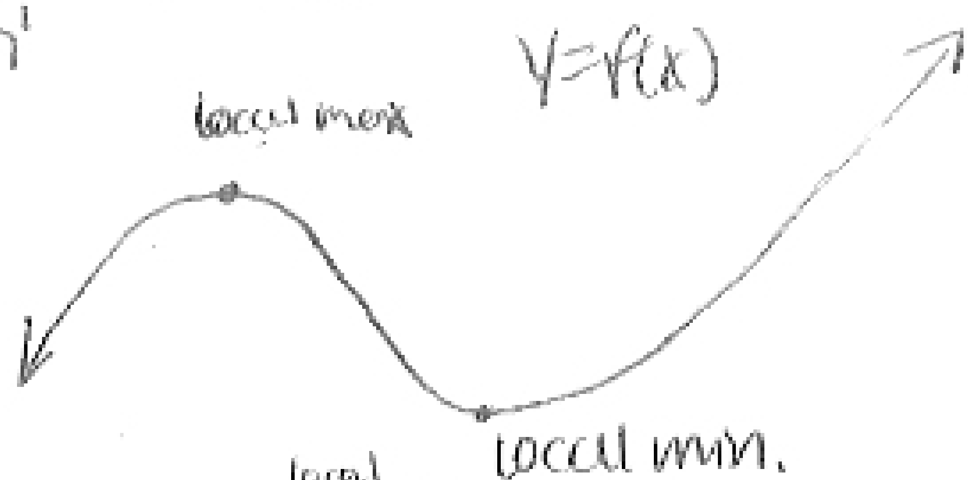
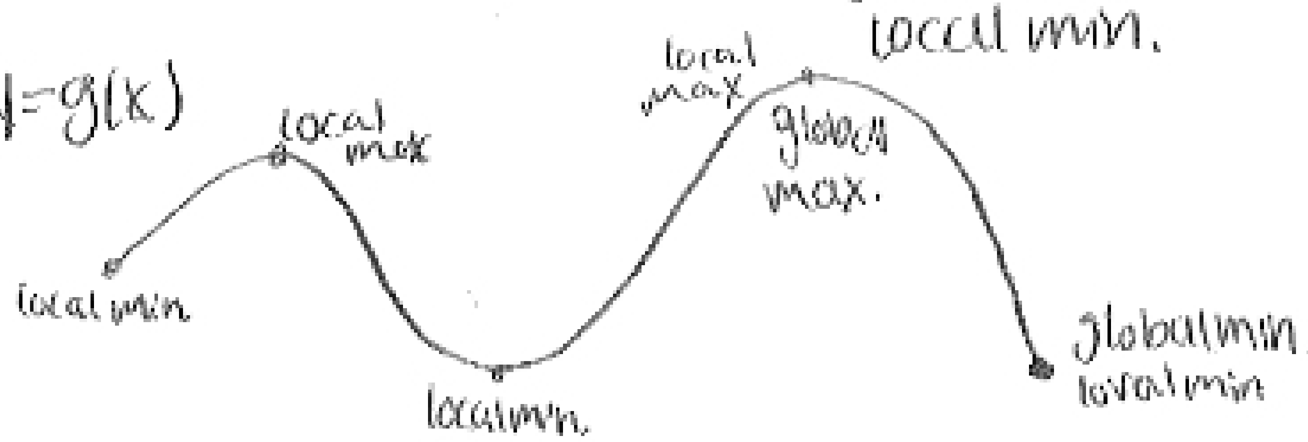
9/29/14 Math 2850

- $f: \mathbb{R}^n \to \mathbb{R}^1$ $y = f(x)$

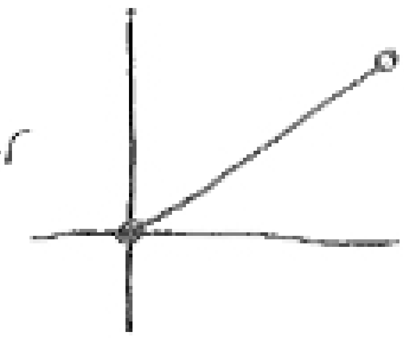


- $y = g(x)$



- ex: $y = x$ $0 < x < 1$

  *can always go a little higher and a little lower.

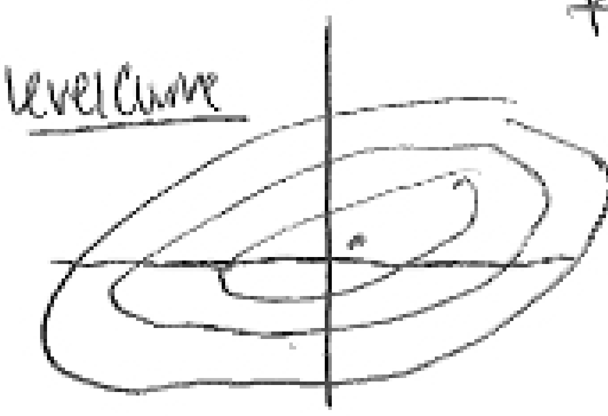


*local cases today

- $f(x,y) = x^2 + xy - 7x + y^2 + 4y$

  in demension of t

level curve



$P \to P + \Delta P$

$f(P + \Delta P) = f(P) + f'(P)\Delta P$
$= f(P) + \nabla f(P)\Delta P + \text{error}$

$f(P \geq f(P + \Delta P)$

only if $\nabla f(P) = 0$

$\nabla f(x,y) = \langle 2x + y - 7, x + 2y + 4 \rangle$

set $\nabla f(x,y) = \langle 0, 0 \rangle$

$$\begin{cases} 2x + y - 7 = 0 \\ x + 2y + 4 = 0 \end{cases}$$

$2x + y - 7 = x + 2y + 4$

$x - 7 = y + 4$ $\boxed{x = y + 11}$

or you could do this:

$2(-2y-4)+y-7=0$ $\quad$ $-4y-8+y-7=0$

$-15=3y$

$\boxed{-5=y}$

$x=(-5)+11=\boxed{6=x}$

$P_0(6,-5)$

$f(P_0+\Delta P)-f(P_0) \quad \Delta P=(h,k)$

$f(6+h,-5+k)-f(6,-5)$

$=(6+h)^2+(6+h)(-5+k)-7(6+h)+(-5+k)^2+4(-5+k)-$

$[6^2+6(-5)-7(6)+(-5)^2+4(-5)]$

$=36+12h+h^2+(-30)-6k-5h+hk-42-7h+25-10k+k^2-20+4k$

$-(36-30-42+25-20)$

$=h^2(1)+hk(1)+k^2(1)+h(0)+k(0)$

$=h^2+hk+k^2=(h+k/2)^2+\frac{3}{4}k^2\geq 0$

*it's always increasing so as it moves away from P_0 gets bigger - local min.

$f(x)=x^2 \quad f'(x)=2x \quad$ set $f'(x)=0$

$2x=0 \quad x=0$

$f''(x)=2 \leftarrow$ pos. is concave up. $\quad f''(0)=2>0$ local min.

$f(x,y)=x^2+xy-7x+y^2+4y$

$\nabla f(x,y)=\langle 2x+y-7,\ x+2y+4\rangle$

$\quad f(x) \qquad f(y)$

$f_{xx}=2$

$f_{yy}\ 2$

$f_{xy}=f_{yx}=1$