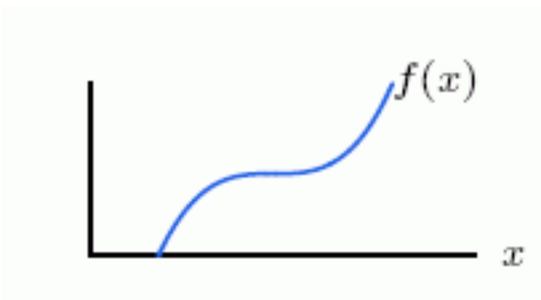
Math 122

Section 003/S03

Part Three: Applications to Derivatives

Brendan Kelly, Critical Points

1) How many critical points are there? How many are local maxima? How many are local minima?



2) $f(x) = x^4-3x^3+17x$ Critical point at $x=2$. Use the Second Derivative test to identify it as a local max or min.

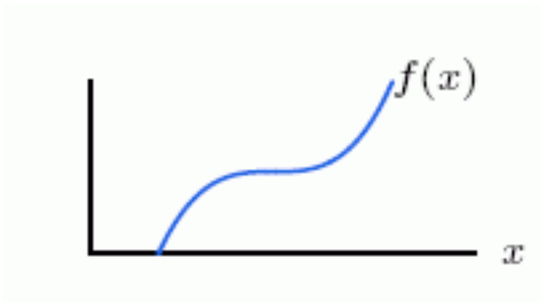
3) Use the first derivative to find all critical points.

$$f(x) = (4x^3)+(2x^2)-90x+6$$

Identify each critical point as a local maximum, minimum, or neither.

Jeremy Kleinwaks, Inflection Points

1) How many inflection points are there?



2) Use the second derivative test to find all inflection points of the function

$$f(x) = (2x^4)+(x^3)-(35x^2)+6$$

3) Make a sign chart to decide whether this is an actual inflection point.

Find the inflection points of $f(x) = (4x^3)-(9x^2)+18$

Jenn Colter, Logistic Growth

1) If t is the year since 2001, the one model for the population of the world. Population (P), in billions, is P=40/(1+11e^-.09t)
   a. What does this model predict for the maximum substance population of the world?
   b. Plot this function including P-intersect, inflection, and carrying concavity.
   c. According to this model when will the population of the world reach 20 billion?

Jenn Colter, Interpretations in terms of the Concavity / 2nd Derivative

1) Use the second derivative test to find where the function $f(x) = (x^6)-(24x^5)+12$ is concave up.
2) Given the same function $f(x) = (x^6)-(24x^5)+12$. Use the second derivative to find the point of inflection.

William Hansen, Global Max/Min

1) Find global max and min values of: $f(x) = (1/3x^2)-(x^2)+16$ over the interval [-1,1].

2) The demand curve for a product is given by $q = 1100-6p^2$. Find the price that maximizes revenue for sales of this product.

3) Plot the graph of $f(x) = (5x^3)-(4e^x)$ over the intercal [-1,5]. Find all global max and min.

Jared Gulden, Maximizing Revenue

1) At a price of $80 for a half day trip, a white water rafting company attracts 300 customers. Every $5 decreases in price attracts an additional 30 customers.

    a. Find demand equation.

    b. Show revenue as function of price.

    c. What price will maximize revenue?

Samuel Hanna, Elasticity of Demand

1) The demand curve for a product is given by $q= 1000-2p^2$, where p is the price. Find the elasticity of demand at $p=10$ and $p=15$.

