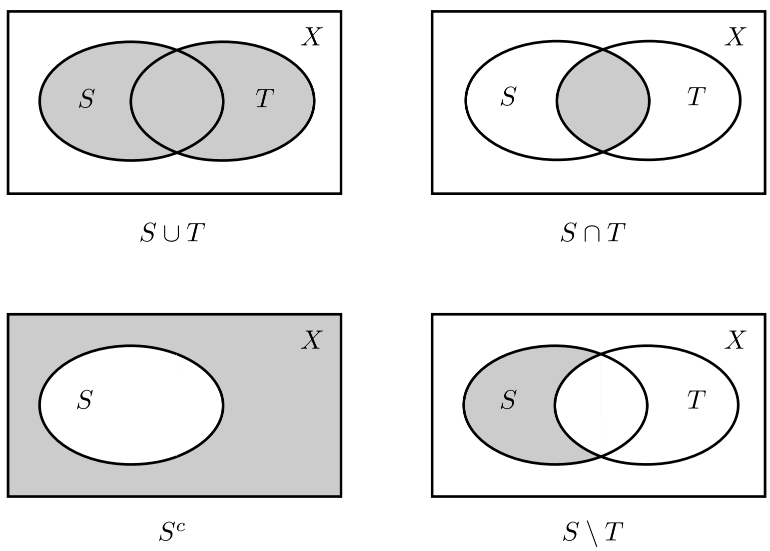


Figure 1.1: Venn diagrams

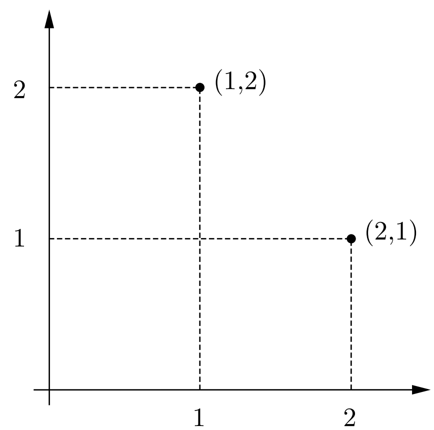


Figure 1.2: The coordinate plane $\Re^2$

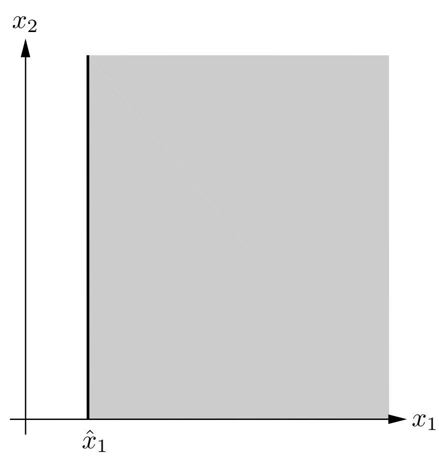


Figure 1.3: A consumption set with two commodities

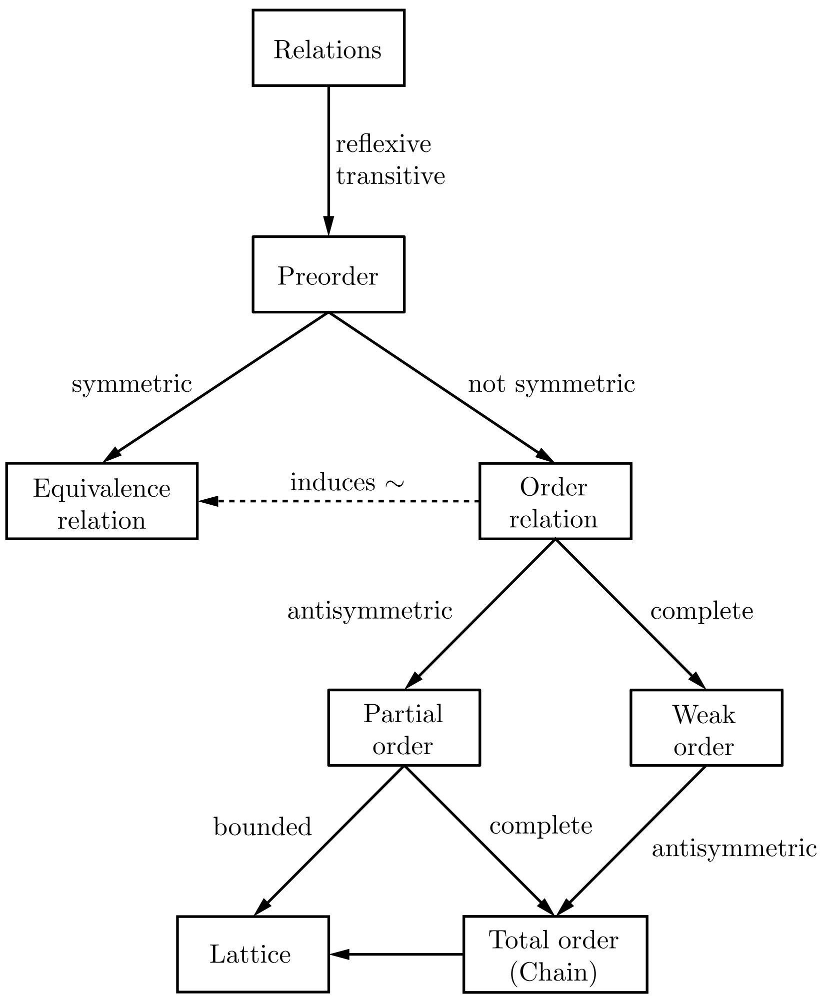


Figure 1.4: Types of relations

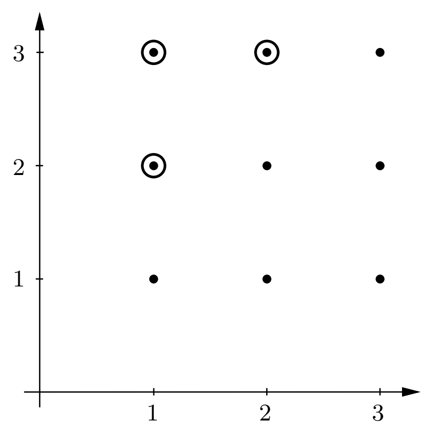


Figure 1.5: A relation

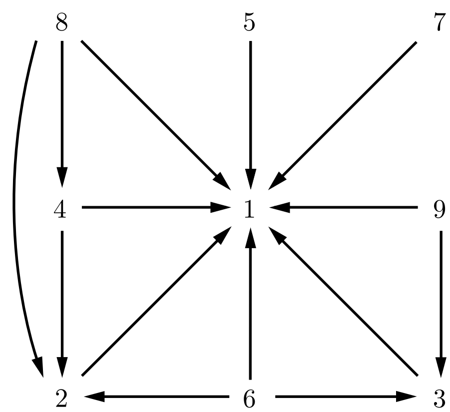


Figure 1.6: Integer multiples

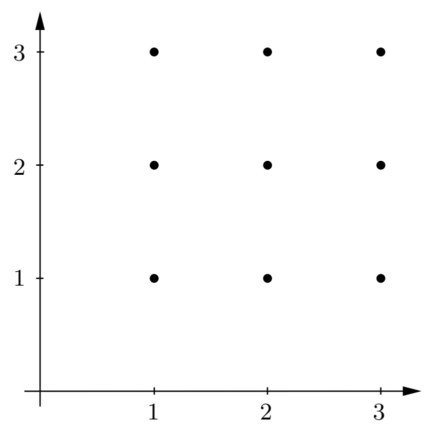


Figure 1.7: A simple lattice in $\Re^2$

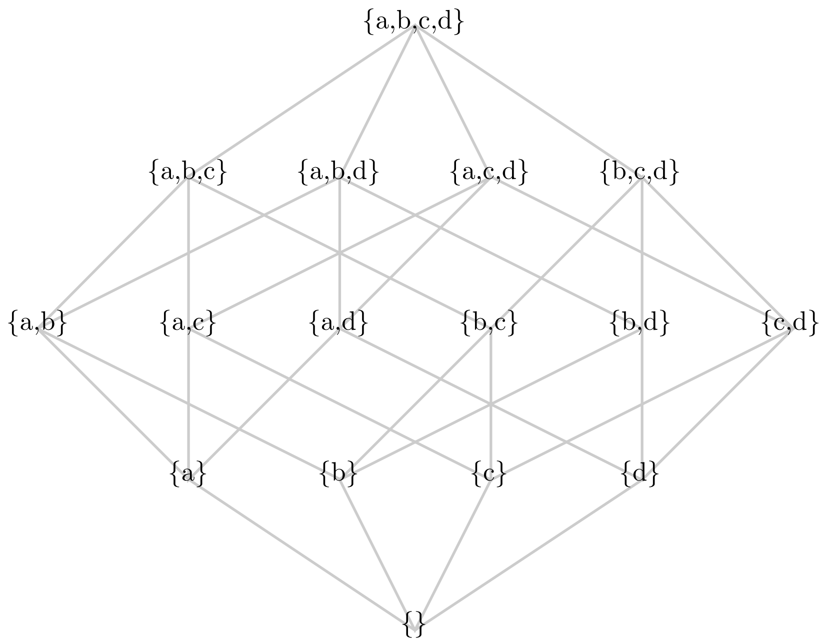


Figure 1.8: The lattice of subsets of a four element set

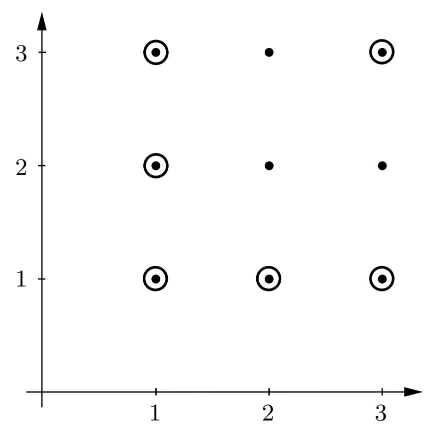


Figure 1.9: A lattice which is not a sublattice

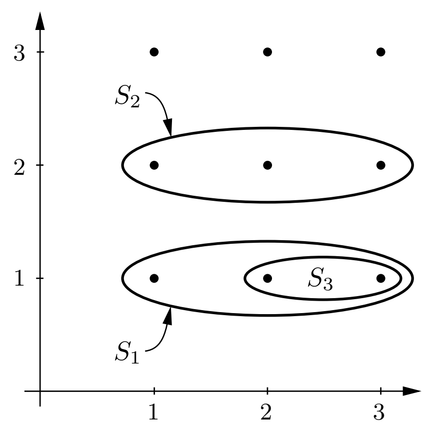


Figure 1.10: The strong set order

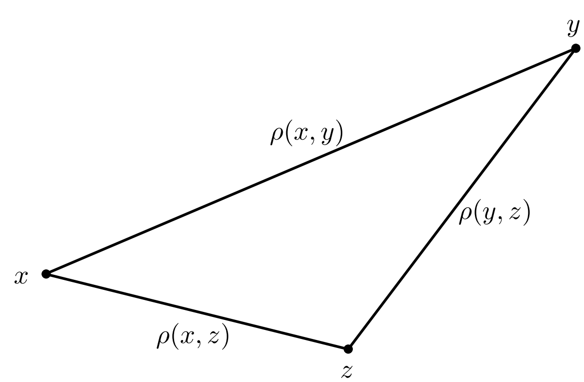


Figure 1.11: The triangle inequality

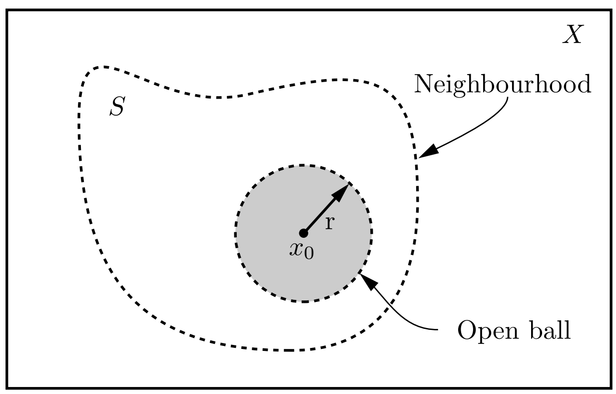


Figure 1.12: An open ball and its neighborhood

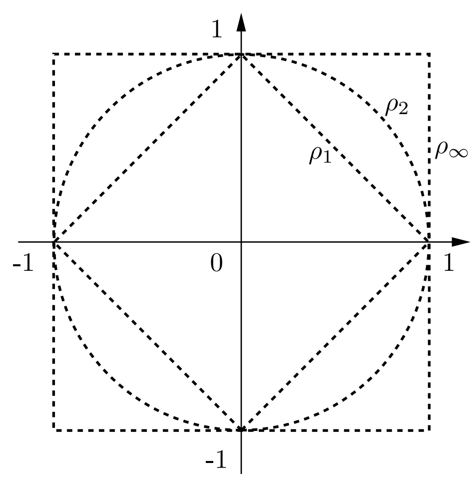


Figure 1.13: Unit balls in $\Re^2$

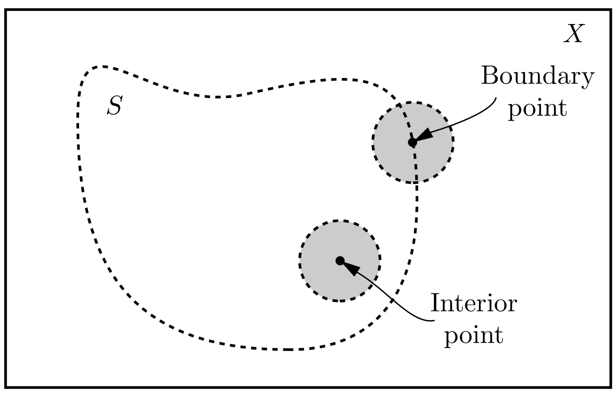


Figure 1.14: Interior and boundary points

