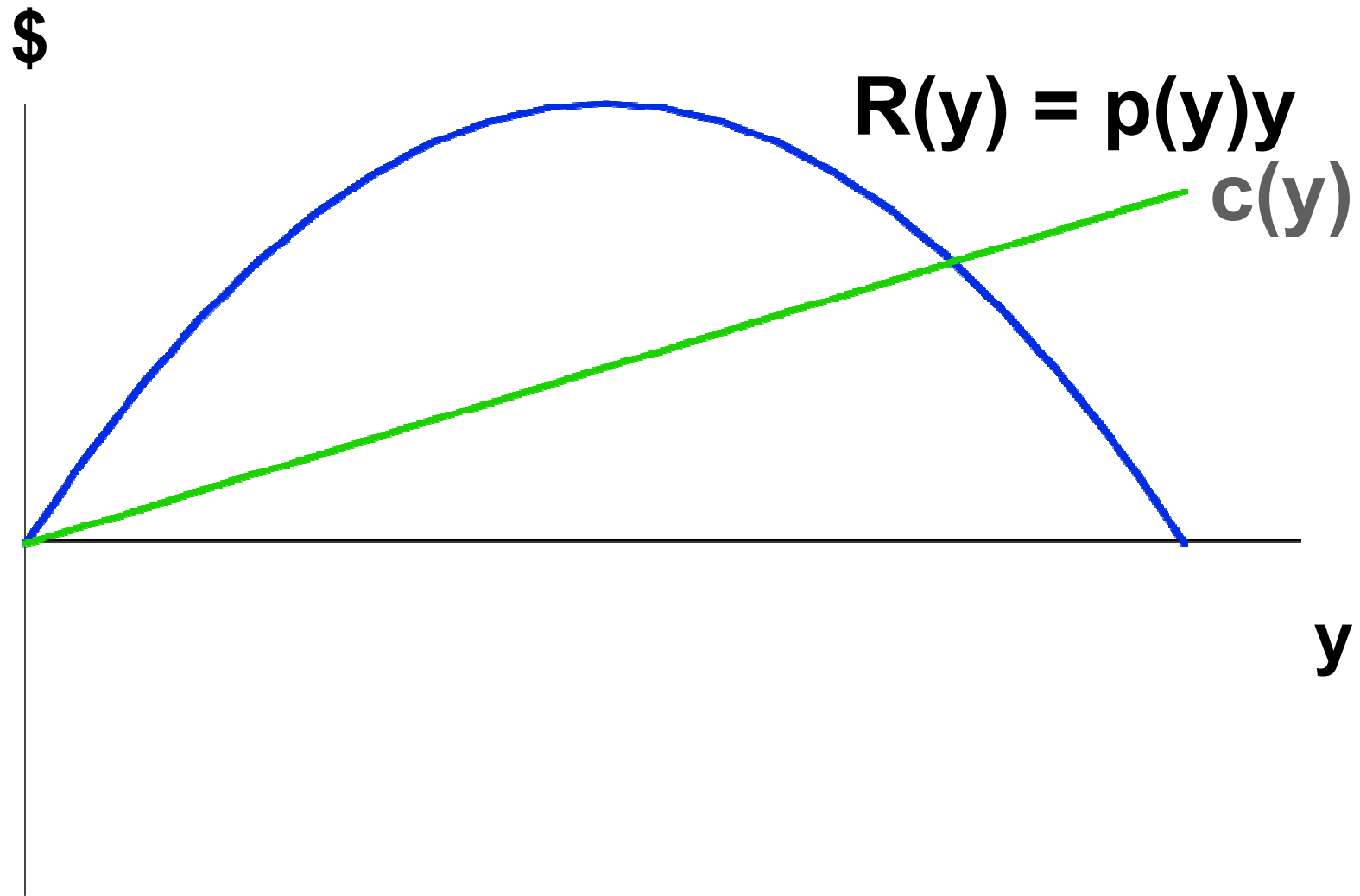
so, for $y = y^*$,

$$\frac{d}{dy}(p(y)y) = \frac{dc(y)}{dy}.$$

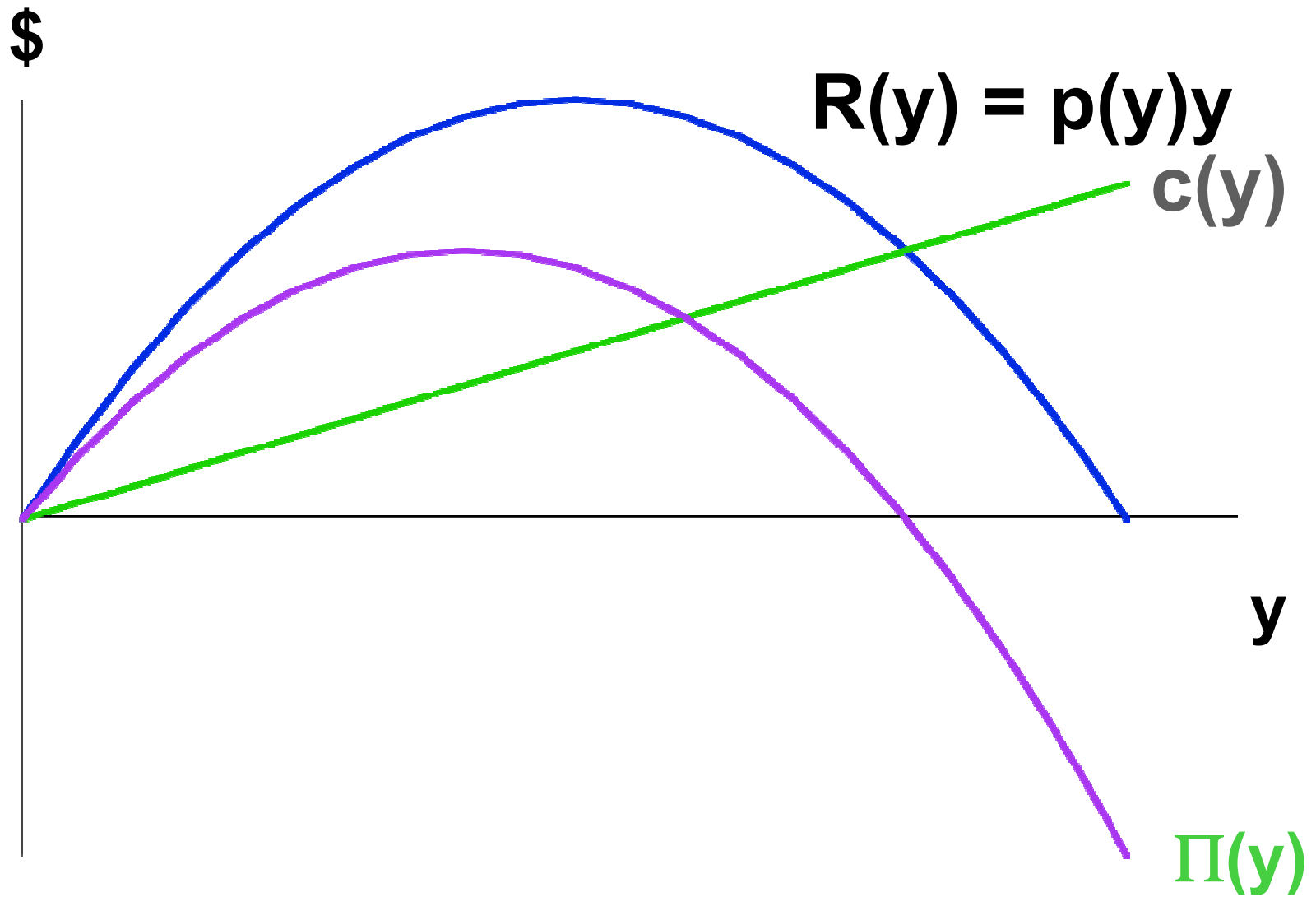
Profit-Maximization



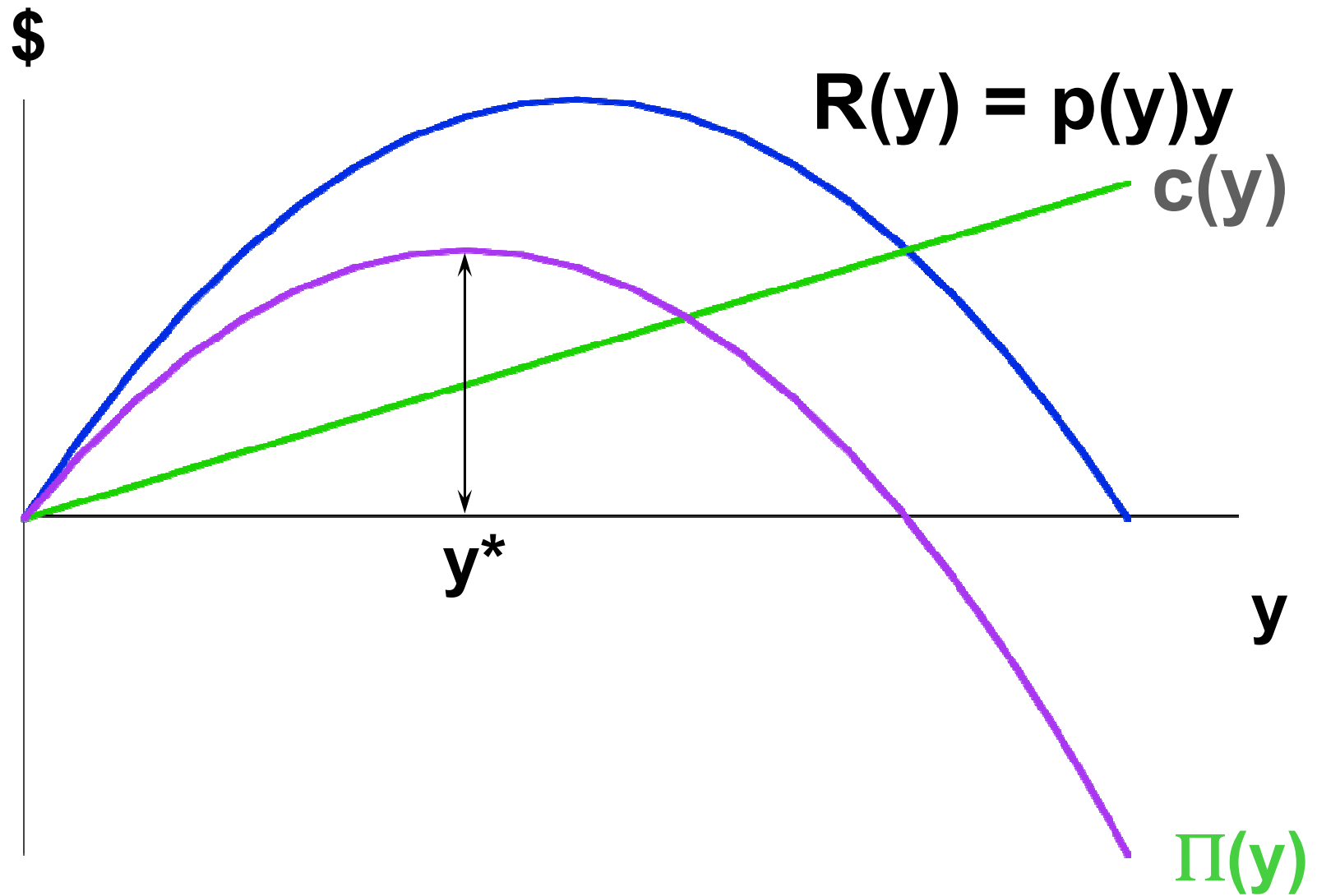
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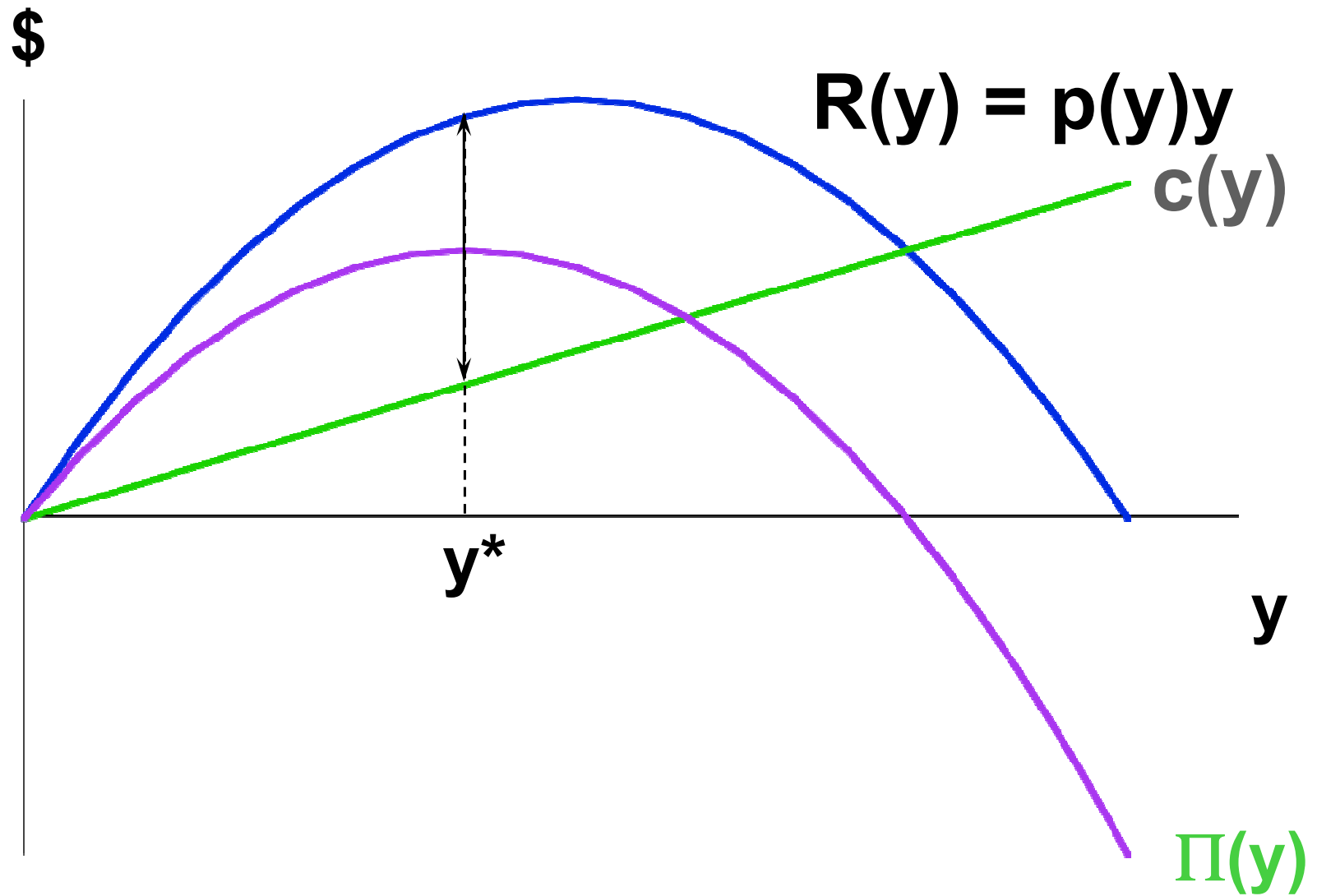
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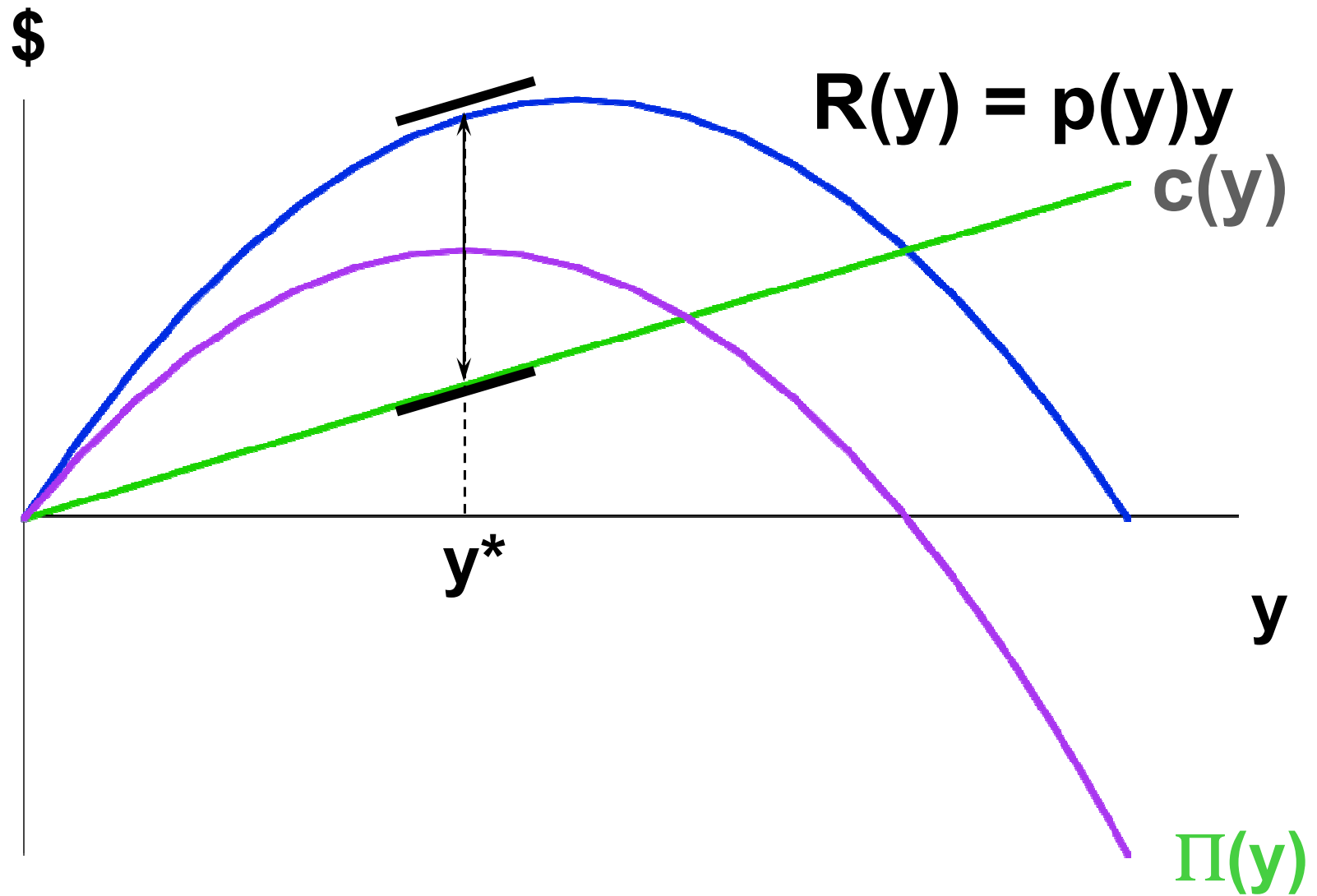
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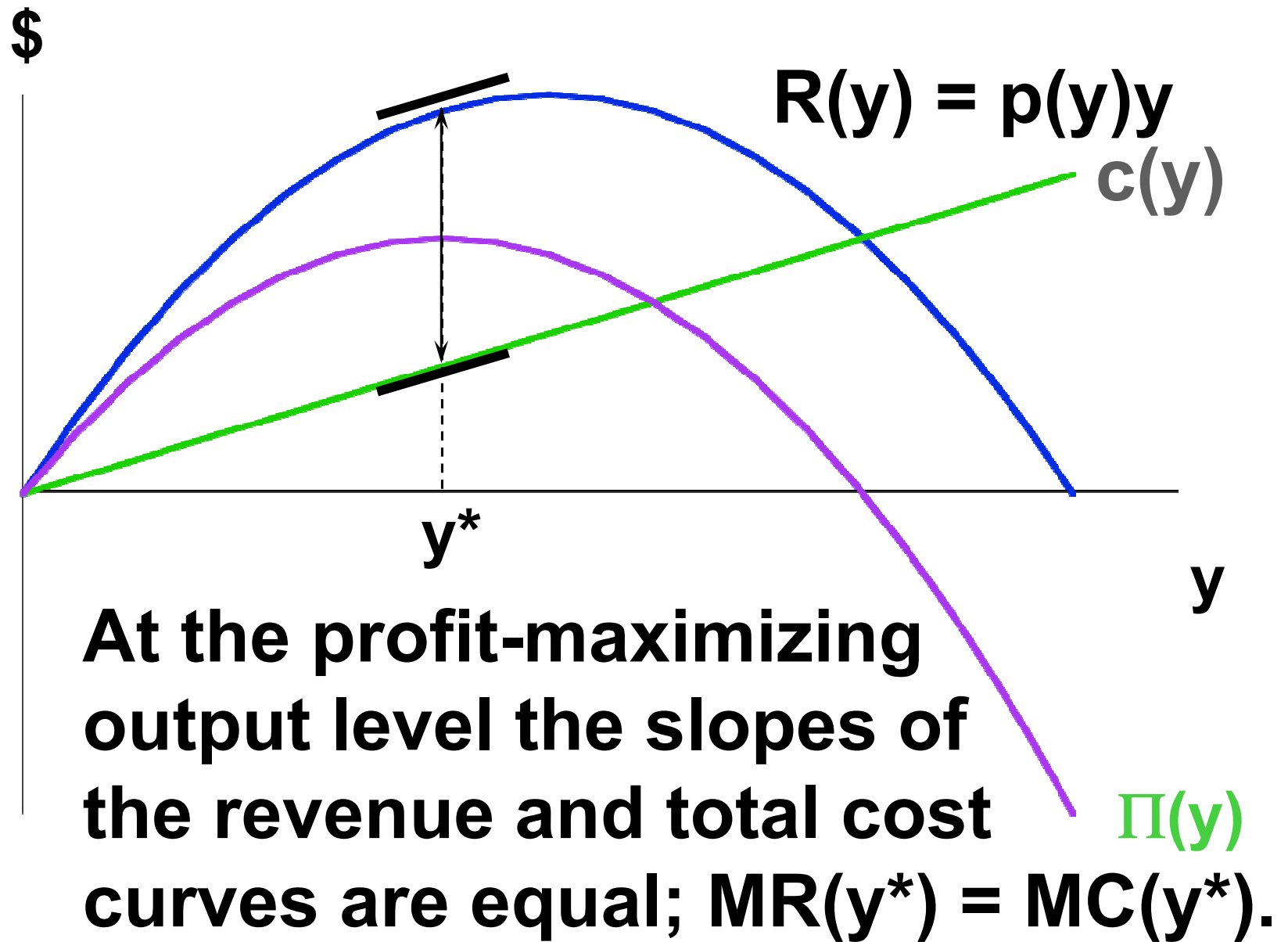
Profit-Maximization



