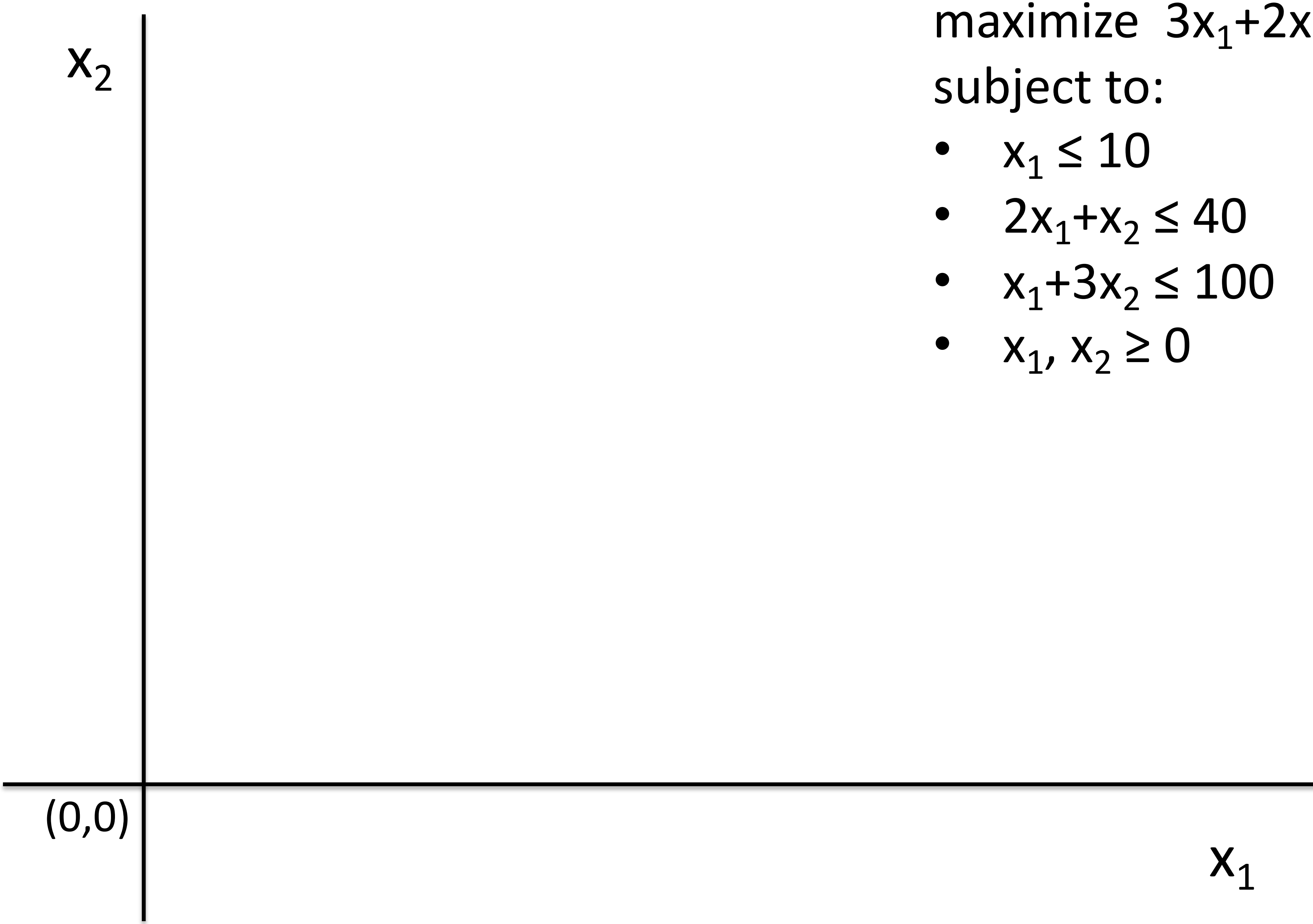
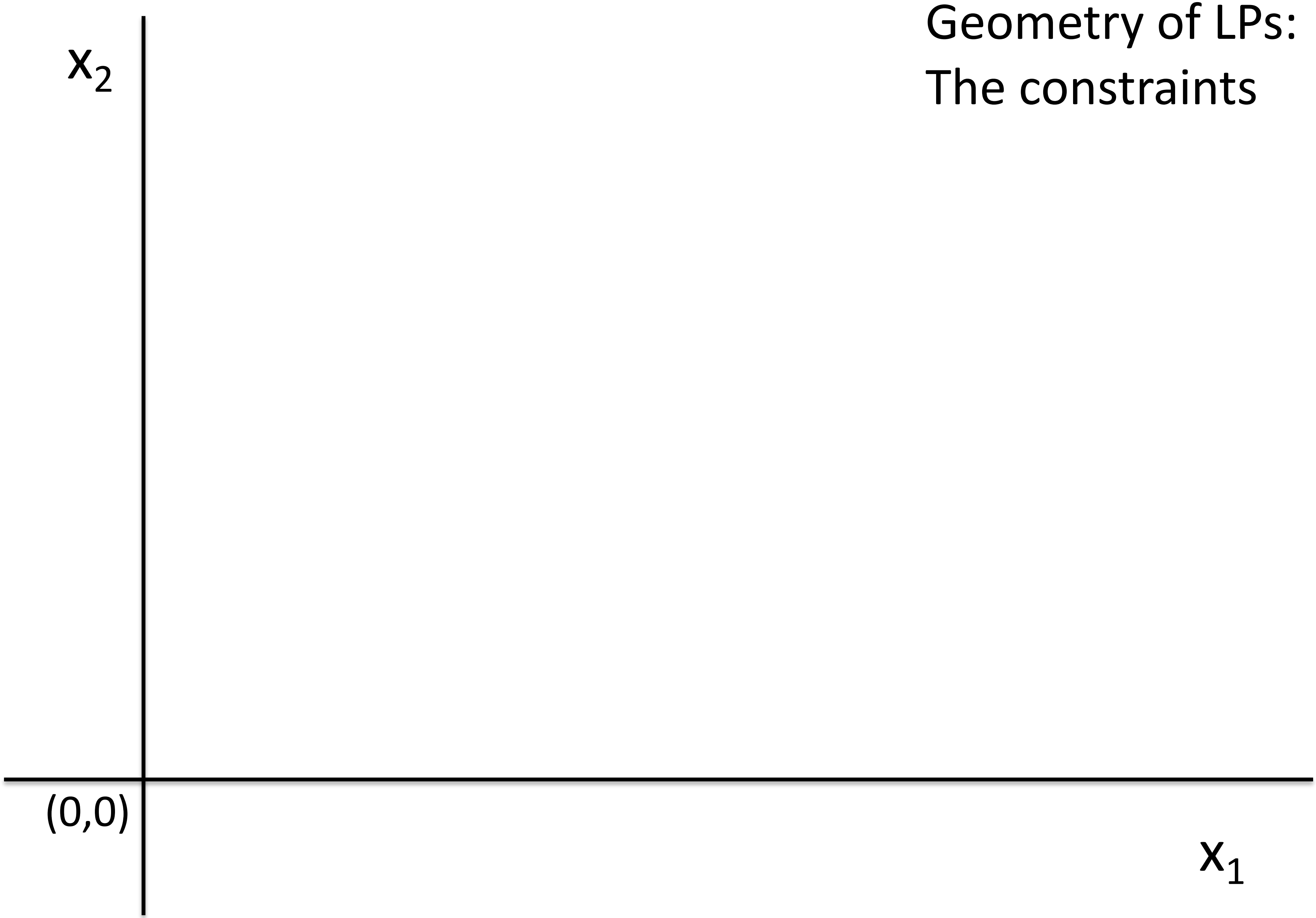
maximize $3x_1+2x_2$

subject to:

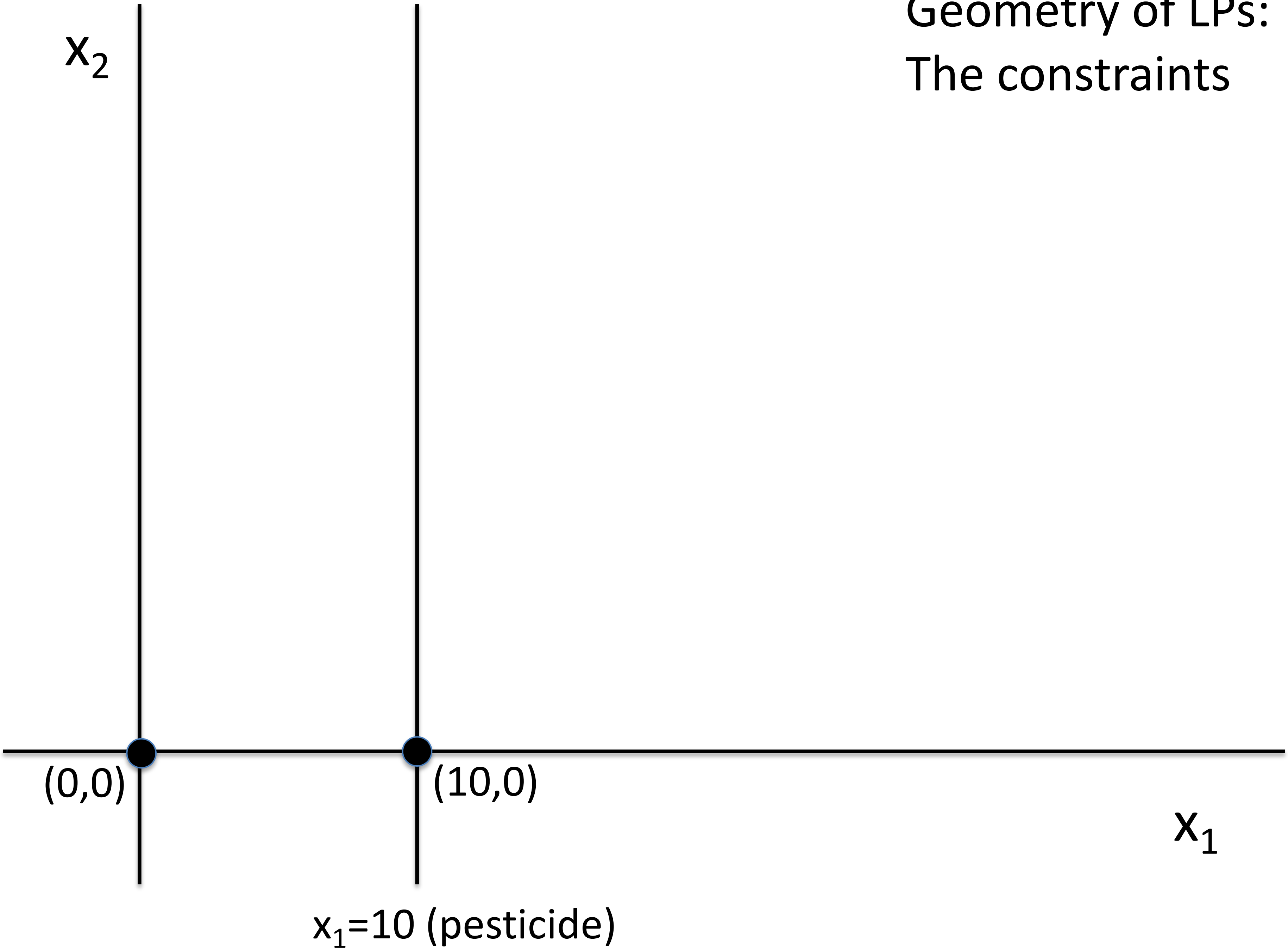
- $x_1 \leq 10$
- $2x_1+x_2 \leq 40$
- $x_1+3x_2 \leq 100$
- $x_1, x_2 \geq 0$