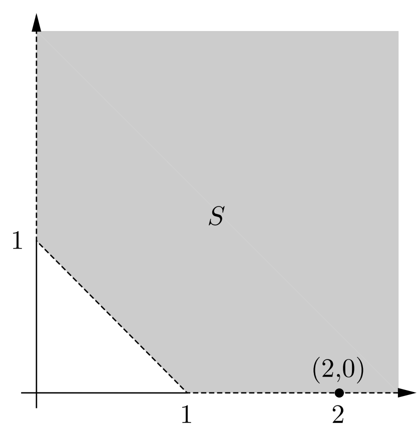


Figure 1.15: The relative topology of the consumption set

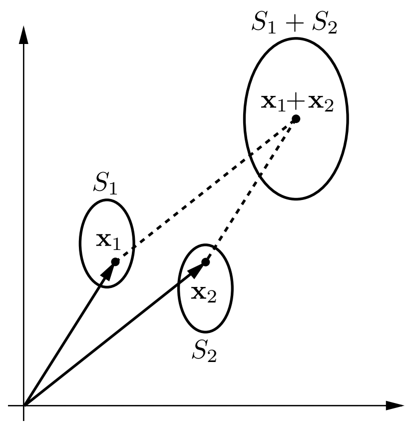


Figure 1.16: The sum of two sets

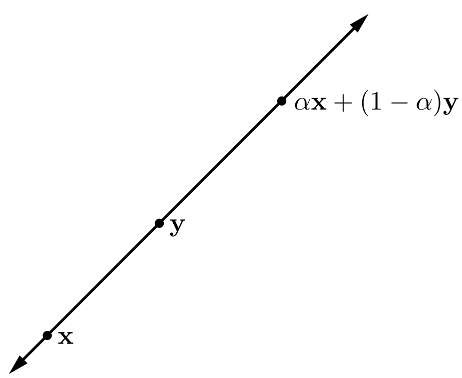


Figure 1.17: The line through $\mathbf{x}$ and $\mathbf{y}$

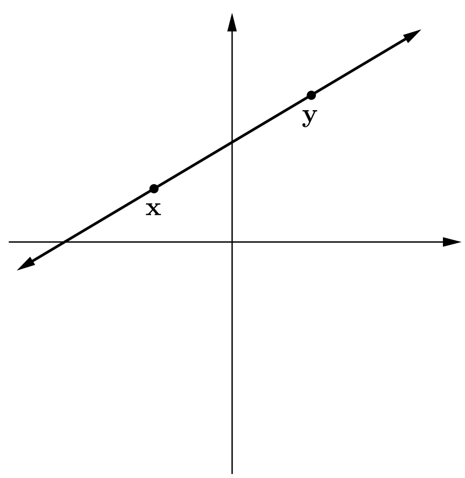


Figure 1.18: An affine set in the plane

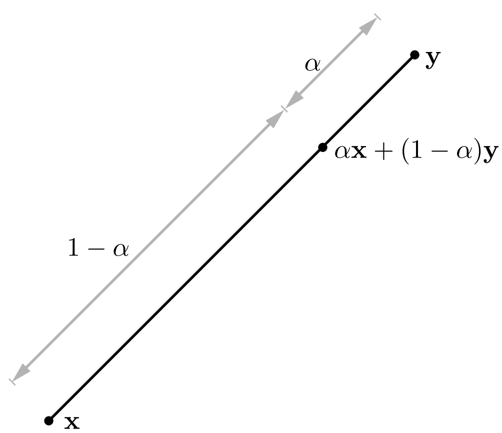


Figure 1.19: The line joining two points

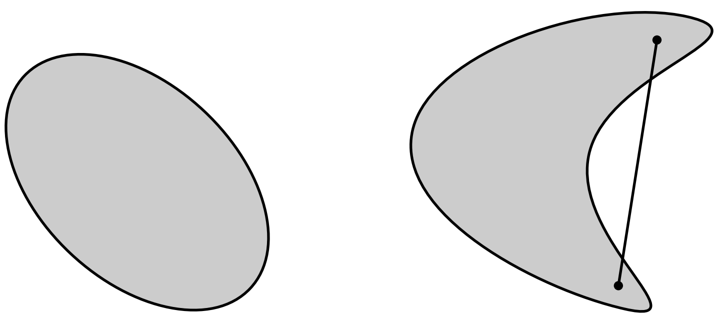


Figure 1.20: Convex and nonconvex sets

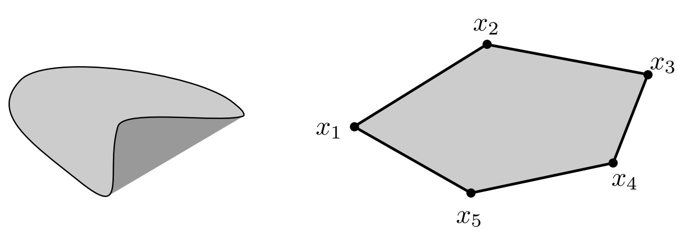


Figure 1.21: Two convex hulls

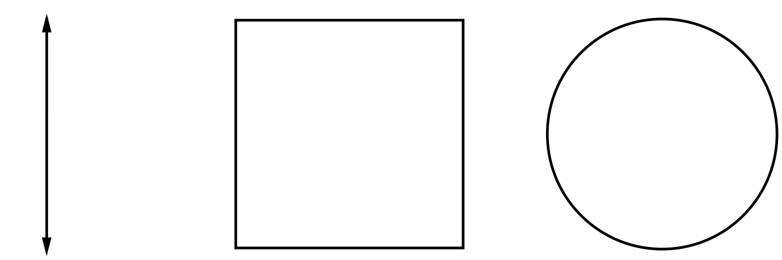


Figure 1.22: Sets with and without extreme points

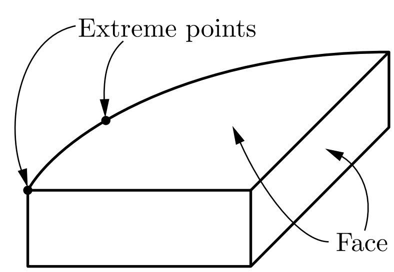


Figure 1.23: Faces and extreme points

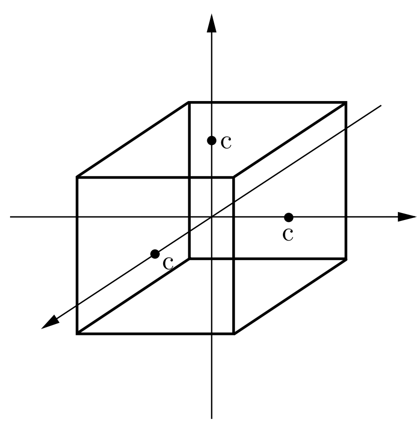


Figure 1.24: A three dimensional cube.

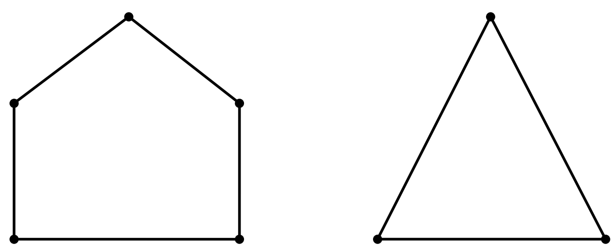


Figure 1.25: A polytope and a simplex

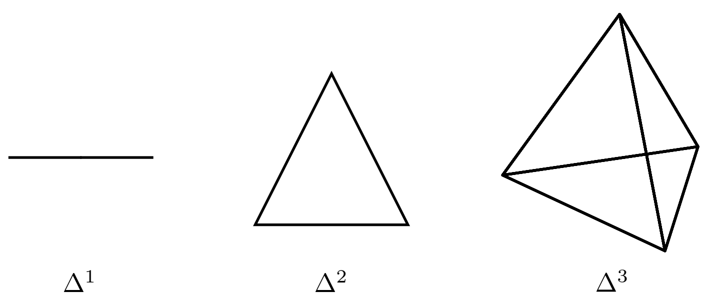


Figure 1.26: Some simplices

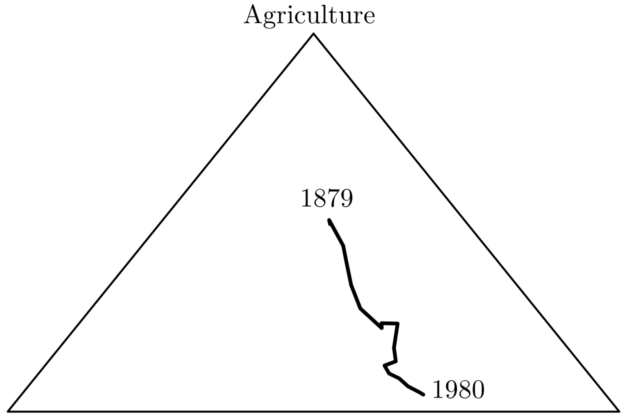


Figure 1.27: Illustrating the changing sectoral distribution of employment in the US

