Derivative Applications
3.1 – Marginal & Other Applications

There is another interpretation for the derivative, one that is particularly important in business and economics. Suppose that a company has calculated its *revenue, cost,* and *profit functions* as defined below.

If x = *quantity produced or sold*, then the following equations are true.

Cost Function
C(x) = (Total cost of producing *x* units)
$C(x) = (unit\ cost)x + (fixed\ cost)$

Revenue Function
R(x) = (Total revenue (income) from selling *x* units)
$R(x) = (selling\ price\ per\ unit)x$

Profit Function
P(x) = (Total profit from producing & selling *x* units)
$P(x) = R(x) - C(x)$

The term *marginal cost* means the cost of producing one more unit. The cost of one more unit is the *rate* at which total costs are rising (measured in dollars per unit.) If we calculate rates of change as *instantaneous* rates of change (that is, derivatives), we see that the marginal cost function *MC(x)* is the derivative of the cost function:

The term *marginal revenue*, *MR(x),* means the revenue from selling one more unit.

The term *marginal profit*, *MP(x),* means the profit from selling one more unit.

Marginal Cost Function
MC(x) = C'(x) *Marginal cost is the derivative of cost*

Marginal Revenue Function
MR(x) = R'(x) *Marginal revenue is the derivative of revenue*

Marginal Profit Function
MP(x) = P'(x) *Marginal profit is the derivative of profit*

Derivative: slope, instantaneous rates of change, marginal.

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Ex A: Finding and Interpreting Marginal Cost

A company manufactures cordless telephones and finds that its cost function (the total cost of manufacturing *x* telephones) is $C(x) = 400\sqrt{x} + 500$ dollars, where *x* is the number of telephones produced.

a. Find the marginal cost function *MC(x)*.

b. Find the marginal cost when 100 telephones have been produced.

c. Interpret your answer.

Ex B: Finding a Learning Rate

A psychology researcher finds that the number of names that a person can memorize in *x* minutes is approximately $f(x) = 6\sqrt[3]{x^2}$.

a. Find the instantaneous rate of change of this function in 8 minutes.

b. Interpret your answer.