Profit-Maximization



Profit-Maximization



Marginal Revenue

Marginal revenue is the rate-of-change of revenue as the output level y increases;

$$\mathbf{MR(y) = \frac{d}{dy} (p(y)y) = p(y) + y \frac{dp(y)}{dy} .}$$

Marginal Revenue

Marginal revenue is the rate-of-change of revenue as the output level y increases;

$$\mathbf{MR(y) = \frac{d}{dy}(p(y)y) = p(y) + y \frac{dp(y)}{dy} .}$$

$dp(y)/dy$ is the slope of the market inverse demand function so $dp(y)/dy < 0$. Therefore

$$\mathbf{MR(y) = p(y) + y \frac{dp(y)}{dy} < p(y)}$$

for $y > 0$.

Marginal Revenue

E.g. if $p(y) = a - by$ then

$$\mathbf{R(y) = p(y)y = ay - by^2}$$

and so

$$\mathbf{MR(y) = a - 2by < a - by = p(y) \text{ for } y > 0.}$$

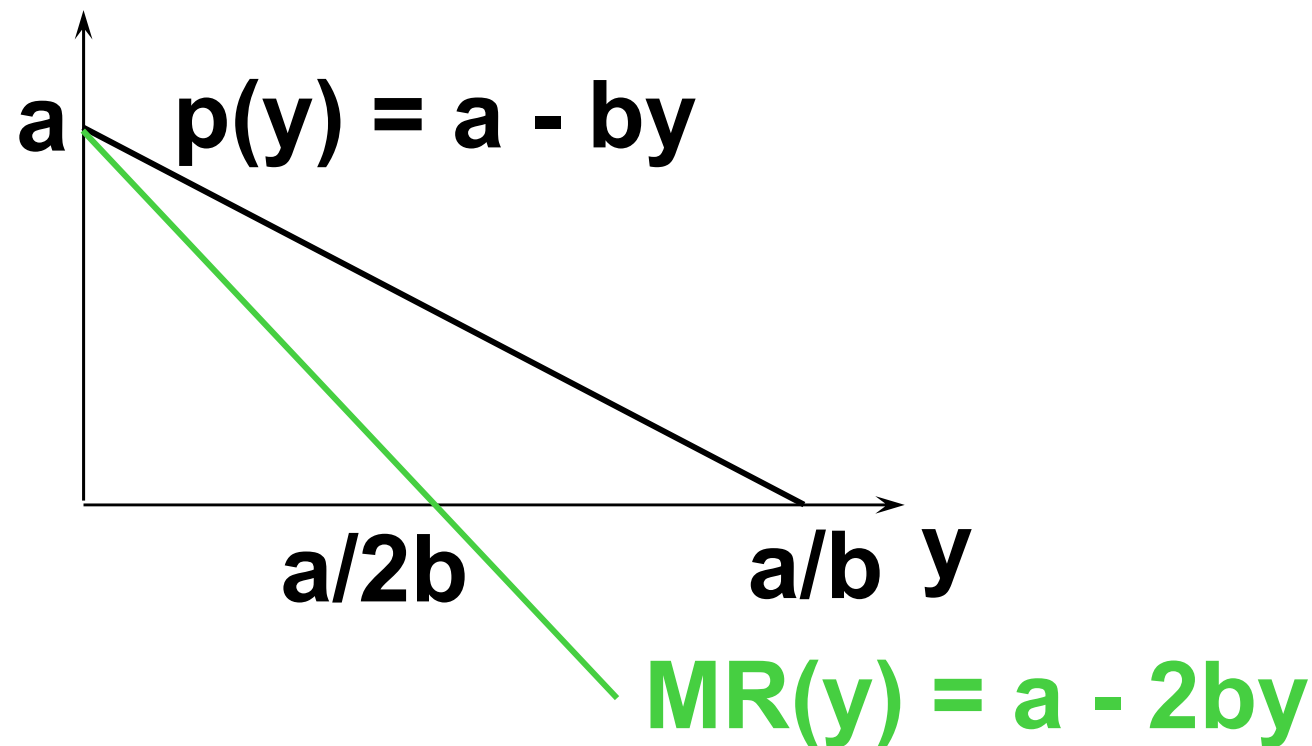
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Marginal Cost

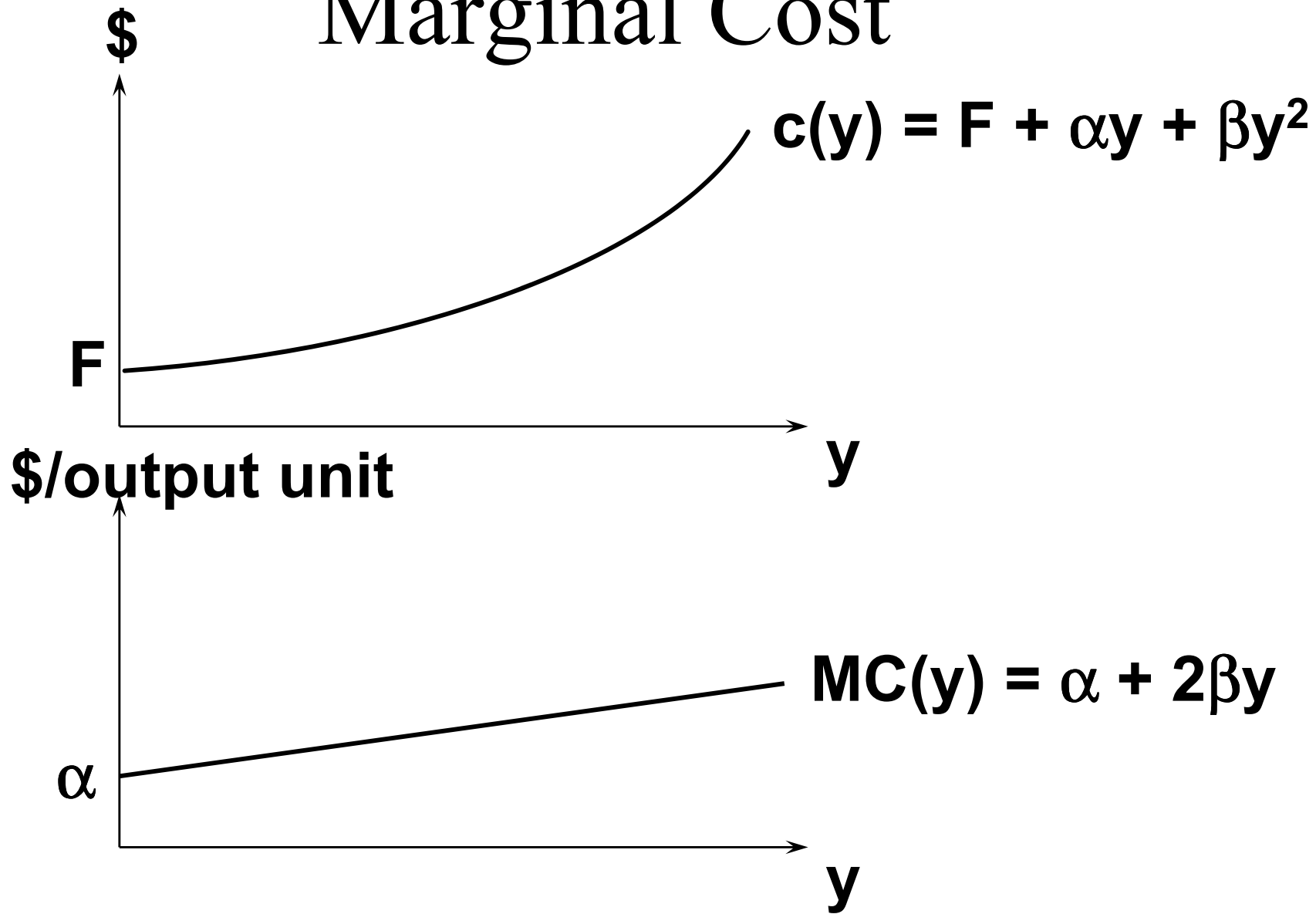
Marginal cost is the rate-of-change of total cost as the output level y increases;

$$\mathbf{MC(y) = \frac{dc(y)}{dy} .}$$

E.g. if $c(y) = F + \alpha y + \beta y^2$ then

$$\mathbf{MC(y) = \alpha + 2\beta y .}$$

Marginal Cost



Profit-Maximization; An Example

At the profit-maximizing output level y^* , $MR(y^*) = MC(y^*)$. So if $p(y) = a - by$ and $c(y) = F + \alpha y + \beta y^2$ then

$$\mathbf{MR(y^*) = a - 2by^* = \alpha + 2\beta y^* = MC(y^*)}$$

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and the profit-maximizing output level is

$$\mathbf{y^* = \frac{a - \alpha}{2(b + \beta)}}$$

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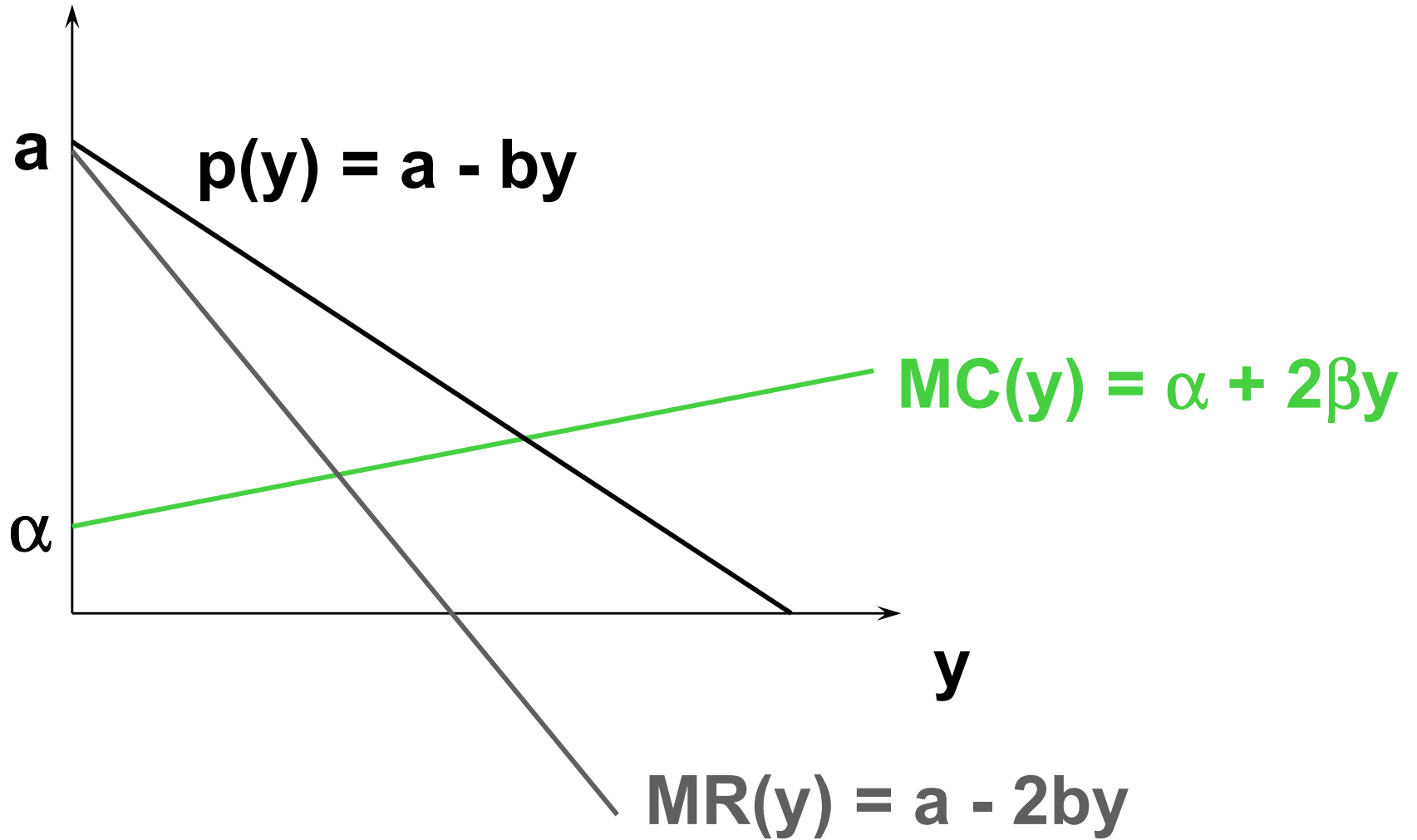
$$\mathbf{y^* = \frac{a - \alpha}{2(b + \beta)}}$$