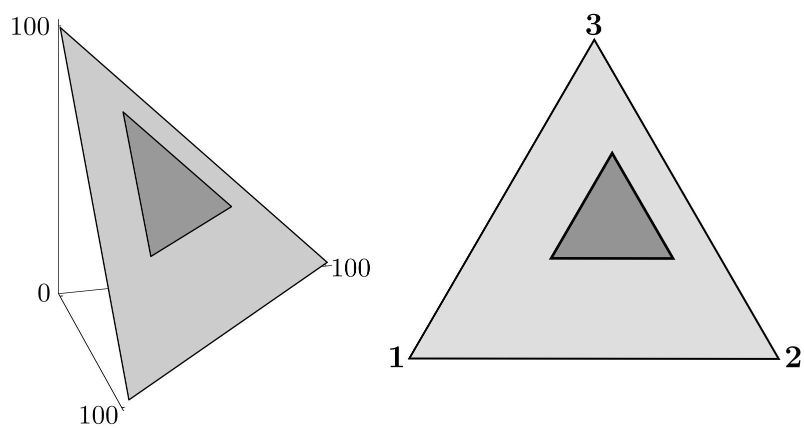


Figure 1.28: Outcomes in a three player cooperative game

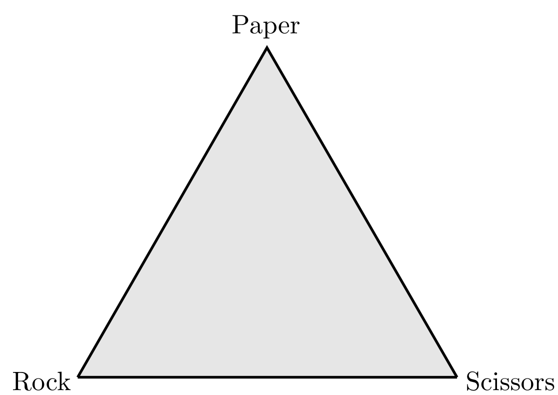


Figure 1.29: Mixed strategies in Rock-Scissors-Paper

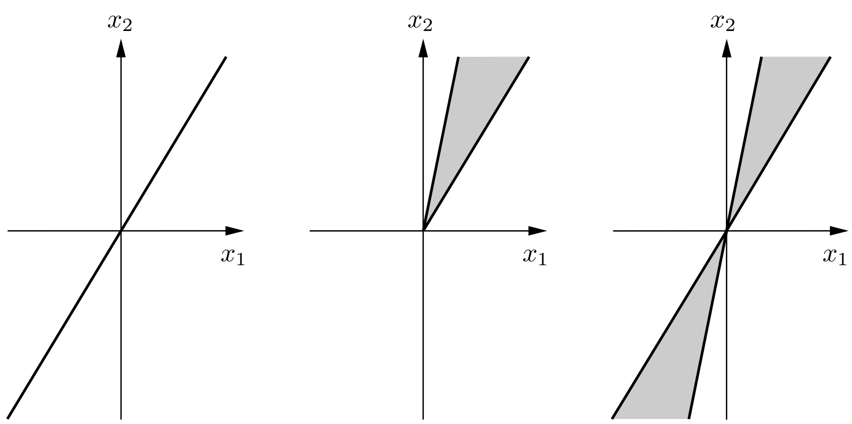


Figure 1.30: Some cones in $\Re^2$

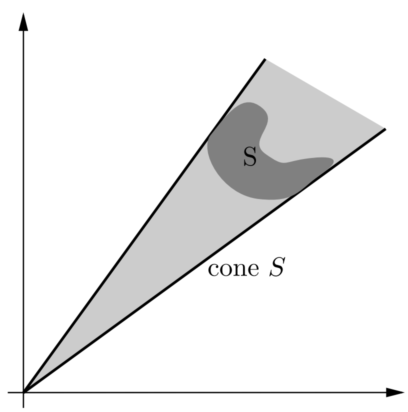


Figure 1.31: The conic hull of S

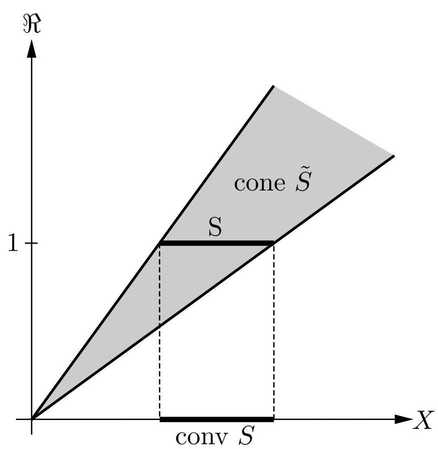


Figure 1.32: Caratheodory's theorem for cones

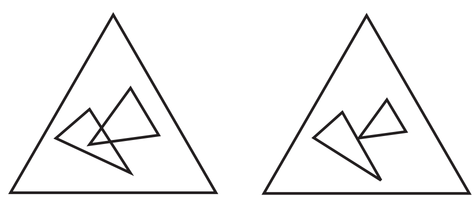


Figure 1.33: Invalid intersections of subsimplices

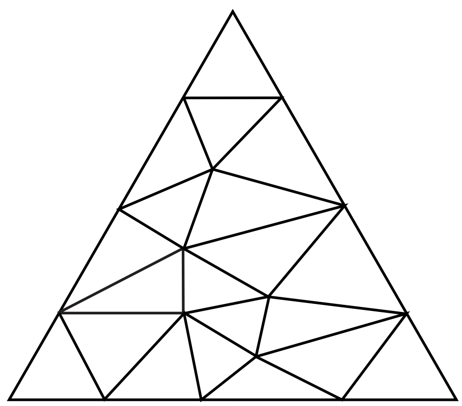


Figure 1.34: A simplicial partition

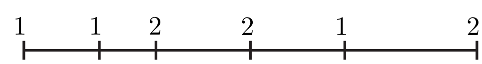


Figure 1.35: An admissibly labeled partition of a one dimensional simplex

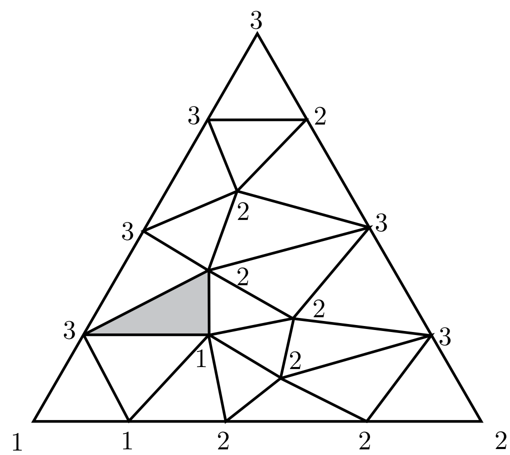


Figure 1.36: An admissibly labeled simplicial partition

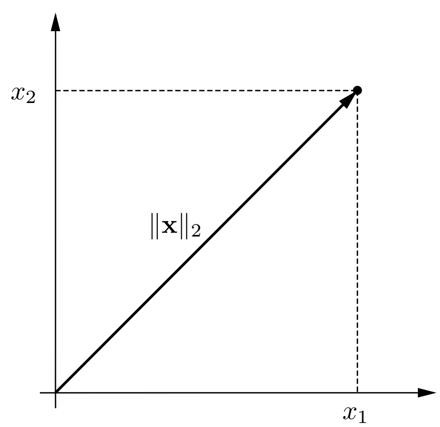


Figure 1.37: The theorem of Pythagorus

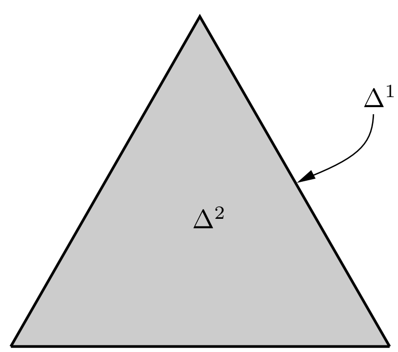


Figure 1.38: The relative interiors of Δ^1 and Δ^2

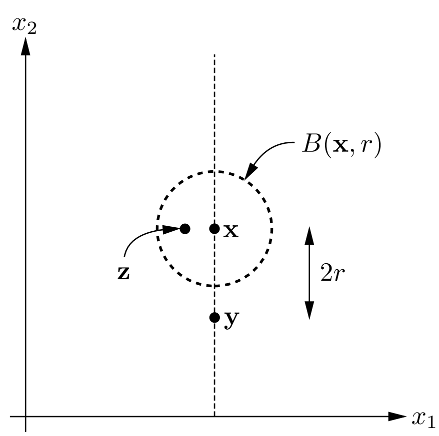


Figure 1.39: Lexicographic preferences are not continuous

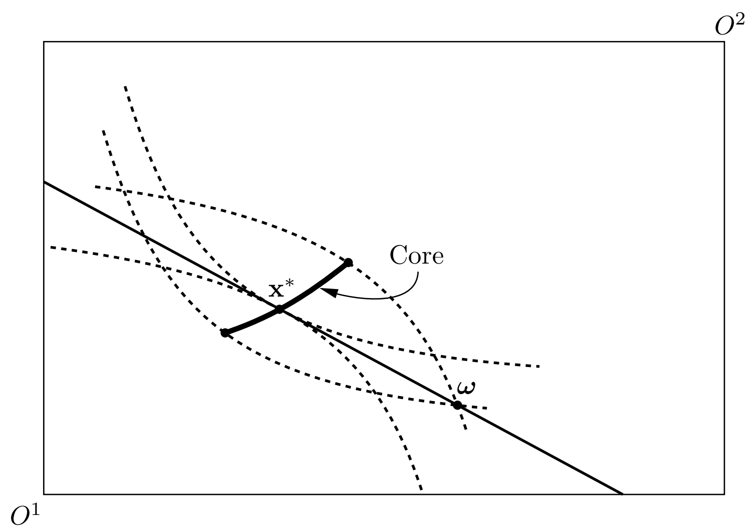


Figure 1.40: An Edgeworth box, illustrating an exchange economy with two traders and two goods