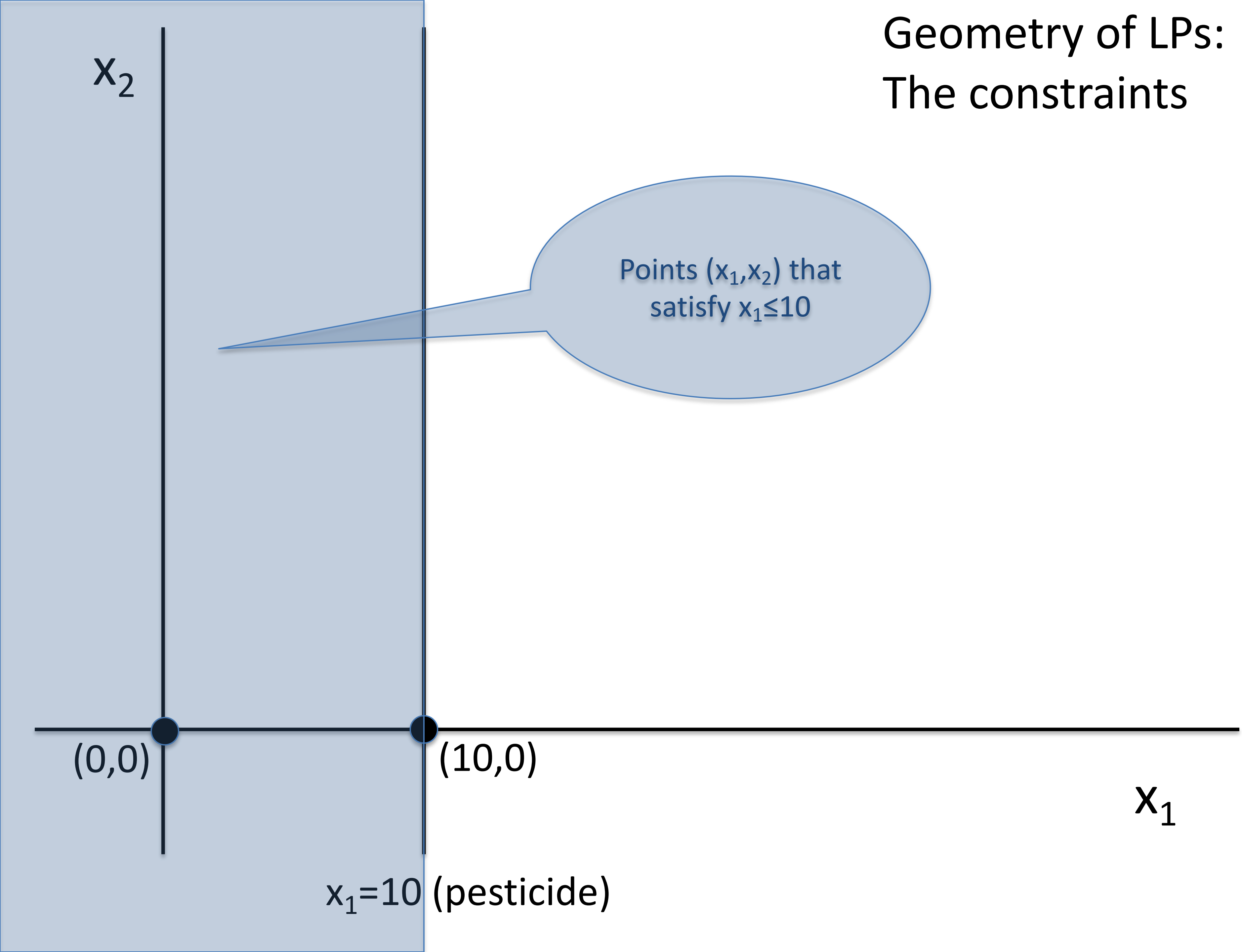
Geometry of LPs:
The constraints



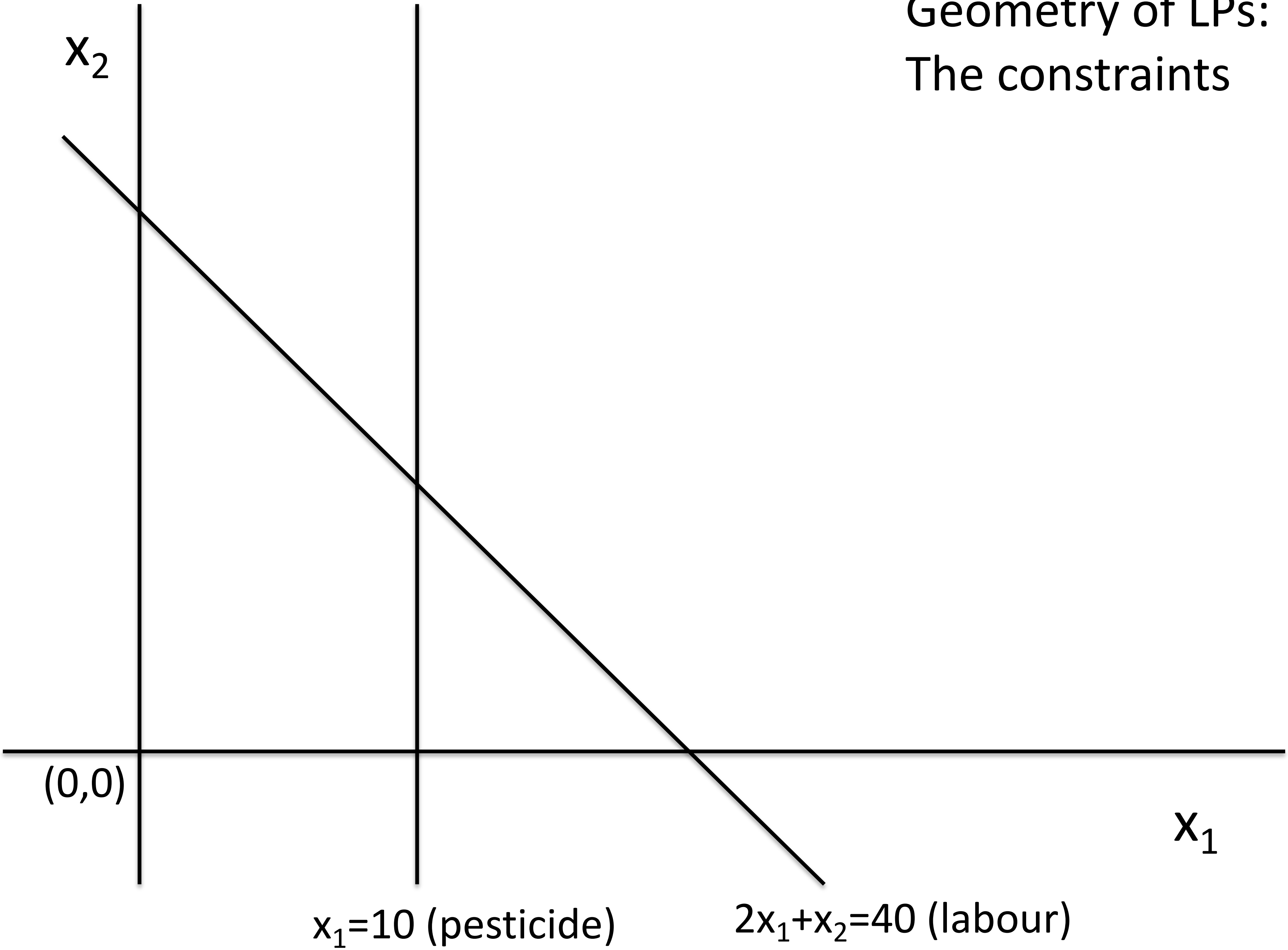
Geometry of LPs: The constraints



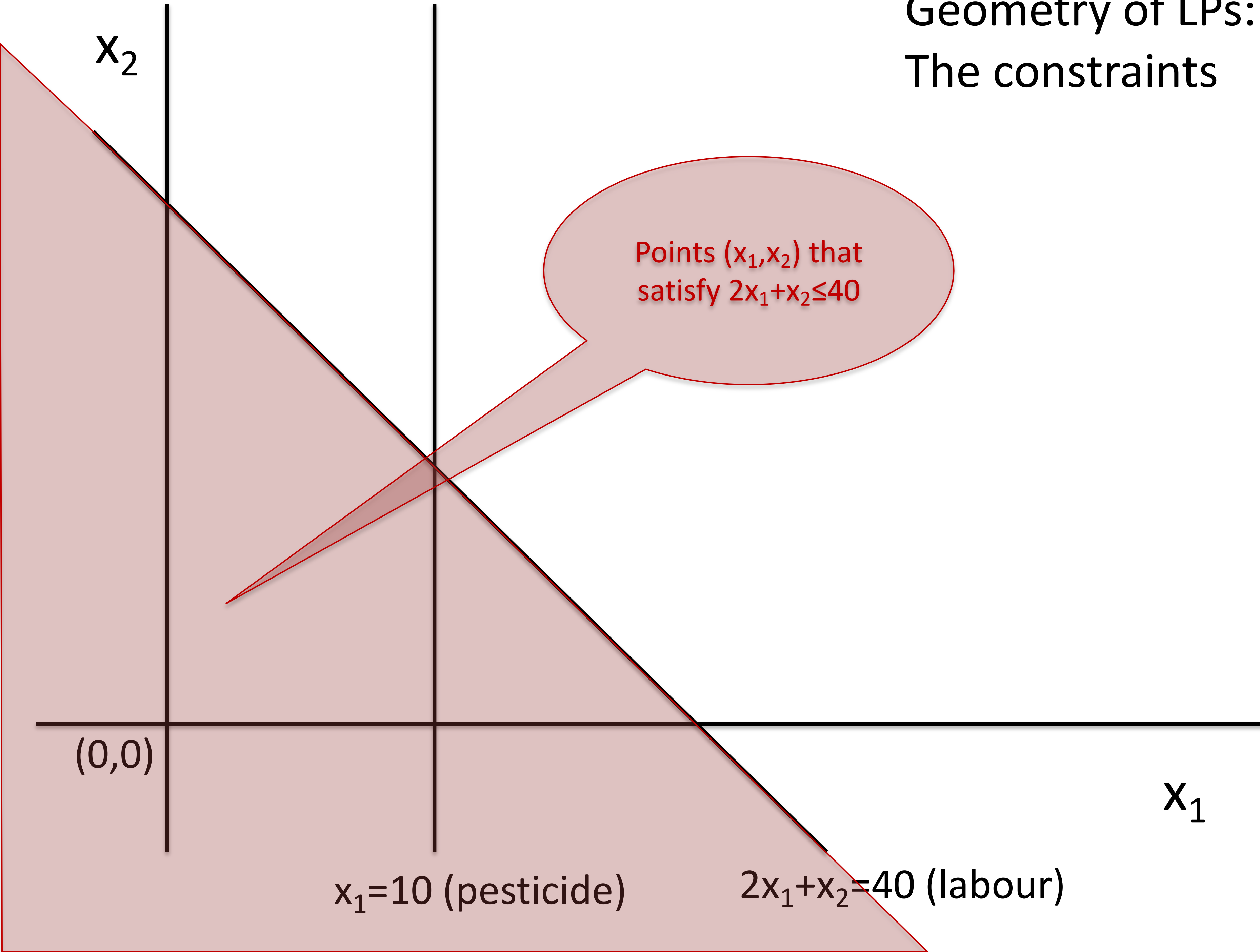
Geometry of LPs: The constraints



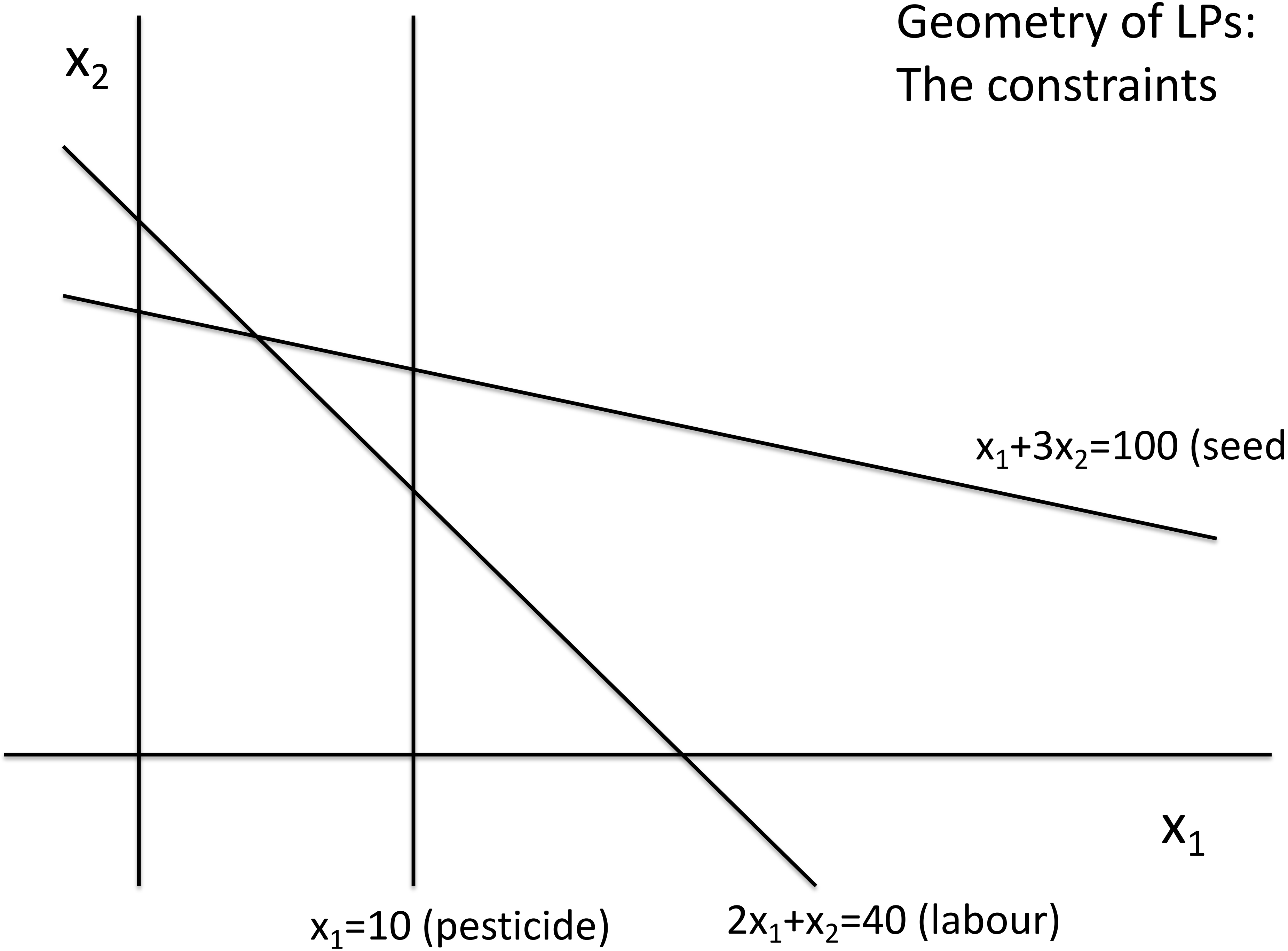
Geometry of LPs: The constraints



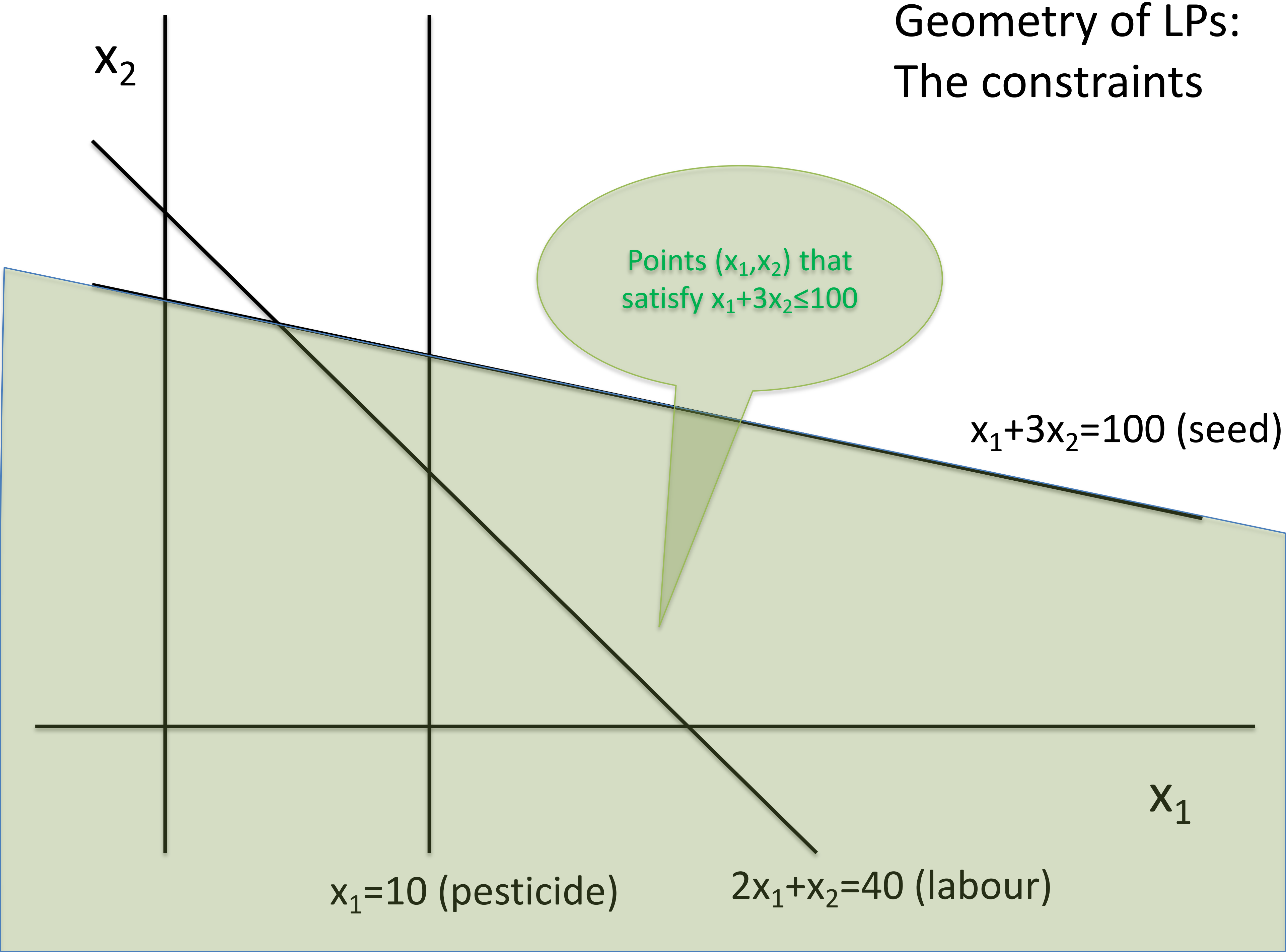
Geometry of LPs: The constraints



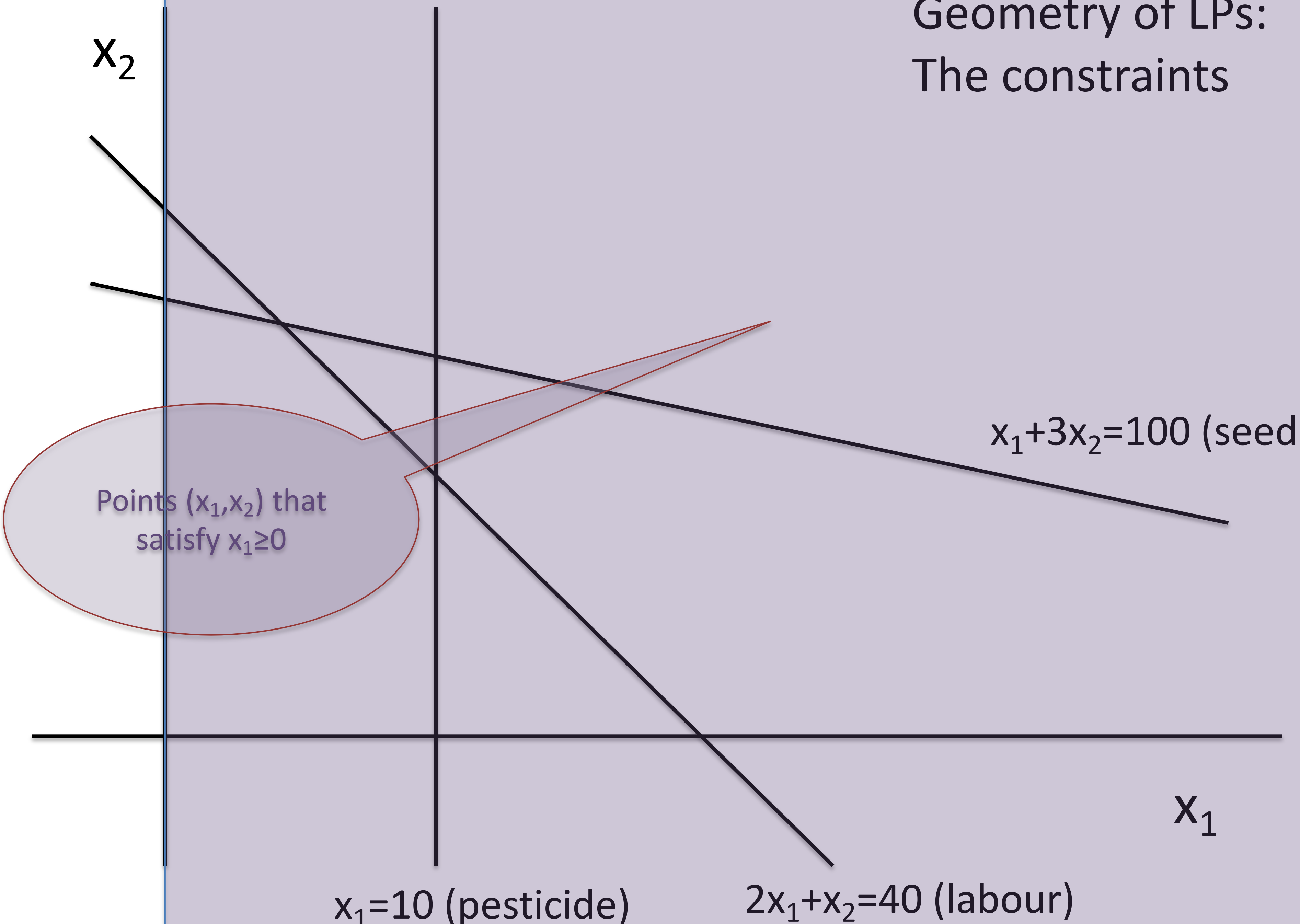
Geometry of LPs:
The constraints



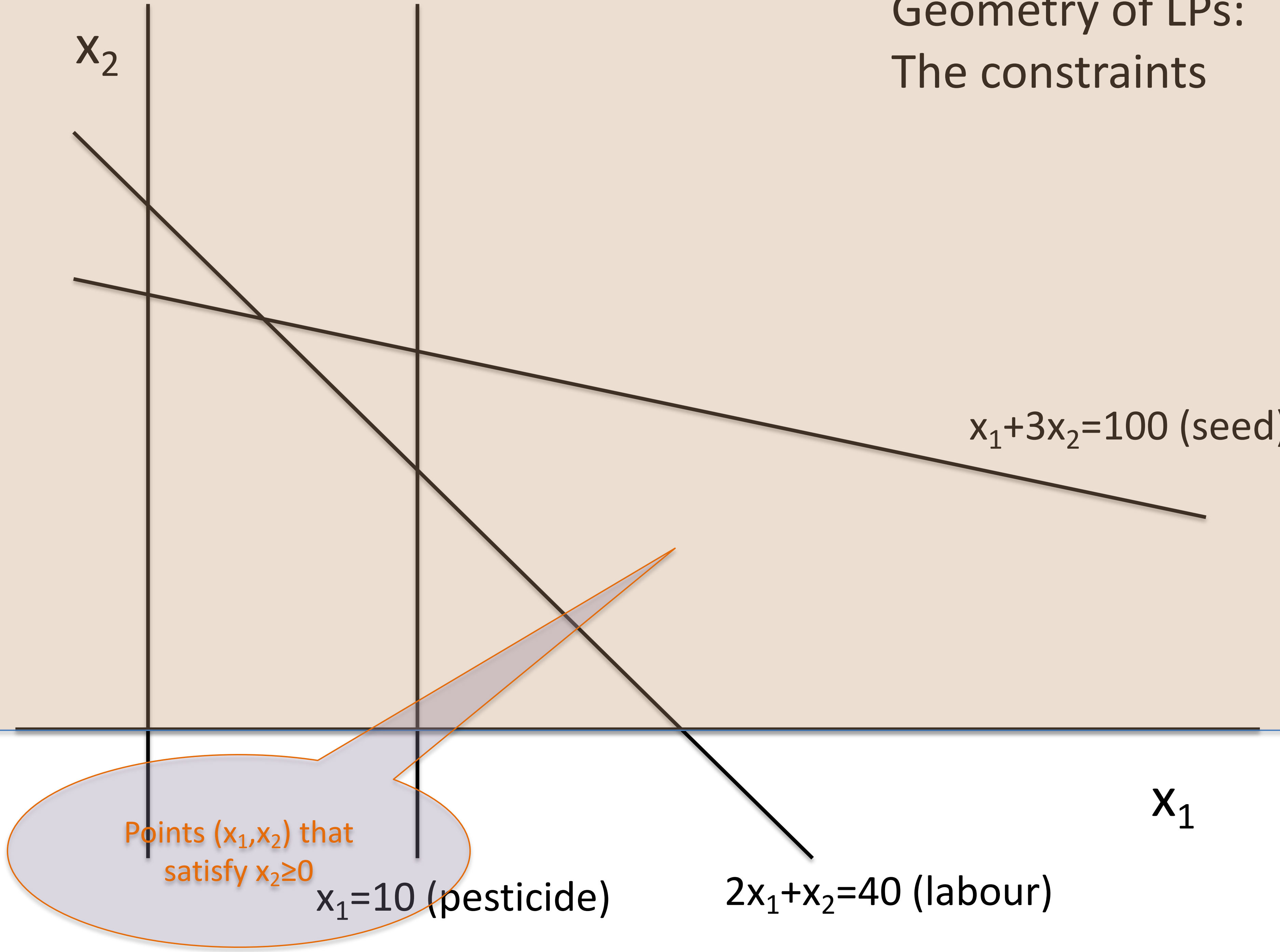
Geometry of LPs: The constraints



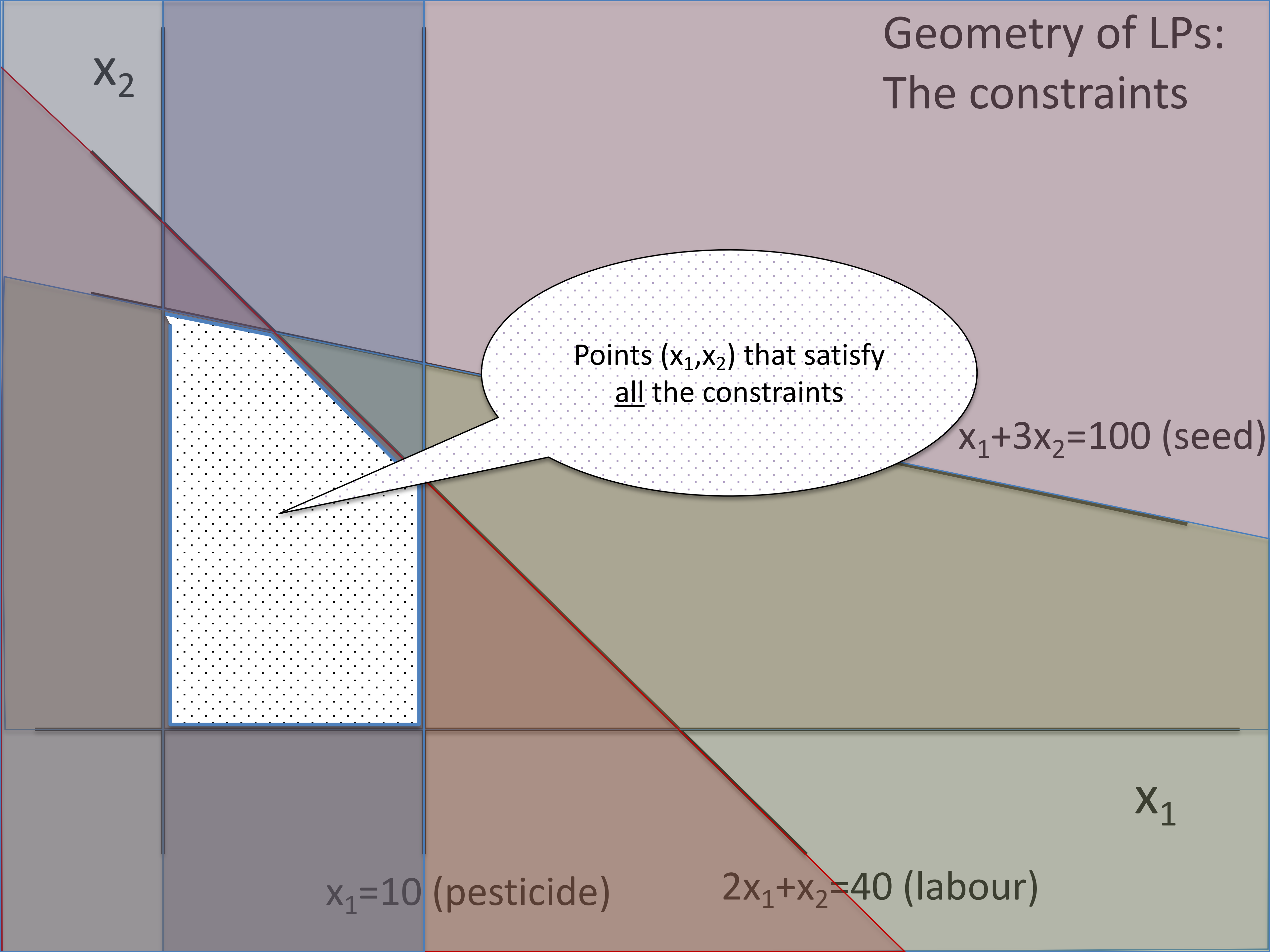
Geometry of LPs: The constraints



Geometry of LPs:
The constraints



Geometry of LPs: The constraints



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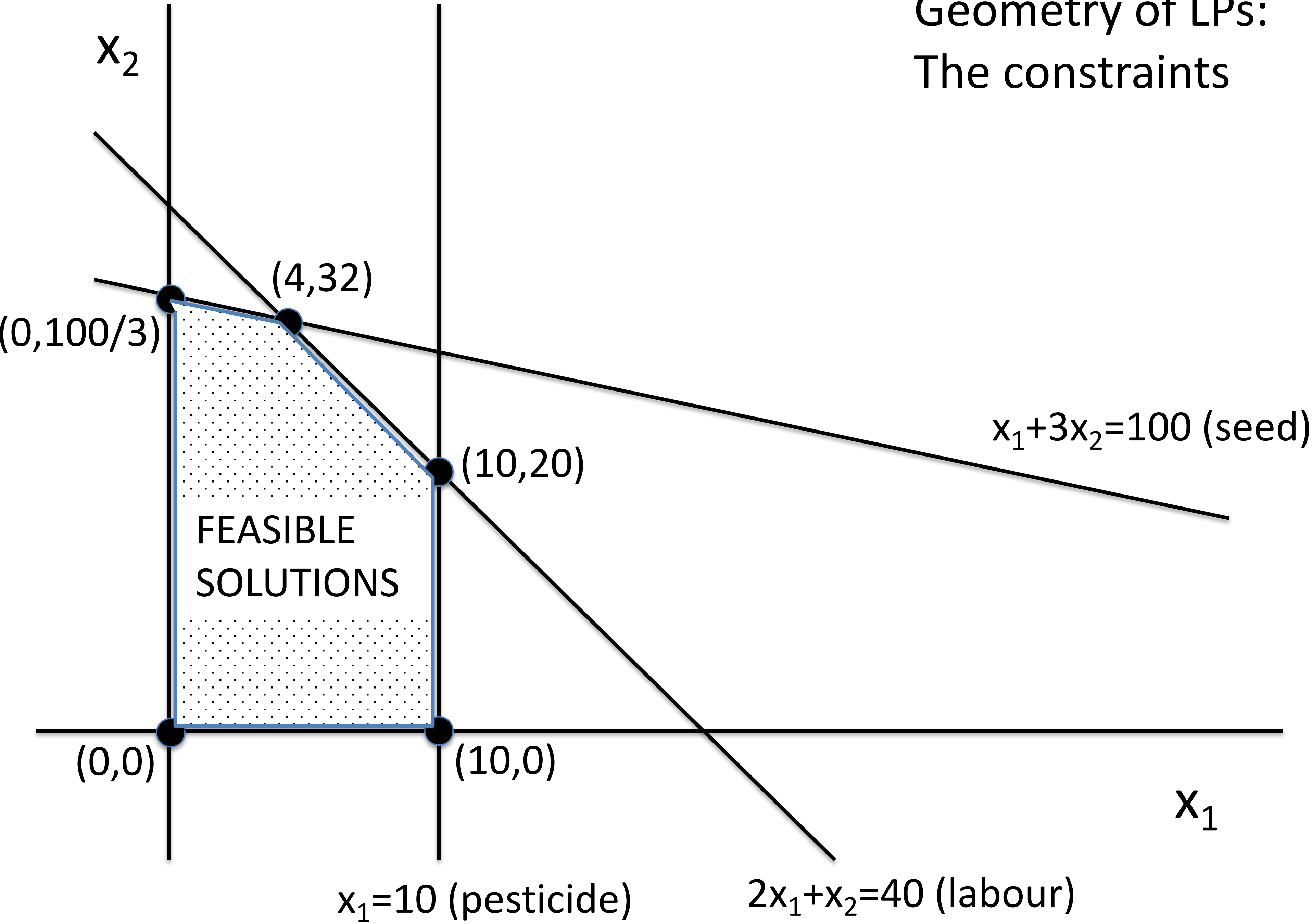
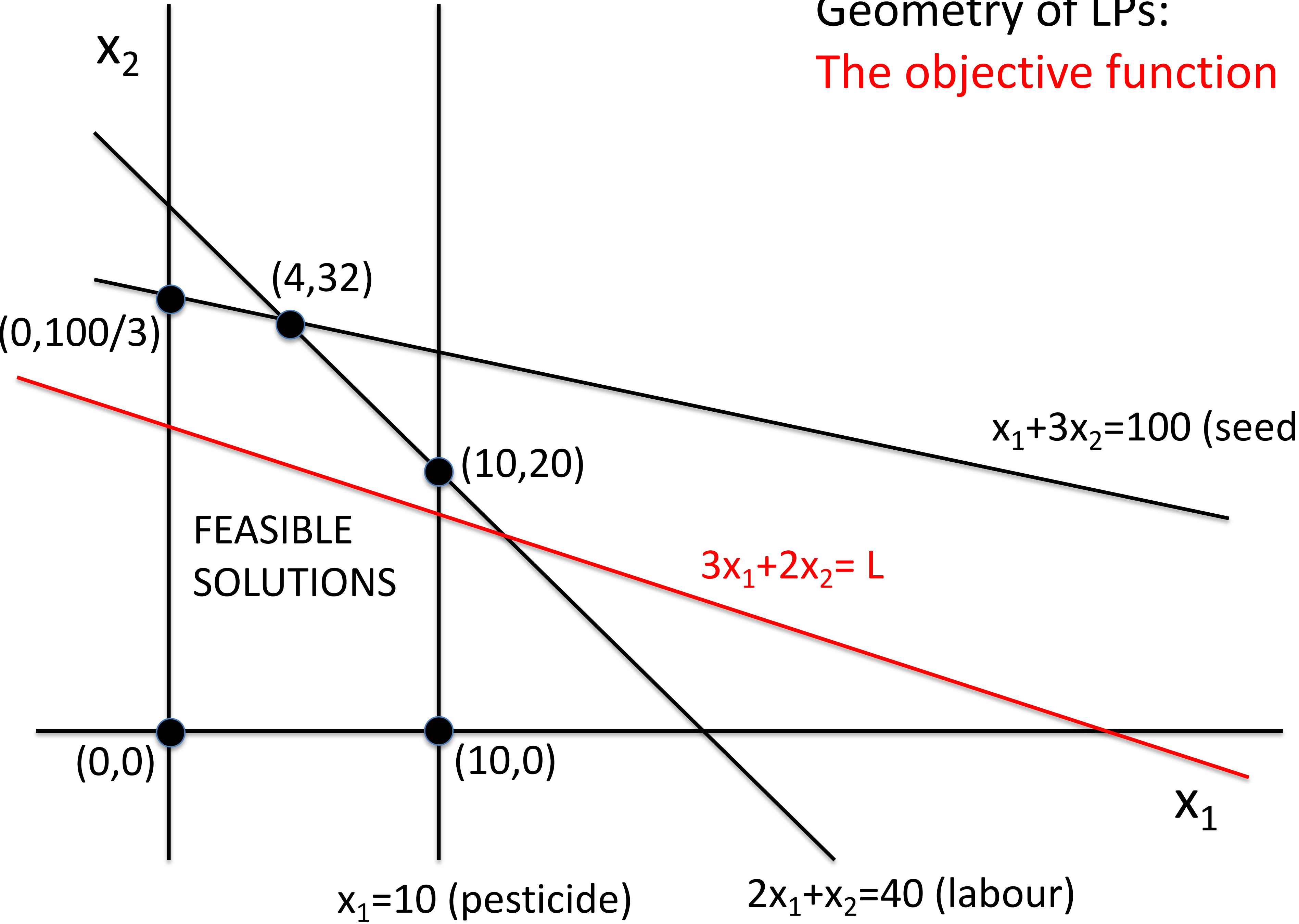


