4-4 Day 3 Opmizaon: Economics

Learning Targets:

I can use derivaves to opmize quanes in real world situaons.

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Economics

x = The number of items produced and sold

r(x) = The revenue generated from selling x items

c(x) = The cost from making x items

p(x) = The profit from making and selling x items

$$p(x) = r(x) - c(x)$$

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Economics

$\dfrac{dr}{dx} =$ *The rate of change of the revenue*

The Marginal Revenue (MR)

$\dfrac{dc}{dx} =$ *The rate of change of the cost*
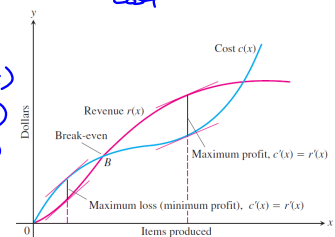
The Marginal Cost (MC)

$\dfrac{dp}{dx} =$ *The rate of change of the profit*

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Maximum Profit

The maximum profit occurs at a producon level at which the marginal ~~profit~~ cost equals the marginal revenue.

$$p(x) = r(x) - c(x)$$
$$p'(x) = r'(x) - c'(x)$$
$$0 = r'(x) - c'(x)$$
$$c'(x) = r'(x)$$

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Ex1. You start a garage band with some of your friends. You record an album using and sell CD's for $10 each in the lunchroom. The cost of producing x CD's is

$$c(x) = .009x^2 + 3.083x + 152.201$$
$$r(x) = 10x$$

State ordinances allow garage bands to produce at most 500 CD's independently before requiring bands to have a record label. You have not signed a record deal.

$$p(x) = 10x - (\underline{\qquad})$$

a.) What producon level will maximize the profits? What is the profit at this producon level?

$$p(x) = 10x - .009x^2 - 3.083x - 152.201$$
$$\rightarrow (384, \ \$1176.82) \quad p' = 10 - .018x - 3.083$$
$$(500, \ \$1056.30)$$

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b.) What producon level will minimize your average cost? What is your average cost at this producon level?

$$\overline{c}(x) = \frac{.009x^2 + 3.083x + 152.201}{x}$$

average cost

$$AC = .009x + 3.083 + \frac{152.201}{x}$$
$$AC' = .009 - \frac{152.201}{x^2} = 0 \quad \begin{cases} 500 \\ \$7.89 \end{cases}$$
$$x = 130.041$$
$$= 130 \ CD's \quad \$5.42 \leftarrow$$

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c.) Find the producon level at which the average cost equals the marginal cost?

$$\frac{.009x^2 + 3.083x + 152.201}{x} = .018x + 3.083$$

$$.009x^2 + 3.083x + 152.201 = .018x^2 + 3.083x$$

$$152.201 = .009x^2$$

$$x = 130$$

d.) Something special happens at this producon level. Make a hypotheses as to what that is.

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Homework

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