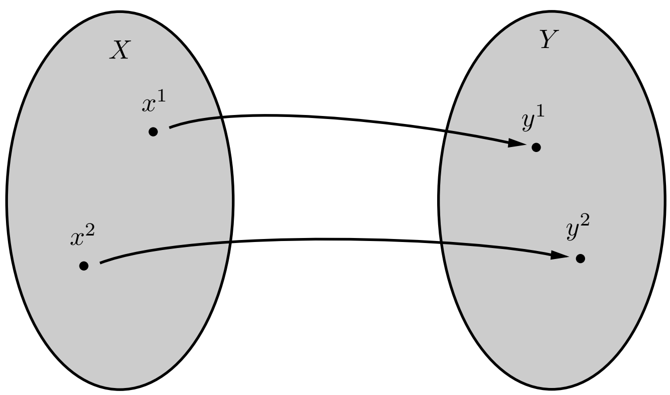


Figure 2.1: A function mapping X to Y

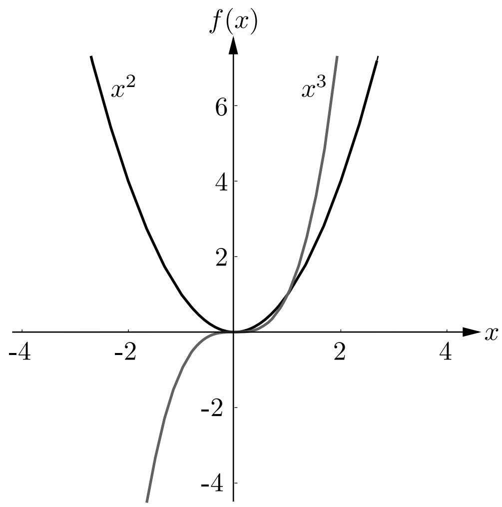


Figure 2.2: The functions $f(x) = x^2$ and $f(x) = x^3$

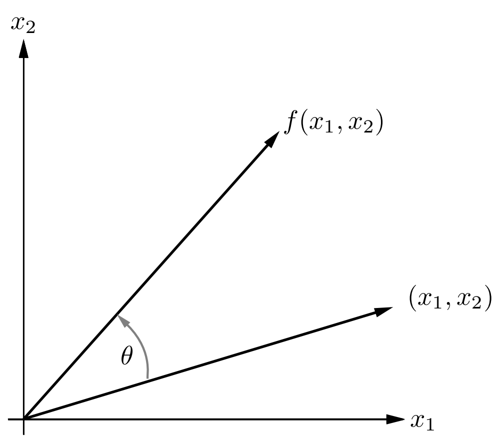


Figure 2.3: Rotation of a vector

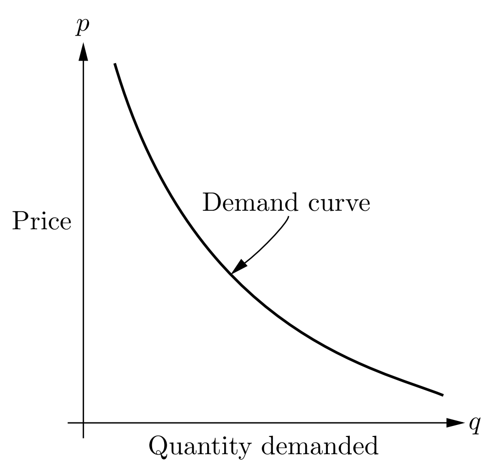


Figure 2.4: A downward sloping demand function

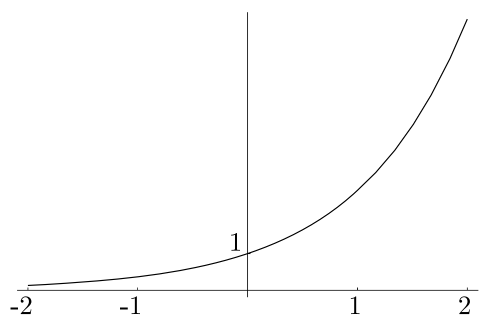


Figure 2.5: The exponential function

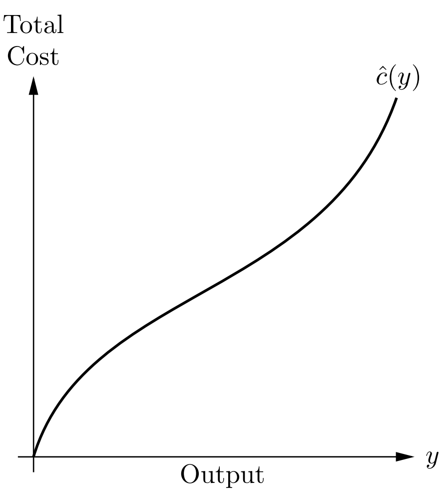


Figure 2.6: A total cost function

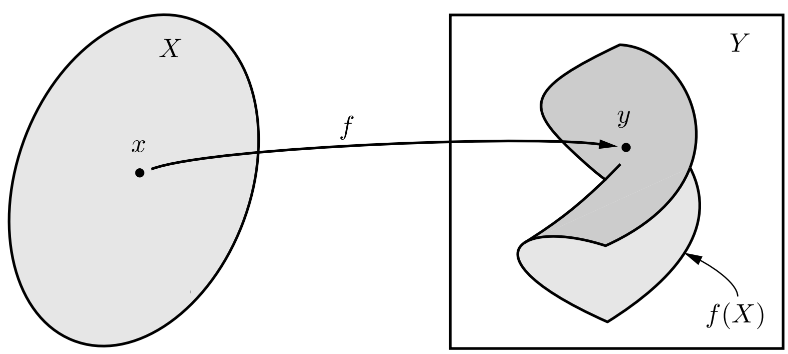


Figure 2.7: Illustrating a function from $\Re^n \to \Re^m$

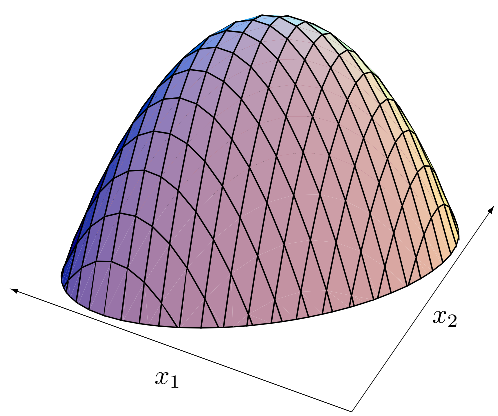


Figure 2.8: A function from $\Re^2 \to \Re$

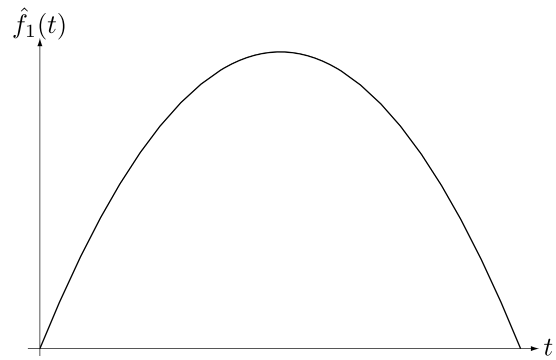


Figure 2.9: A vertical cross section of Figure 2.8

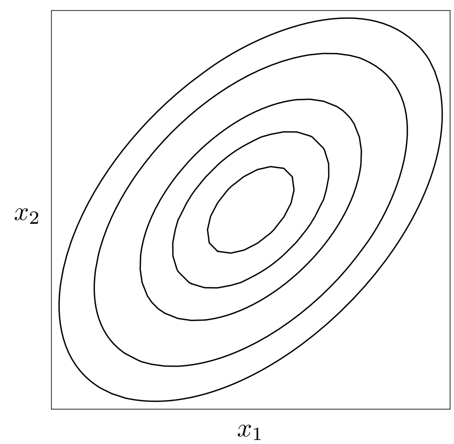


Figure 2.10: Horizontal cross-sections (contours) of Figure 2.8

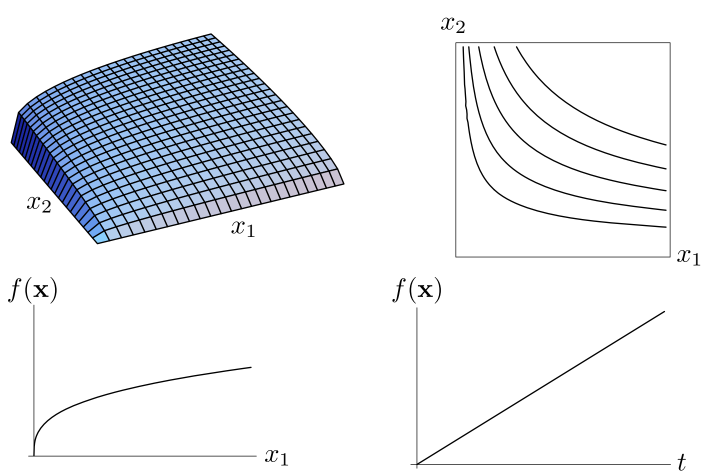


Figure 2.11: A Cobb-Douglas function and three useful cross-sections

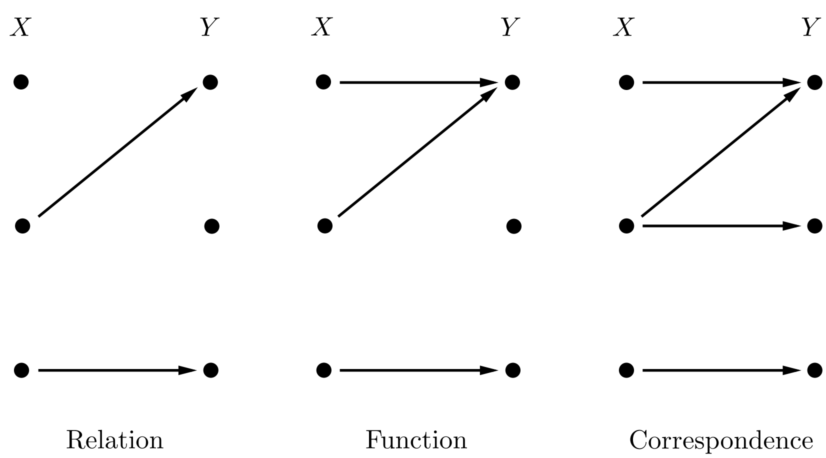


Figure 2.12: Comparing a relation, a correspondence and a function