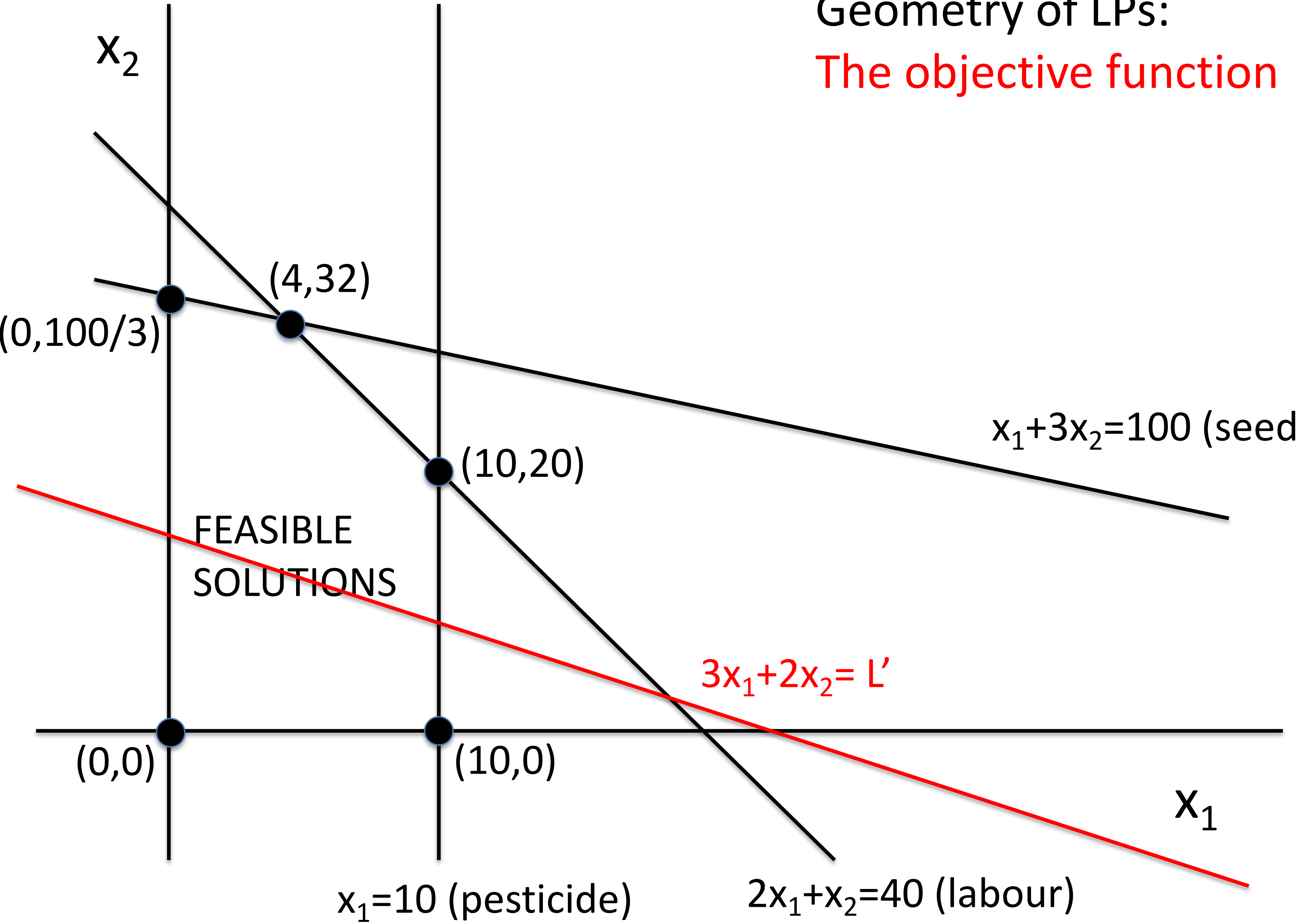
Geometry of LPs:

The objective function

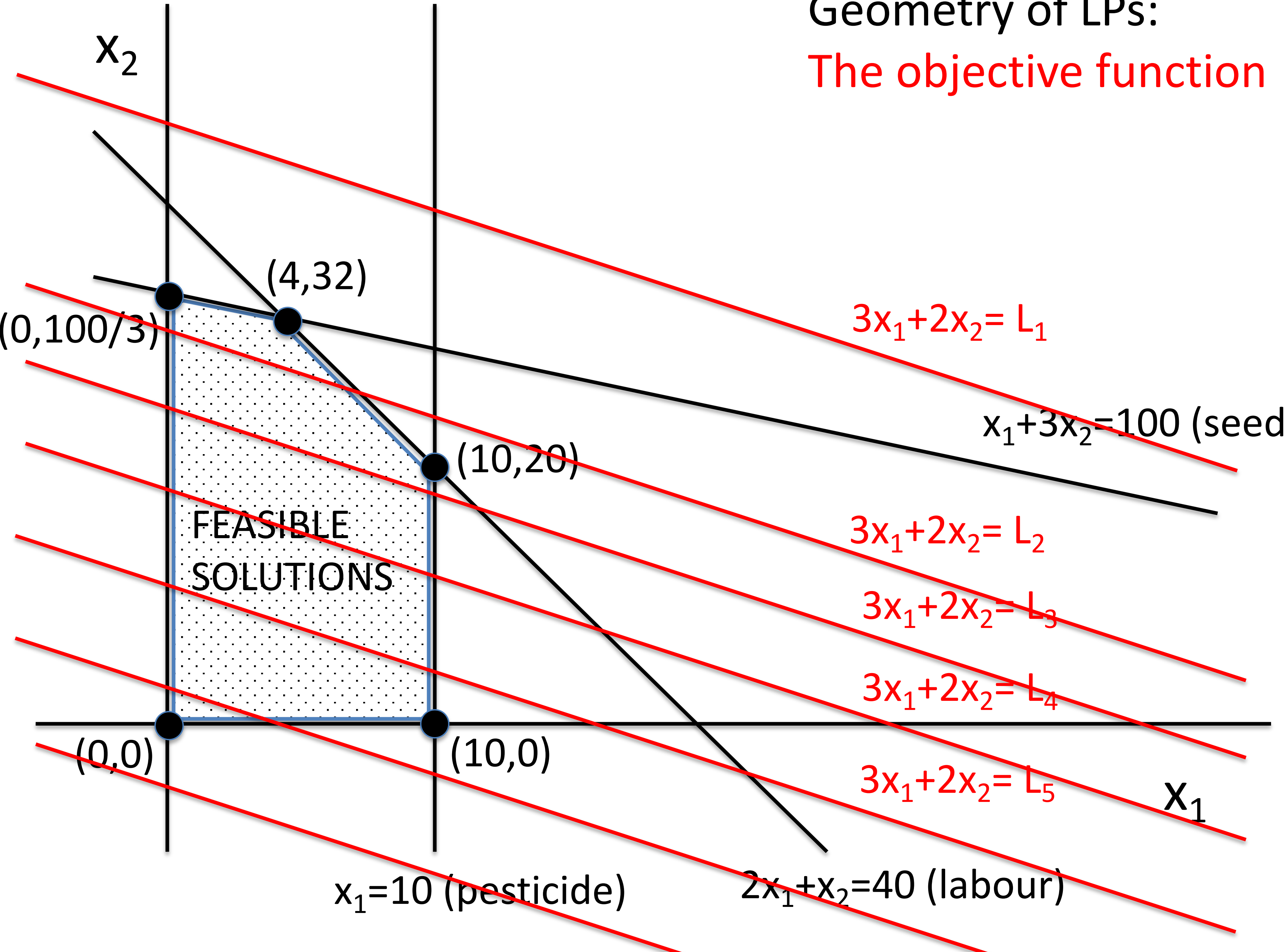


Geometry of LPs:

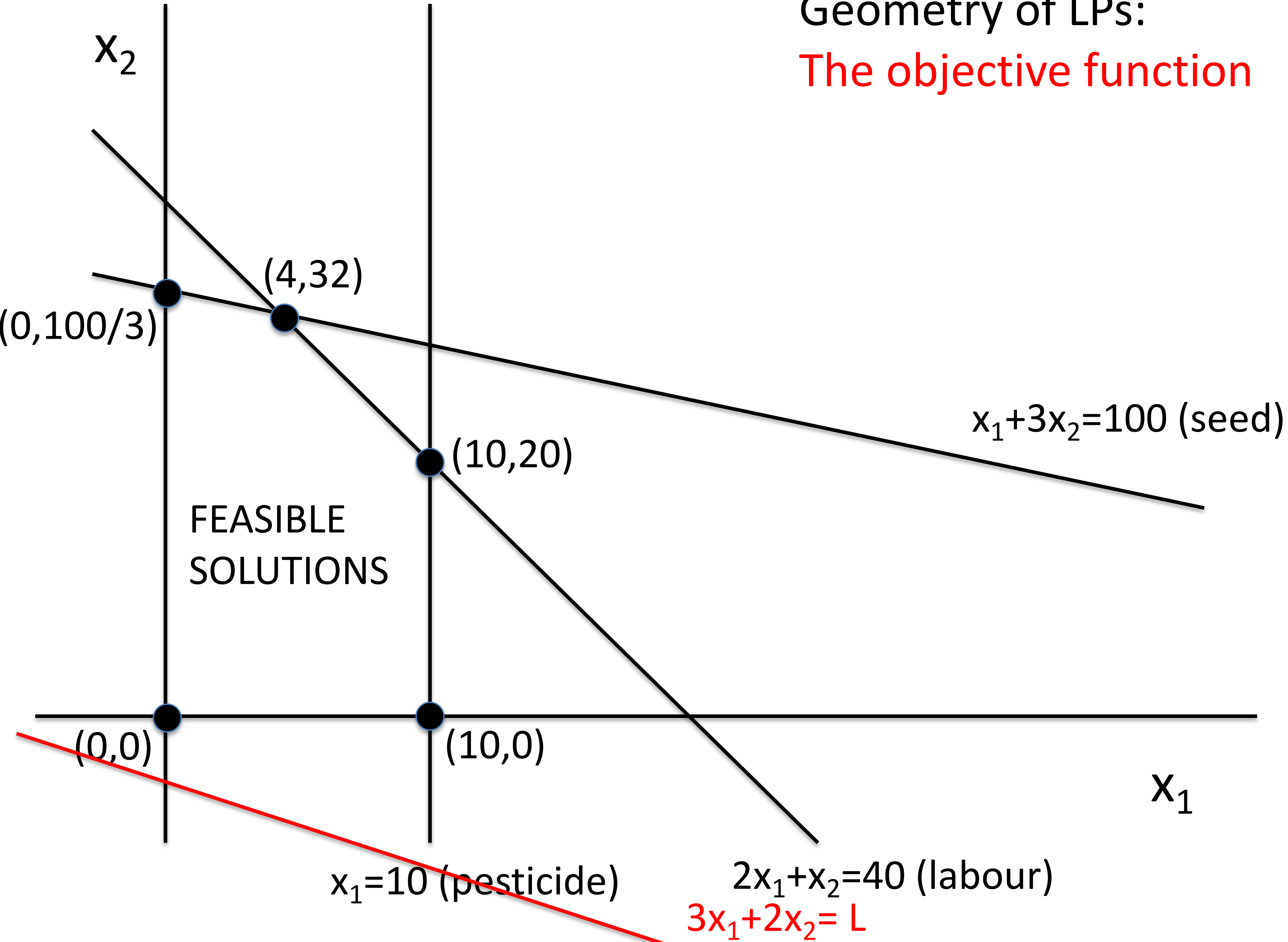
The objective function



Geometry of LPs: The objective function

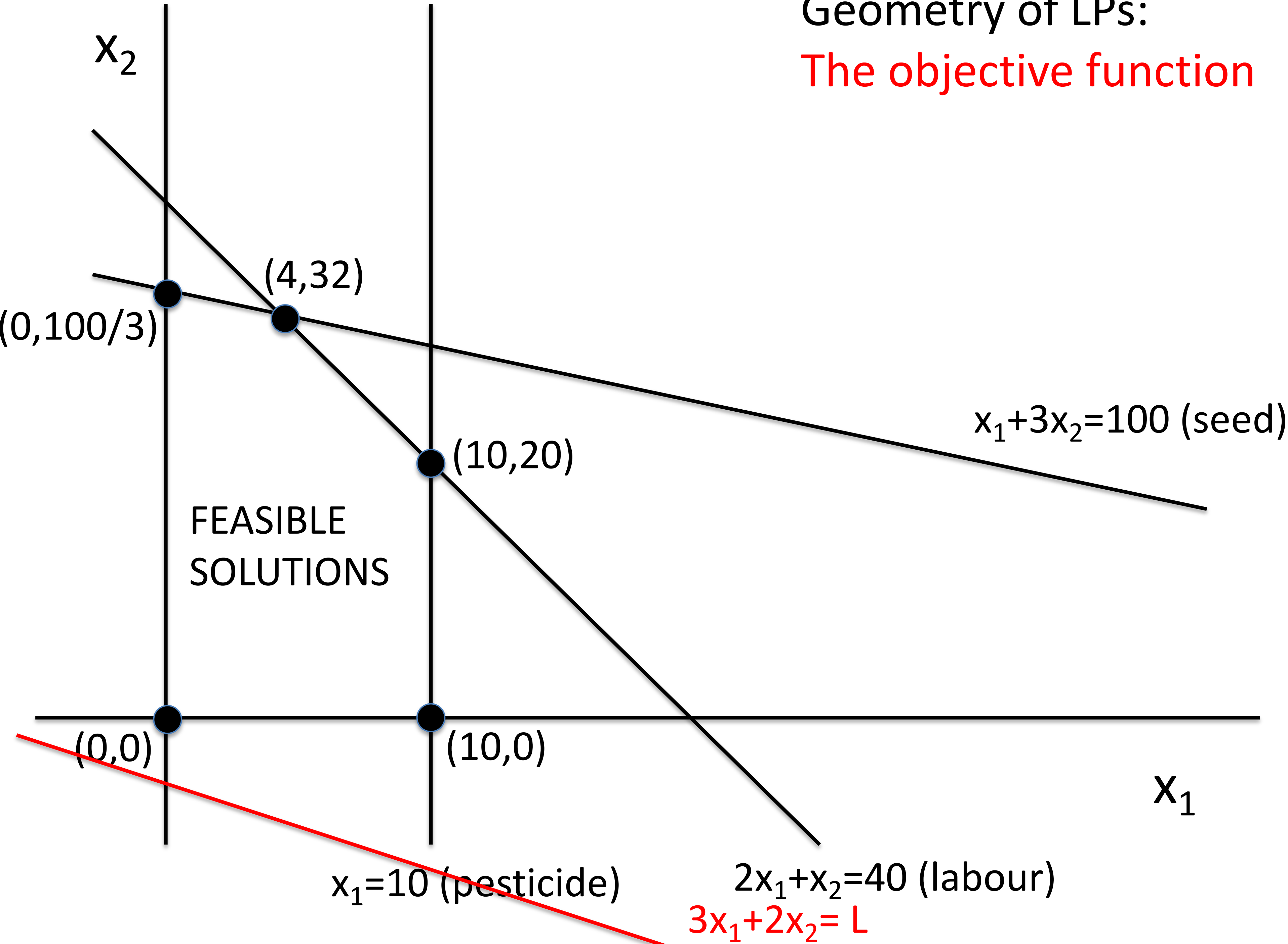


Geometry of LPs:
The objective function

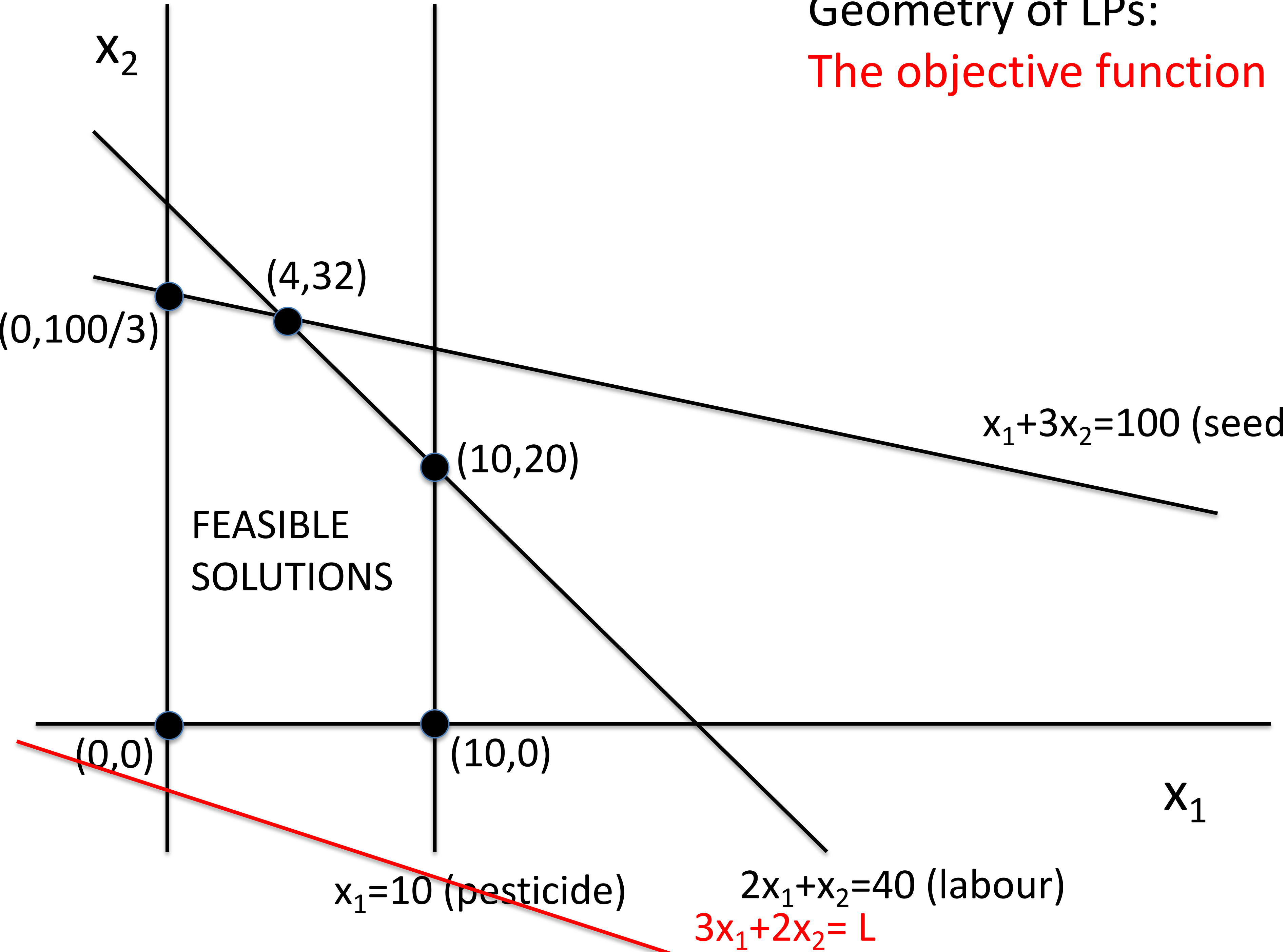


Geometry of LPs:

The objective function

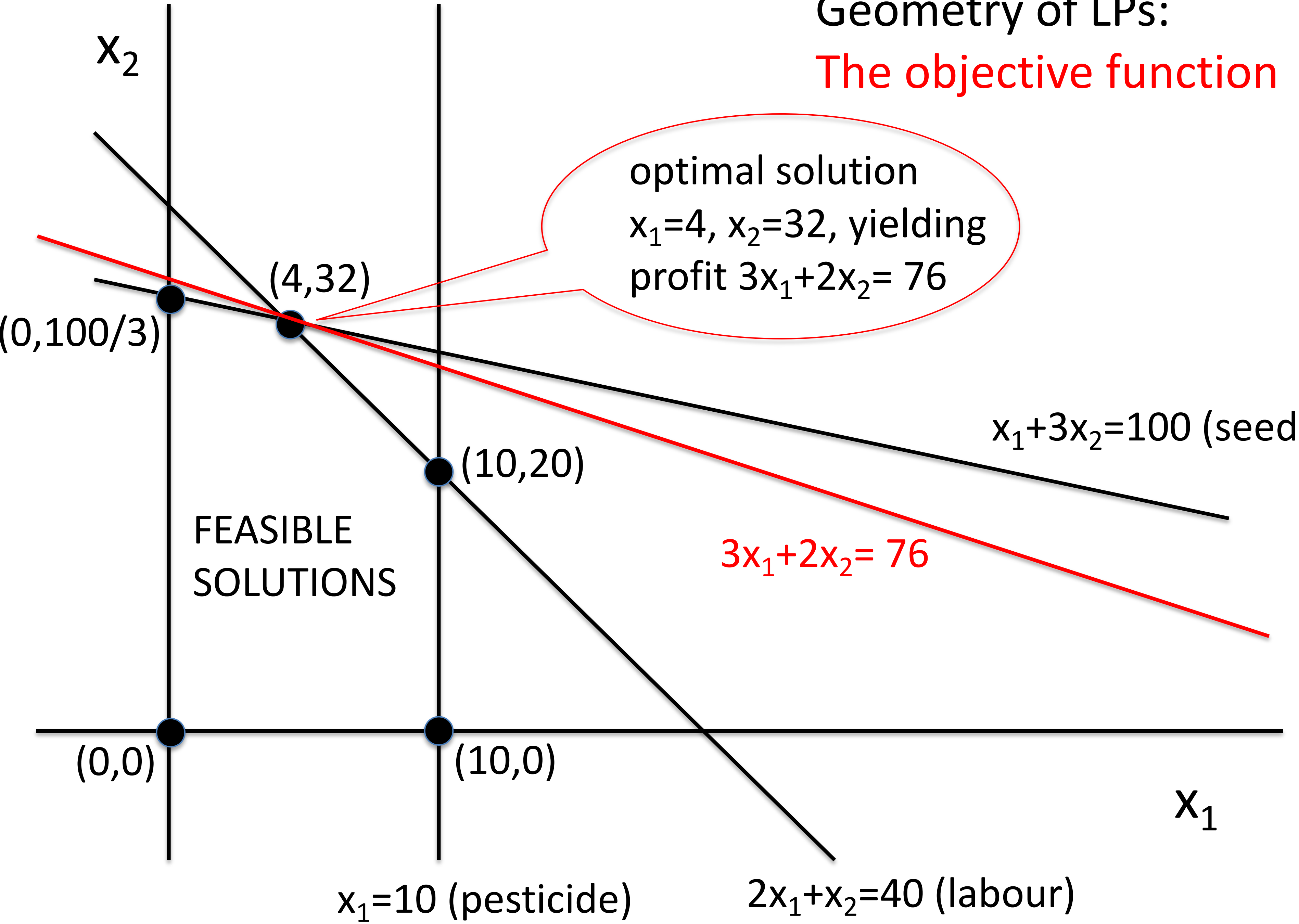


Geometry of LPs:
The objective function



Geometry of LPs:

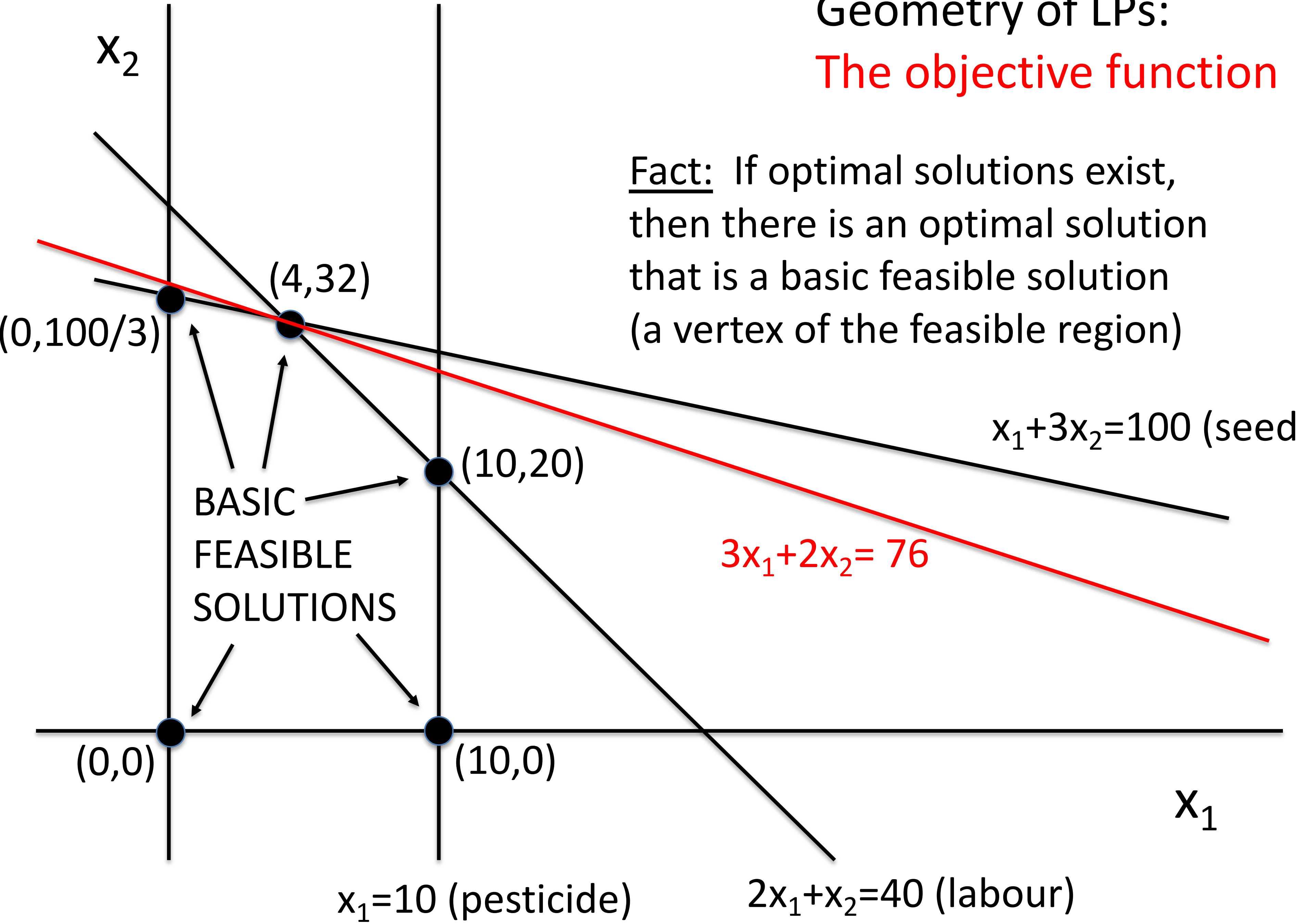
The objective function



Geometry of LPs:

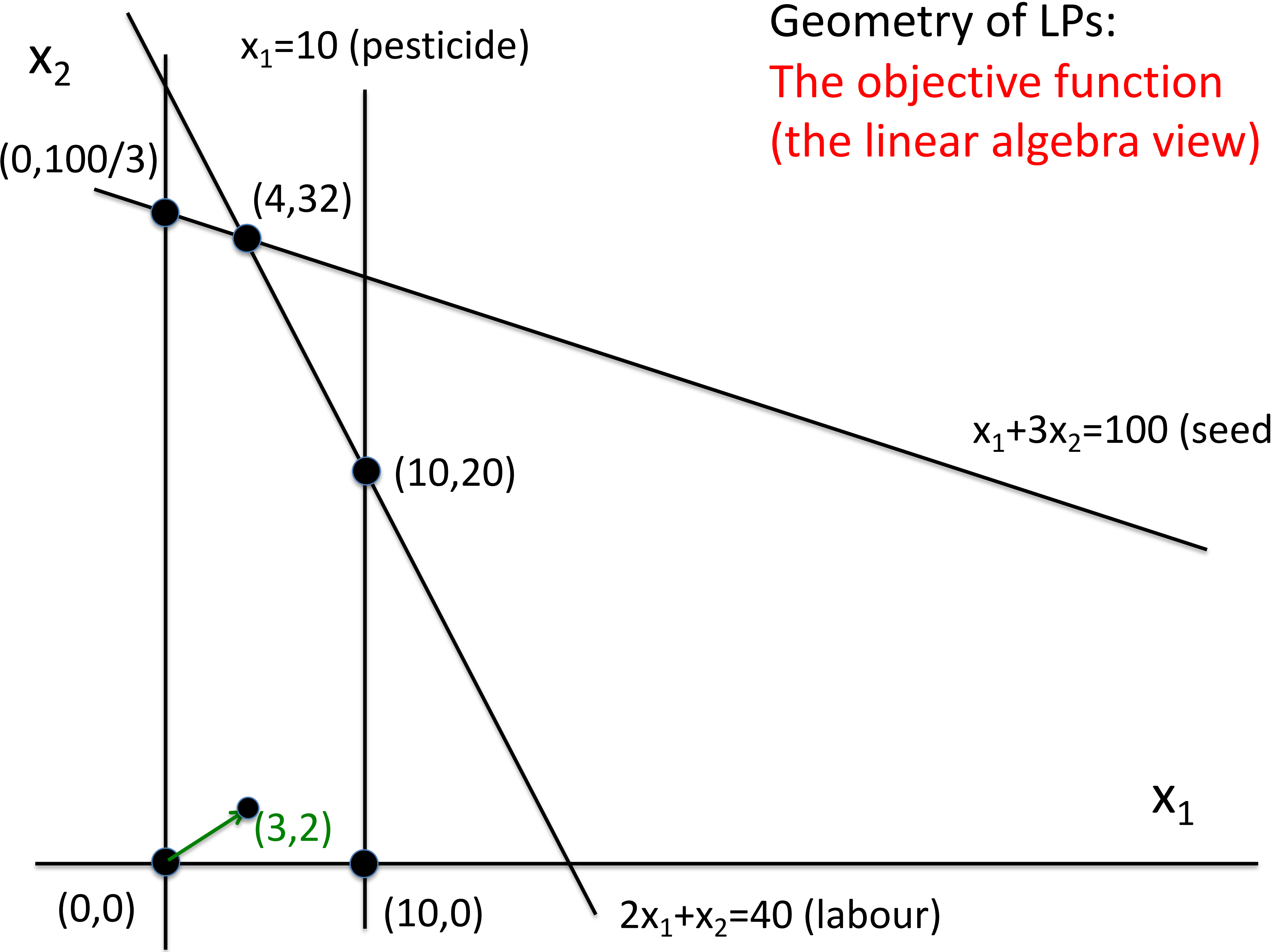
The objective function

<u>Fact:</u> If optimal solutions exist, then there is an optimal solution that is a basic feasible solution (a vertex of the feasible region)



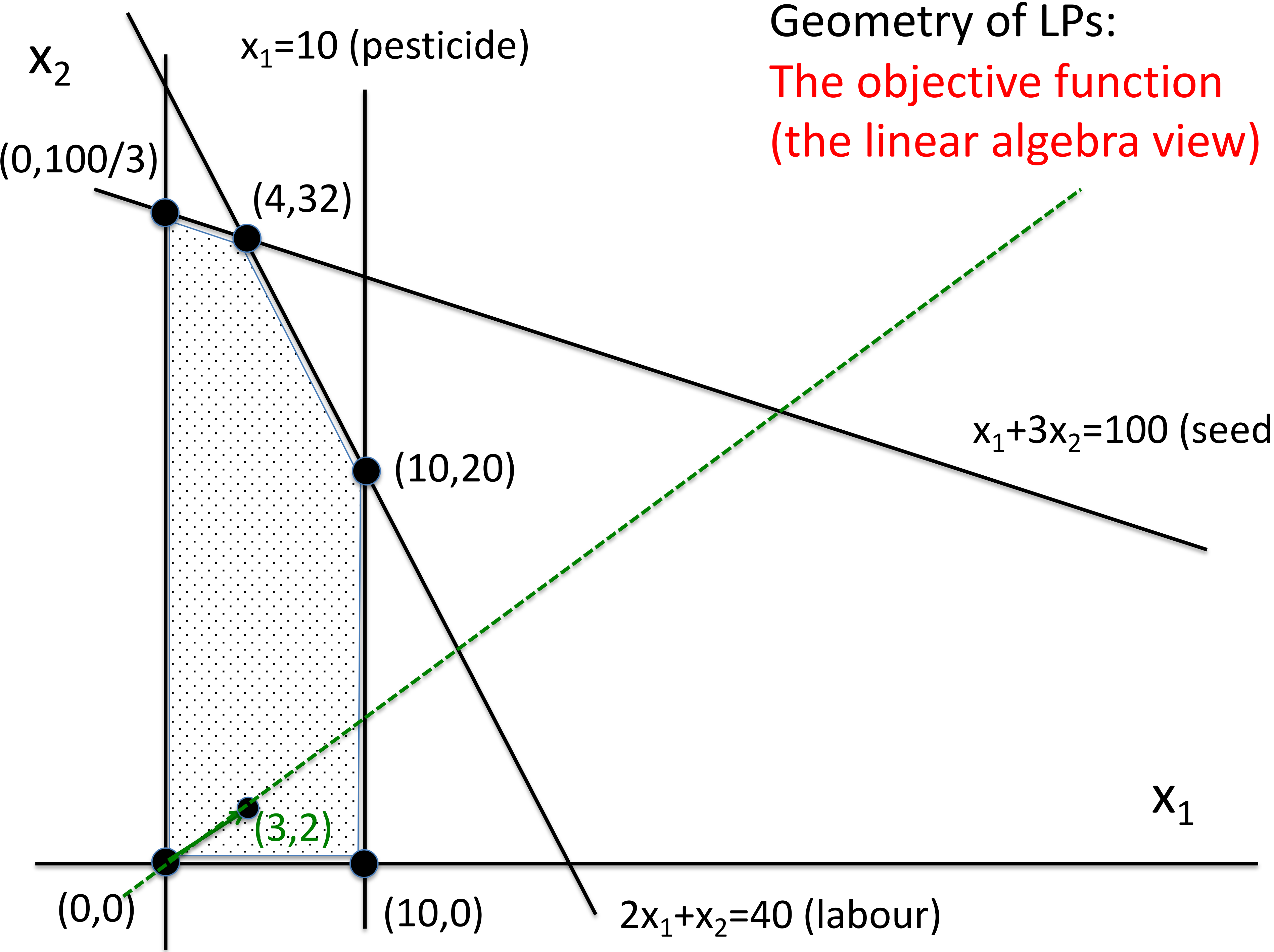
Geometry of LPs:

The objective function (the linear algebra view)



Geometry of LPs:

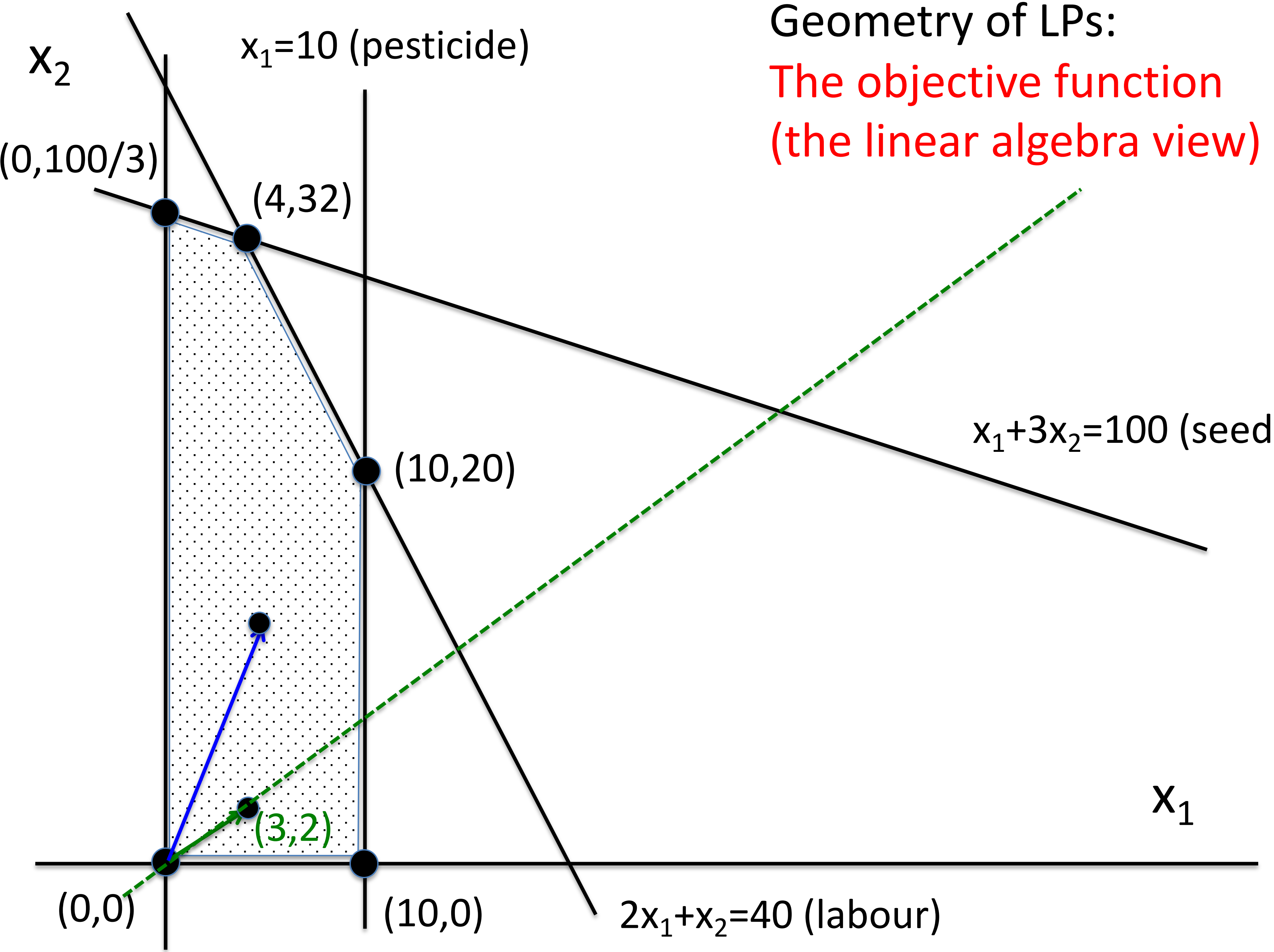
The objective function (the linear algebra view)



Geometry of LPs:

The objective function

(the linear algebra view)



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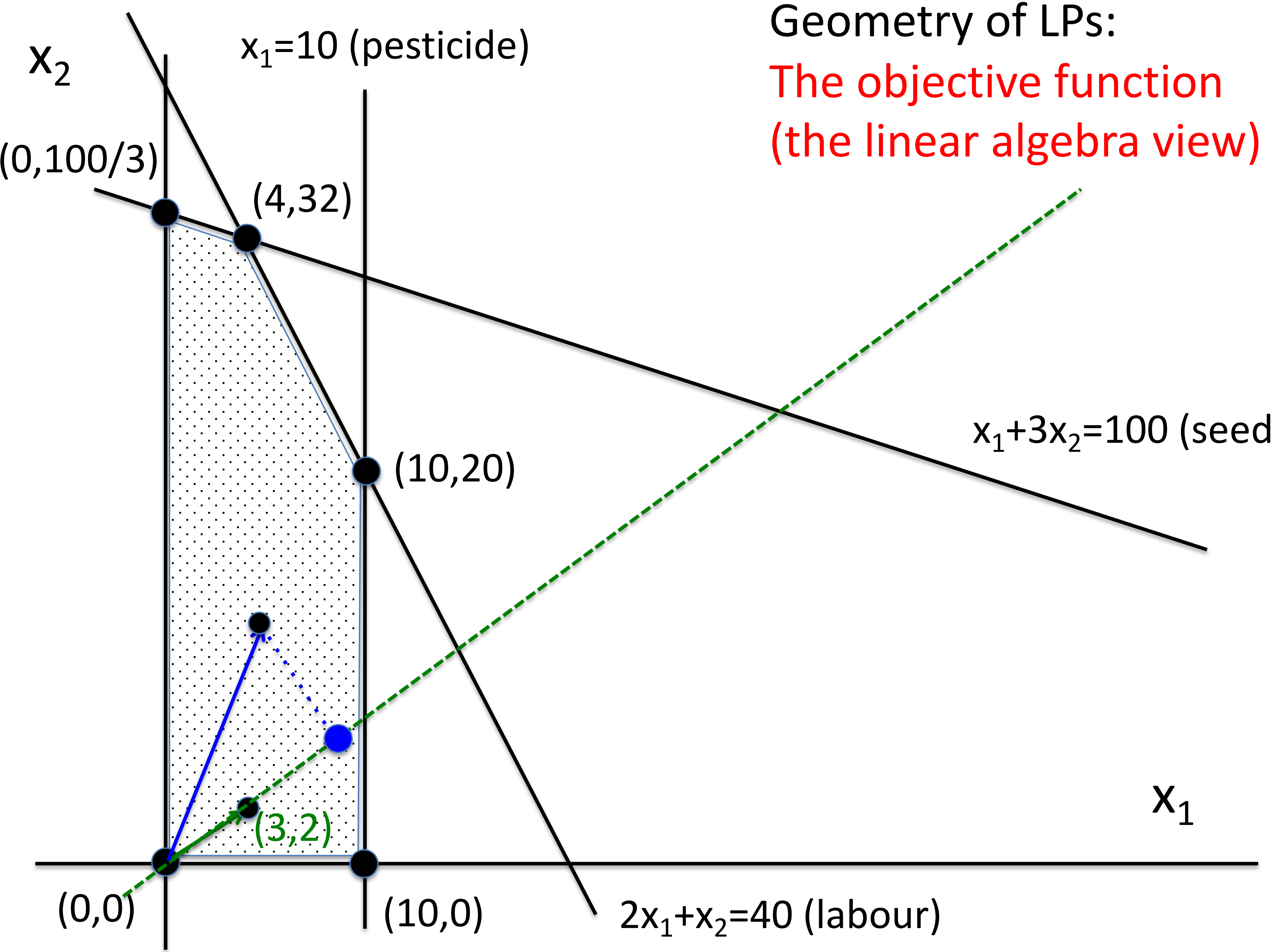
The objective function (the linear algebra view)



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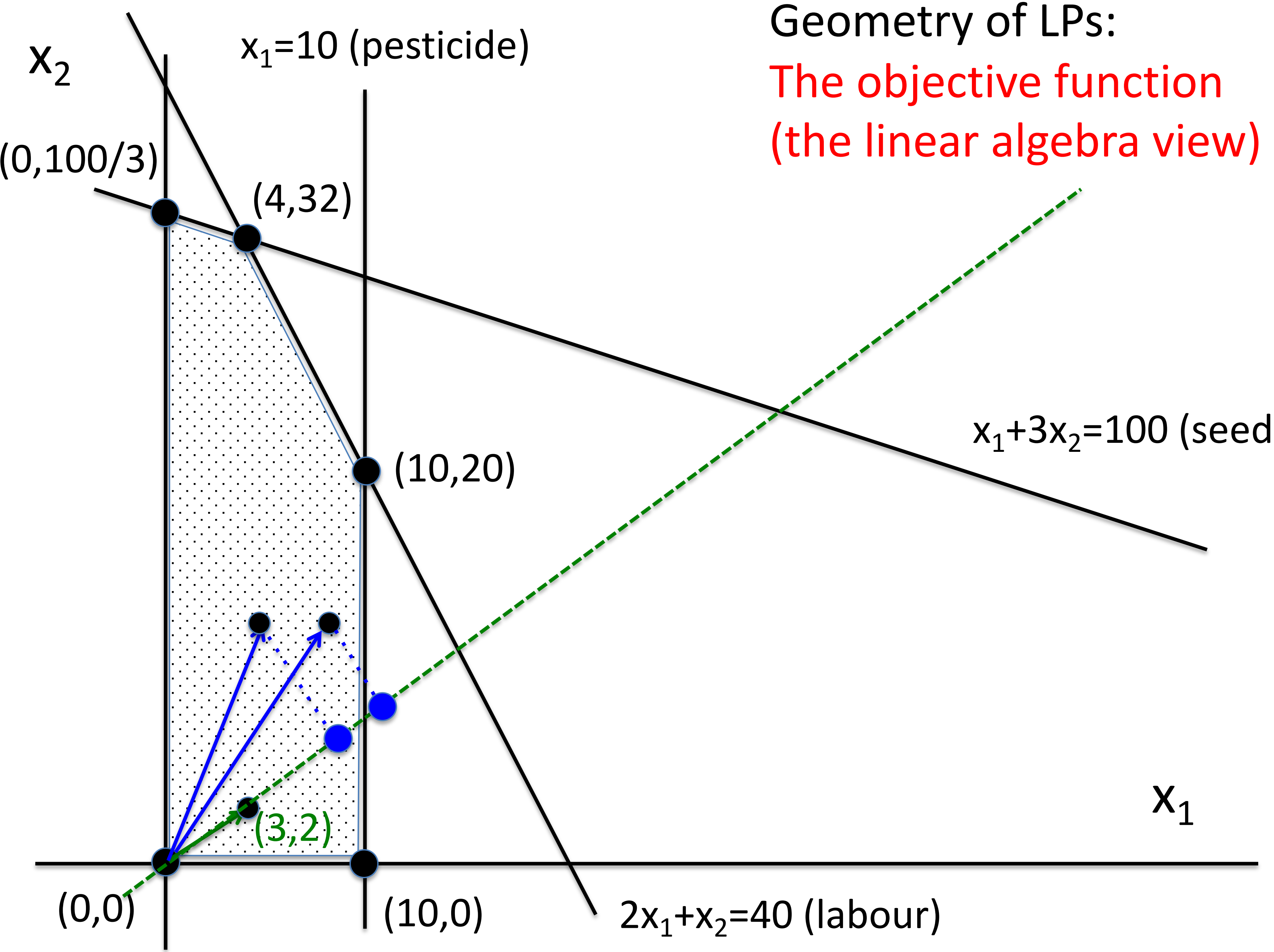
The objective function (the linear algebra view)



