Optimization

$f(x) = 0$	Objective function
$g_i(x) = 0$	Equality constraints
$h_i(x) <= 0$	Inequality constraints

Terminology

Feasible set

Degrees of freedom

Active constraint

classifications

Unconstrained v. constrained

Linear v. non-linear

Convex v. concave v. neither

Continuous space v. discrete space

Linear case

Unconstrained makes no sense

Simplex method

Minimum at a vertex

Start at a vertex,
jump to adjacent vertex as long as objective is less

Uses slack variables to turn inequality constraints
Into equality constraints with variable:
$h(x) - s = 0;$

Non-linear unconstrained case

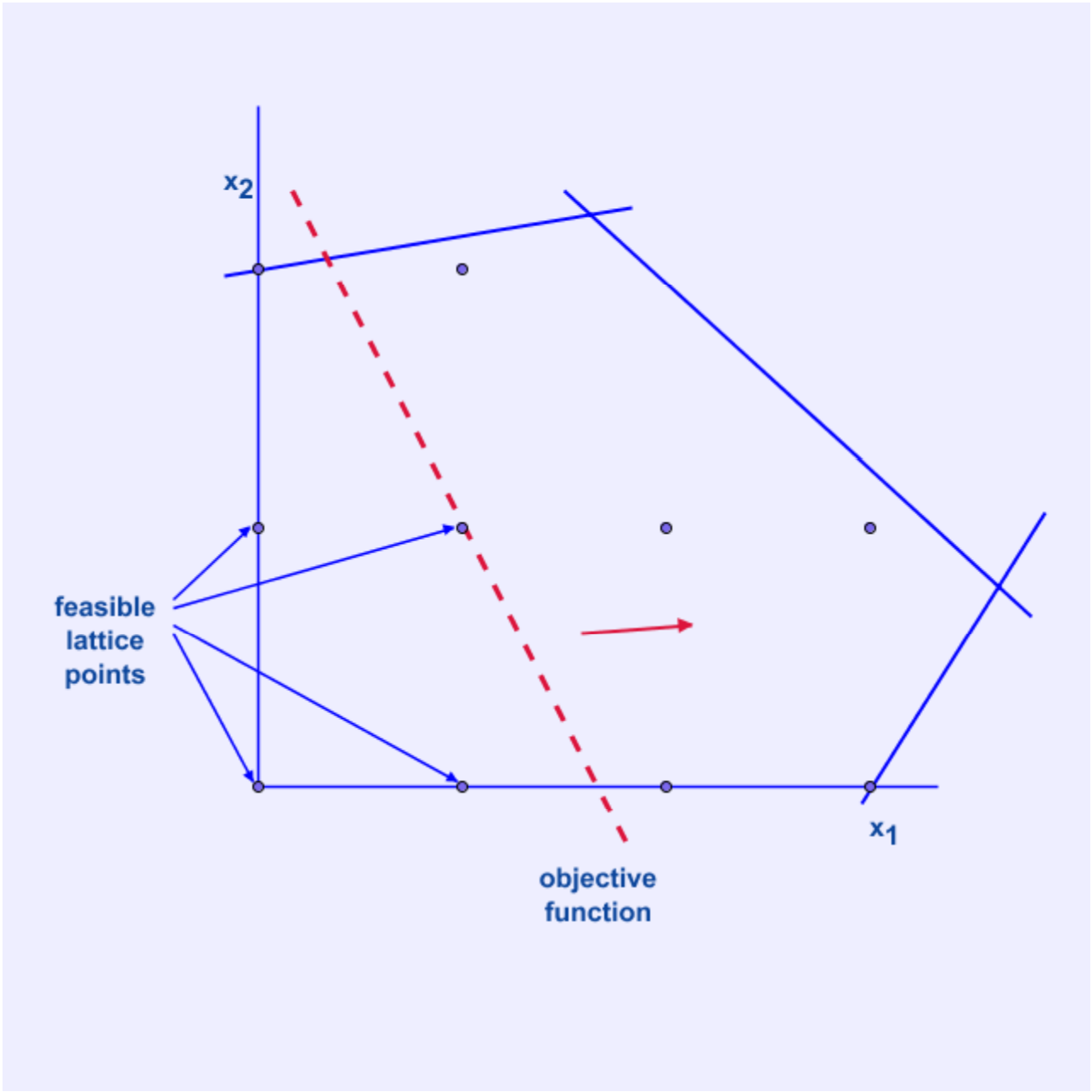
Unconstrained makes no sense

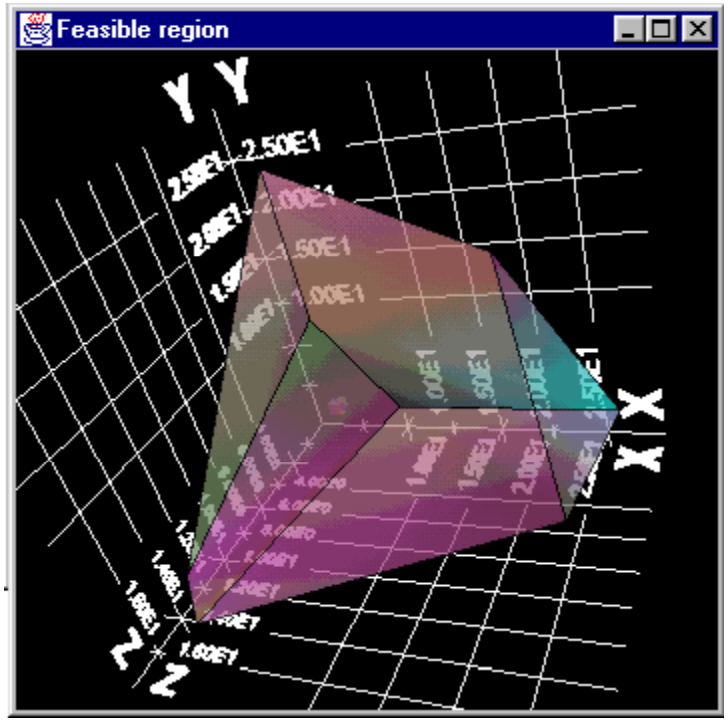