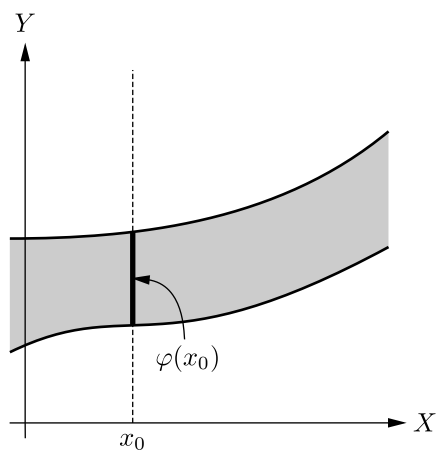


Figure 2.13: The graph of a correspondence

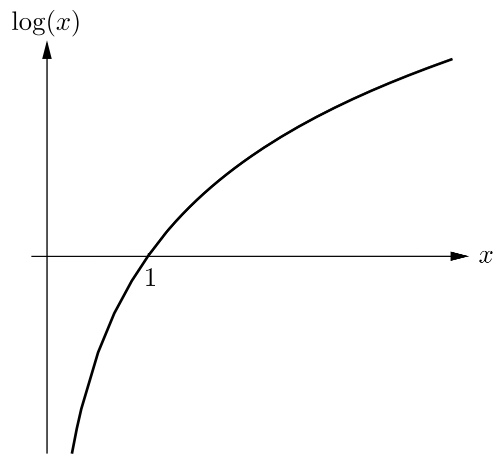


Figure 2.14: The log function

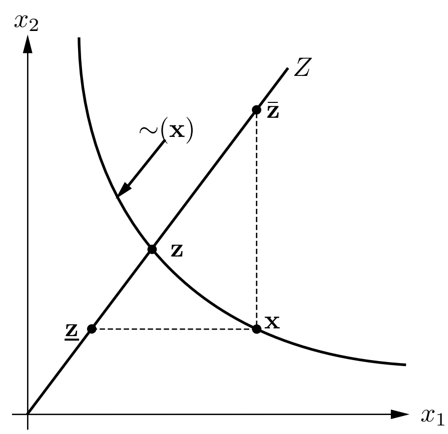


Figure 2.15: Constructive proof of the existence of a utility function

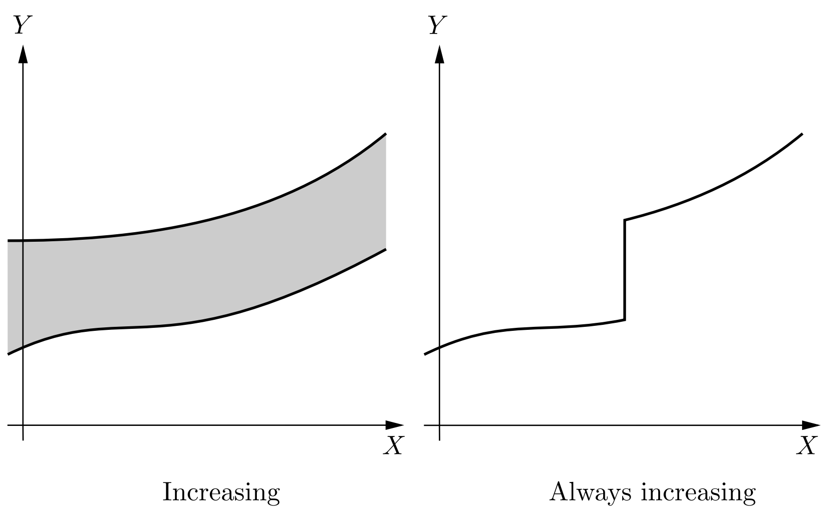


Figure 2.16: Monotone correspondences

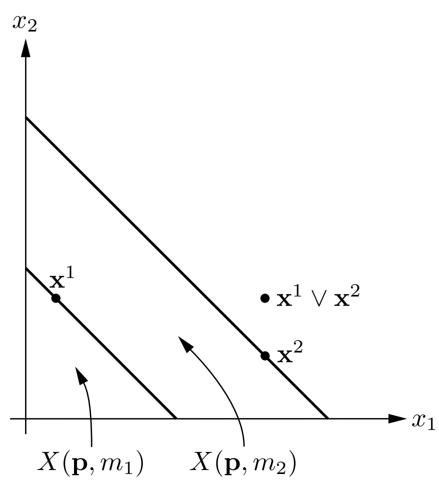


Figure 2.17: The budget correspondence is not monotone

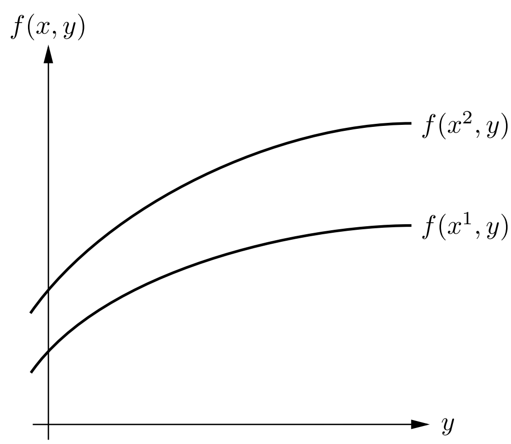


Figure 2.18: A supermodular function displays increasing differences

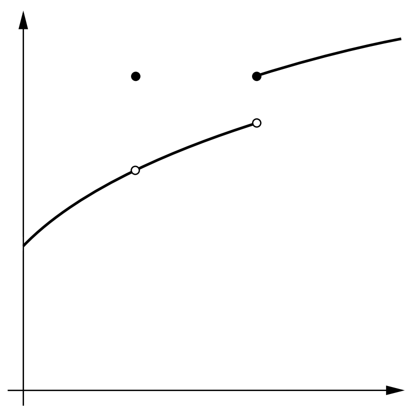


Figure 2.19: An upper semicontinuous function

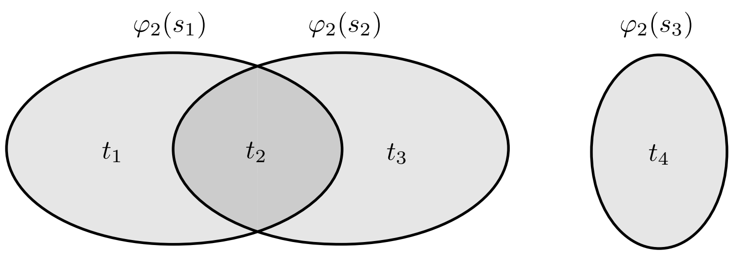


Figure 2.20: The best response correspondence of Player 2

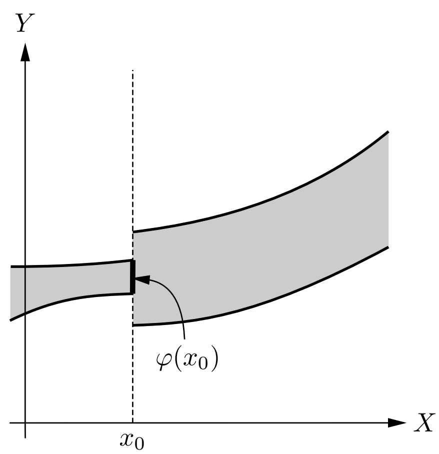


Figure 2.21: φ is not uhc at x_0

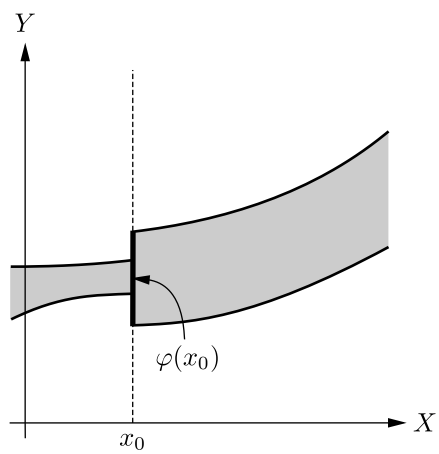


Figure 2.22: φ is not lhc at x_0

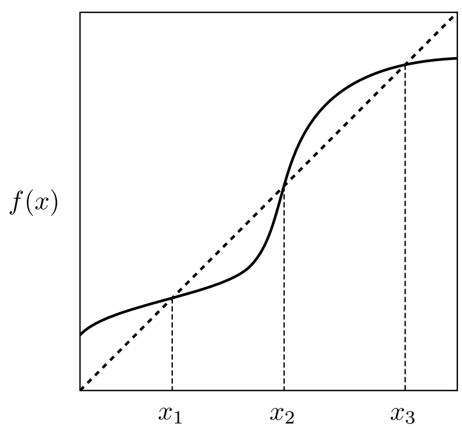


Figure 2.23: A function with three fixed points

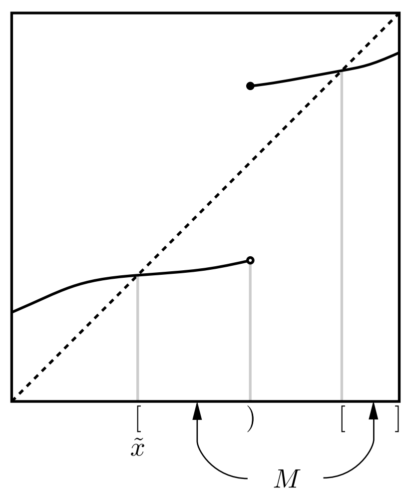


Figure 2.24: Illustrating the proof of the Tarksi theorem.