causing the market price to be

$$\mathbf{p(y^*) = a - by^* = a - b \frac{a - \alpha}{2(b + \beta)}}.$$

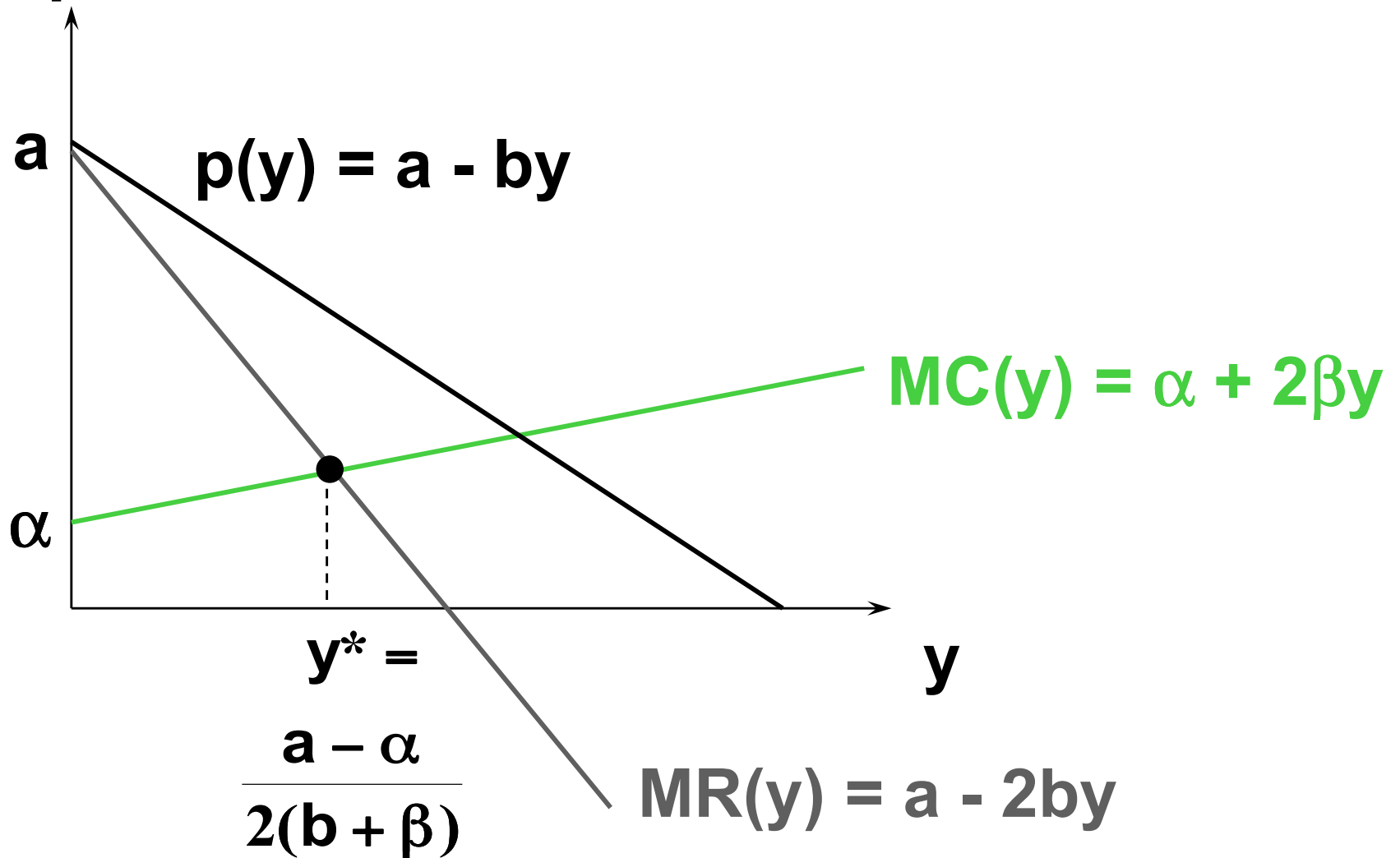
Profit-Maximization; An Example

\$/output unit

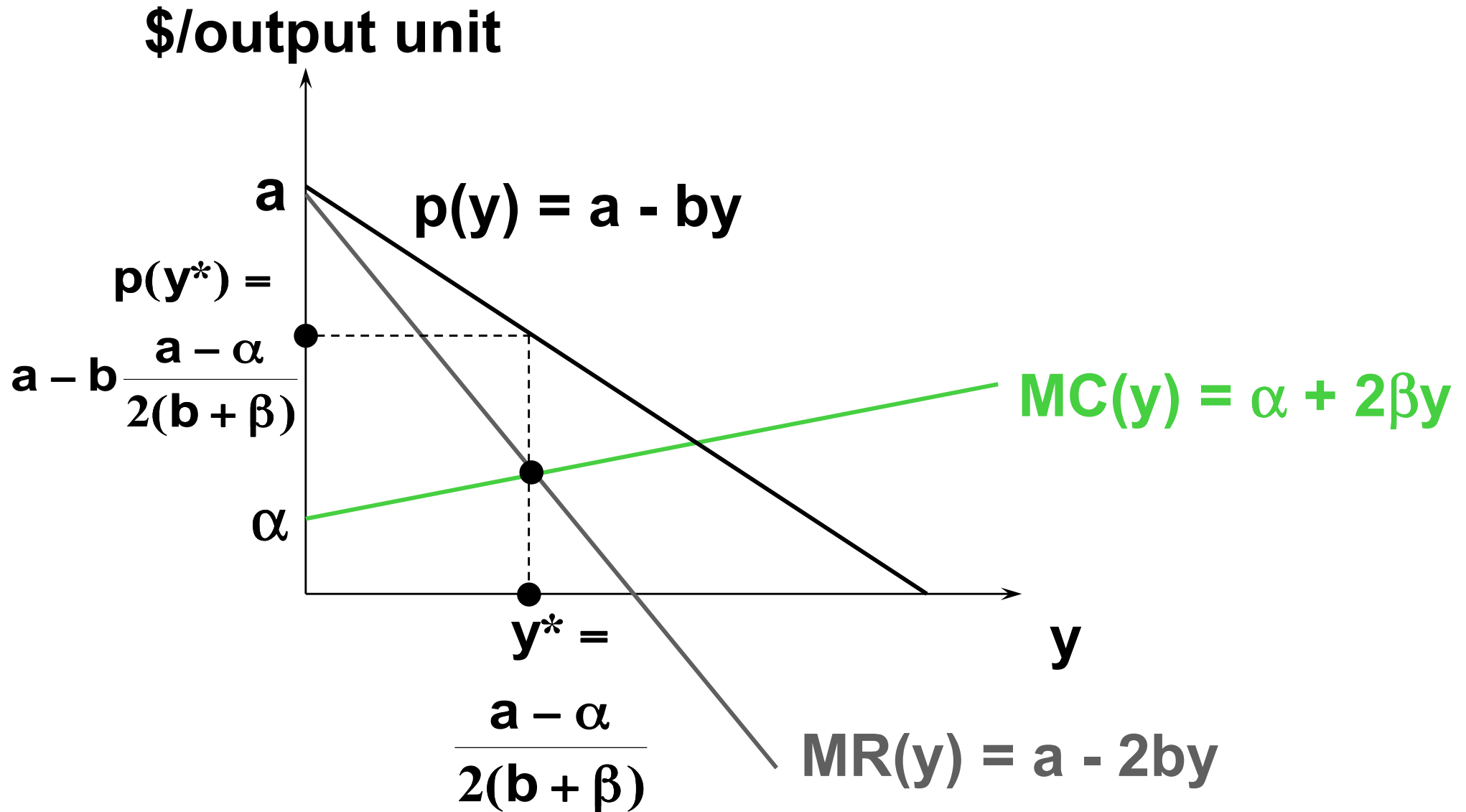


Profit-Maximization; An Example

\$/output unit



Profit-Maximization; An Example



Monopolistic Pricing & Own-Price Elasticity of Demand

- ◆ **Suppose that market demand becomes less sensitive to changes in price (*i.e.* the own-price elasticity of demand becomes less negative). Does the monopolist exploit this by causing the market price to rise?**

Monopolistic Pricing & Own-Price

Elasticity of Demand

$$\mathbf{MR(y) = \frac{d}{dy} (p(y)y) = p(y) + y \frac{dp(y)}{dy}}$$

$$= \mathbf{p(y) \left[1 + \frac{y}{p(y)} \frac{dp(y)}{dy} \right]}.$$

Monopolistic Pricing & Own-Price

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Own-price elasticity of demand is

$$\mathbf{\varepsilon = \frac{p(y)}{y} \frac{dy}{dp(y)}}$$

Monopolistic Pricing & Own-Price

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Own-price elasticity of demand is

$$\mathbf{\varepsilon = \frac{p(y)}{y} \frac{dy}{dp(y)} \quad \text{so} \quad \mathbf{MR(y) = p(y) \left[1 + \frac{1}{\varepsilon} \right].}$$

Monopolistic Pricing & Own-Price Elasticity of Demand

$$\mathbf{MR(y) = p(y) \left[1 + \frac{1}{\varepsilon} \right].}$$

Suppose the monopolist's marginal cost of production is constant, at \$k/output unit.

For a profit-maximum

$$\mathbf{MR(y^*) = p(y^*) \left[1 + \frac{1}{\varepsilon} \right] = k \quad \text{which is} \quad p(y^*) = \frac{k}{1 + \frac{1}{\varepsilon}}.}$$

Monopolistic Pricing & Own-Price Elasticity of Demand

$$p(y^*) = \frac{k}{1 + \frac{1}{\varepsilon}}$$

E.g. if $\varepsilon = -3$ then $p(y^*) = 3k/2$,

and if $\varepsilon = -2$ then $p(y^*) = 2k$.

So as ε rises towards -1 the monopolist alters its output level to make the market price of its product to rise.

Monopolistic Pricing & Own-Price Elasticity of Demand

Notice that, since $MR(y^*) = p(y^*) \left[1 + \frac{1}{\varepsilon} \right] = k,$

$$p(y^*) \left[1 + \frac{1}{\varepsilon} \right] > 0$$

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Monopolistic Pricing & Own-Price Elasticity of Demand

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That is, $\frac{1}{\varepsilon} > -1 \quad \Rightarrow \quad \varepsilon < -1$.

So a profit-maximizing monopolist always selects an output level for which market demand is own-price elastic.

Markup Pricing

- ◆ **Markup pricing: Output price is the marginal cost of production plus a “markup.”**
- ◆ **How big is a monopolist’s markup and how does it change with the own-price elasticity of demand?**

Markup Pricing

$$p(y^*) \left[1 + \frac{1}{\varepsilon} \right] = k \quad \Rightarrow \quad p(y^*) = \frac{k}{1 + \frac{1}{\varepsilon}} = \frac{k\varepsilon}{1 + \varepsilon}$$

is the monopolist's price.

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$$p(y^*) - k = \frac{k\varepsilon}{1 + \varepsilon} - k = -\frac{k}{1 + \varepsilon}.$$

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**E.g. if $\varepsilon = -3$ then the markup is $k/2$,
and if $\varepsilon = -2$ then the markup is k .**

**The markup rises as the own-price
elasticity of demand rises towards -1.**

A Profits Tax Levied on a Monopoly

- ◆ A profits tax levied at rate t reduces profit from $\Pi(y^*)$ to $(1-t)\Pi(y^*)$.
- ◆ Q: How is after-tax profit, $(1-t)\Pi(y^*)$, maximized?

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A Profits Tax Levied on a Monopoly

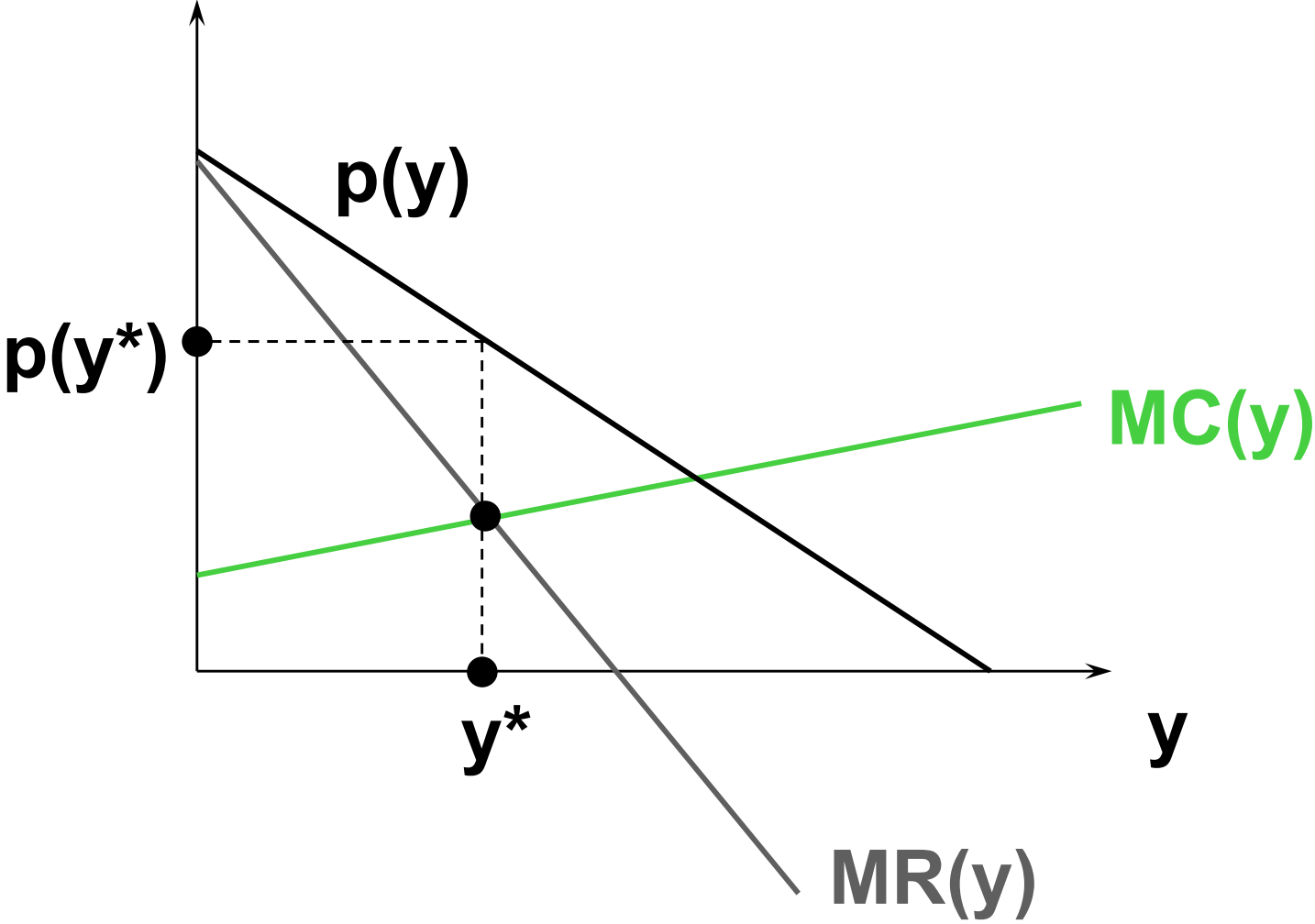
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- ◆ Q: How is after-tax profit, $(1-t)\Pi(y^*)$, maximized?
- ◆ A: By maximizing before-tax profit, $\Pi(y^*)$.
- ◆ So a profits tax has no effect on the monopolist's choices of output level, output price, or demands for inputs.
- ◆ I.e. the profits tax is a neutral tax.

Quantity Tax Levied on a Monopolist

- ◆ **A quantity tax of \$ t /output unit raises the marginal cost of production by \$ t .**
- ◆ **So the tax reduces the profit-maximizing output level, causes the market price to rise, and input demands to fall.**
- ◆ **The quantity tax is distortionary.**