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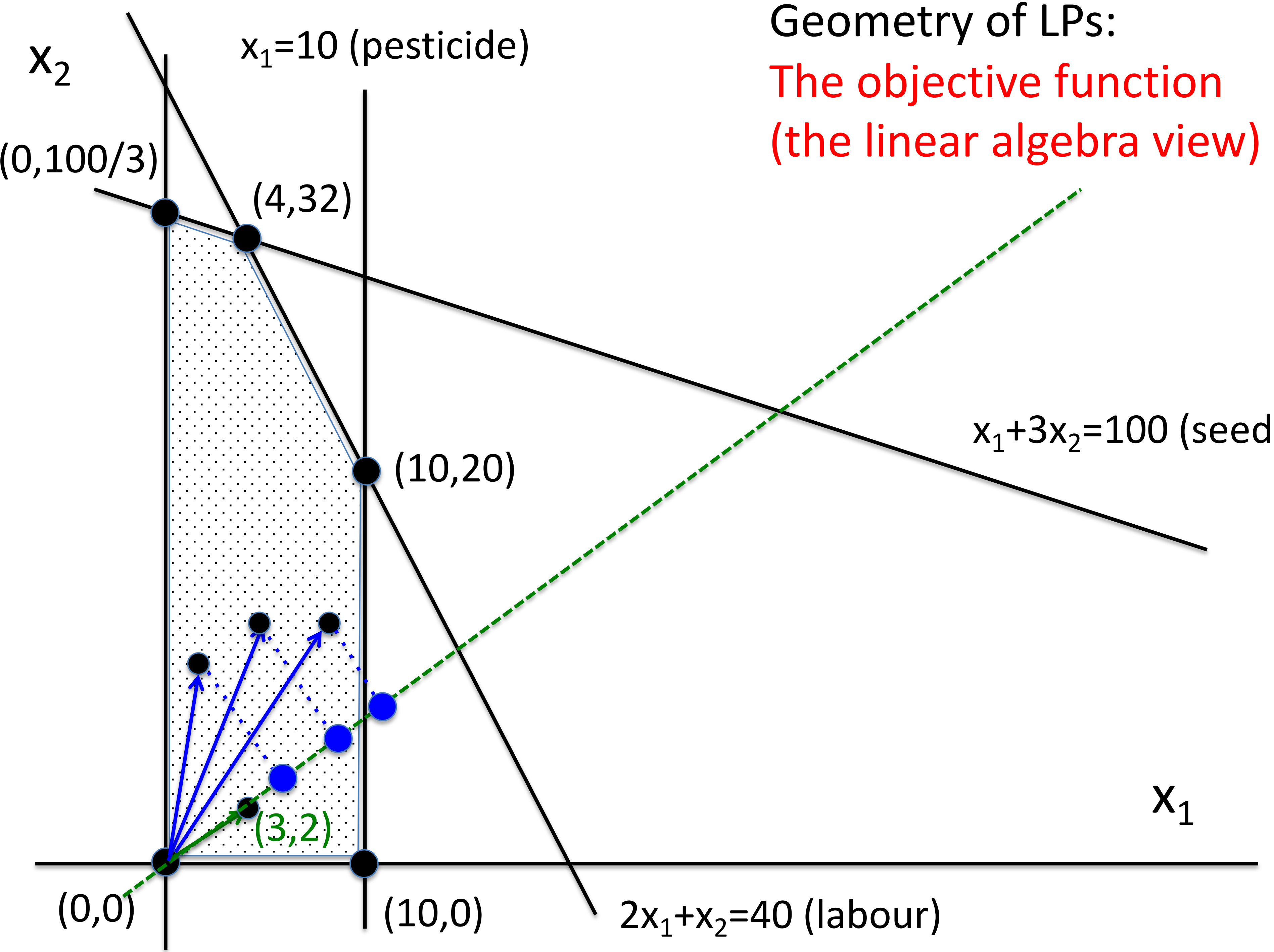
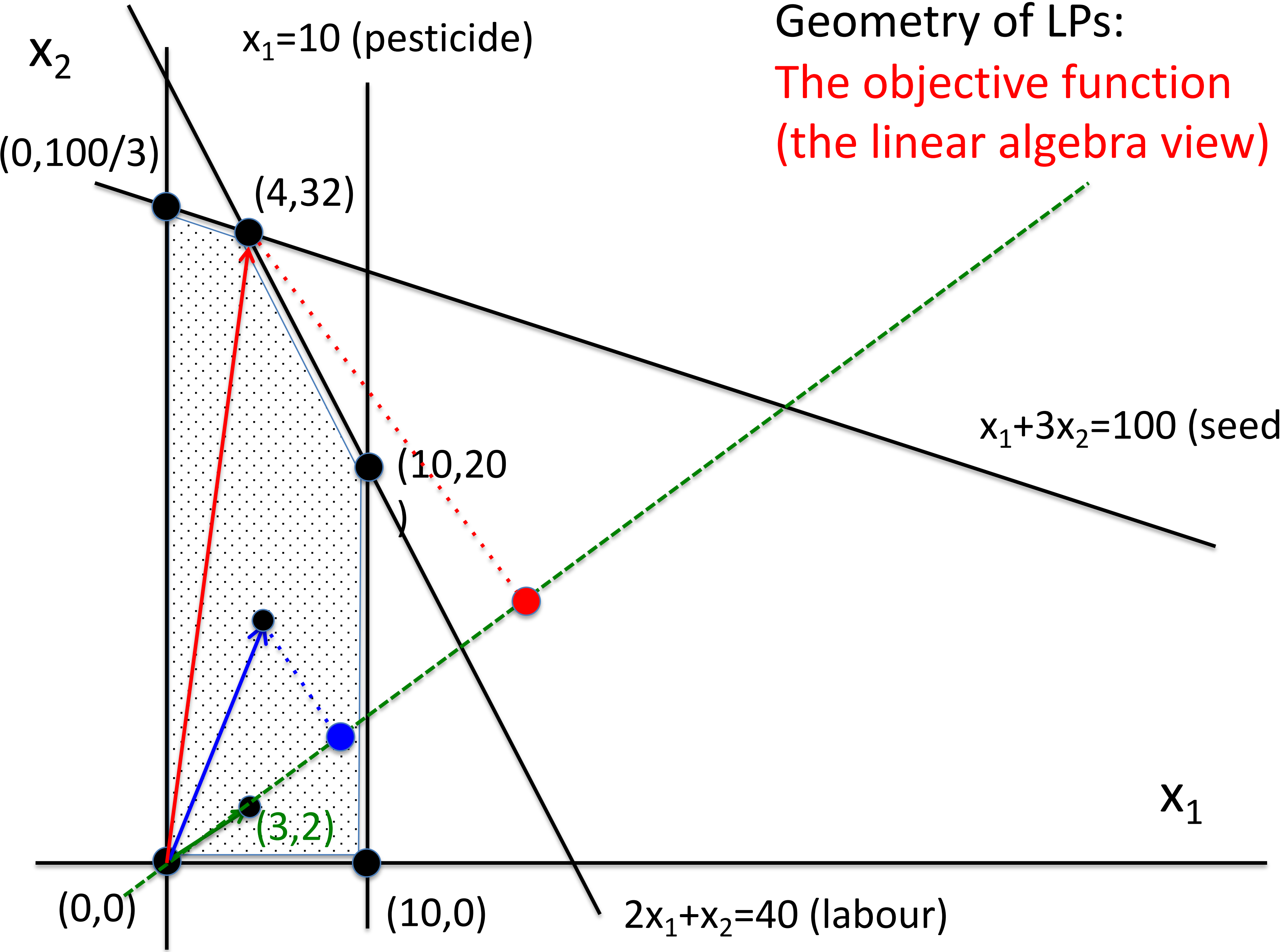
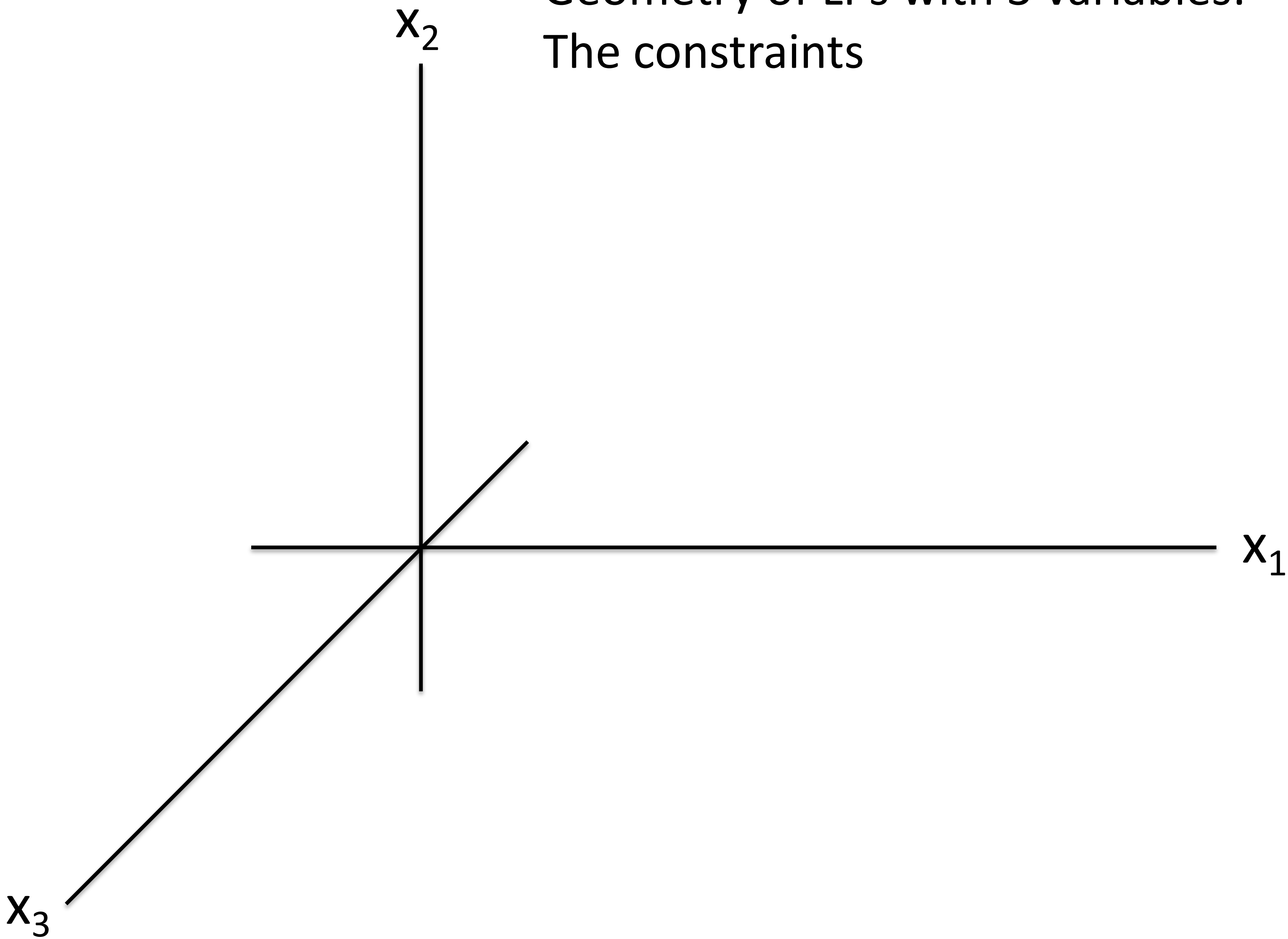


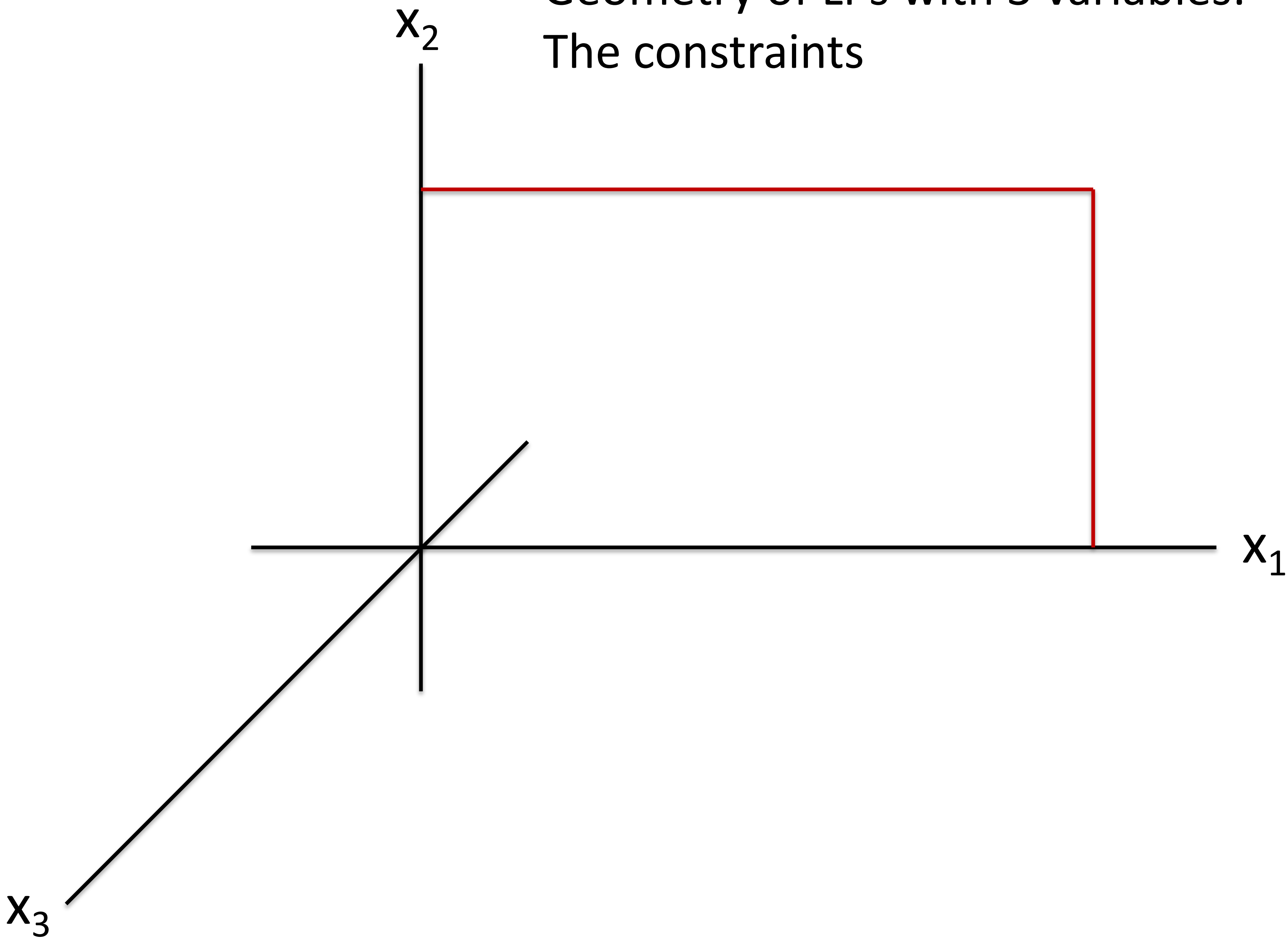
Geometry of LPs:
The objective function (the linear algebra view)



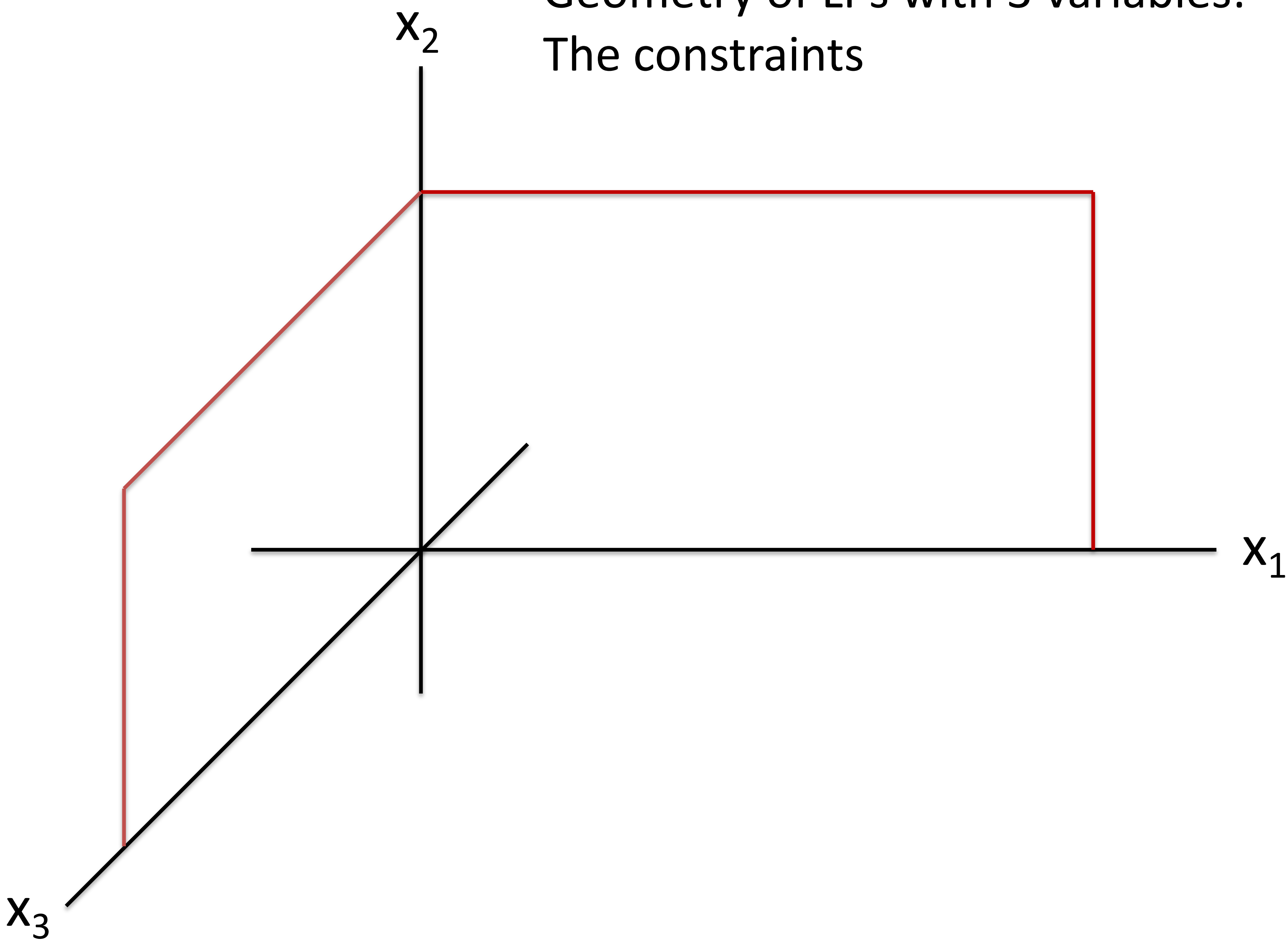
Geometry of LPs with 3 variables: The constraints



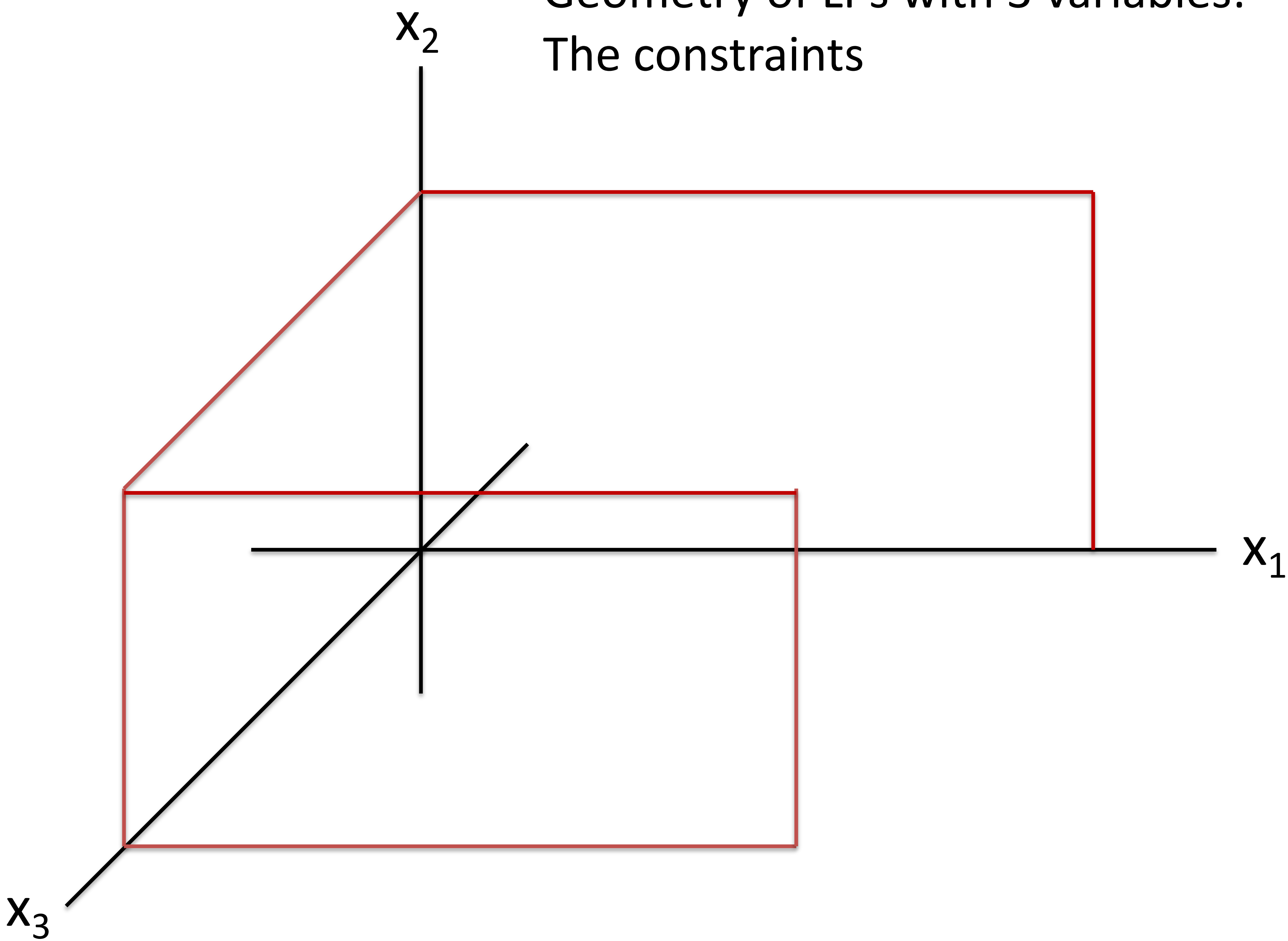
Geometry of LPs with 3 variables:
The constraints