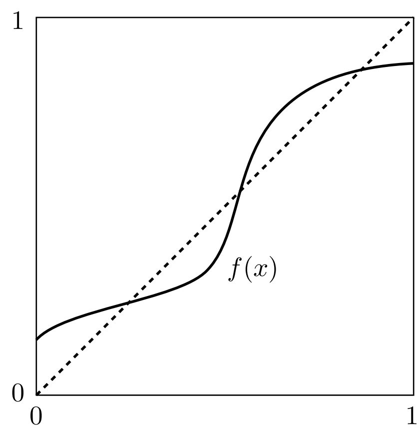


Figure 2.25: Brouwer's theorem in $\Re$

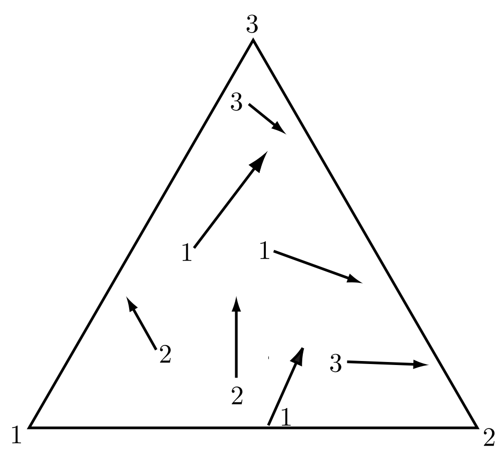


Figure 2.26: Illustrating an operator on the 2-dimensional simplex

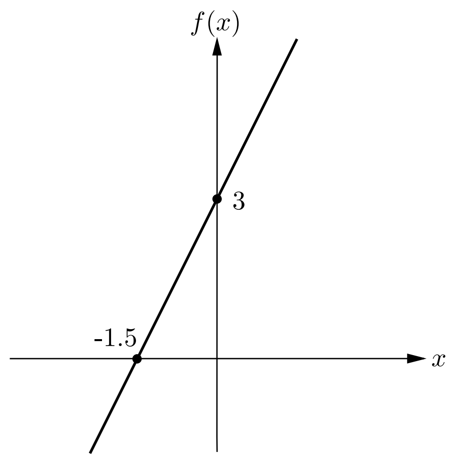


Figure 3.1: The graph of the affine function $f(x) = 2x + 3$

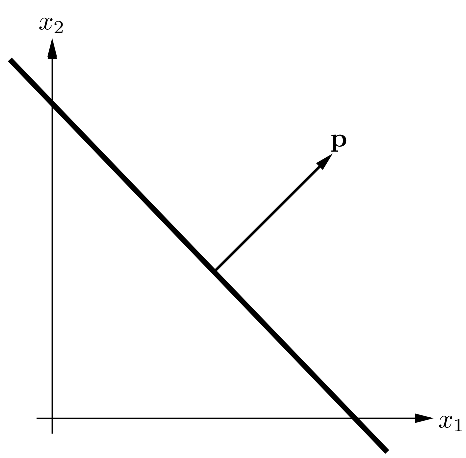


Figure 3.2: A hyperplane in $\Re^2$

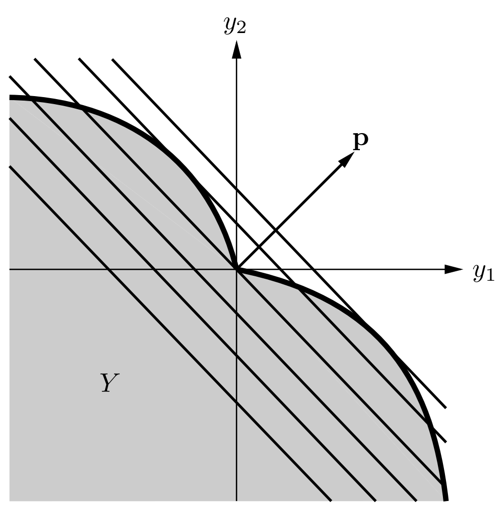


Figure 3.3: Isoprofit lines

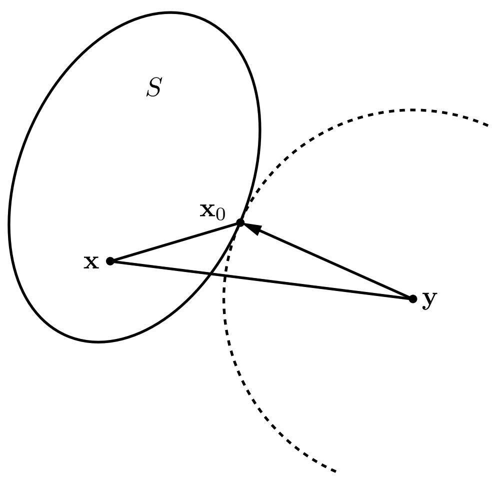


Figure 3.4: Minimum distance to a closed convex set

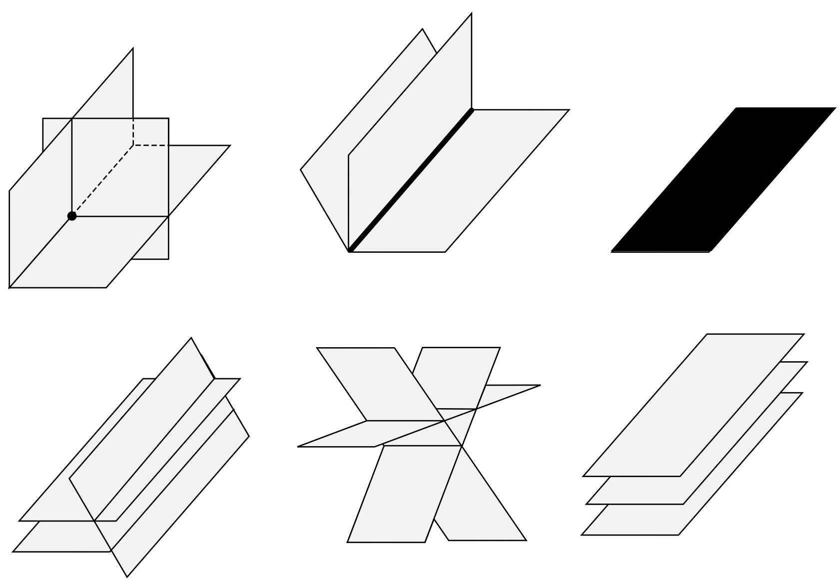


Figure 3.5: The solutions of three equations in three unknowns

Figure from *Foundations of Mathematical Economics*

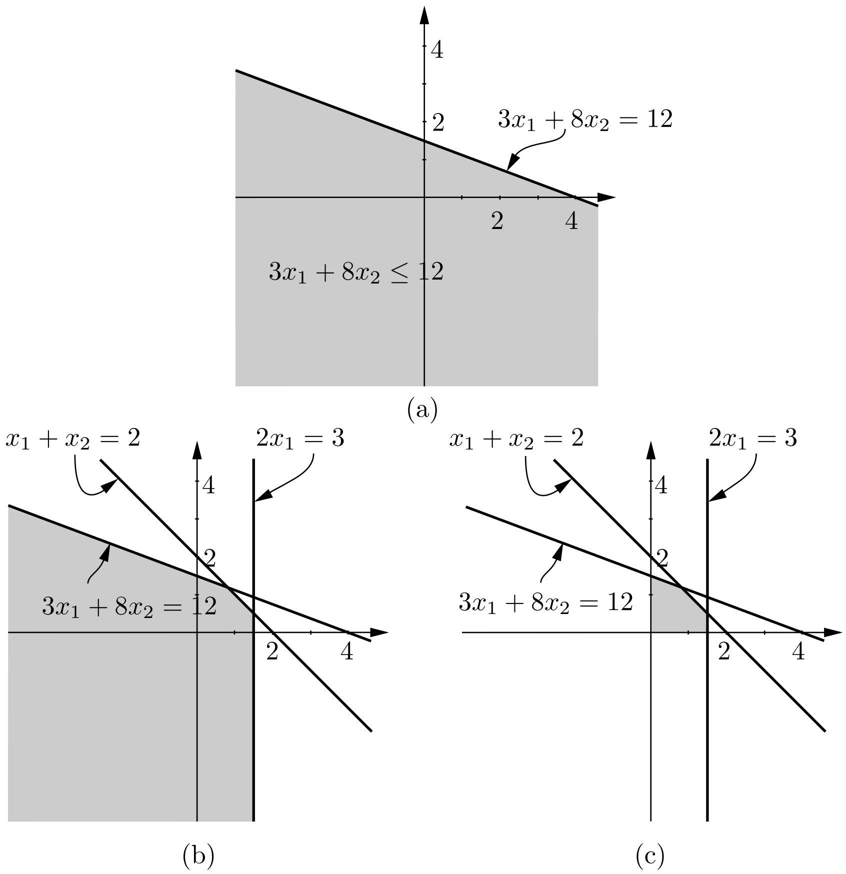


Figure 3.6: Systems of inequalities

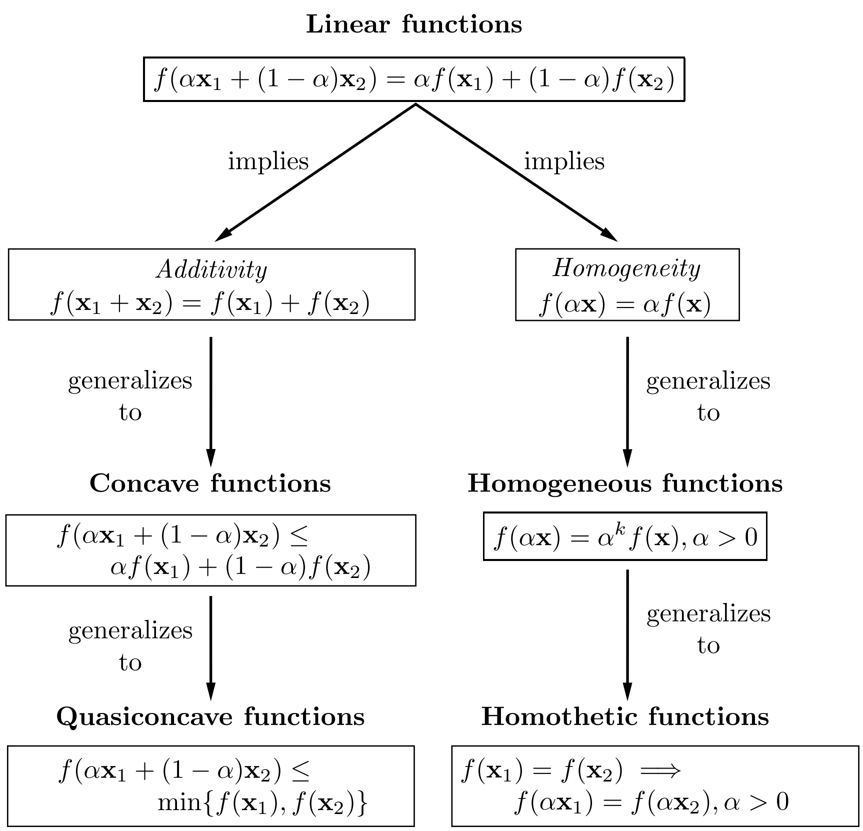


Figure 3.7: Generalizing linear functions

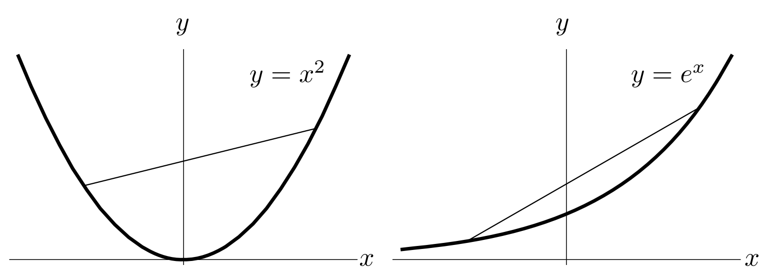


Figure 3.8: Two examples of convex functions

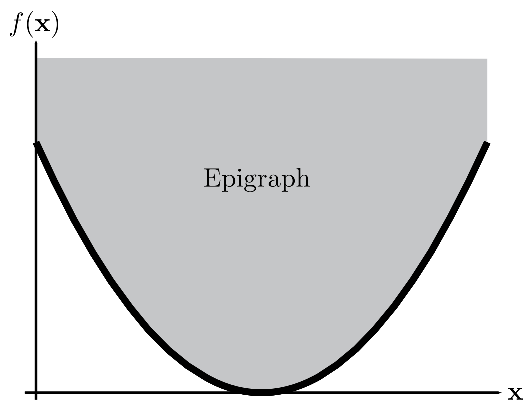


Figure 3.9: The epigraph of a convex function is a convex set

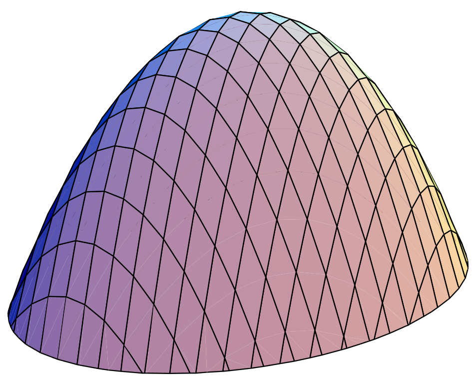


Figure 3.10: A concave function

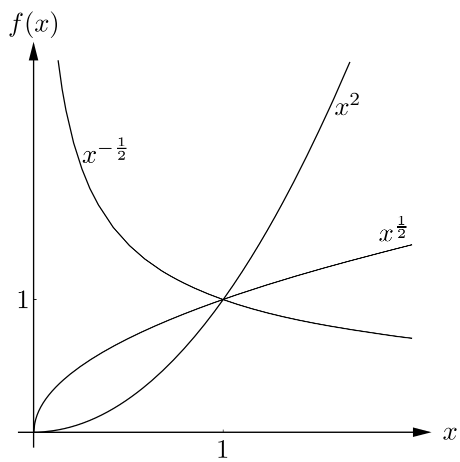


Figure 3.11: The power function x^a for different values of a