Simplex method

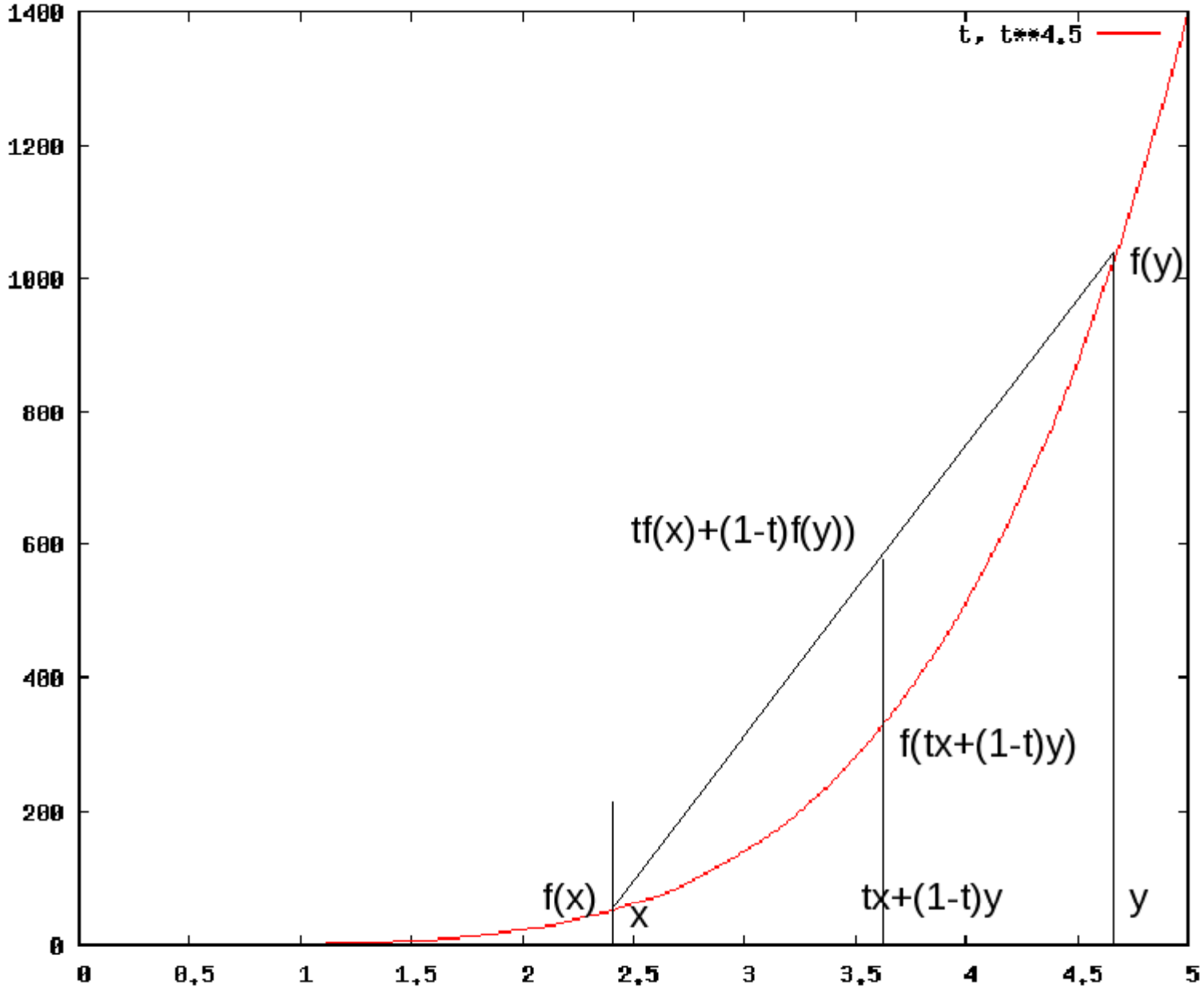
Minimum at a vertex

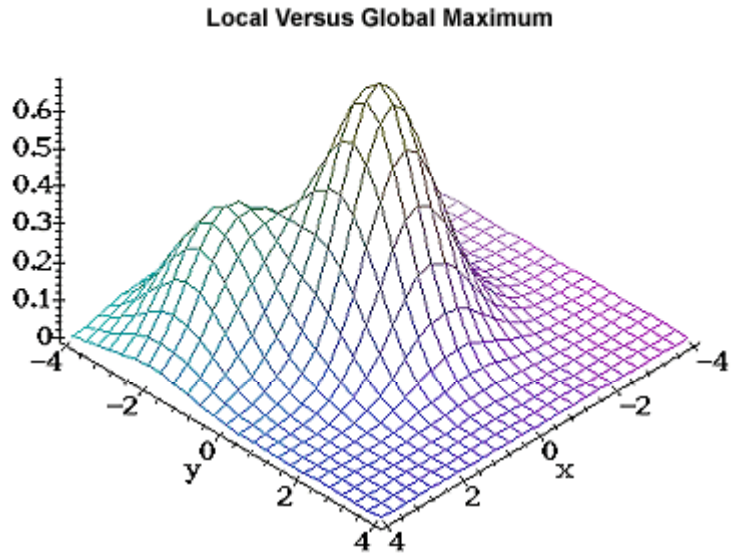
Start at a vertex,
jump to adjacent vertex as long as objective is less

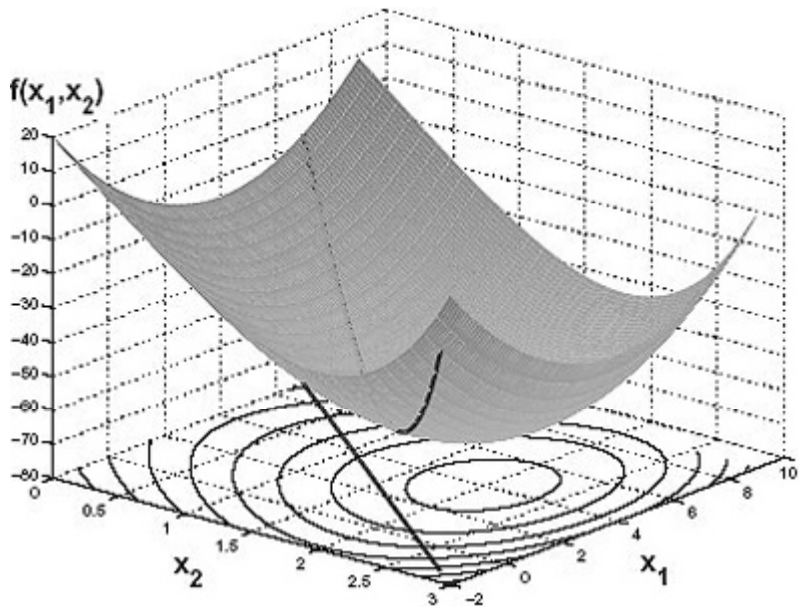
Uses slack variables to turn inequality constraints
Into equality constraints with variable:
$h(x) – s = 0;$