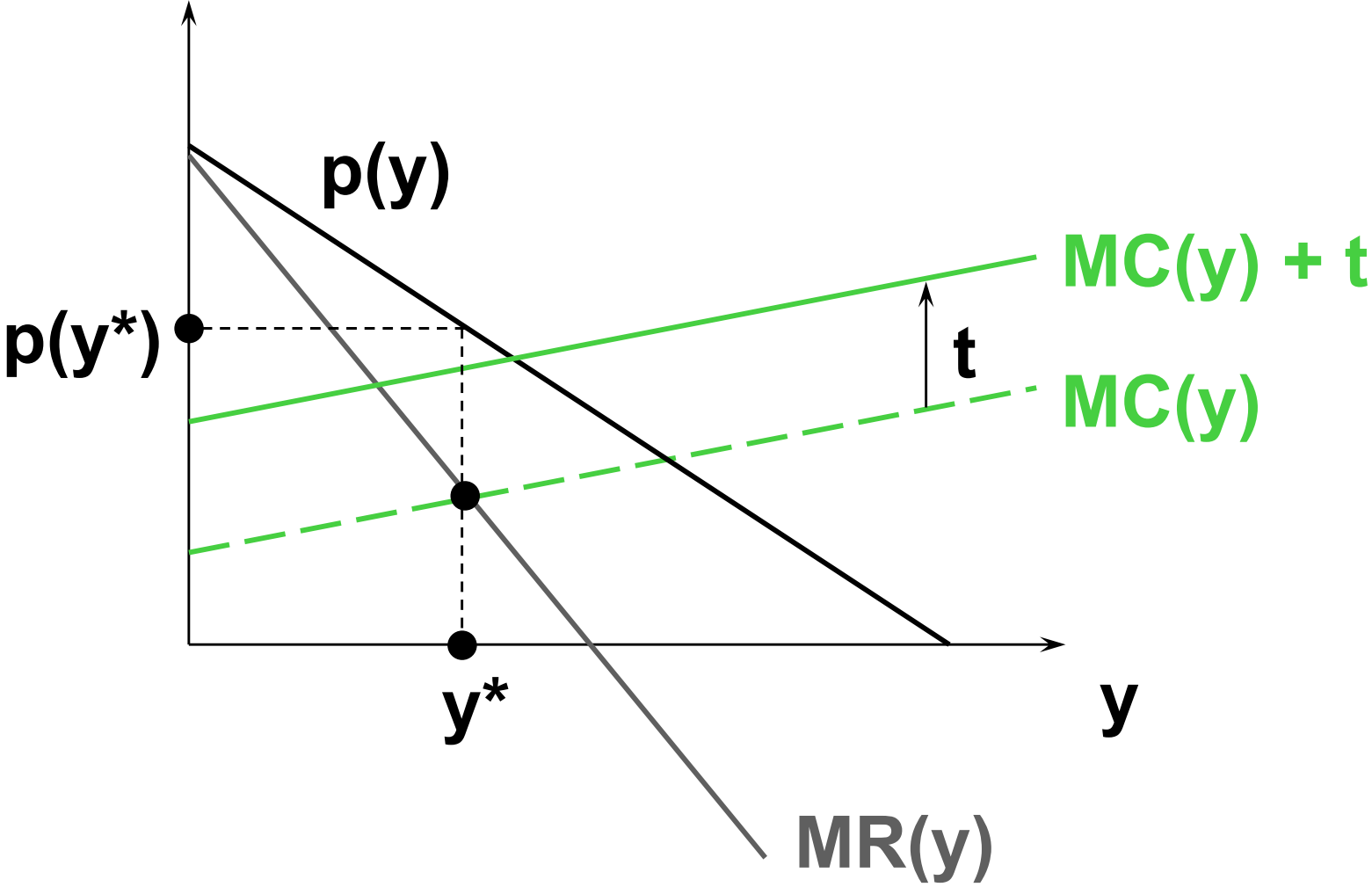
Quantity Tax Levied on a Monopolist

\$/output unit



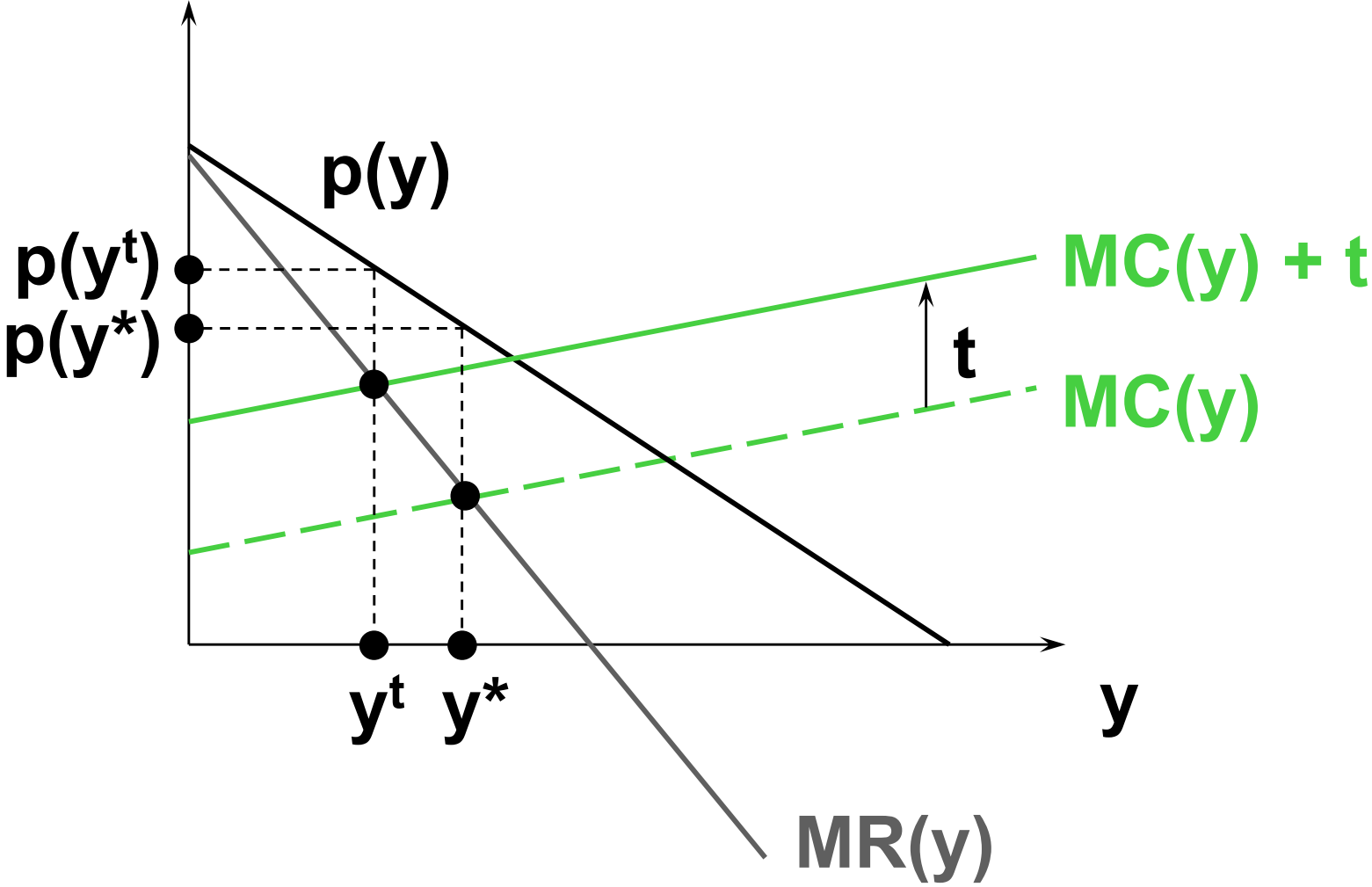
Quantity Tax Levied on a Monopolist

\$/output unit



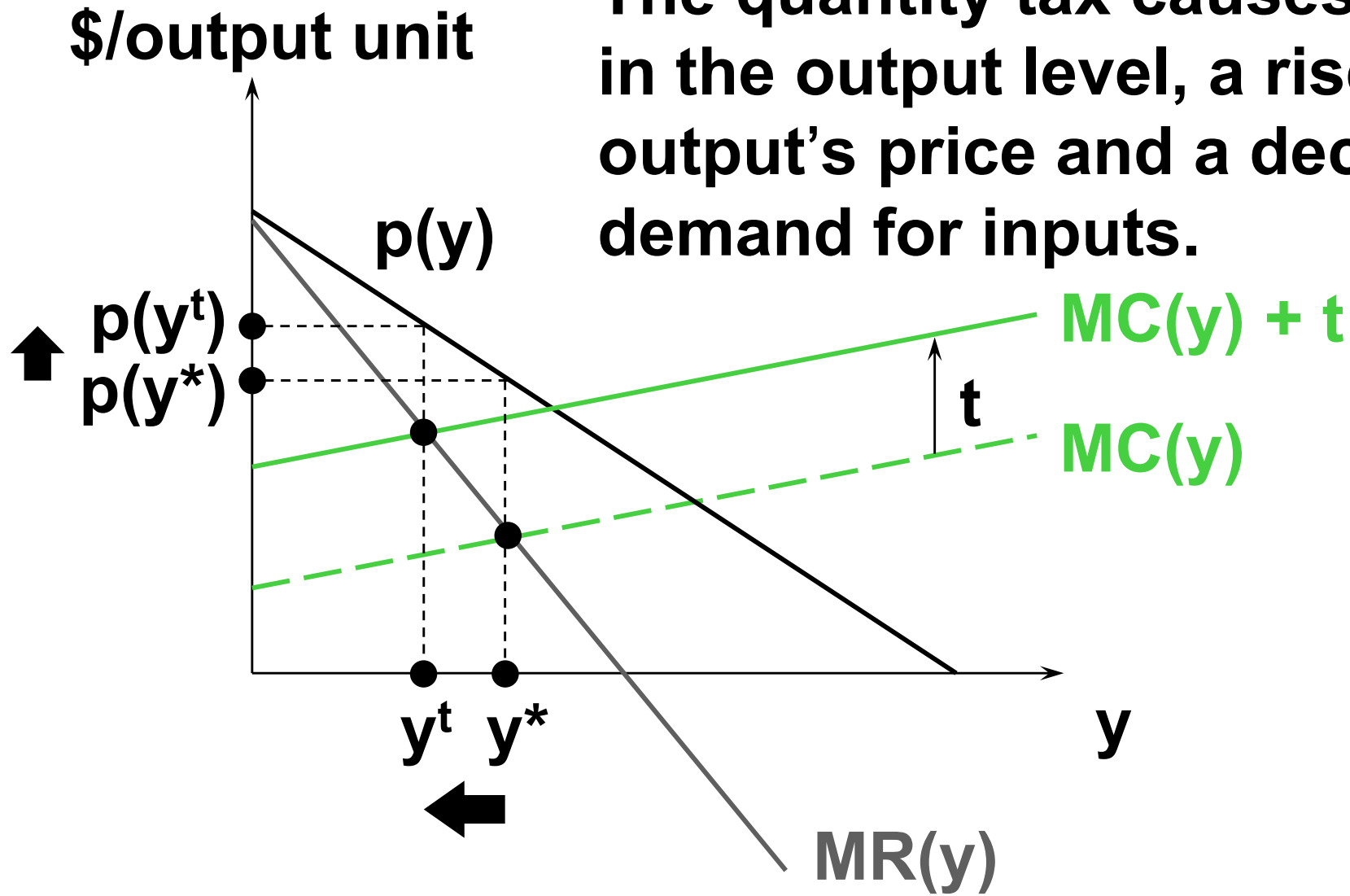
Quantity Tax Levied on a Monopolist

\$/output unit



Quantity Tax Levied on a Monopolist

The quantity tax causes a drop in the output level, a rise in the output's price and a decline in demand for inputs.



Quantity Tax Levied on a Monopolist

- ◆ Can a monopolist “pass” all of a \$t quantity tax to the consumers?
- ◆ Suppose the marginal cost of production is constant at \$k/output unit.
- ◆ With no tax, the monopolist’s price is

$$p(y^*) = \frac{k\varepsilon}{1 + \varepsilon}.$$

Quantity Tax Levied on a Monopolist

- ◆ **The tax increases marginal cost to $\$(k+t)$ /output unit, changing the profit-maximizing price to**

$$p(y^t) = \frac{(k + t)\varepsilon}{1 + \varepsilon}.$$

- ◆ **The amount of the tax paid by buyers is**
 $p(y^t) - p(y^*).$

Quantity Tax Levied on a Monopolist

$$p(y^t) - p(y^*) = \frac{(k + t)\varepsilon}{1 + \varepsilon} - \frac{k\varepsilon}{1 + \varepsilon} = \frac{t\varepsilon}{1 + \varepsilon}$$

is the amount of the tax passed on to buyers. E.g. if $\varepsilon = -2$, the amount of the tax passed on is $2t$.

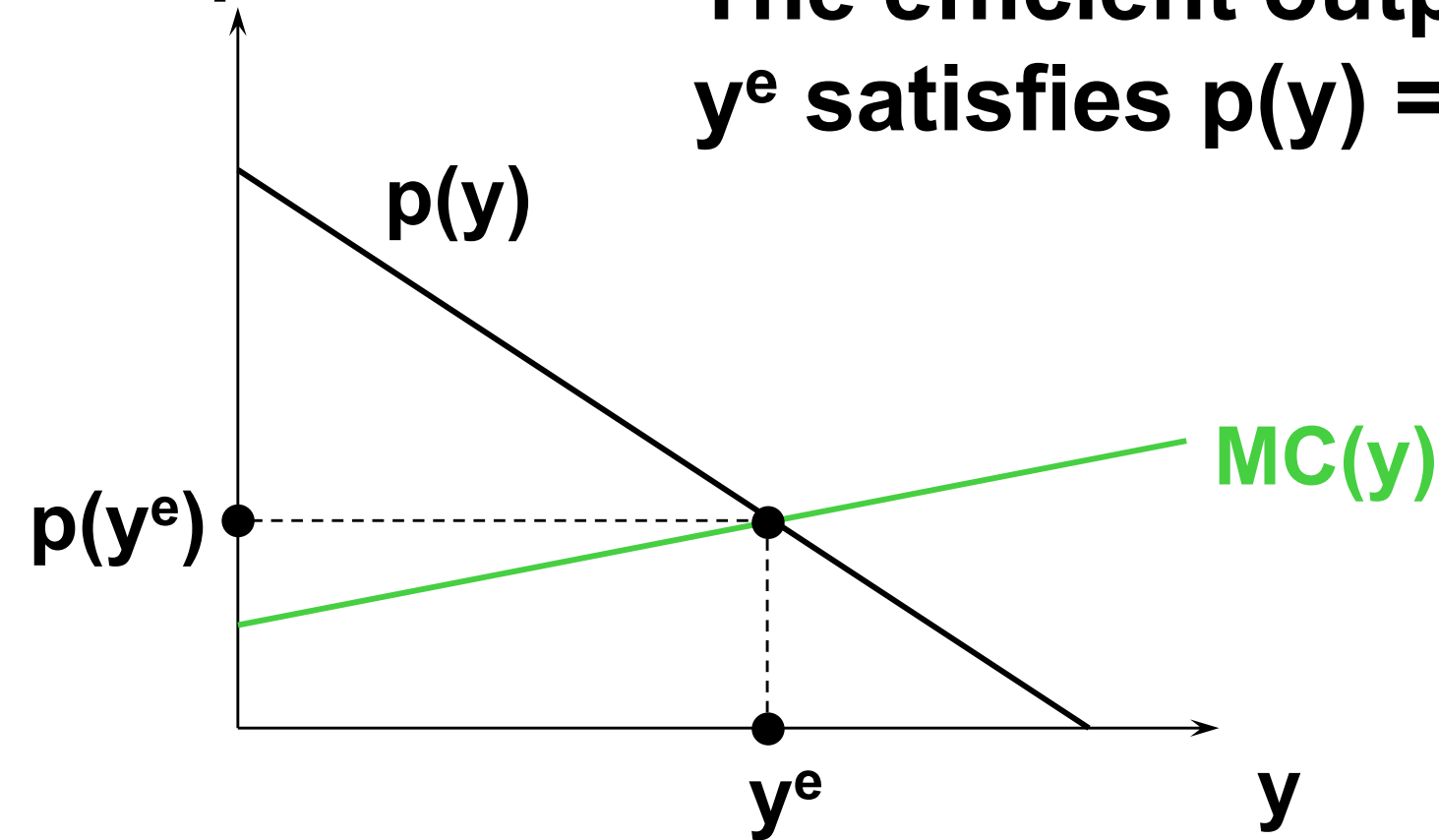
Because $\varepsilon < -1$, $\varepsilon / (1 + \varepsilon) > 1$ and so the monopolist passes on to consumers more than the tax!

The Inefficiency of Monopoly

- ◆ **A market is Pareto efficient if it achieves the maximum possible total gains-to-trade.**
- ◆ **Otherwise a market is Pareto inefficient.**

The Inefficiency of Monopoly

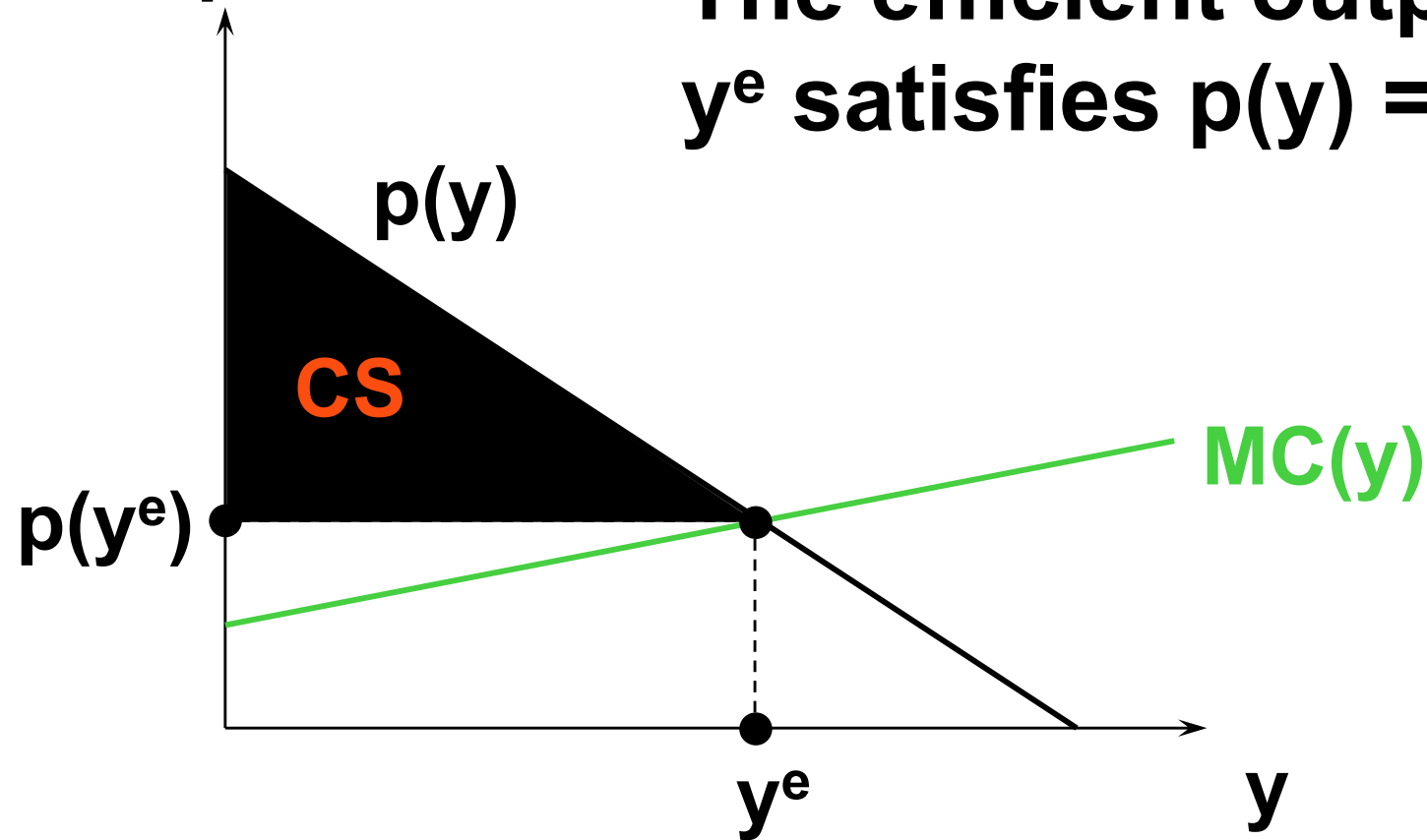
\$/output unit



The efficient output level y^e satisfies $p(y) = MC(y)$.