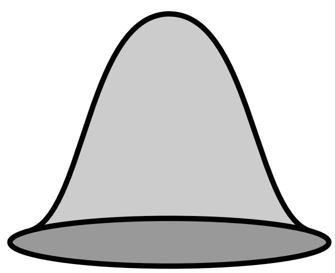


Figure 3.12: A bell

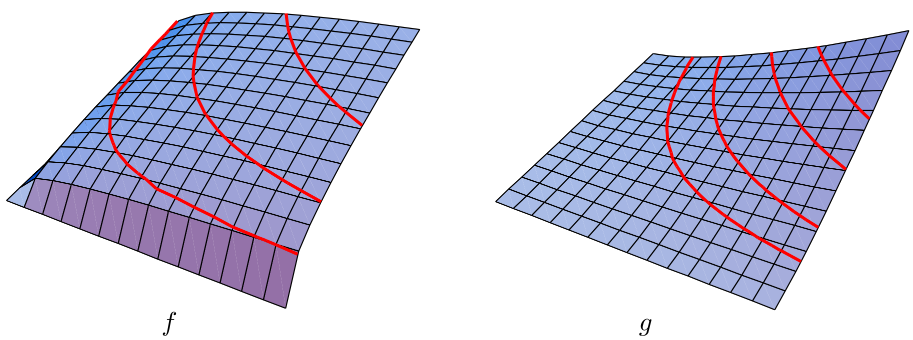


Figure 3.13: The Cobb-Douglas function is quasiconcave

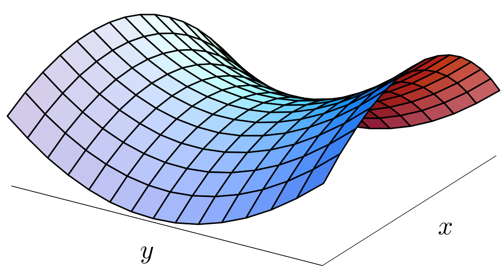


Figure 3.14: A saddle point

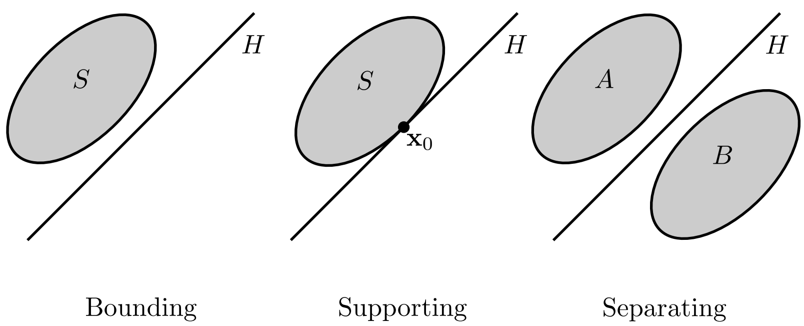


Figure 3.15: Bounding, separating and supporting hyperplanes

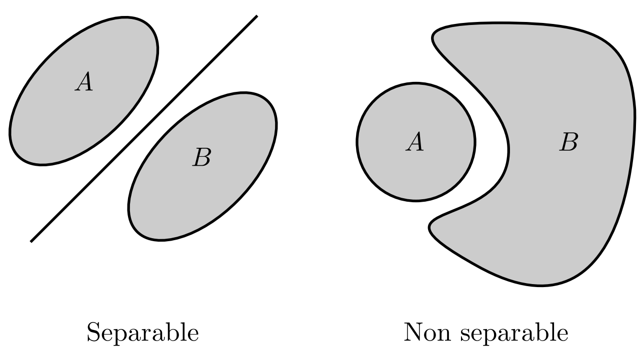


Figure 3.16: Convexity is the fundamental requirement for separation

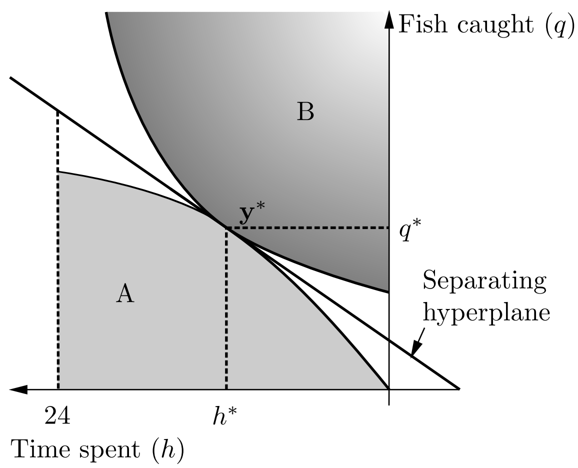


Figure 3.17: Robinson's choice of lifestyle

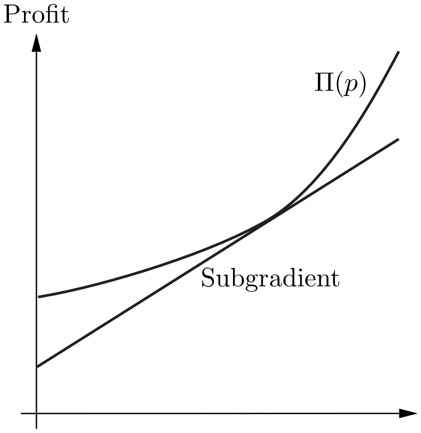


Figure 3.18: A subgradient of the profit function

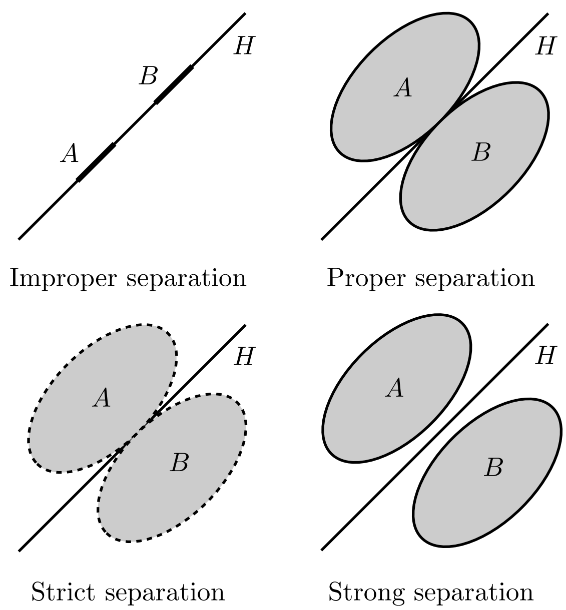


Figure 3.19: Various forms of separation

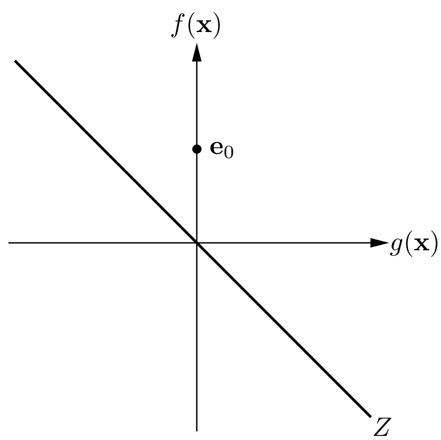


Figure 3.20: The Fredholm alternative via separation

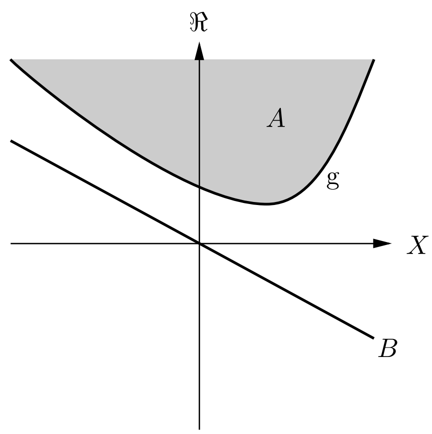


Figure 3.21: Deriving the Hahn-Banach theorem

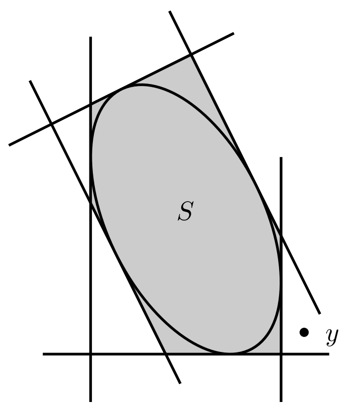


Figure 3.22: Minkowski's theorem

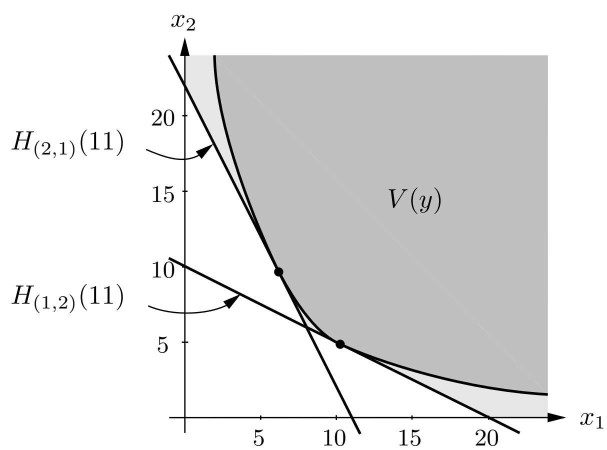


Figure 3.23: Recovering the technology from the cost function

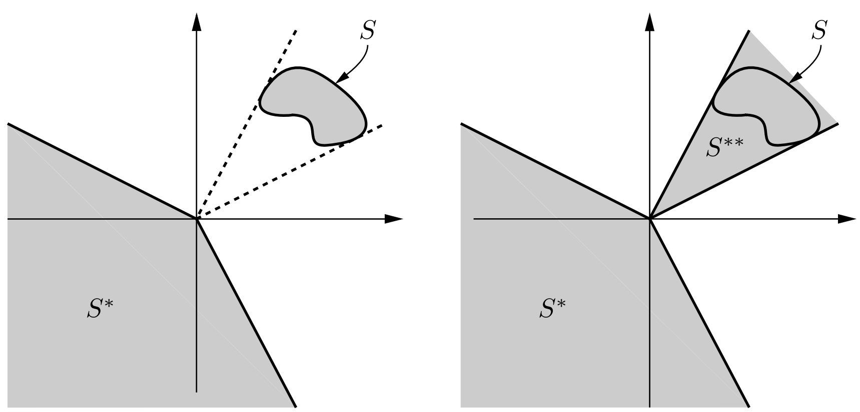


Figure 3.24: Polar cones in $\Re^2$

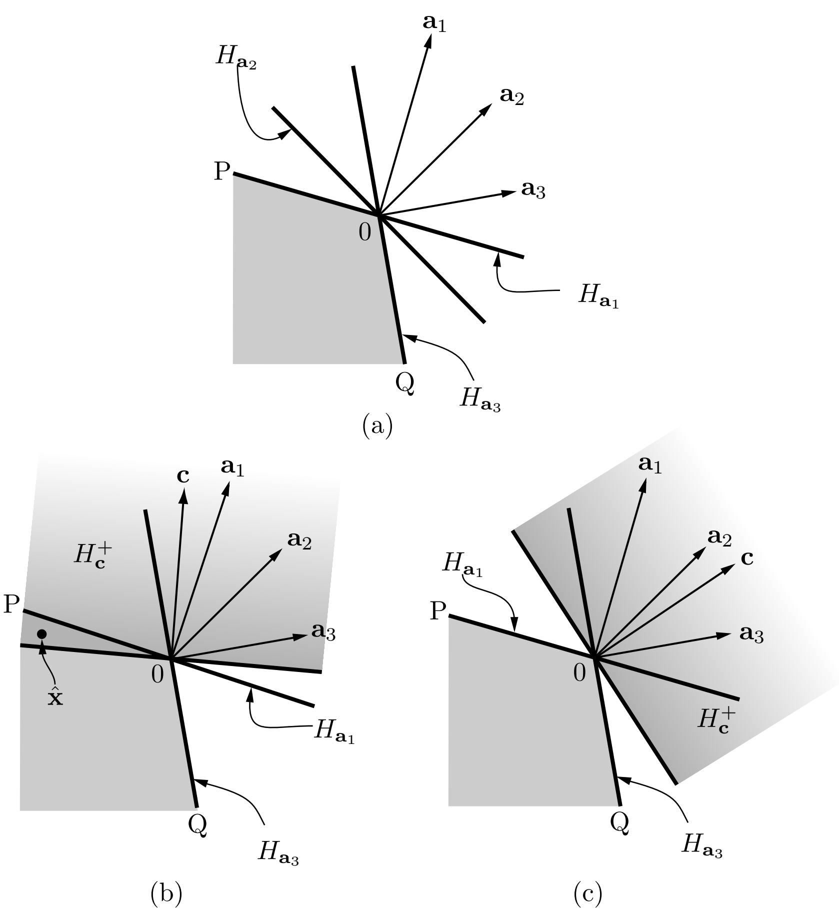
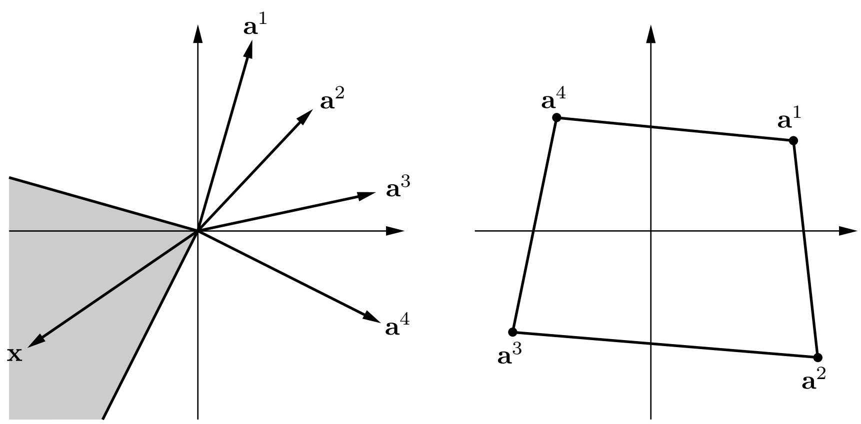