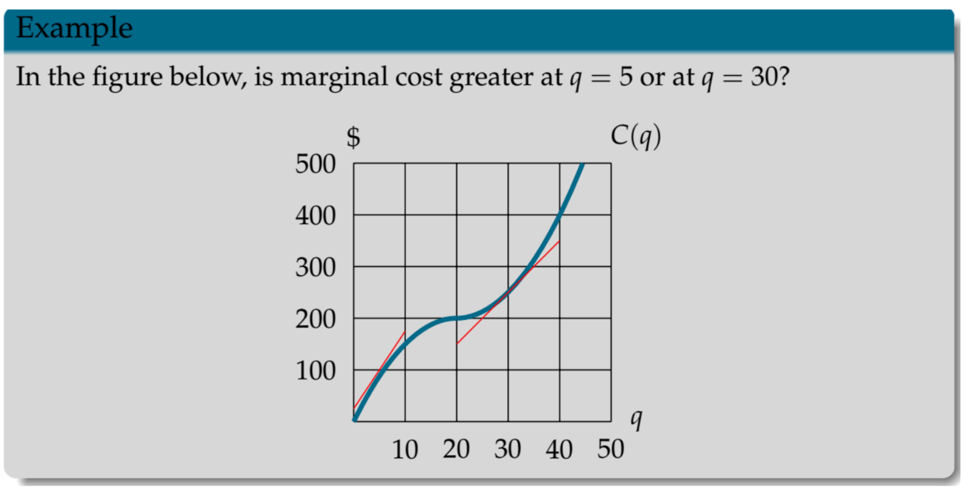
2) The demand of a product is given by $p= 90-10q$. Find the elasticity of demand when $p=80$.

3) Raising the price of a hotel room from $75-$80 per night reduces weekly sales from 100 rooms to 90 rooms.

    a. Should we raise the price?

    b. Complete (an approximation) to the elasticity of demand in this situation.

Amanda Murphy, Finding Marginal Cost Functions

1) 

2) A company manufactures fuel tanks for automobiles. The total weekly cost (in dollars) of producing x tanks is given by C(x)= 10,000+90x-0.05x^2.

   a. Find the marginal cost function.

   b. Find the marginal cost at a production level of 500 tanks per week and interpret the results.

c. Find the exact cost of producing the 501^{st} item.

3) For a company that sells kids' toys, the total cost of production x is given by the function

   $C(x)=2350+80x-0.04x^2$ and that all x toys are sold when the price is equal to

   $p(x)=-2x+35p$

   a. Estimate the marginal cost of producing the 6^{th} unit.

   b. Calculate the actual cost of producing the 6^{th} unit.

Jeffrey Hill, Relative Rate of Change

1) The annual production of peanuts in the world is represented by w= f(t), in million tons, and is a function of t years since the start of the 1990.

   a. Interpret the statements $f(15)=545$ and $f`(15)=36$ in terms of peanut production.

   b. Calculate the Relative Rate of Change of w at t=15; interpret it in terms of peanut production.

2) Compute the Relative Rate of Change of the following functions:

   a. $f(x)=20x+37$

   b. $f(x)=8x^2+\sqrt{x}$

   c. $f(x)=\ln(12x-3)$

   d. $f(x)=7e^4x$

Jeffrey Hill, Marginal Cost Functions

1) The cost of producing q items is given by $C(q)=1100+140q-0.2q^2$.

a. Find the Marginal Cost Function

b. Find C(105) and MC(105). Give units and explain what it means about cost of production.

2) Assume that C(q) and R(q) represent the cost and revenue in dollars, of producing q items.

a. If C(100)=8600 and MC(100)=48, estimate C(104).

b. If MC(100)=48 and MR(100)=70, approximately how much profit is earned by the 101st item?

3) Assume that C(q) and R(q) represent the cost and revenue in dollars, of producing (q) items.

a. If C(400)=412,800 and MC(400)=211, estimate C(402).

b. If MC(400)=211 and MR(400)=251, approximate how much profit is earned by the 401st item.

Ryan Chenette, Marginal Cost and Revenue

1) If C(35)=4200 and MC(35)=6,

a. Estimate C(40)

b. If MC(35)=24 and MR(35)=40, approximately how much profit is earned by the 36th item?

2) An industrial car manufacturer process costs c(q) in billions to produce q million cars; these cars then sell for R(q) billion dollars. If C(4.0)=9, R(4.0)=11, MC(4.0)=3, and MR(4.0)=4, calculate:

   a. The profit producing 4 billion units.

   b. The approximate change in revenue from 4.0 to 7.0 billion units.

Nicole Bellows, Second Derivatives

1) Find the second derivative of the function f(x)=x^3+11x^2-52x.

2) Use the second derivative test to determine whether there is a local maximum or minimum at x=1 for the function f(x)=x^3-3x+10.