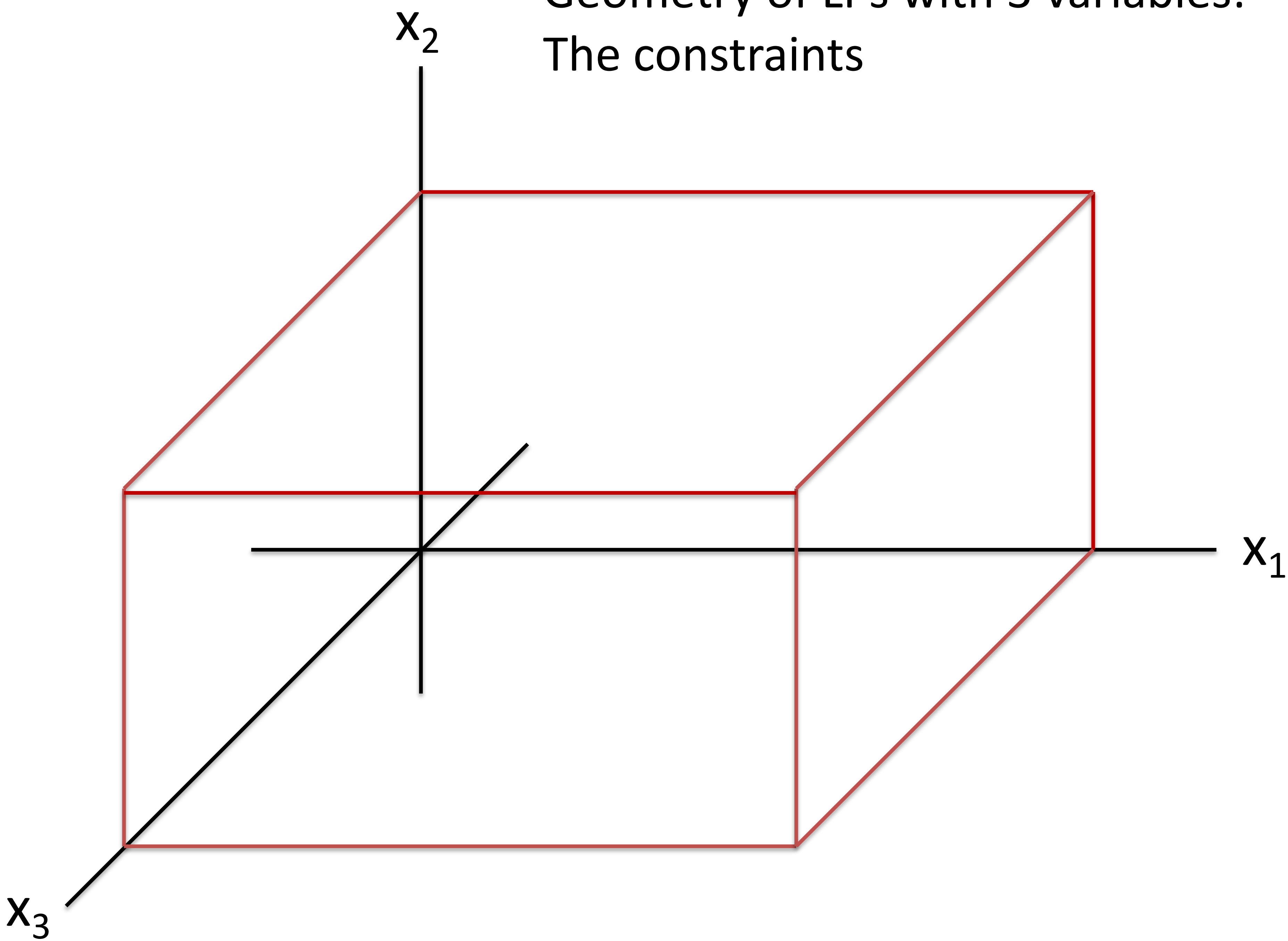
Geometry of LPs with 3 variables: The constraints



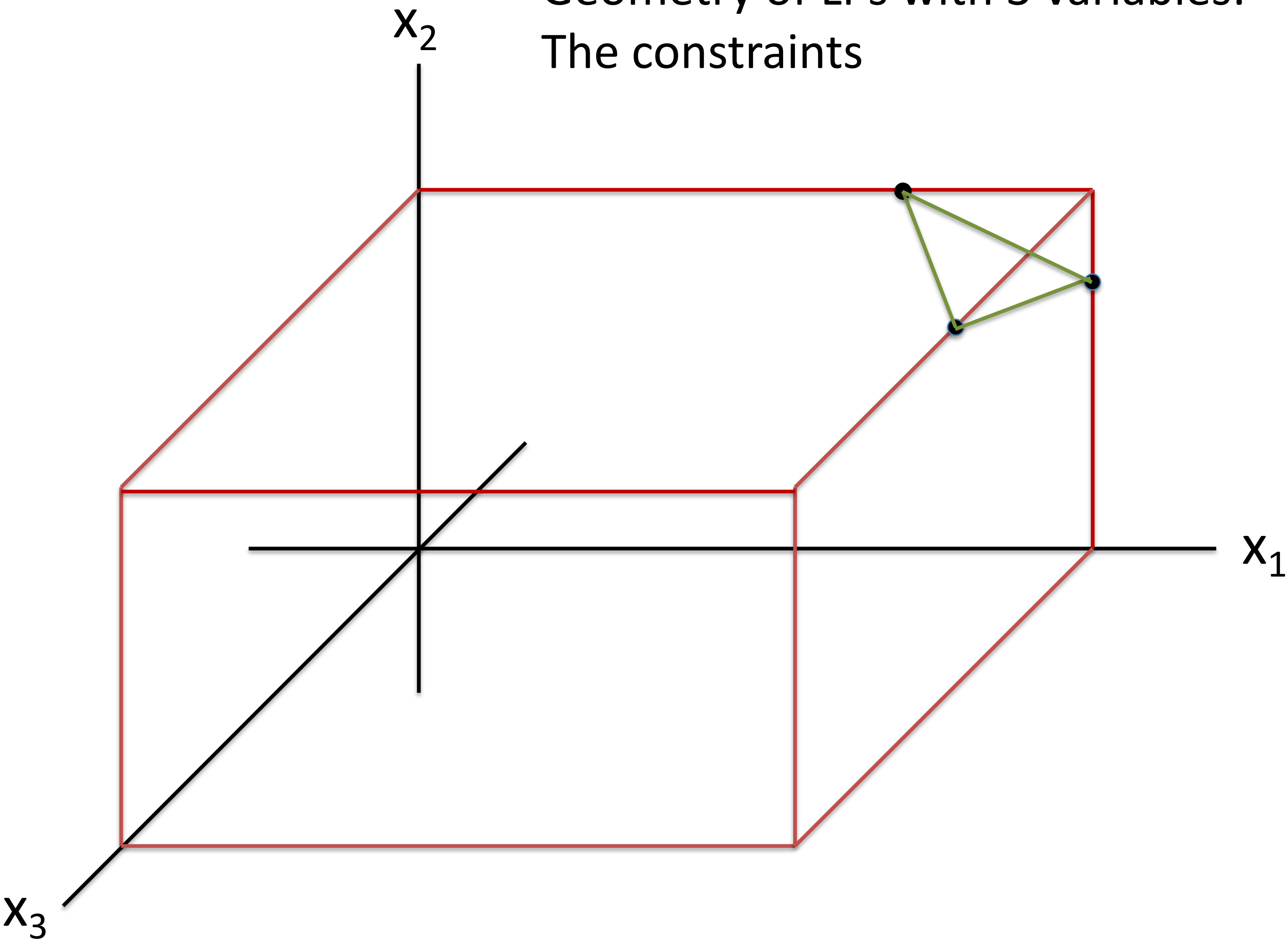
Geometry of LPs with 3 variables: The constraints



Geometry of LPs with 3 variables: The constraints



Geometry of LPs with 3 variables: The constraints



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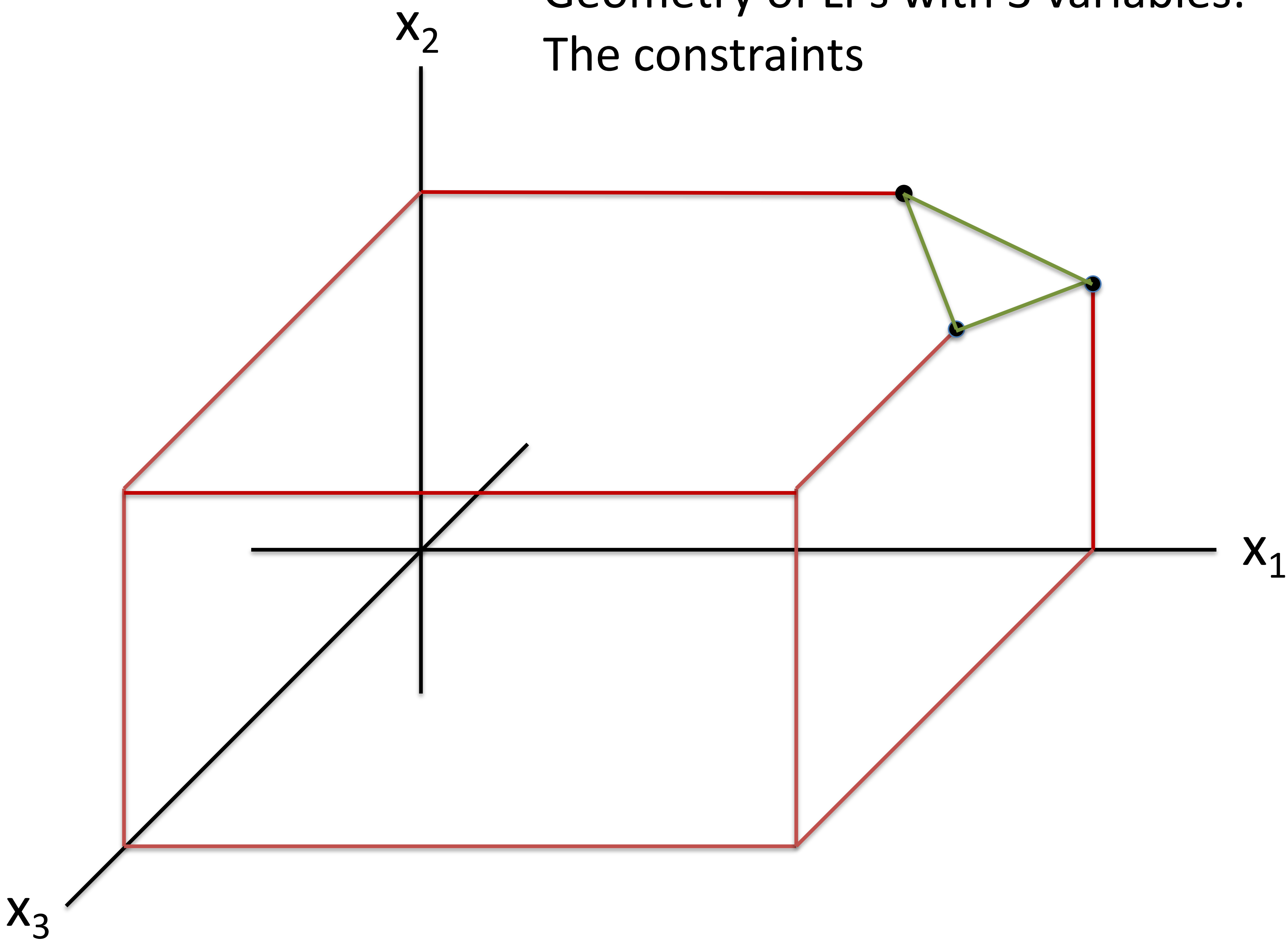

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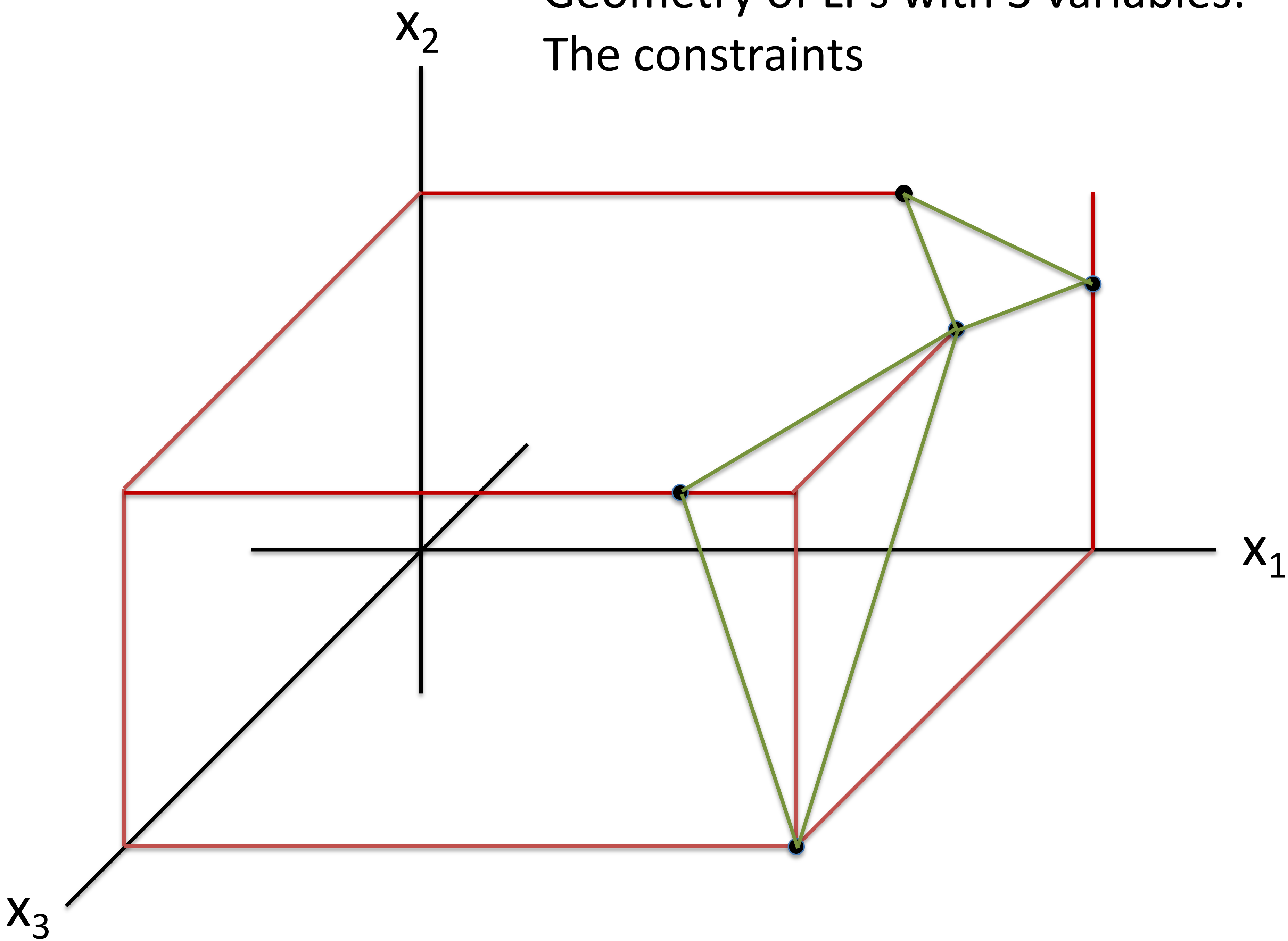

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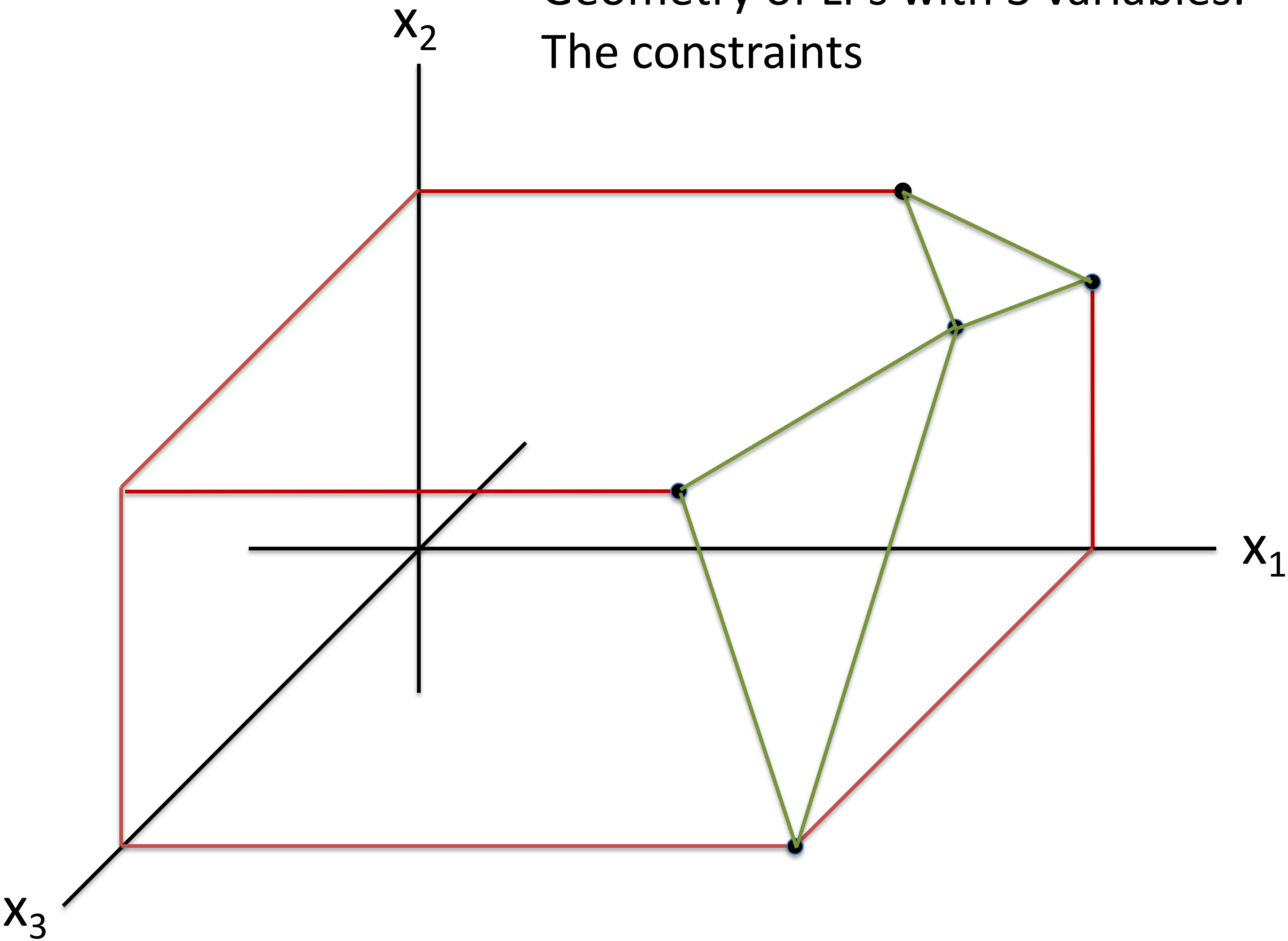
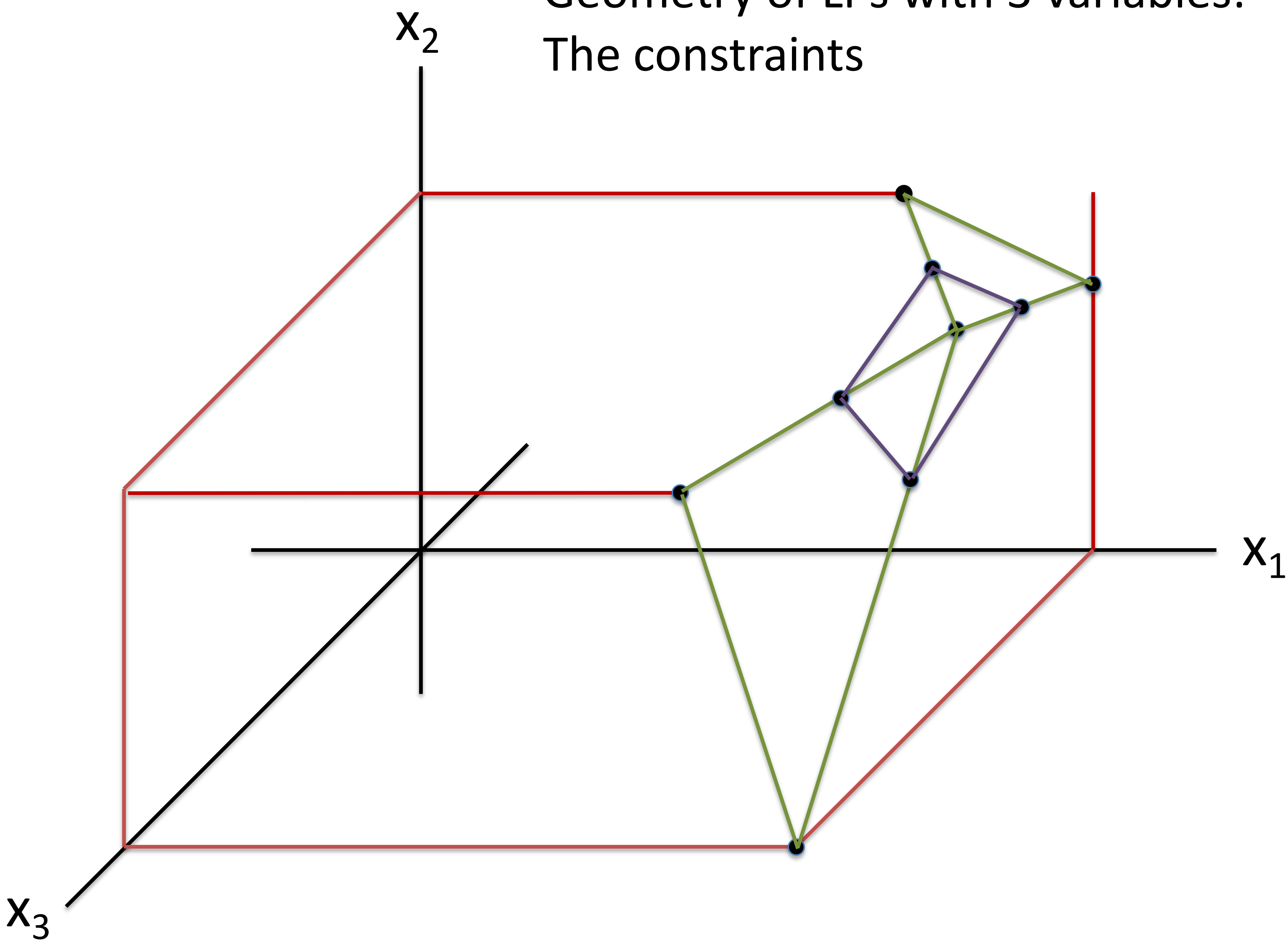
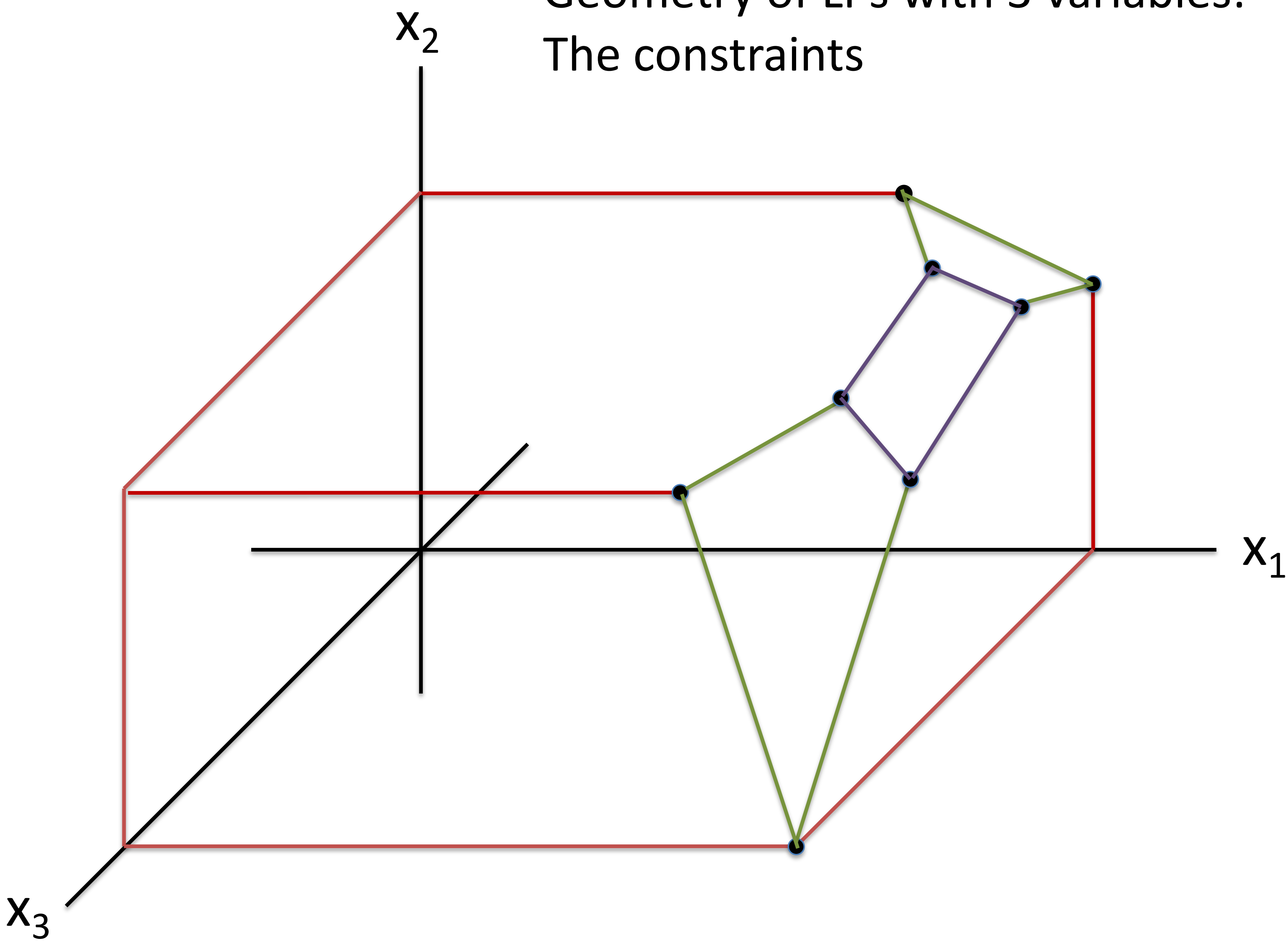