The Inefficiency of Monopoly

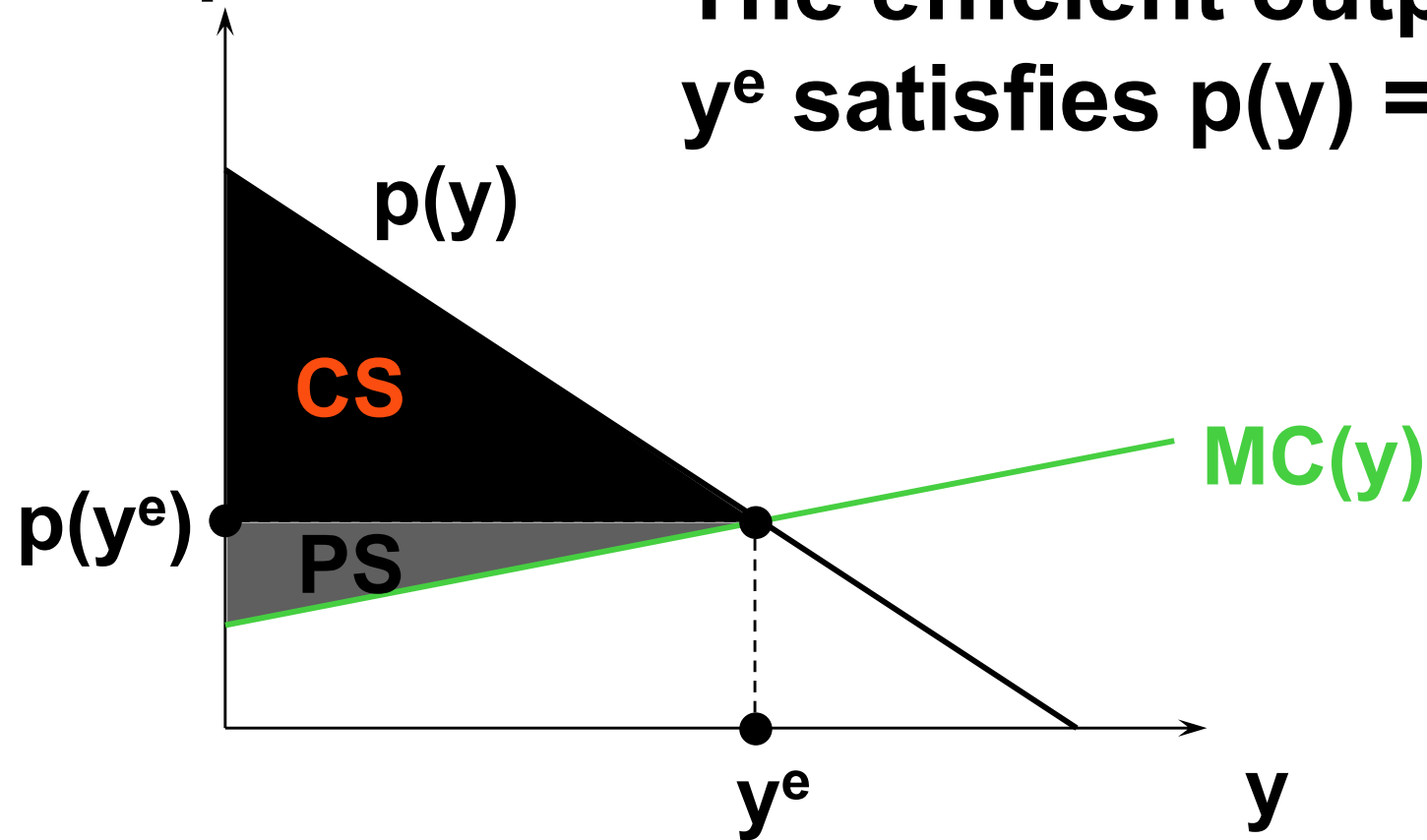
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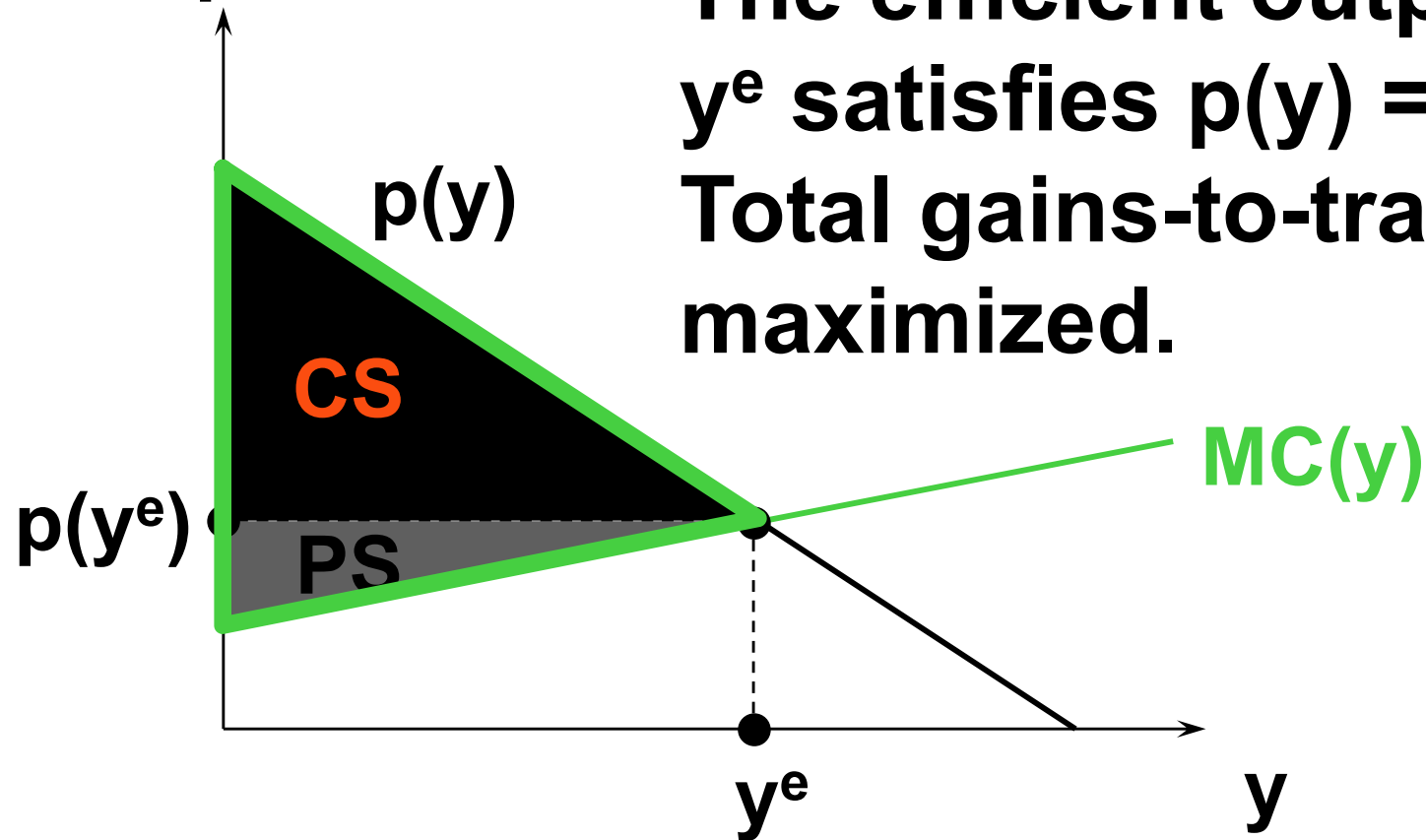
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The Inefficiency of Monopoly

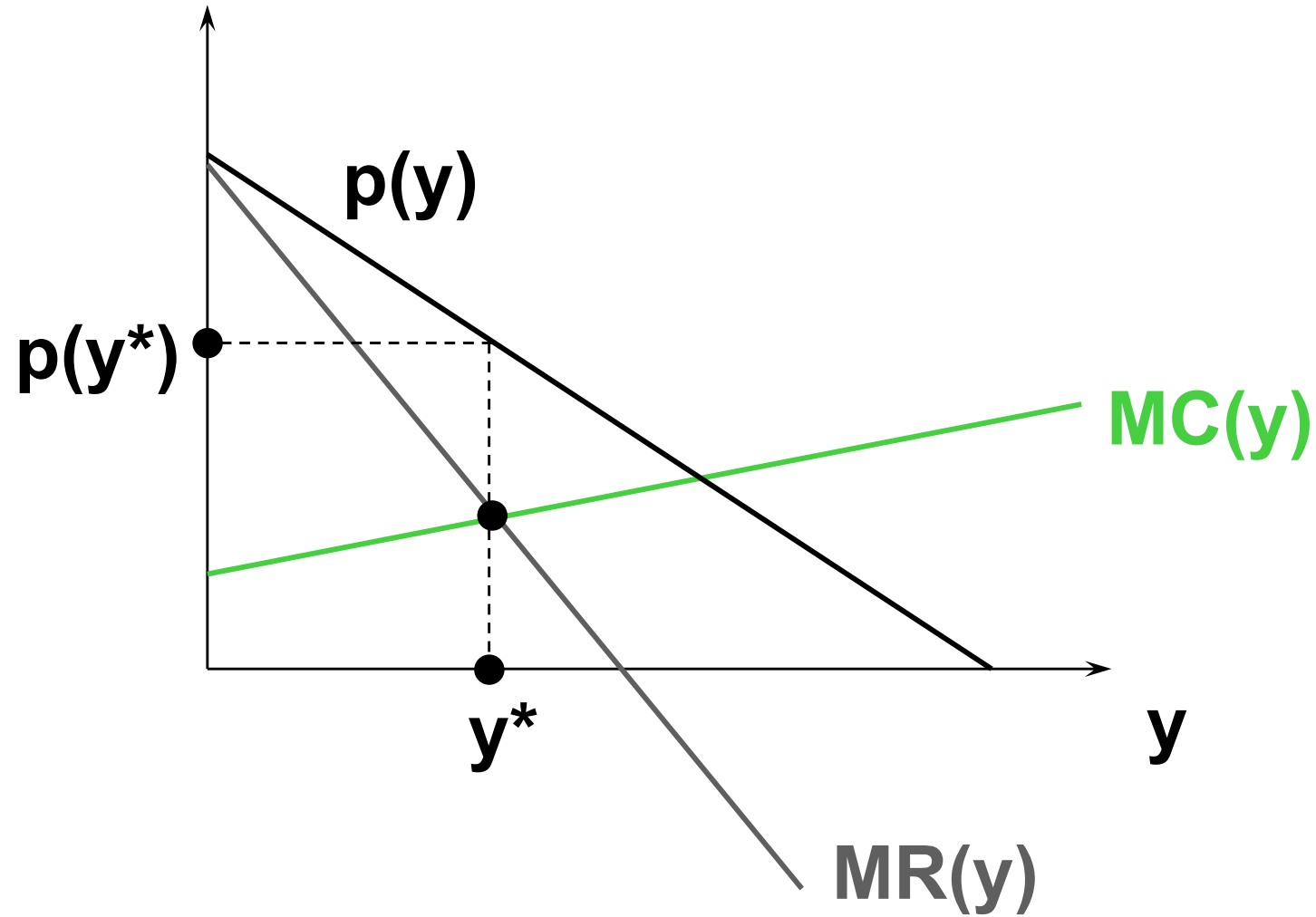
\$/output unit



The efficient output level y^e satisfies $p(y) = MC(y)$. Total gains-to-trade is maximized.