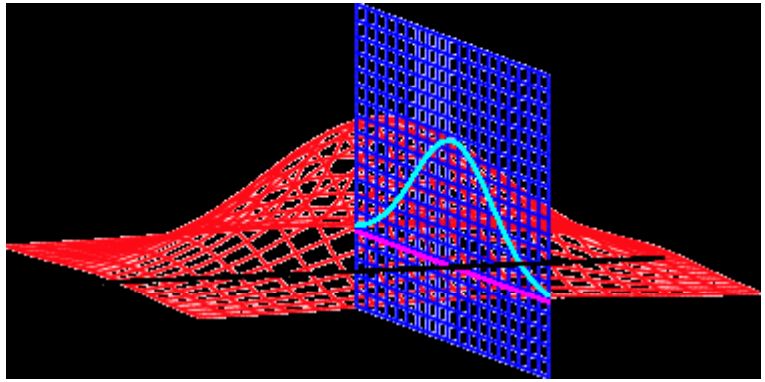

x2
feasible
lattice
points
x1
objective
function

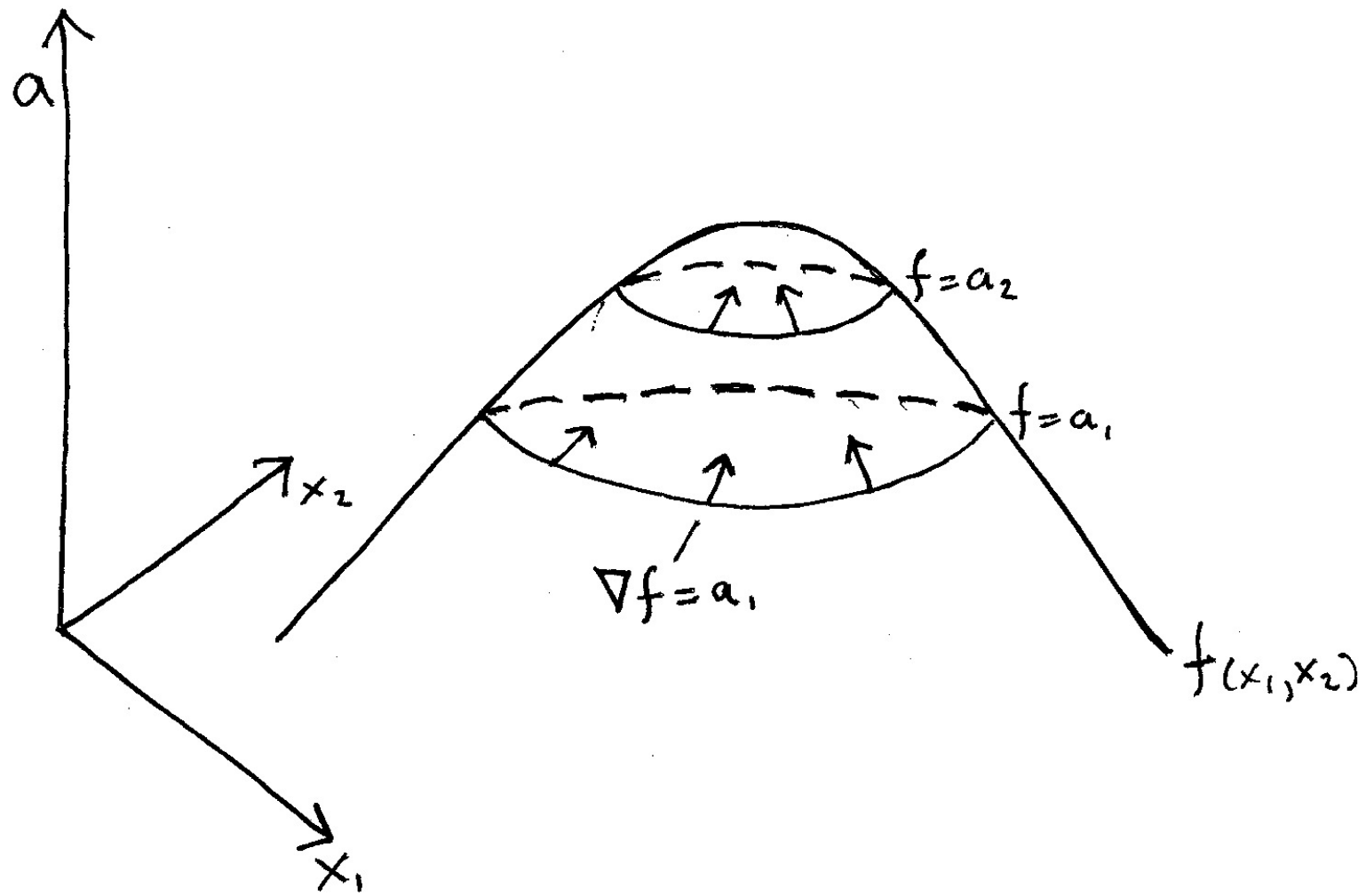

Feasible region
Y
Y
2.50E1
X
X
Z
Z

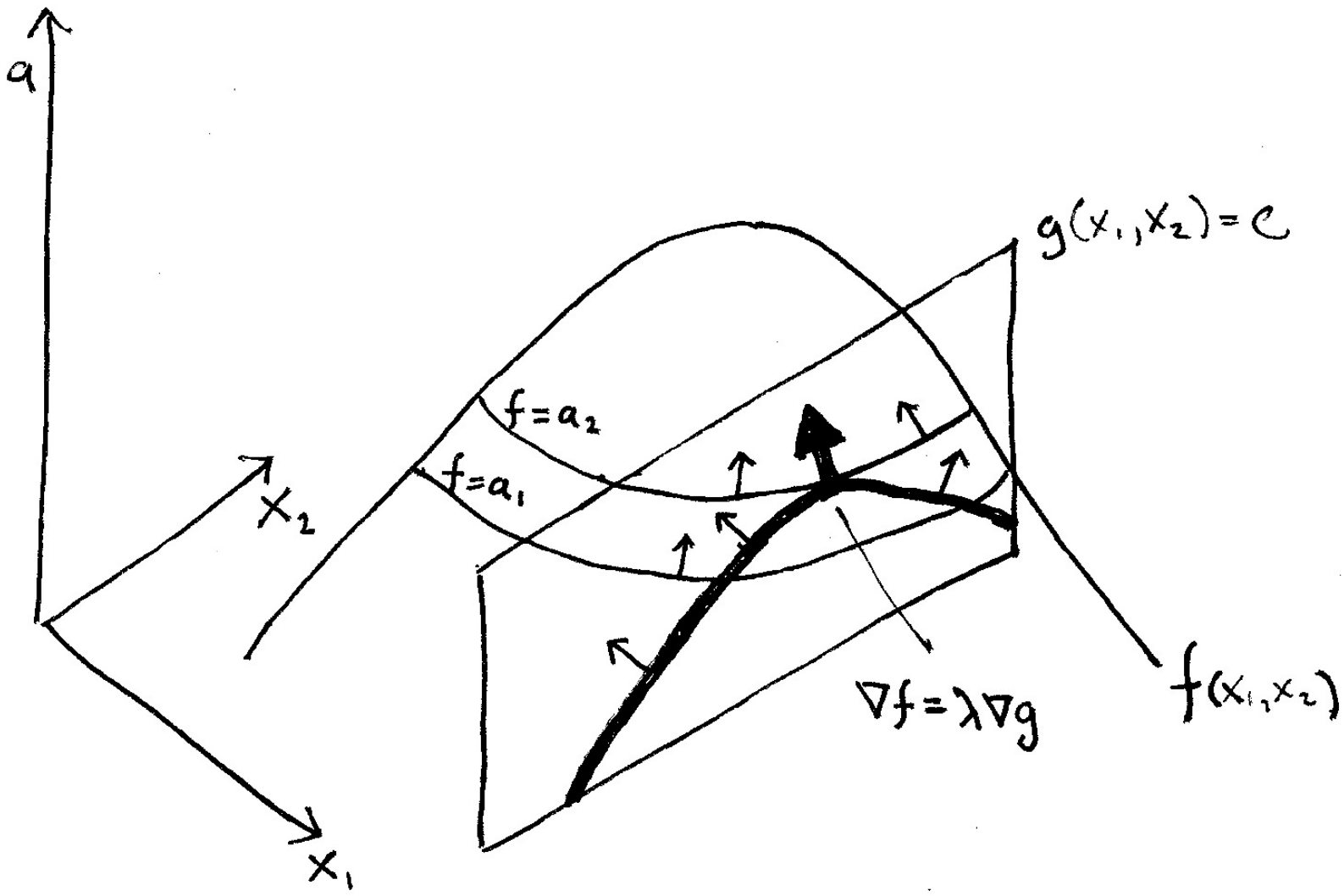

t, t**4.5
1400
1200
1000
800
600
400
200
0
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
f(y)
tf(x)+(1-t)f(y))
f(tx+(1-t)y)
f(x)
x
tx+(1-t)y
y


Local Versus Global Maximum
0.6
0.5
0.4
0.3
0.2
0.1
0
−4
−2
y
0
2
4
−4
−2
0
x
2
4


f(x1,x2)
20
10
0
−10
−20
−30
−40
−50
−60
−70
−80
0
0.5
1
1.5
2
2.5
3
x2
−2
0
2
4
6
8
10
x1




a
x_2
x_1
$f = a_2$
$f = a_1$
$\nabla f = a_1$
$f(x_1, x_2)$


a
$g(x_1,x_2)=c$
$f=a_2$
$f=a_1$
x_2
x_1
$\nabla f=\lambda\nabla g$
$f(x_1,x_2)$