Geometry of LPs with 3 variables: The constraints



Geometry of LPs with 3 variables: The constraints



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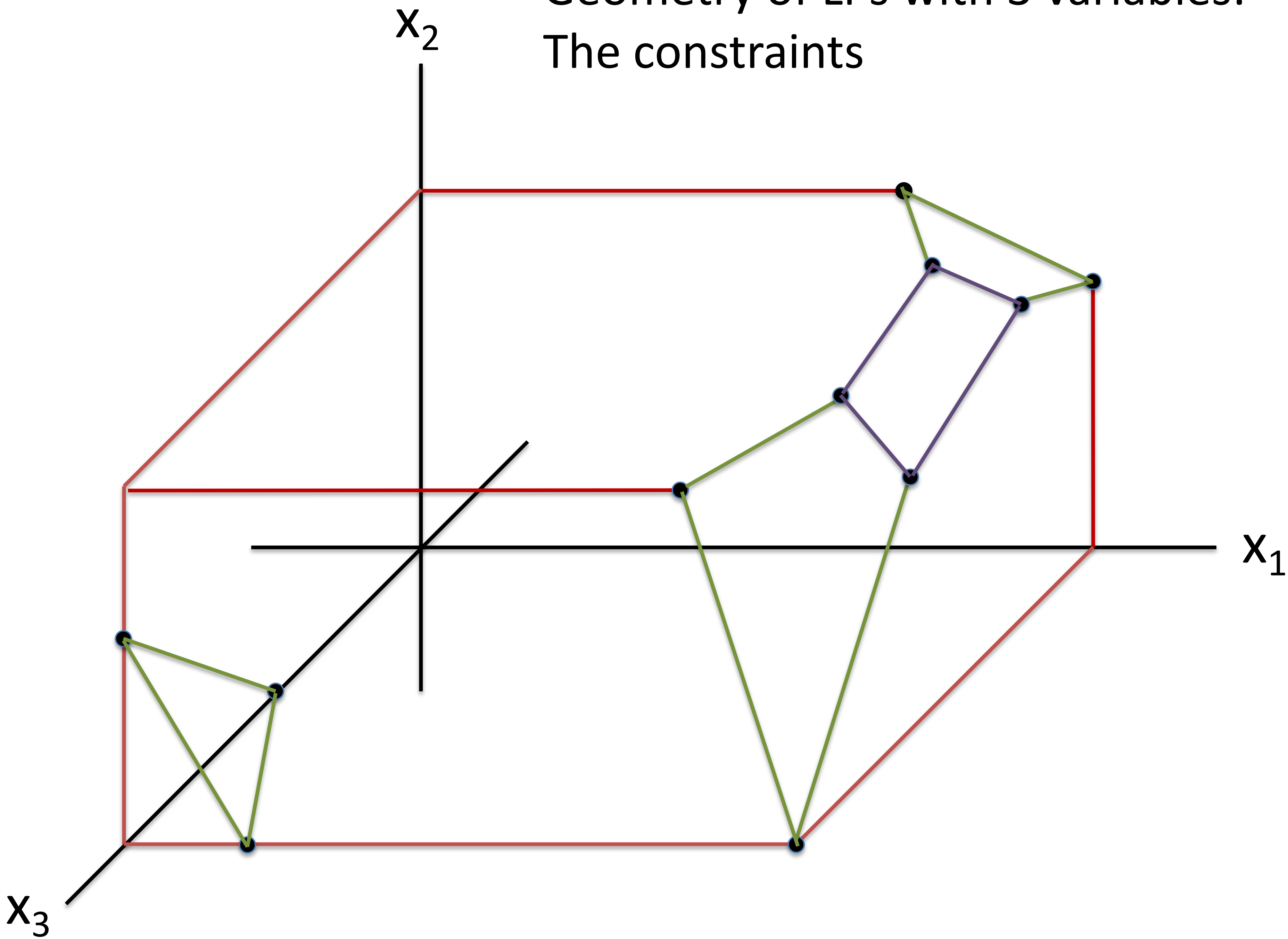

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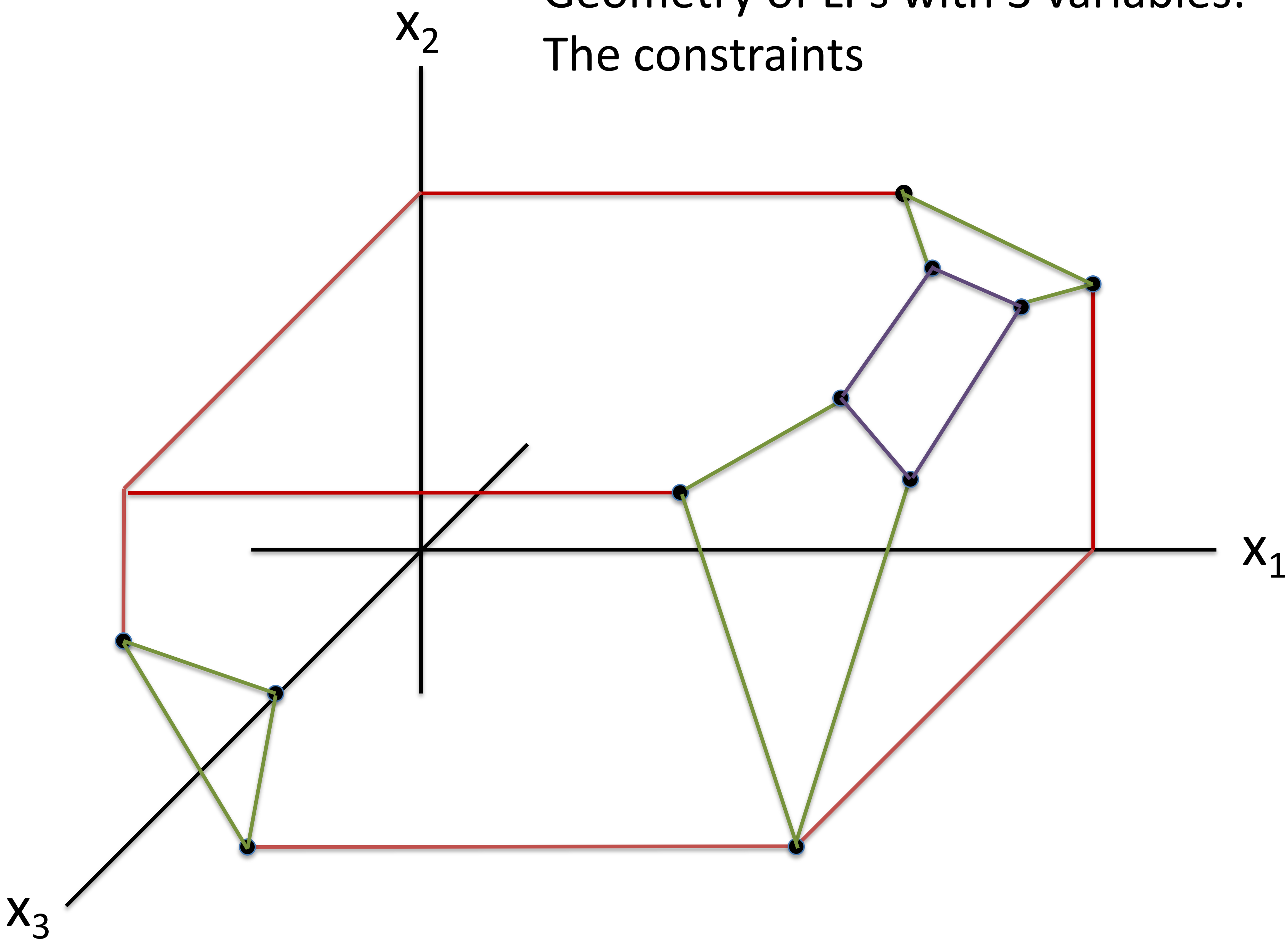

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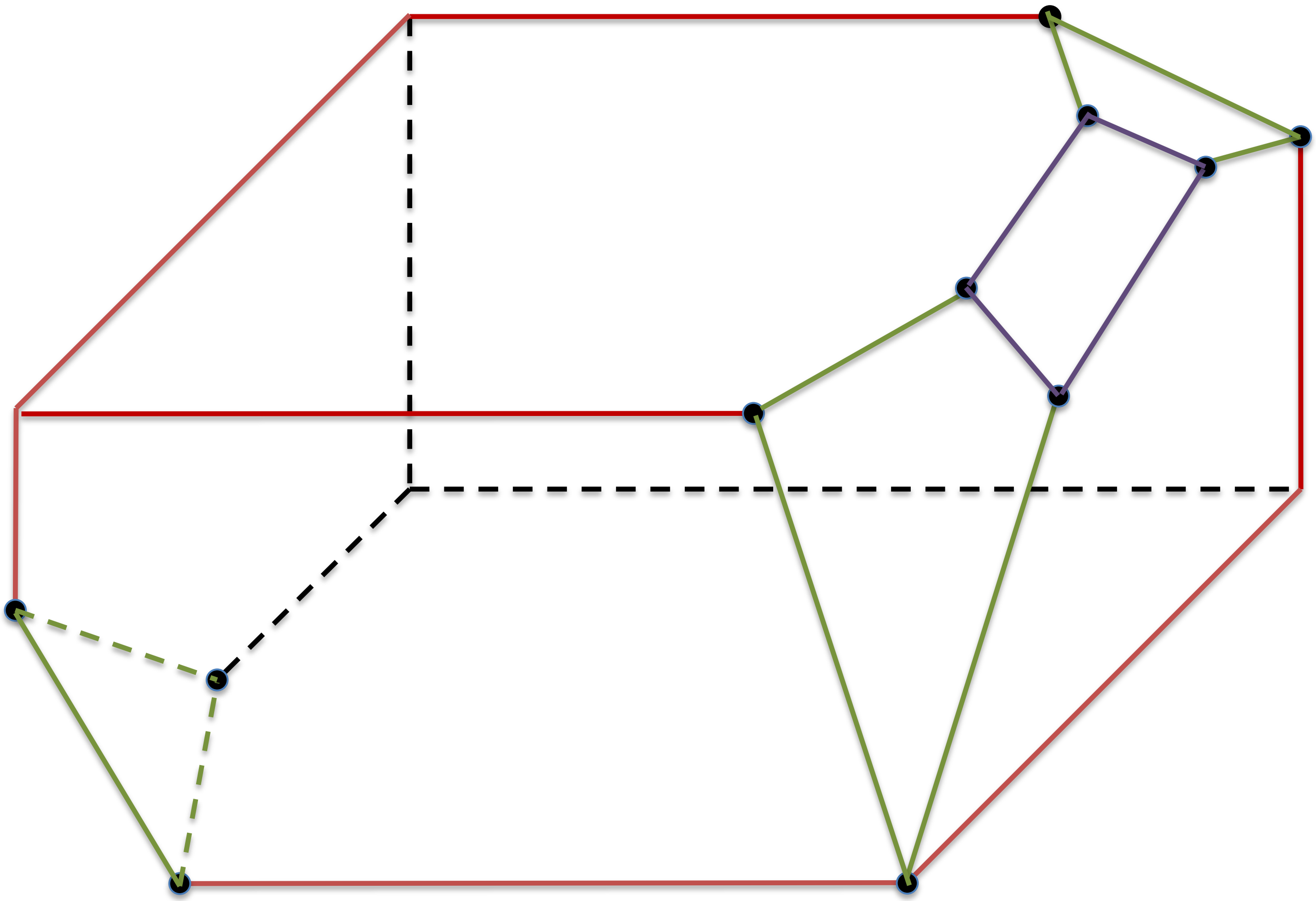
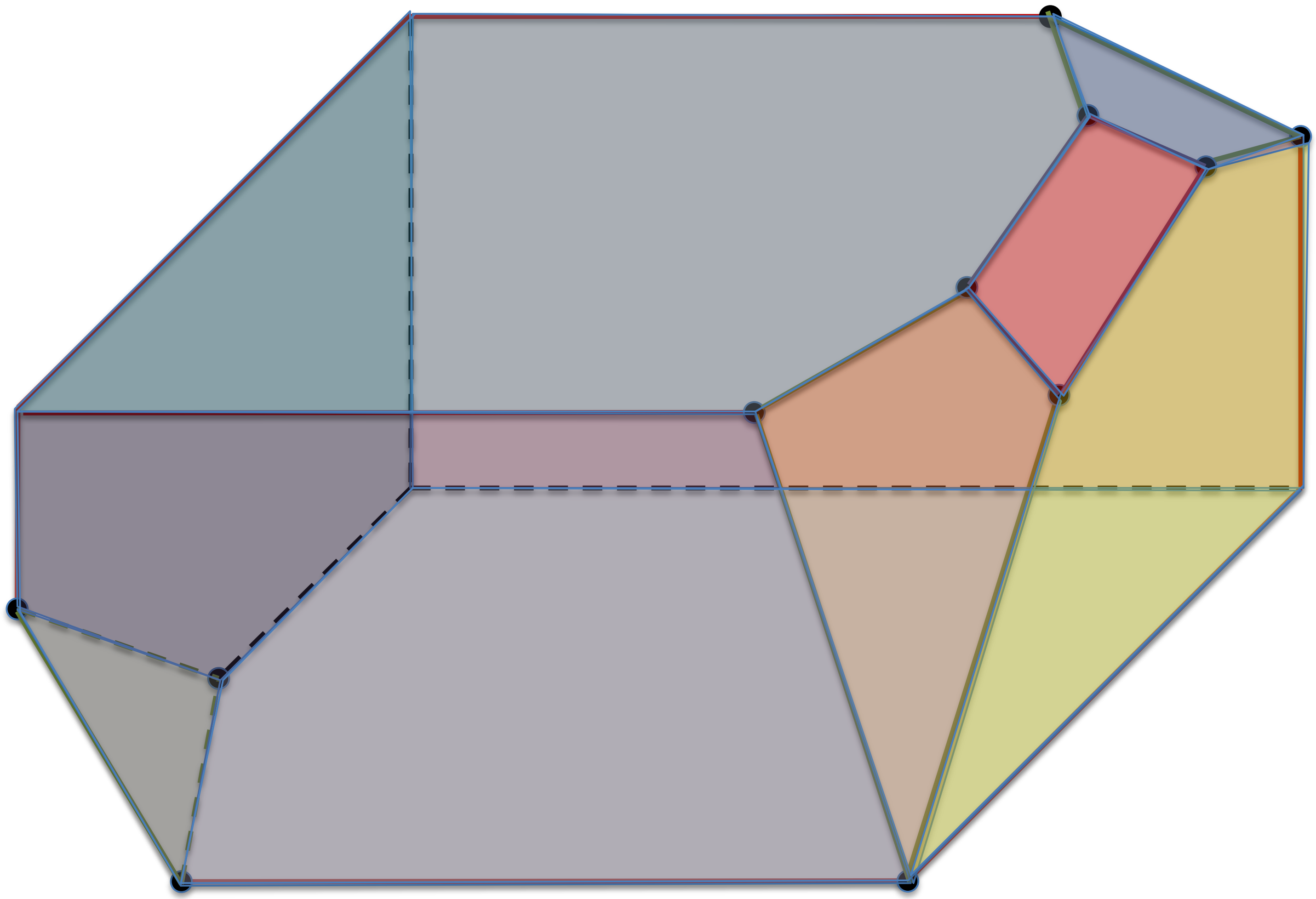


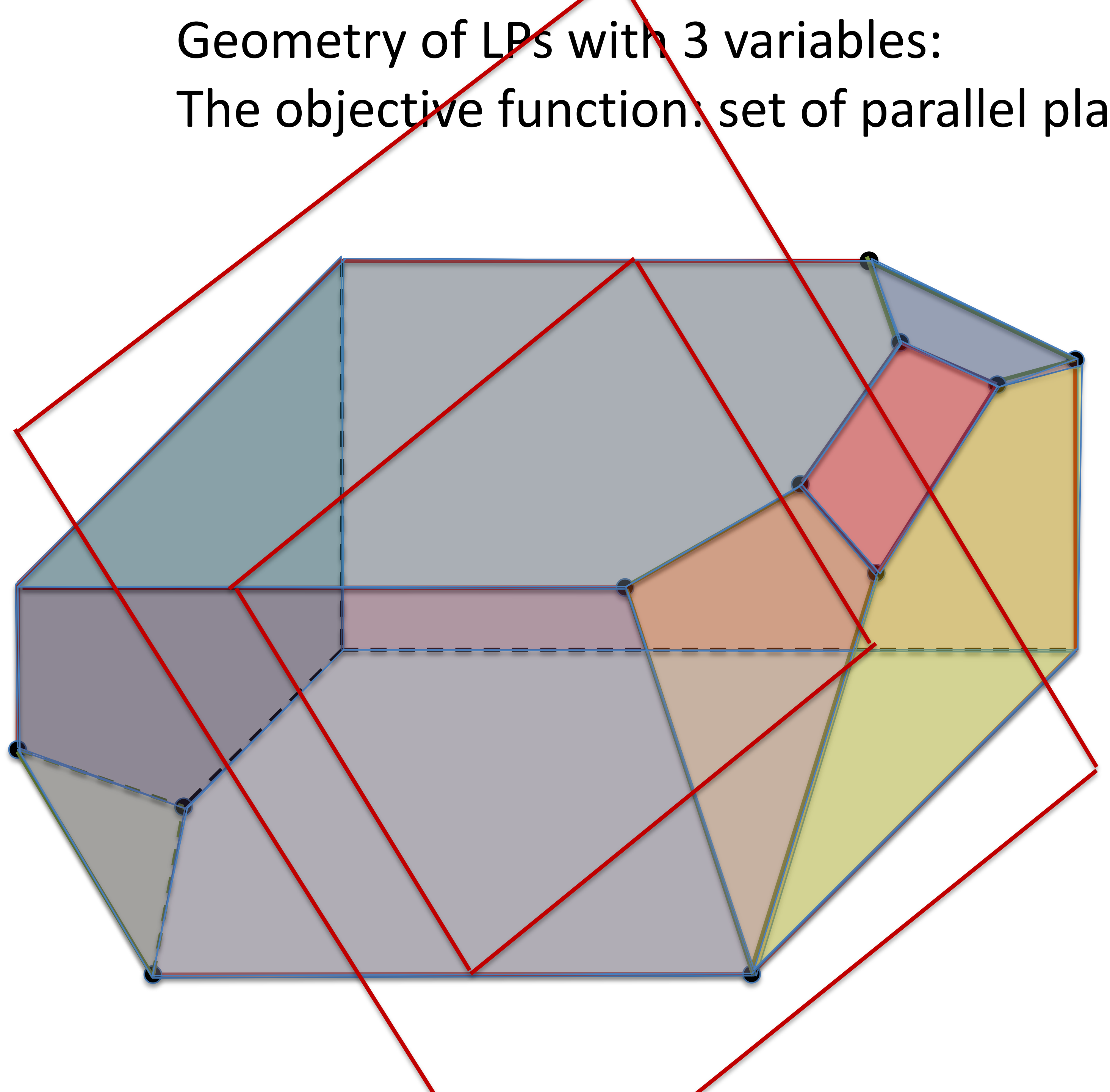
Geometry of LPs with 3 variables: The constraints

Feasible region:
a <u>convex</u> polyhedron

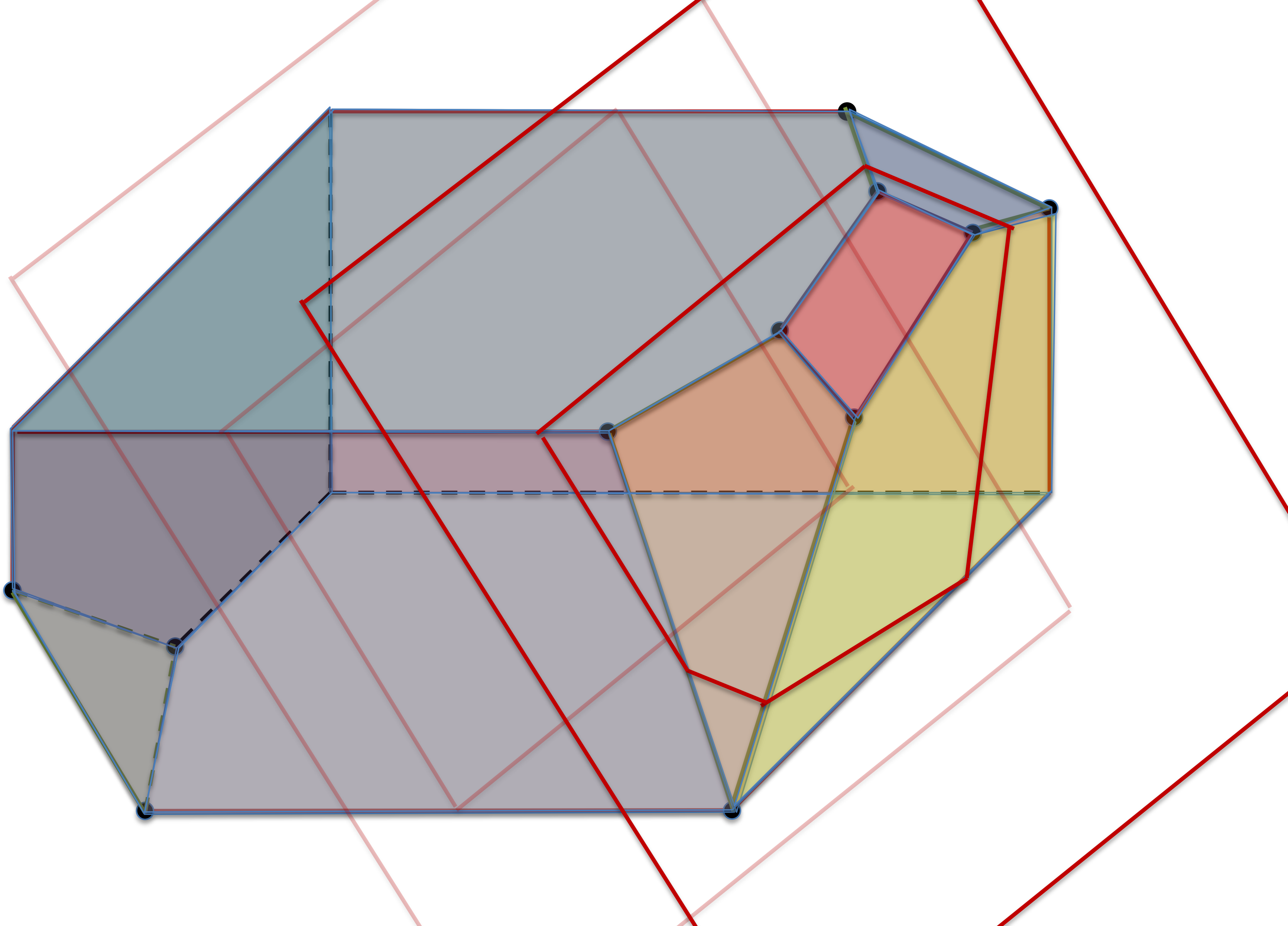


Geometry of LPs with 3 variables:

The objective function: set of parallel planes



Geometry of LPs with 3 variables:
The objective function: set of parallel planes



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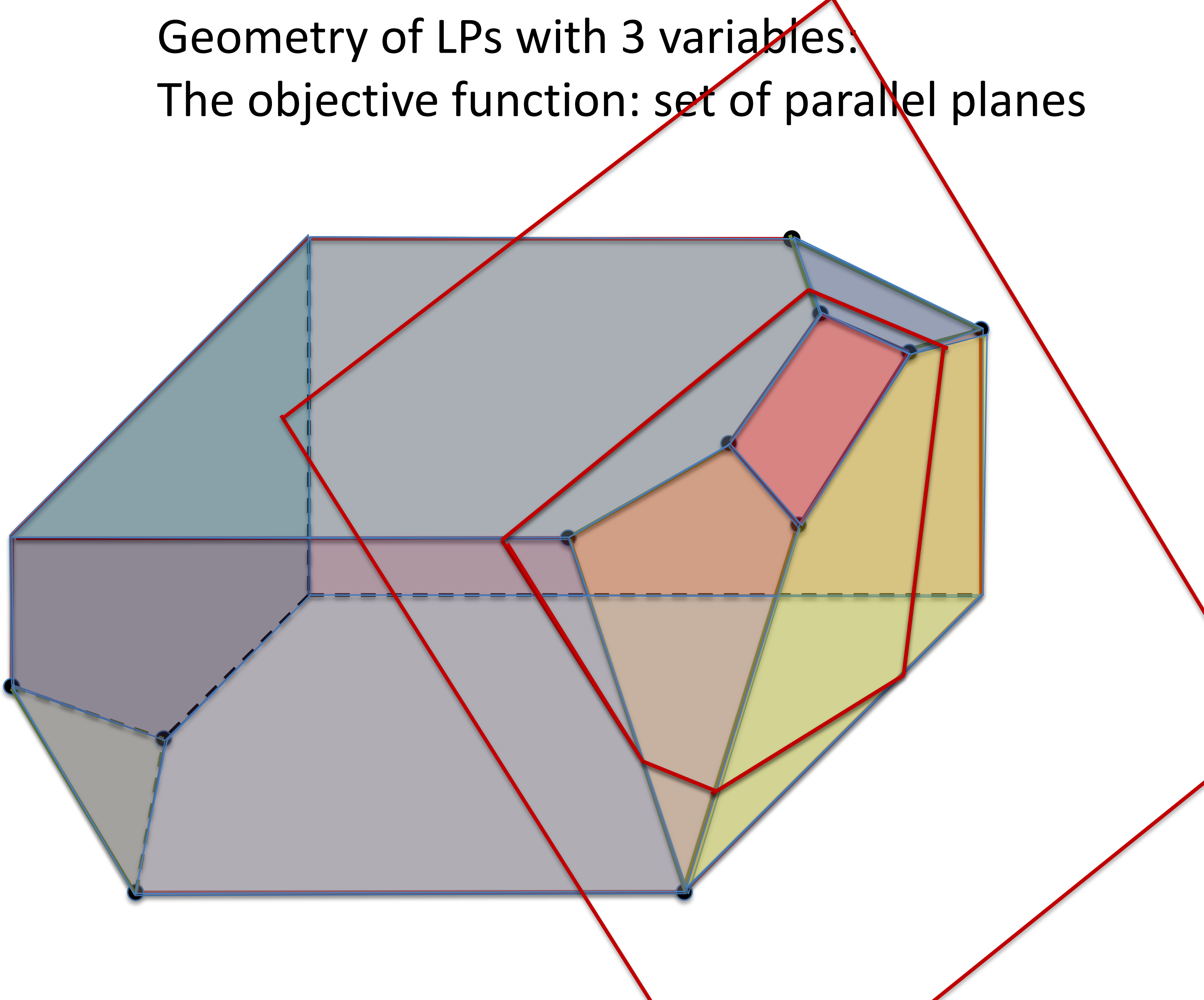

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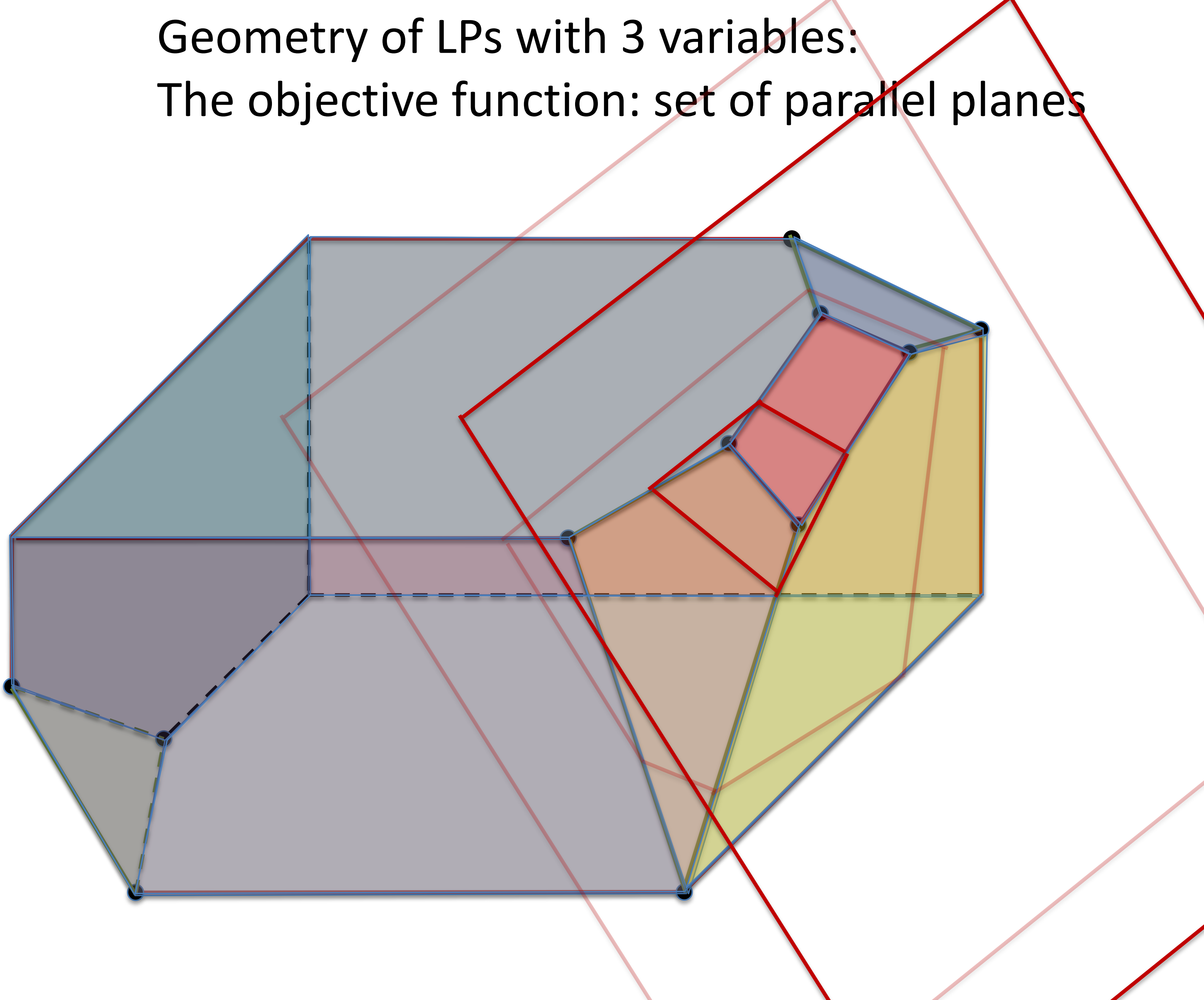
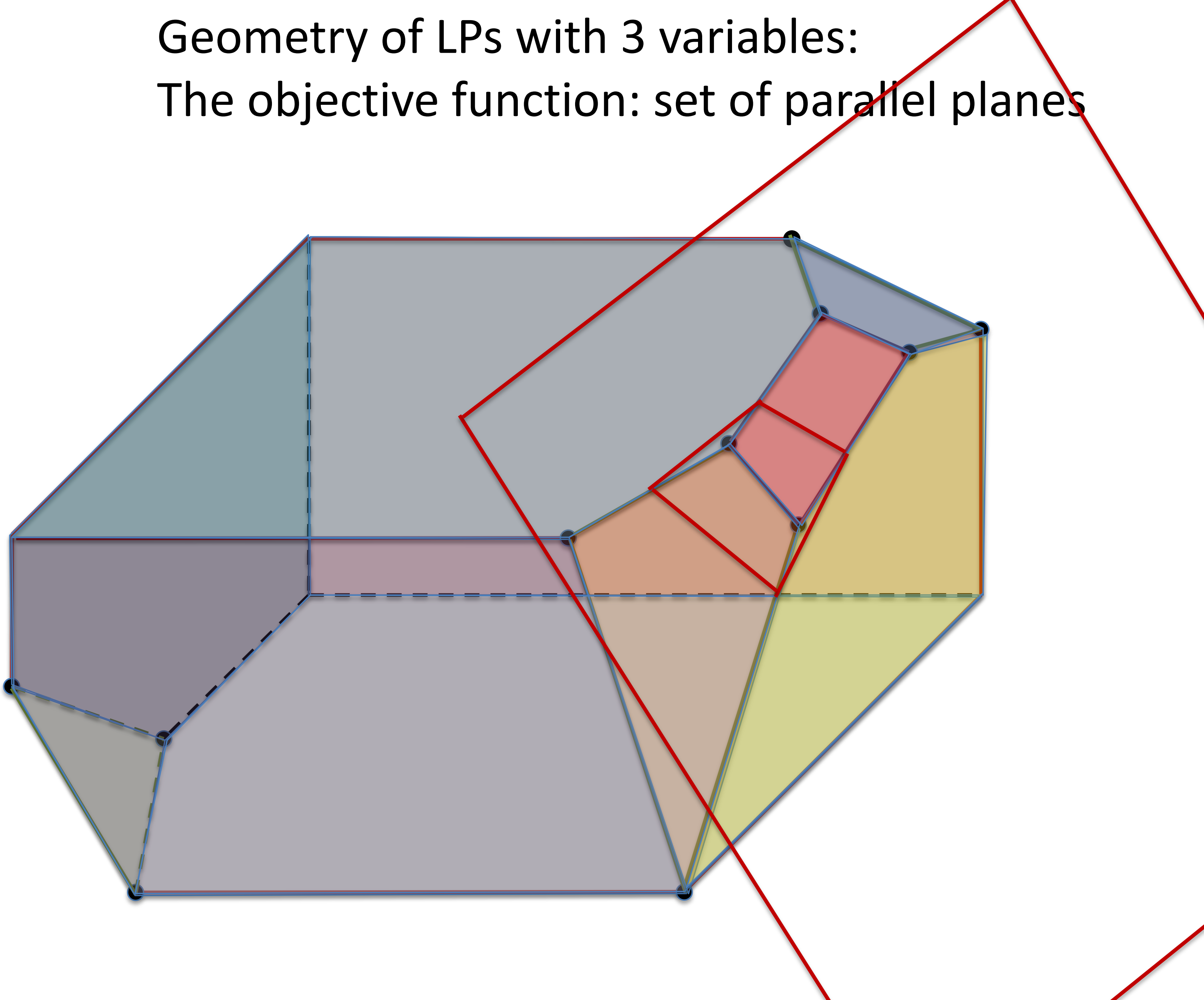


Geometry of LPs with 3 variables:
The objective function: set of parallel planes



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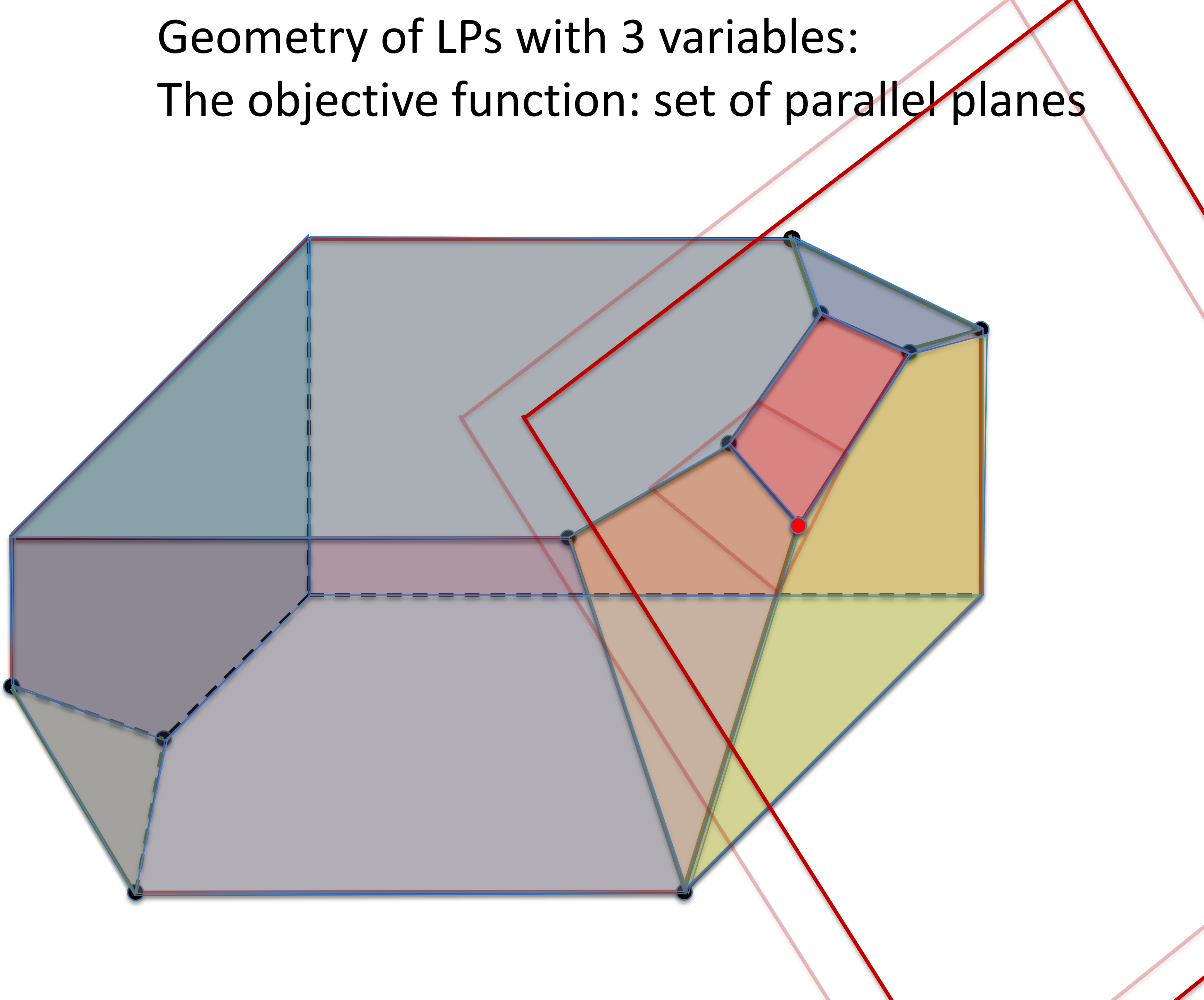

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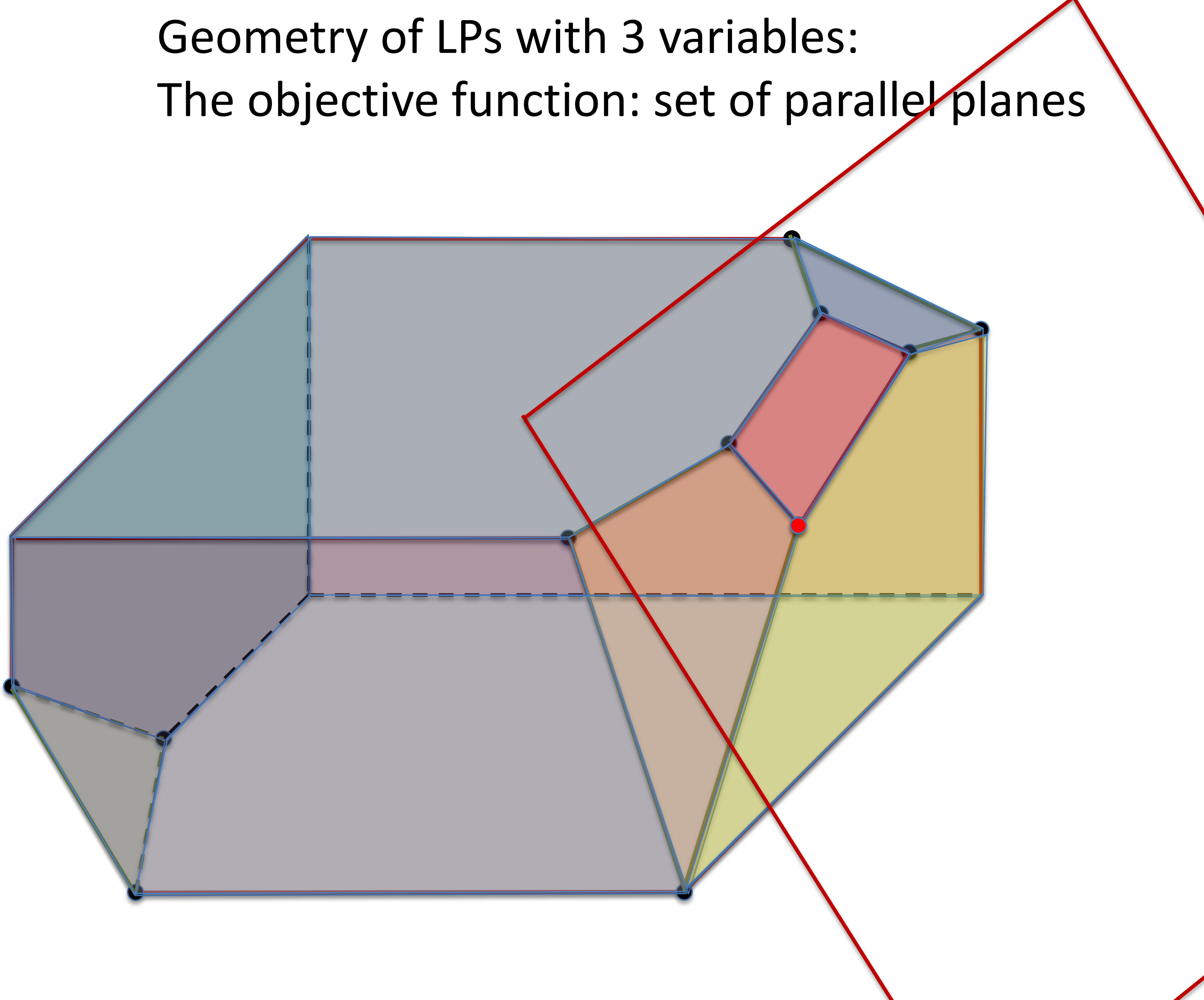
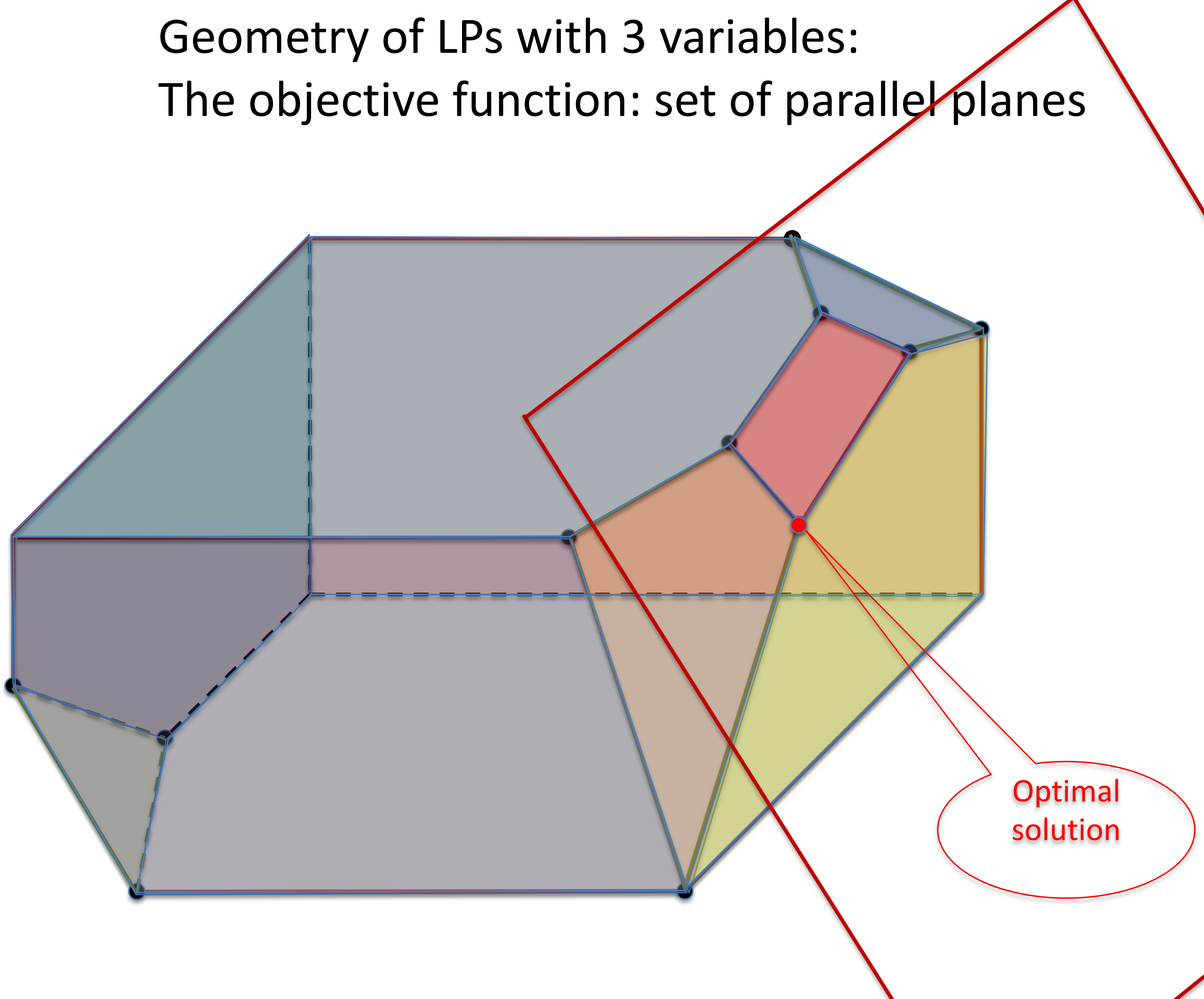
The objective function: set of parallel planes



Geometry of LPs with 3 variables:
The objective function: set of parallel planes



Geometric interpretation of of LPs

	2 variables	3 variables	n variables
constraint	half-plane	half-space	half-hyperspace
feasible region	convex polygon	convex polyhedron	convex polytope
objective function	parallel lines	parallel planes	parallel hyperplanes
basic feasible solution	polygon vertex	polyhedron vertex	polytope vertex

LP terminology

Objective function: Function being minimized or maximized.
Solution: Assignment of real values to the variables.
Feasible solution: Solution that satisfies all the constraints.
Feasible region: The set of feasible solutions; a convex polytope.
Basic feasible solution: A vertex of the feasible solution polytope.
Optimal solution: A feasible solution that minimizes or maximize the objective function; it is not necessarily unique and it might not exist (see below: infeasible and unbounded LP).
Value of a solution: Value of objective function at a solution; sometimes called "cost" of a solution (for minimization problems)
Optimal value: Value of optimal solution; sometimes called "optimal cost" (for minimization problems).
Feasible LP: LP that has feasible solutions.
Infeasible LP: LP with no feasible solutions.
Bounded LP: LP with an optimal solution.
Unbounded LP: LP that is feasible but has no optimal solution.