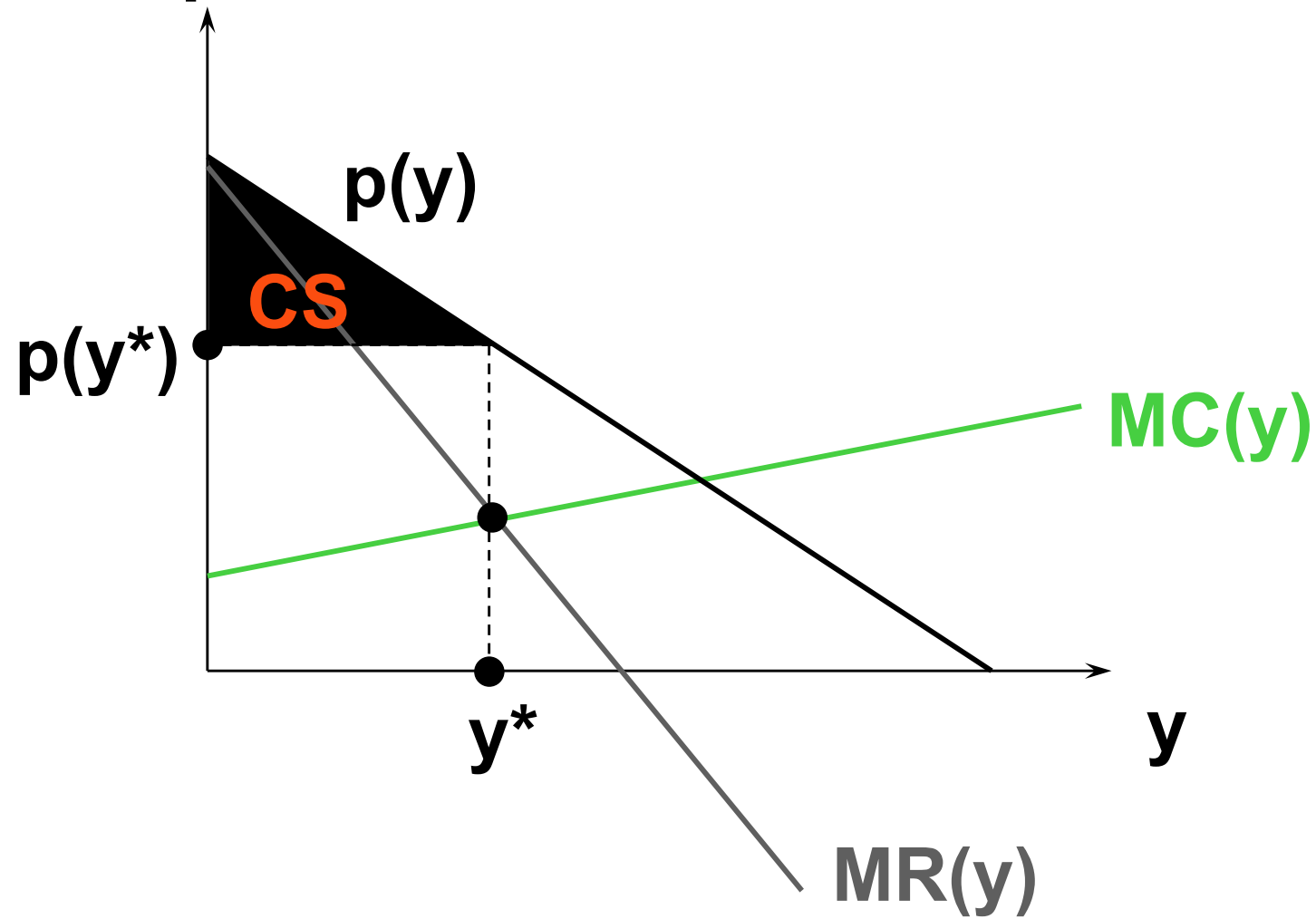
The Inefficiency of Monopoly

\$/output unit



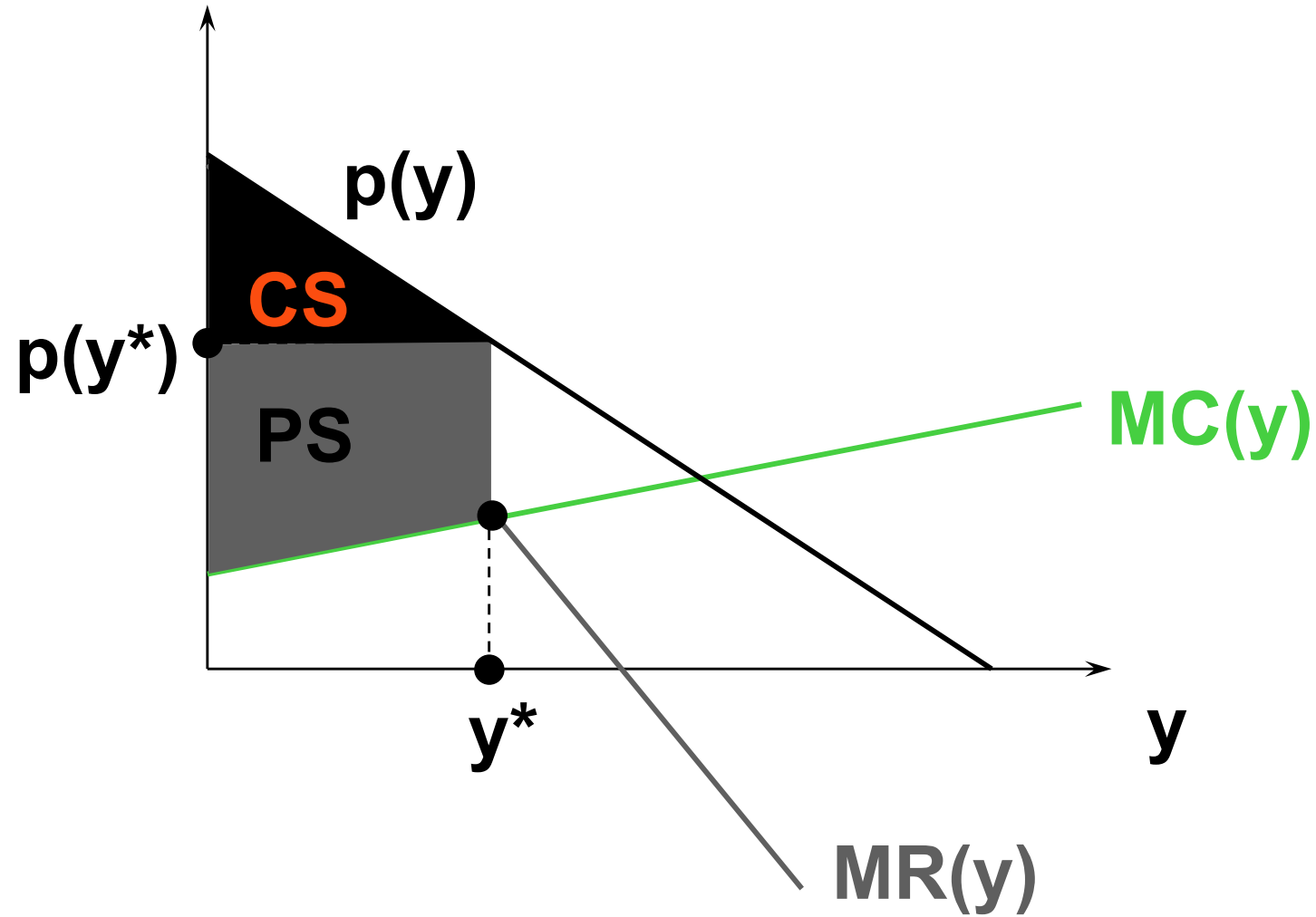
The Inefficiency of Monopoly

\$/output unit



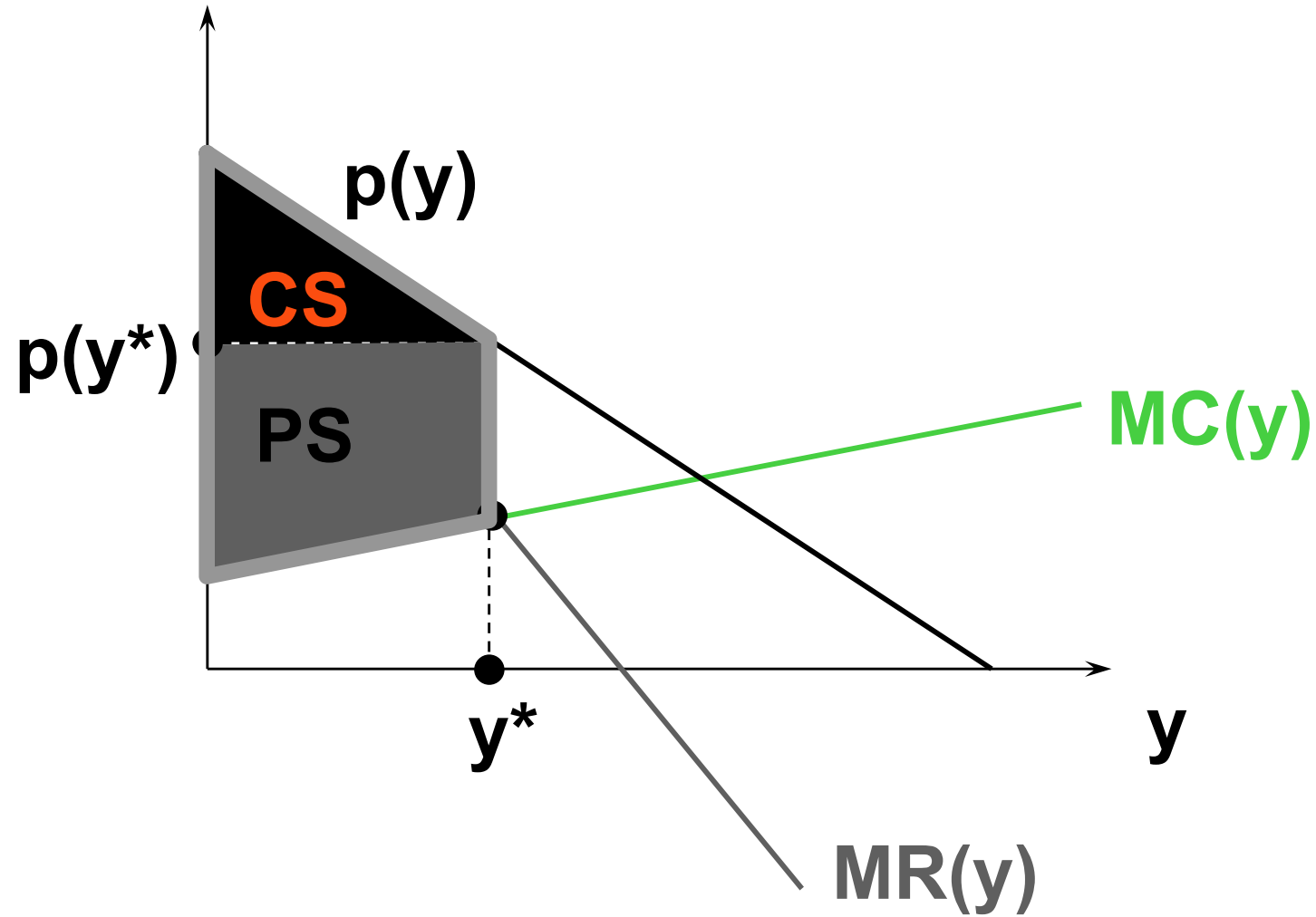
The Inefficiency of Monopoly

\$/output unit



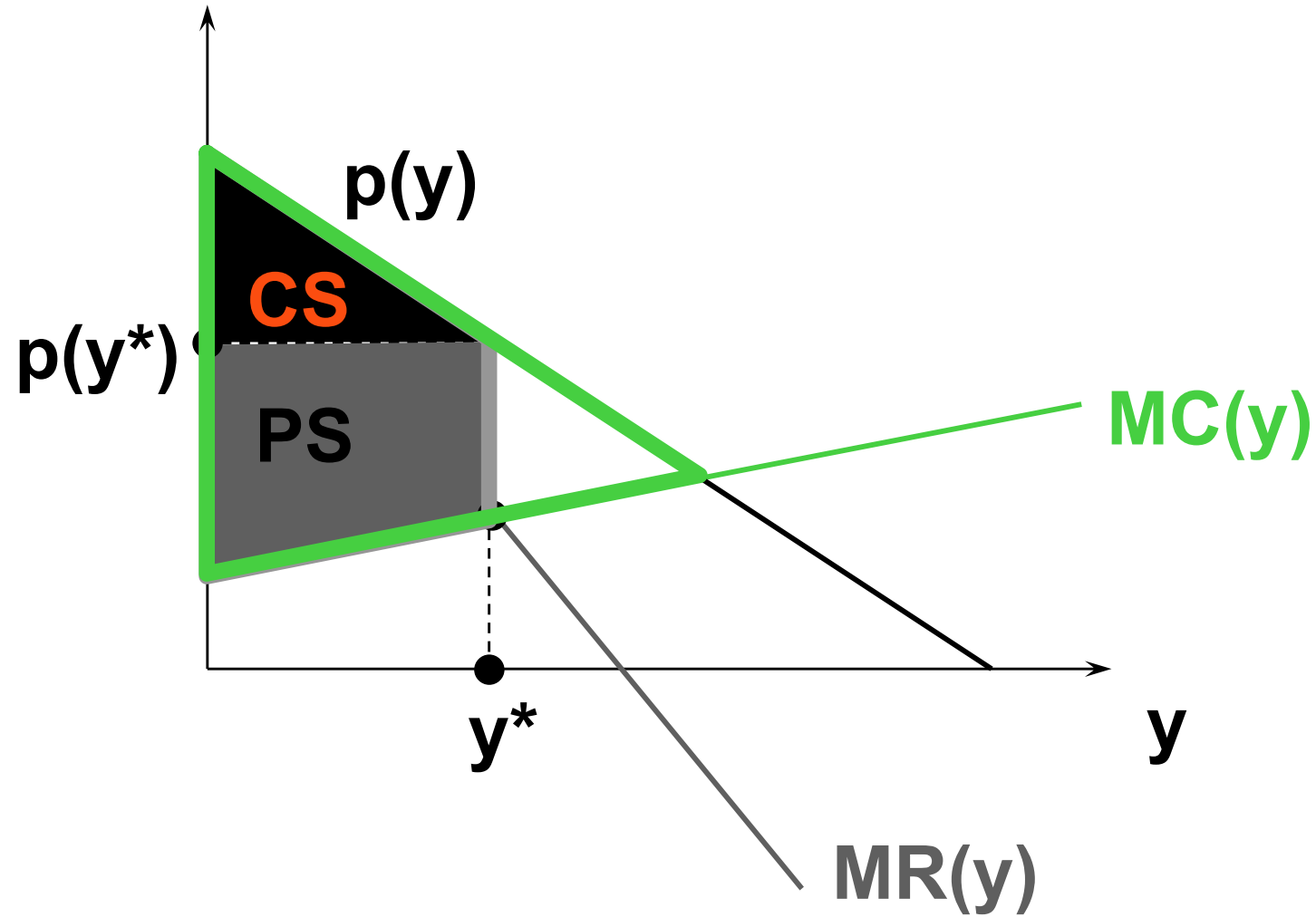
The Inefficiency of Monopoly

\$/output unit



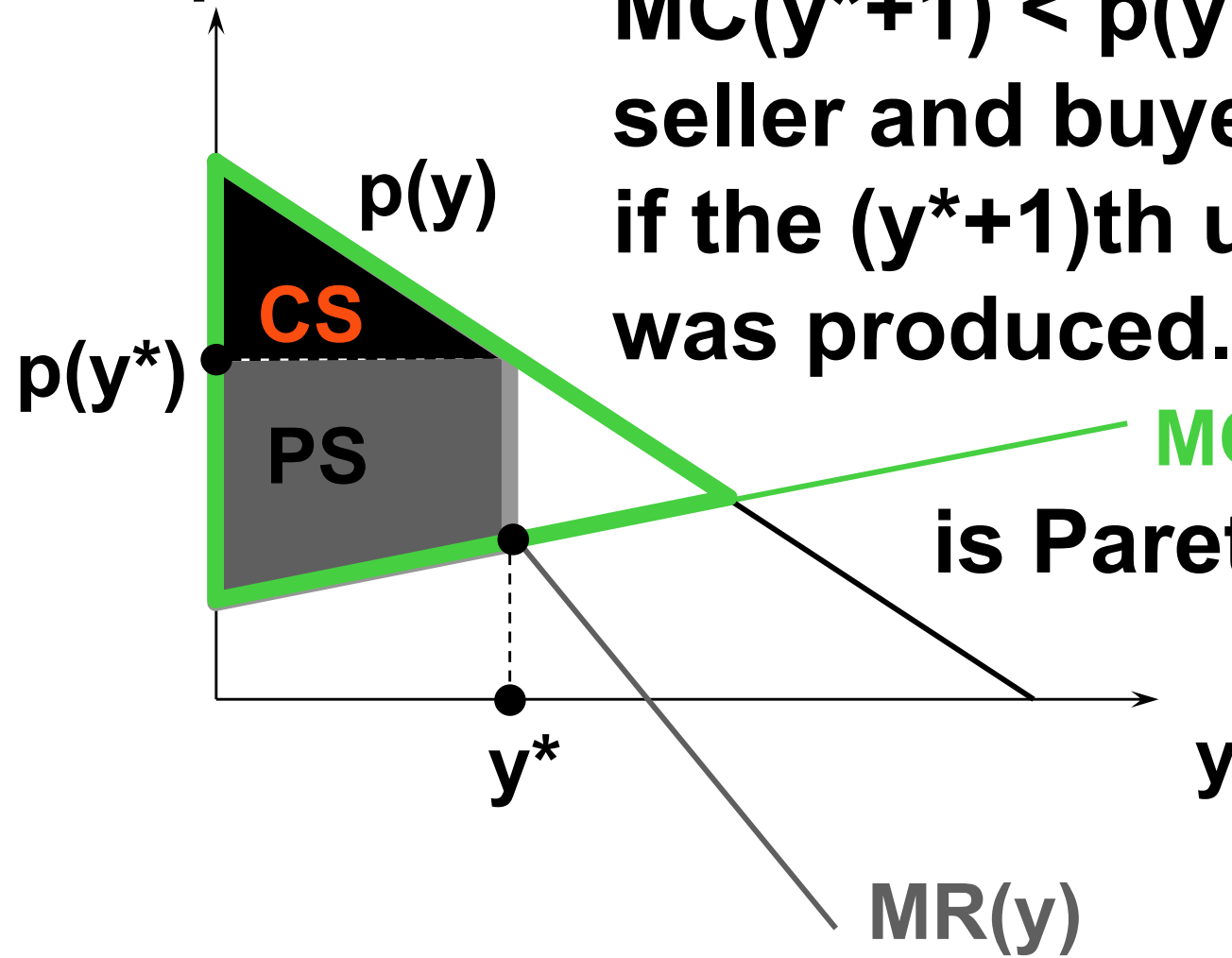
The Inefficiency of Monopoly

\$/output unit



The Inefficiency of Monopoly

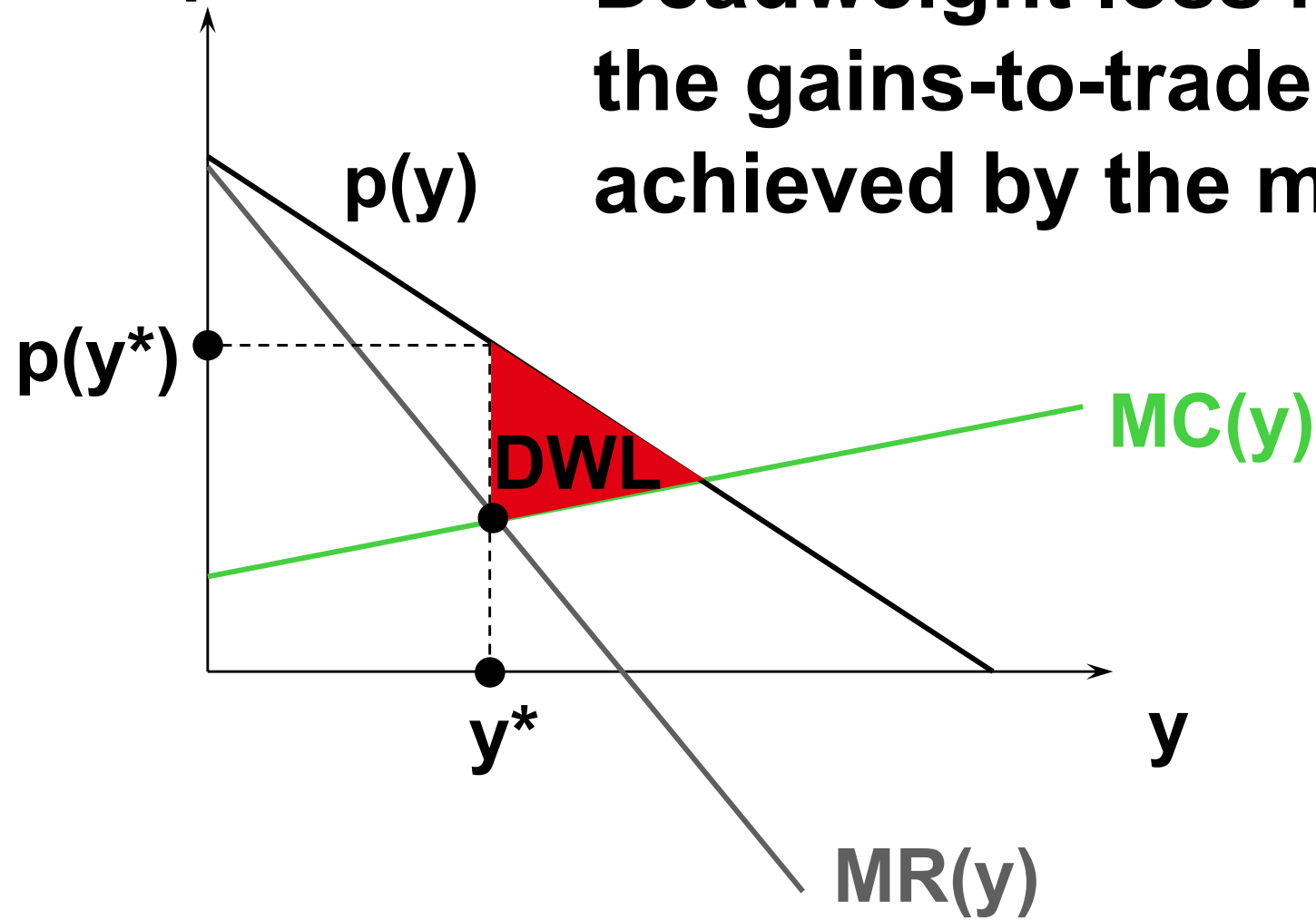
\$/output unit



$MC(y^*+1) < p(y^*+1)$ so both seller and buyer could gain if the (y^*+1) th unit of output was produced. Hence the market is Pareto inefficient.

The Inefficiency of Monopoly

\$/output unit

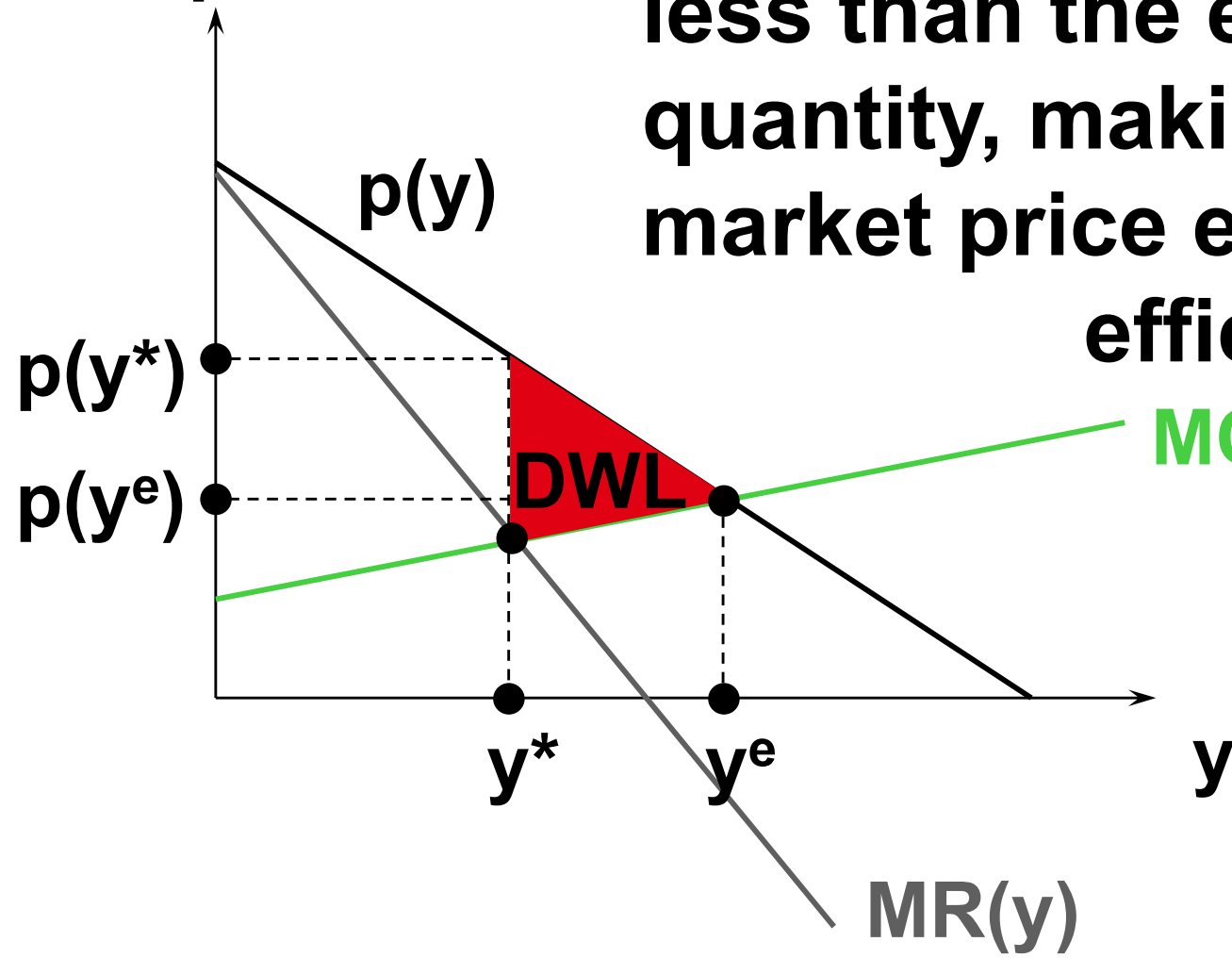


Deadweight loss measures the gains-to-trade not achieved by the market.

The Inefficiency of Monopoly

The monopolist produces less than the efficient quantity, making the market price exceed the efficient market price.

\$/output unit

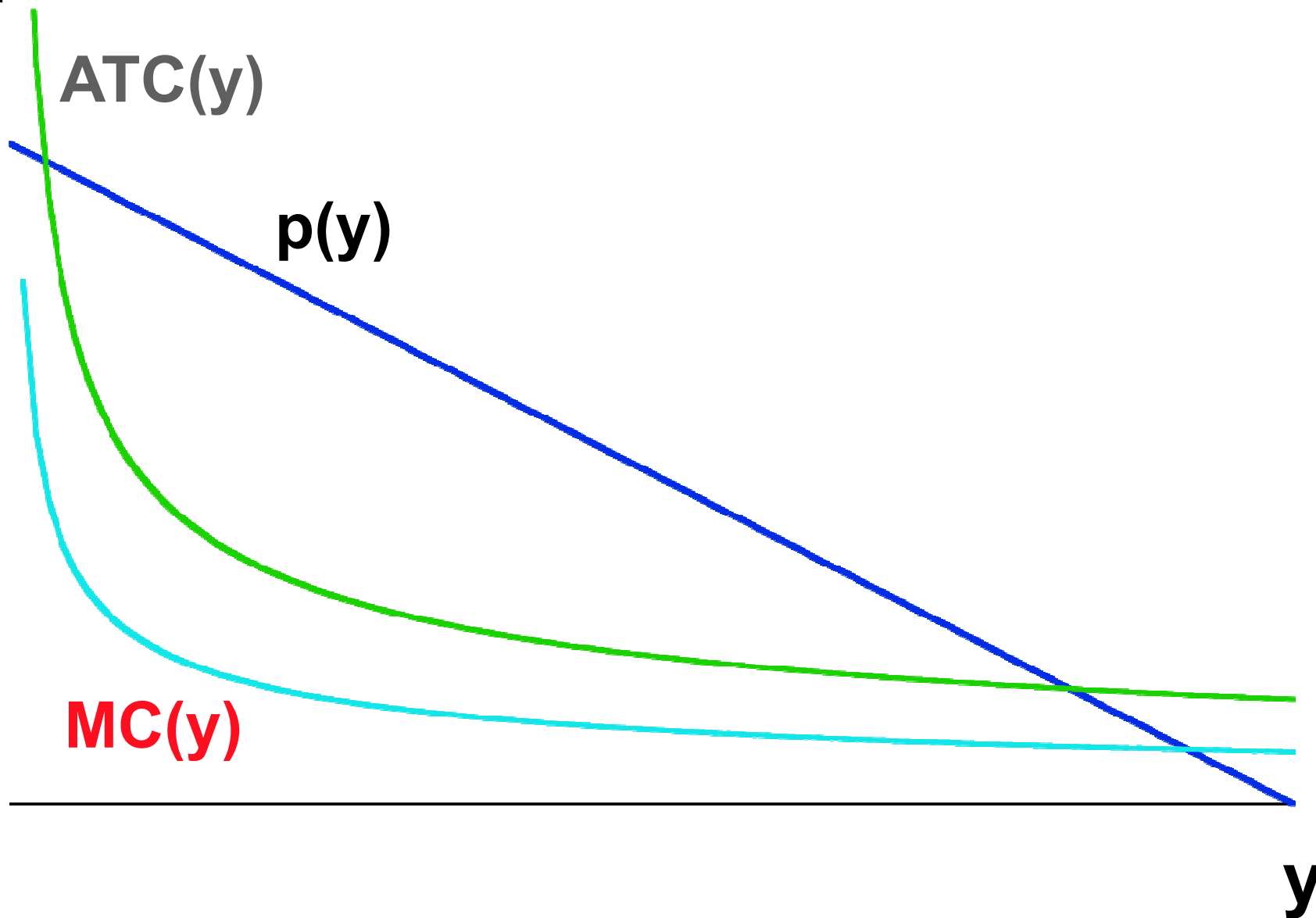


Natural Monopoly

- ◆ **A natural monopoly arises when the firm's technology has economies-of-scale large enough for it to supply the whole market at a lower average total production cost than is possible with more than one firm in the market.**

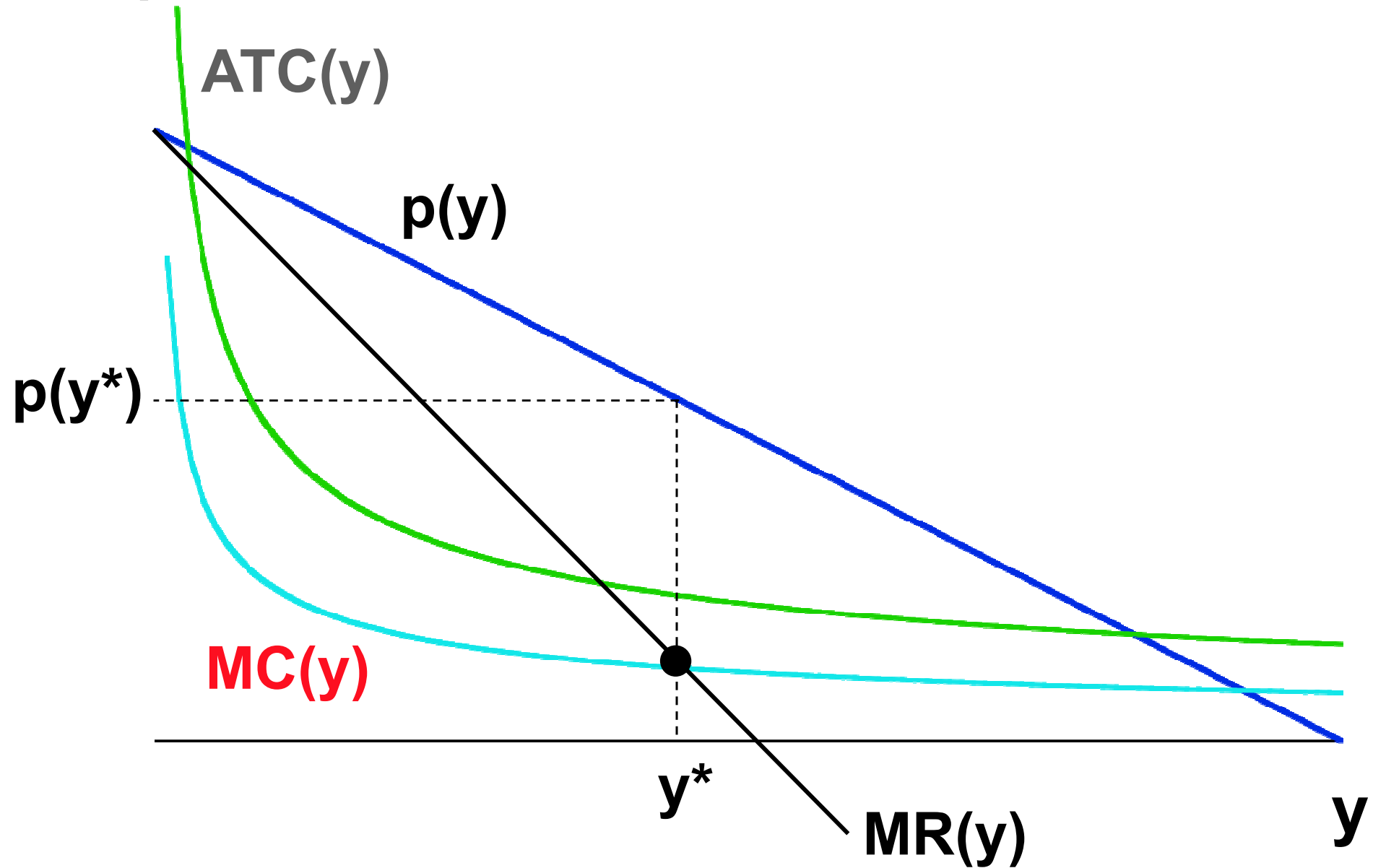
Natural Monopoly

\$/output unit



Natural Monopoly

\$/output unit



Entry Deterrence by a Natural Monopoly

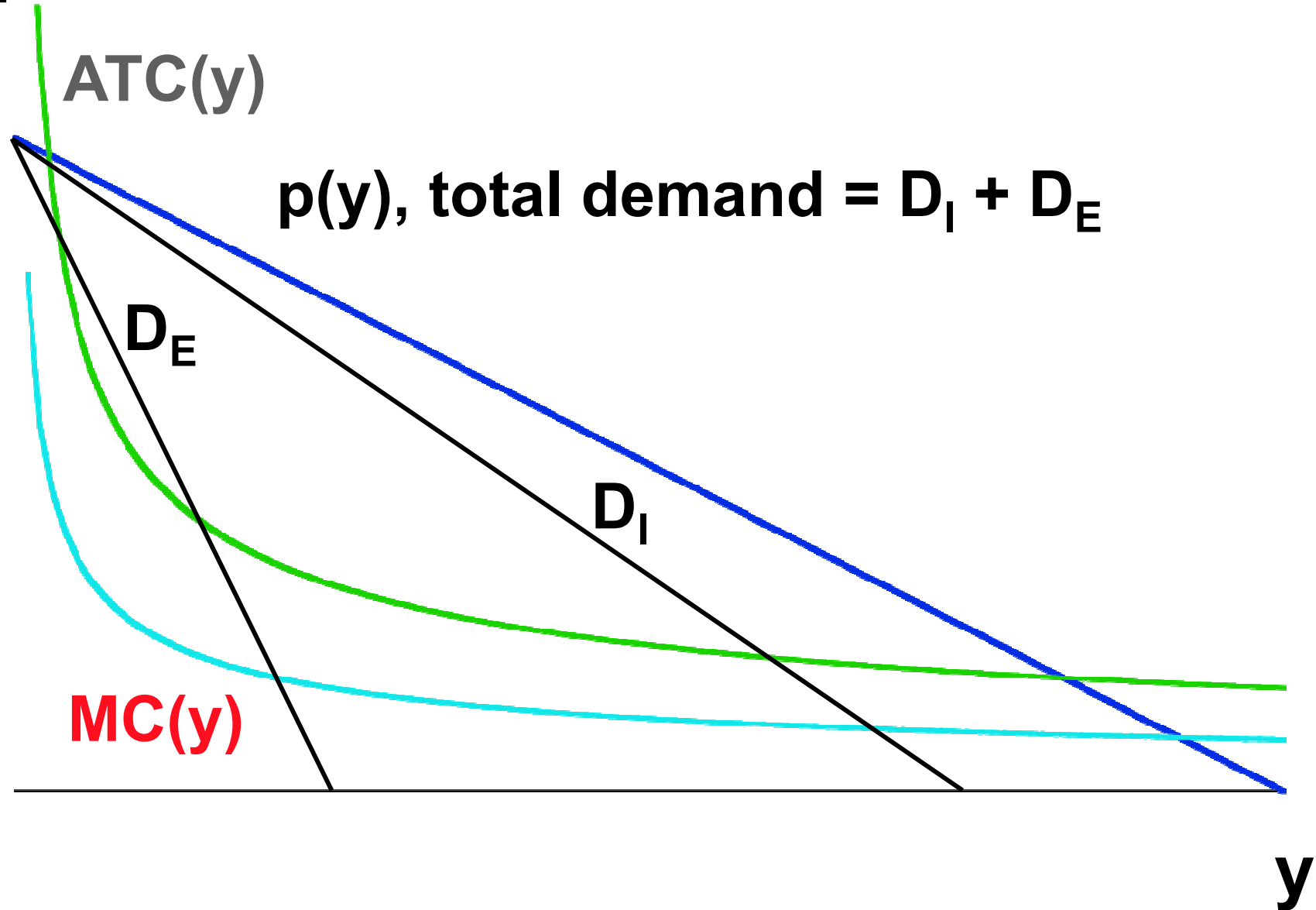
- ◆ **A natural monopoly deters entry by threatening predatory pricing against an entrant.**
- ◆ **A predatory price is a low price set by the incumbent firm when an entrant appears, causing the entrant's economic profits to be negative and inducing its exit.**

Entry Deterrence by a Natural Monopoly

- ◆ **E.g. suppose an entrant initially captures one-quarter of the market, leaving the incumbent firm the other three-quarters.**

Entry Deterrence by a Natural Monopoly

\$/output unit

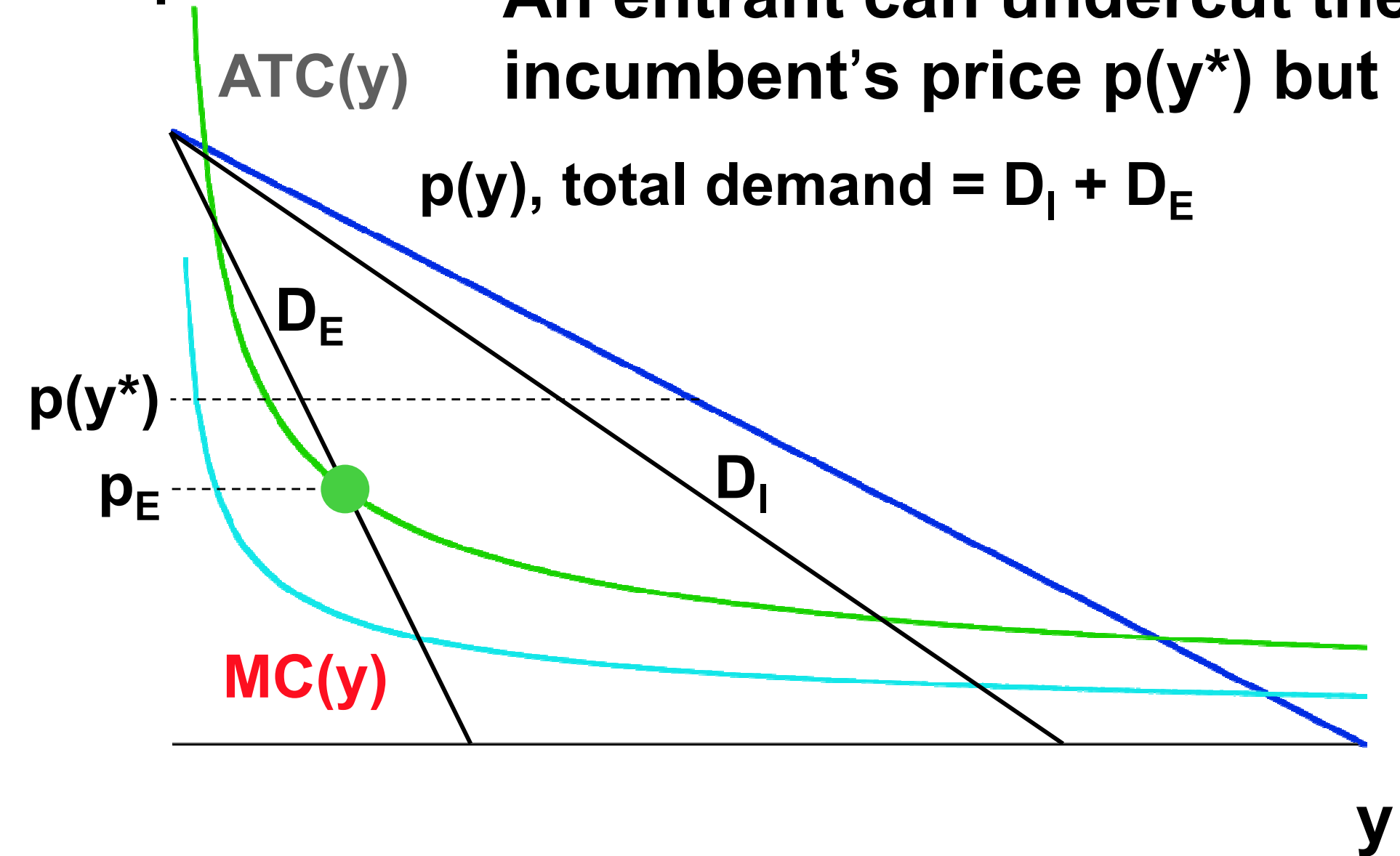


Entry Deterrence by a Natural Monopoly

Monopoly

An entrant can undercut the incumbent's price $p(y^*)$ but ...

\$/output unit



Entry Deterrence by a Natural Monopoly

Monopoly

An entrant can undercut the incumbent's price $p(y^*)$ but

$p(y)$, total demand = $D_I + D_E$

the incumbent can then lower its price as far as p_I , forcing the entrant to exit.

\$/output unit

$ATC(y)$

$p(y^*)$

p_E

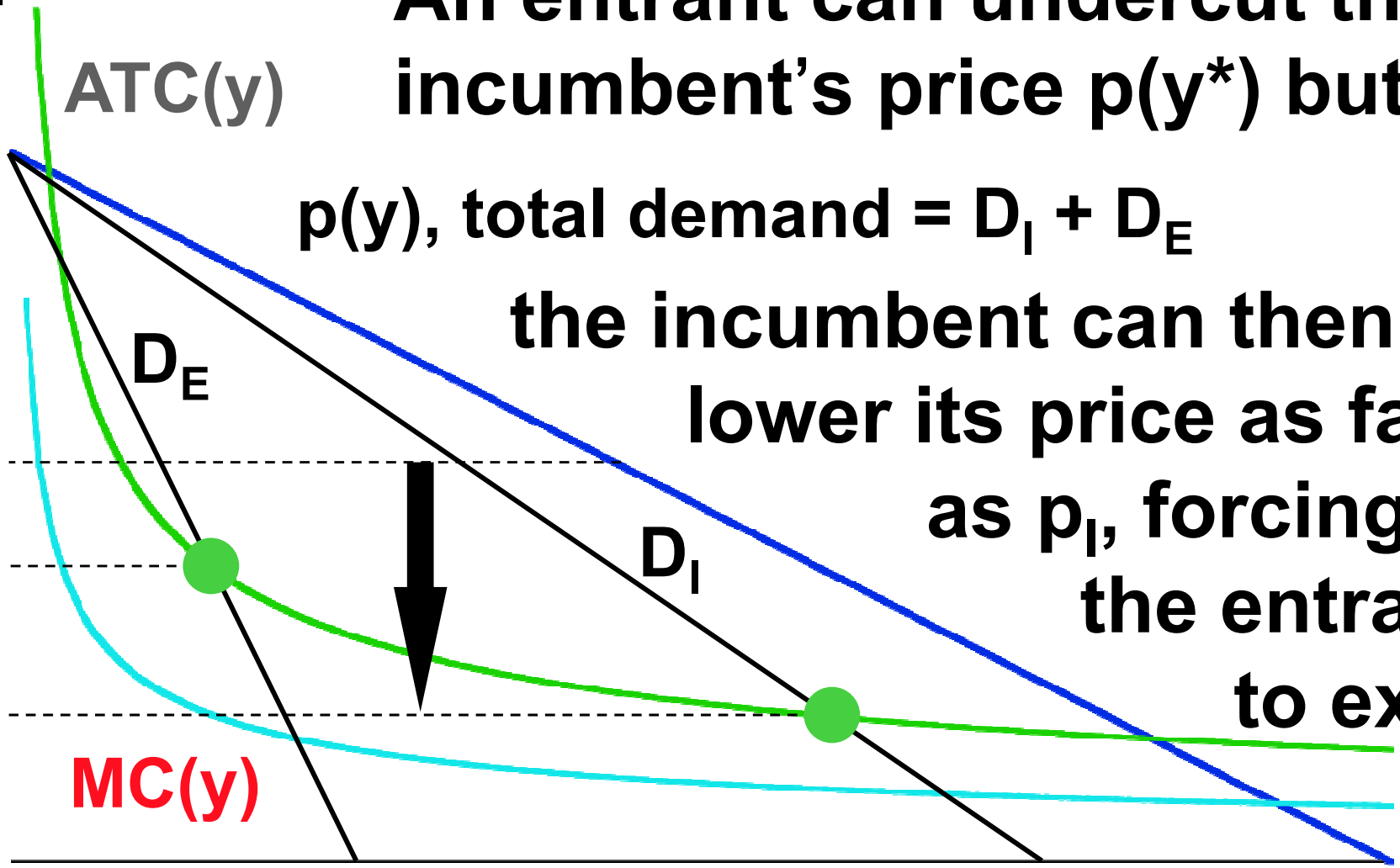
p_I

$MC(y)$

D_E

D_I

y

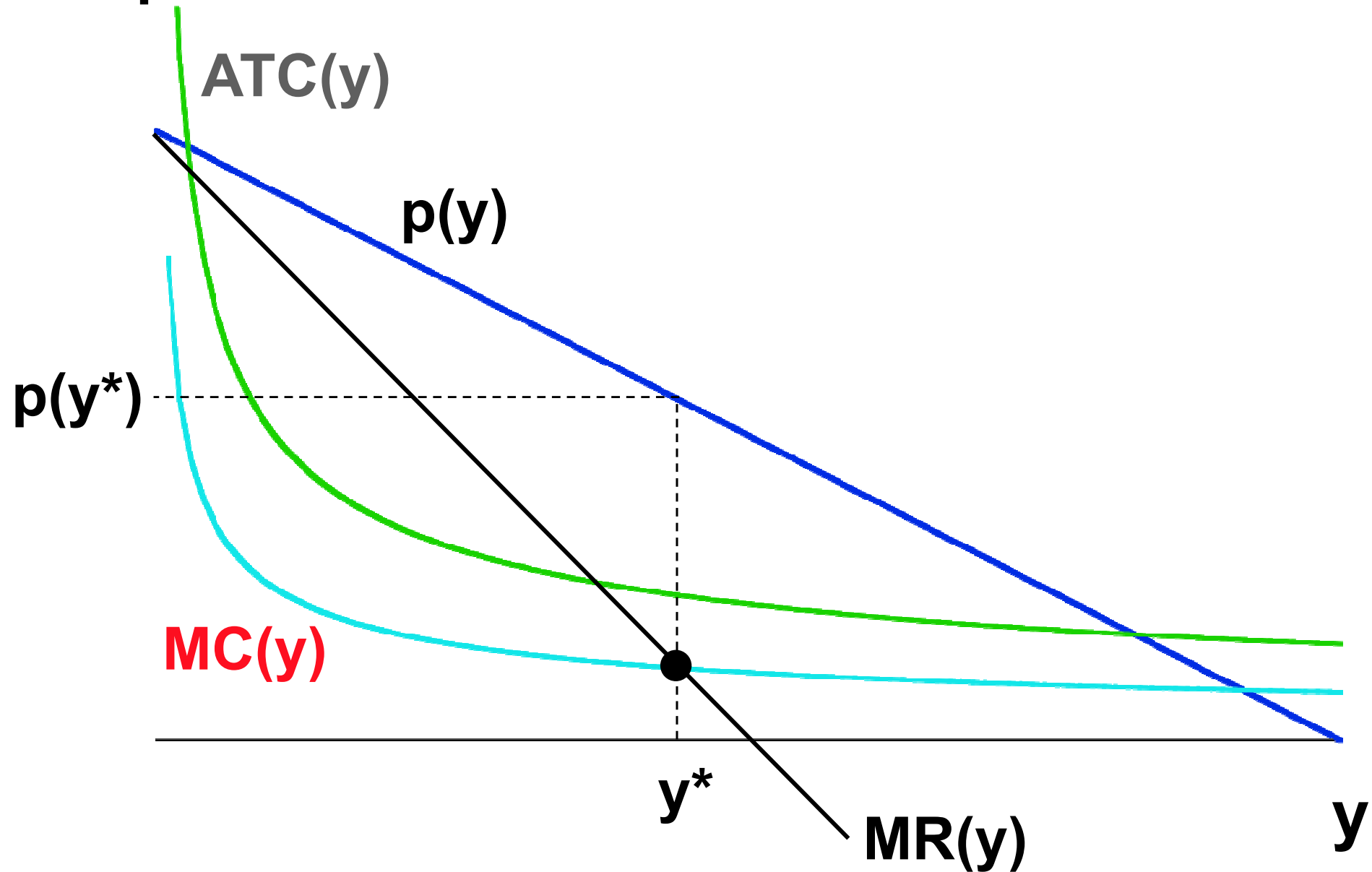


Inefficiency of a Natural Monopolist

- ◆ **Like any profit-maximizing monopolist, the natural monopolist causes a deadweight loss.**

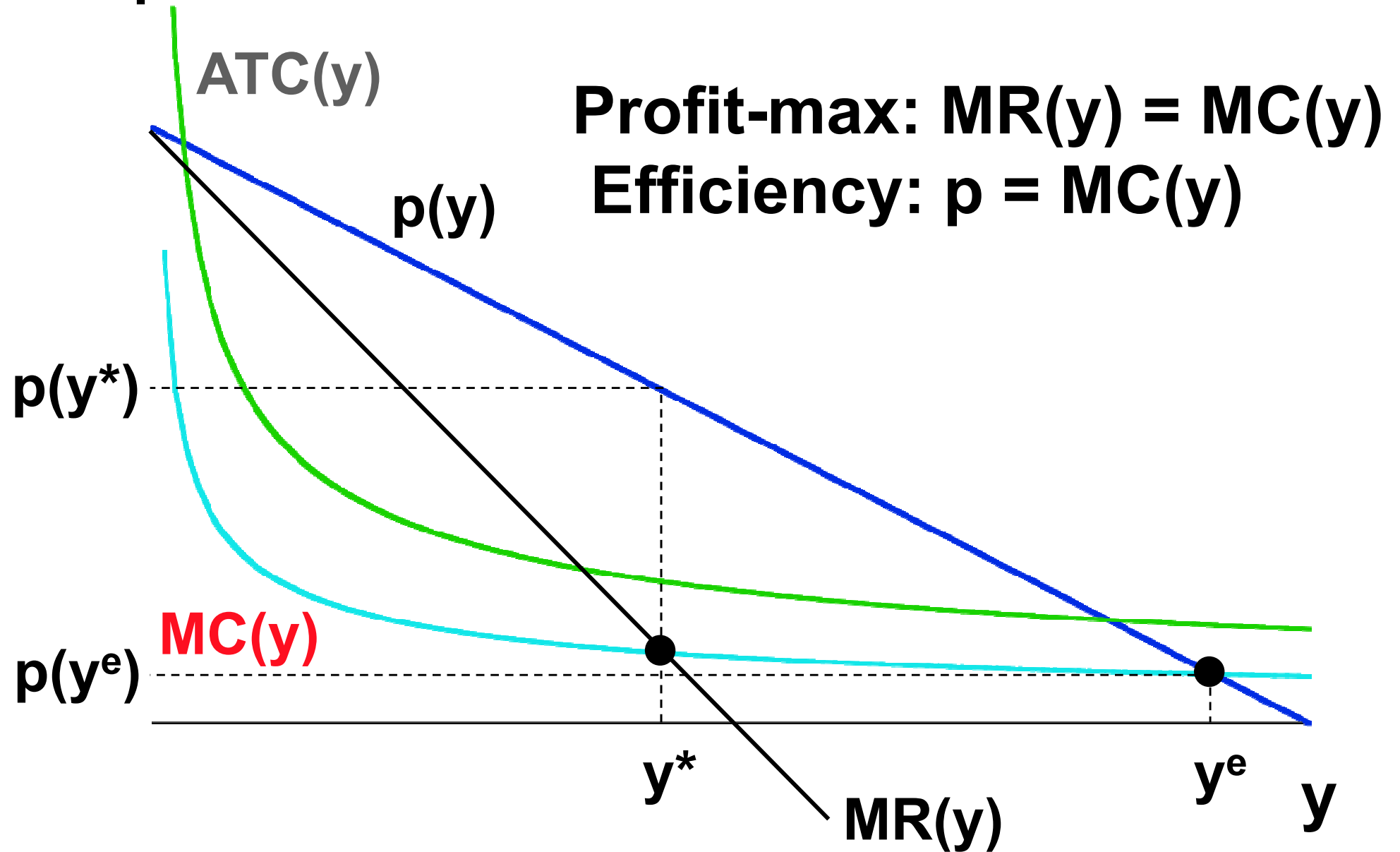
Inefficiency of a Natural Monopoly

\$/output unit



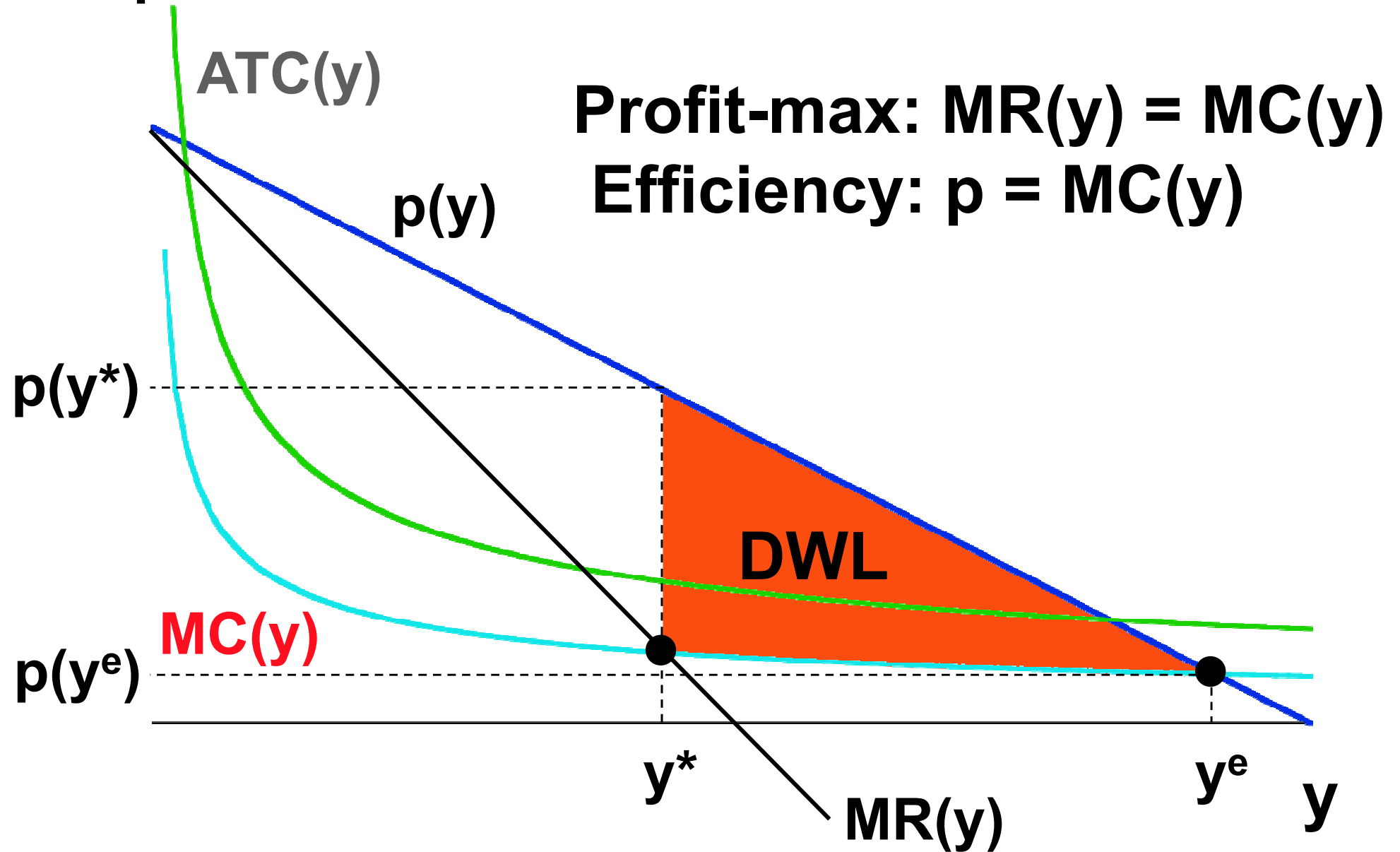
Inefficiency of a Natural Monopoly

\$/output unit



Inefficiency of a Natural Monopoly

\$/output unit



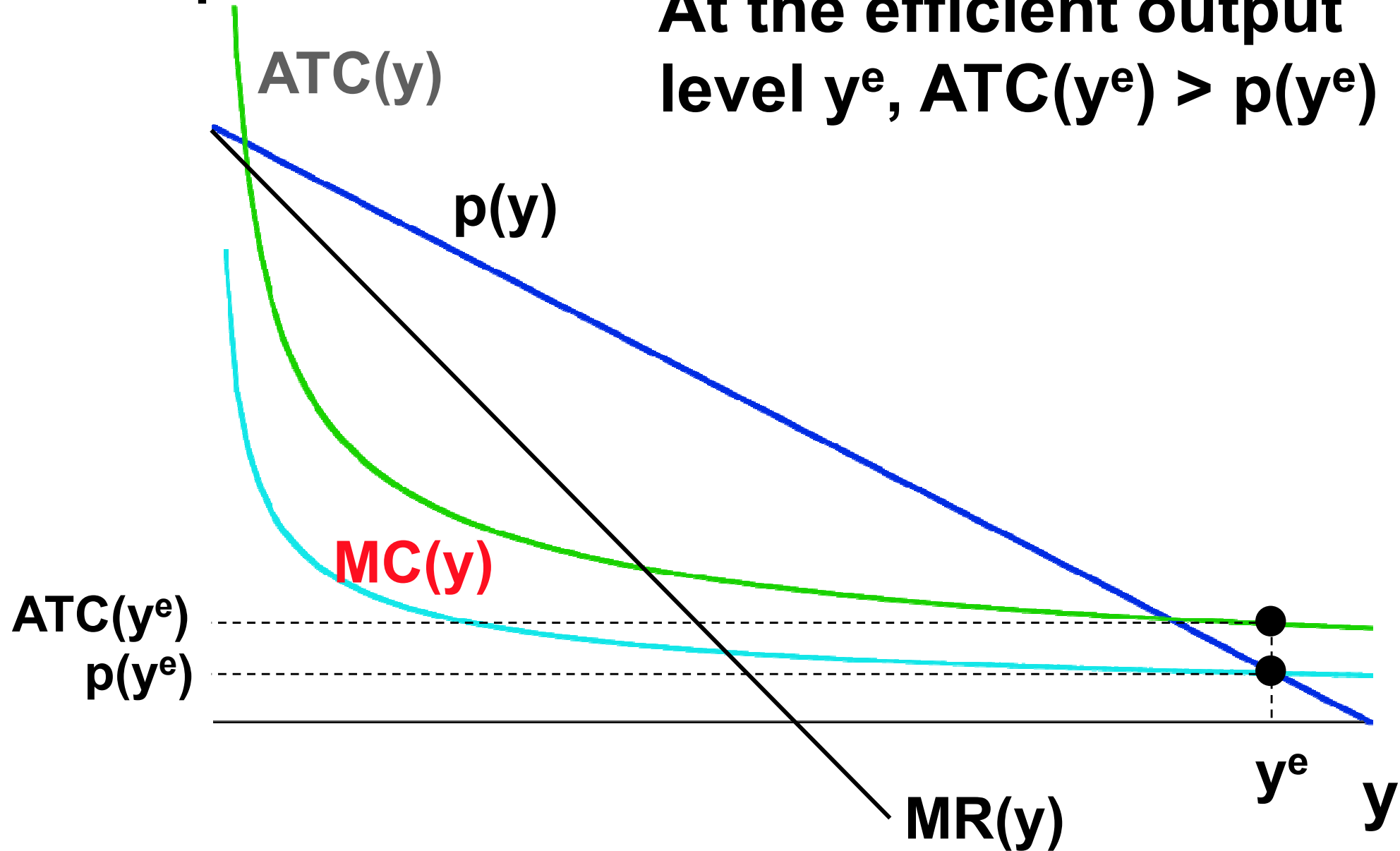
Regulating a Natural Monopoly

- ◆ **Why not command that a natural monopoly produce the efficient amount of output?**
- ◆ **Then the deadweight loss will be zero, won't it?**

Regulating a Natural Monopoly

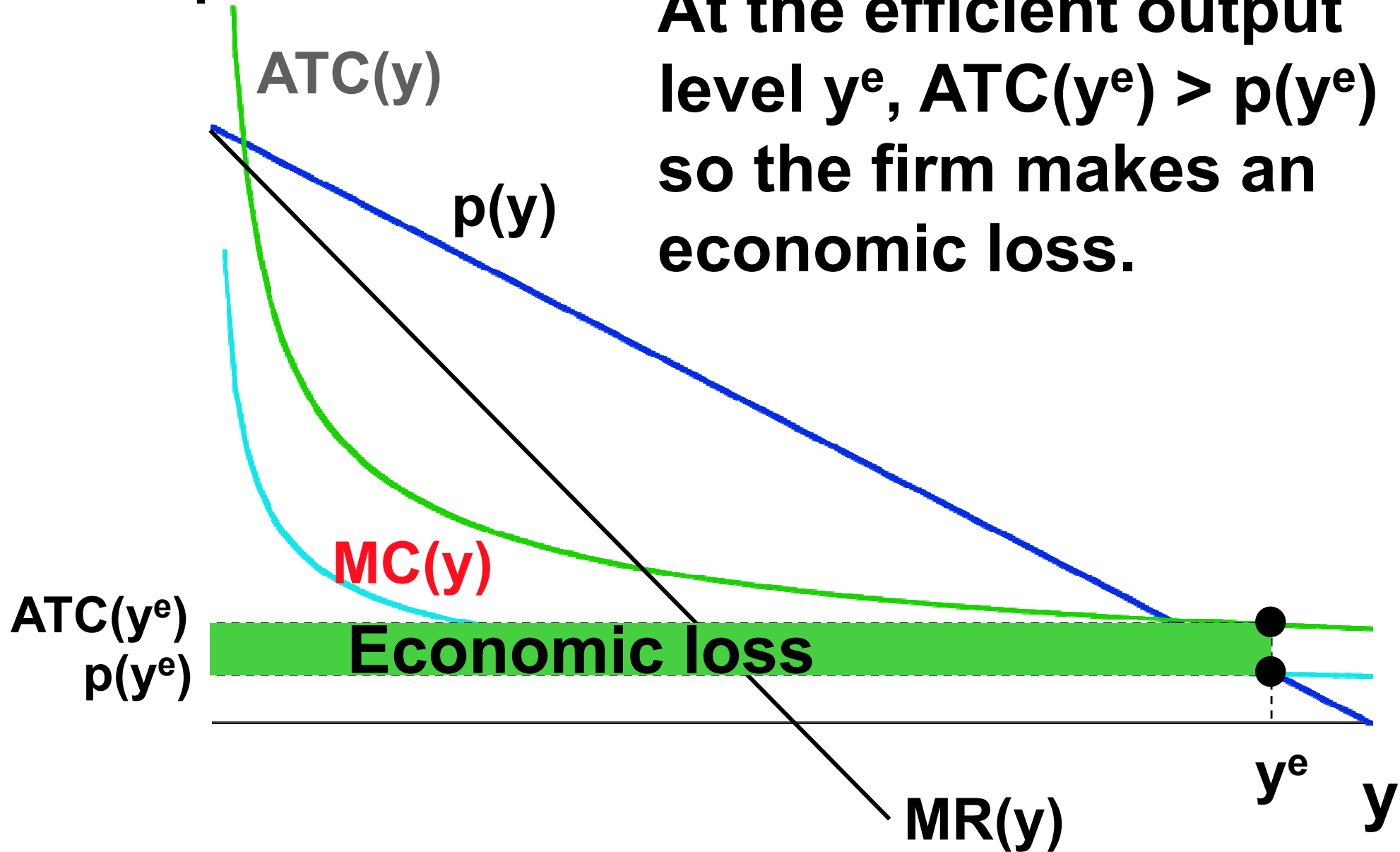
\$/output unit

At the efficient output level y^e , $ATC(y^e) > p(y^e)$



Regulating a Natural Monopoly

\$/output unit



At the efficient output level y^e , $ATC(y^e) > p(y^e)$ so the firm makes an economic loss.

Regulating a Natural Monopoly

- ◆ **So a natural monopoly cannot be forced to use marginal cost pricing. Doing so makes the firm exit, destroying both the market and any gains-to-trade.**
- ◆ **Regulatory schemes can induce the natural monopolist to produce the efficient output level without exiting.**