Figure 3.25: The Farkas lemma



(a) (b)

Figure 3.26: Gordan's Theorem

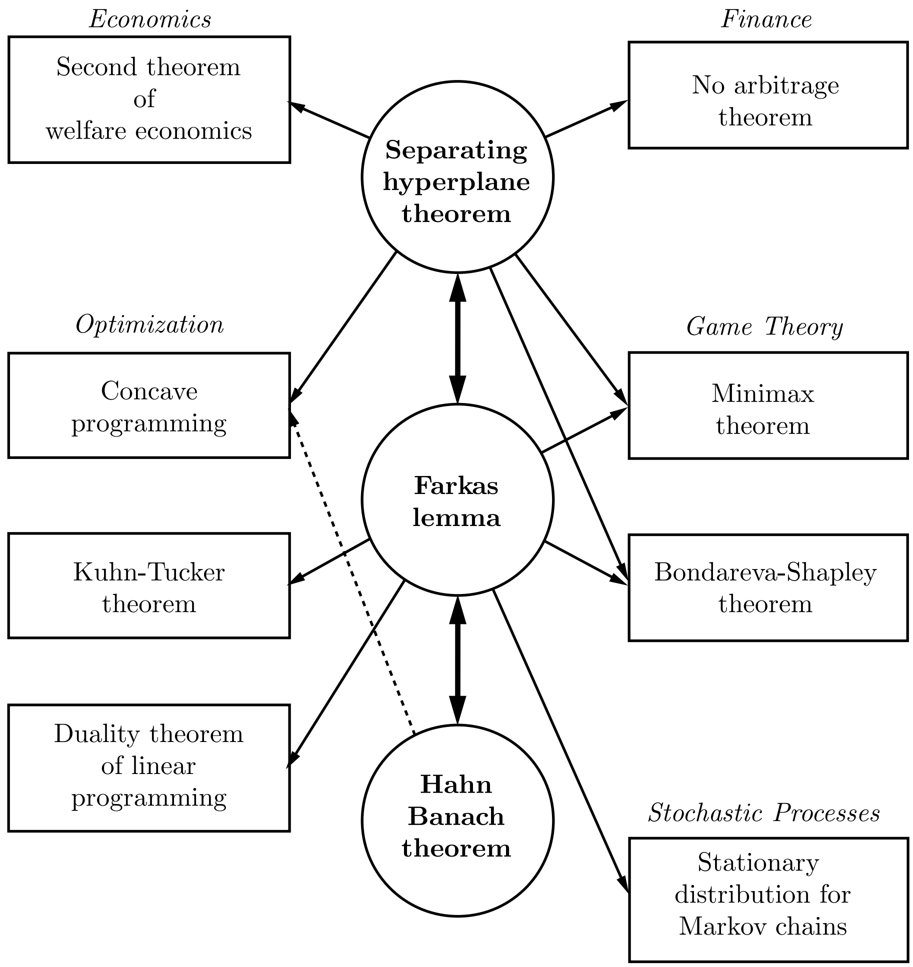


Figure 3.27: Applications of the separating hyperplane theorem

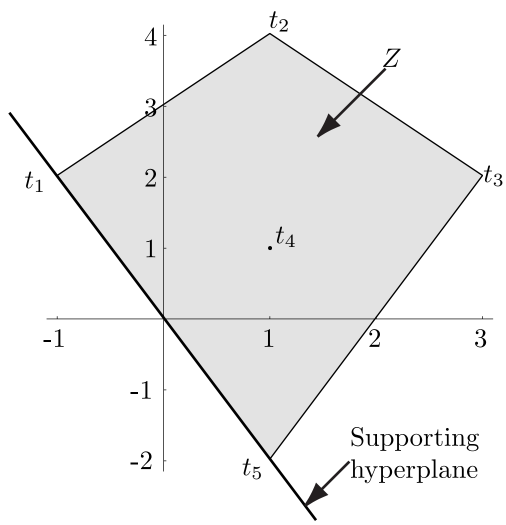


Figure 3.28: The feasible payoffs

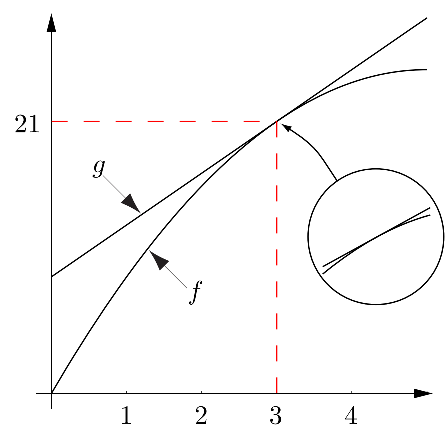


Figure 4.1: The tangency of f and g

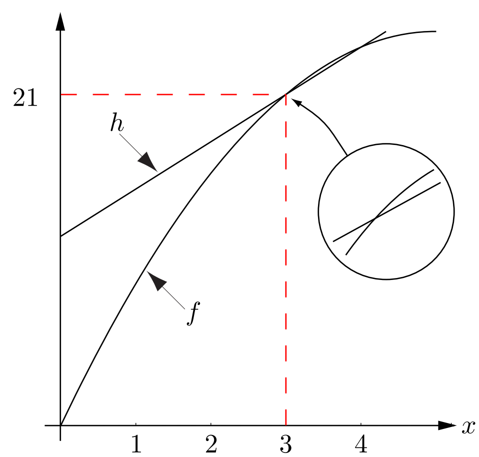


Figure 4.2: f and h are not tangential

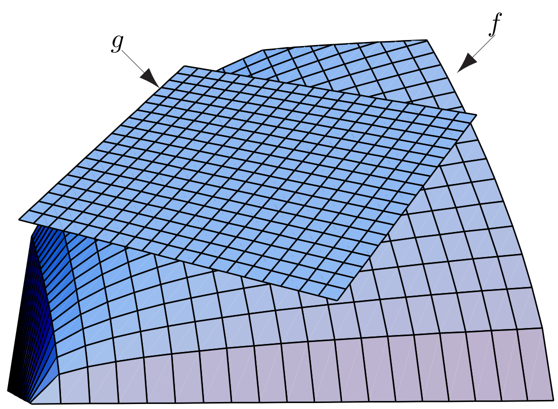


Figure 4.3: The tangency of f and g

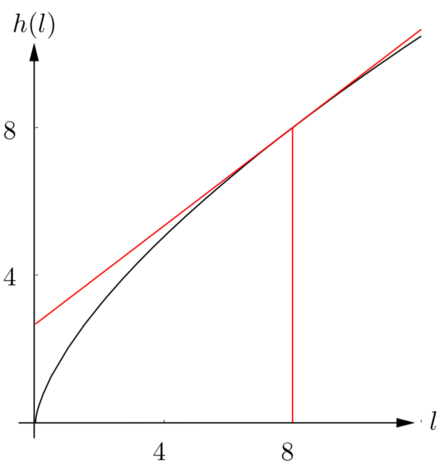


Figure 4.4: The restricted production function

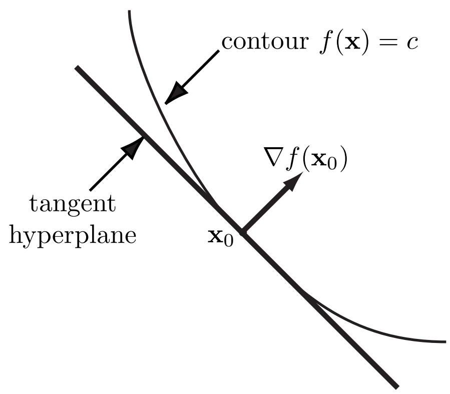


Figure 4.5: A contour and its tangent hyperplane

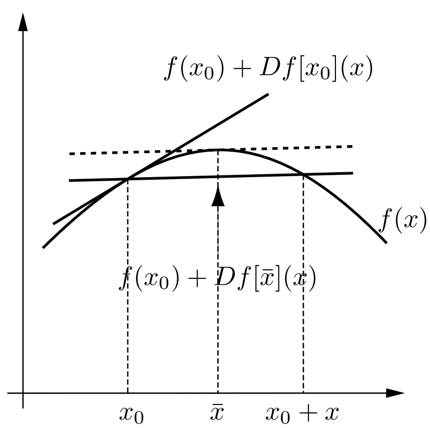


Figure 4.6: Illustrating the mean value theorem

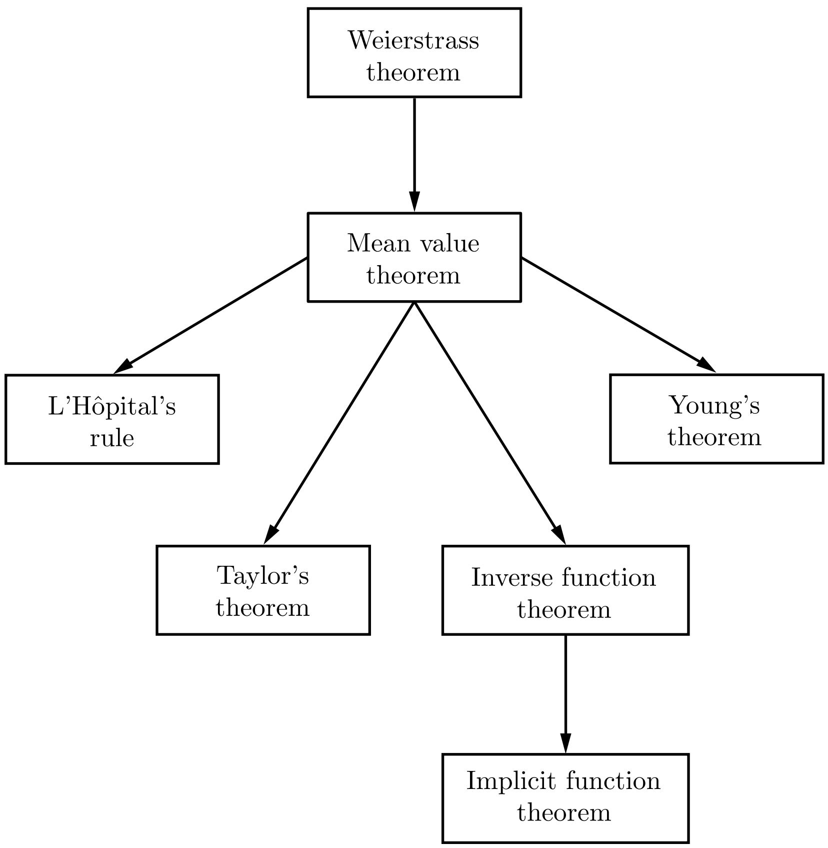


Figure 4.7: Theorems for smooth functions

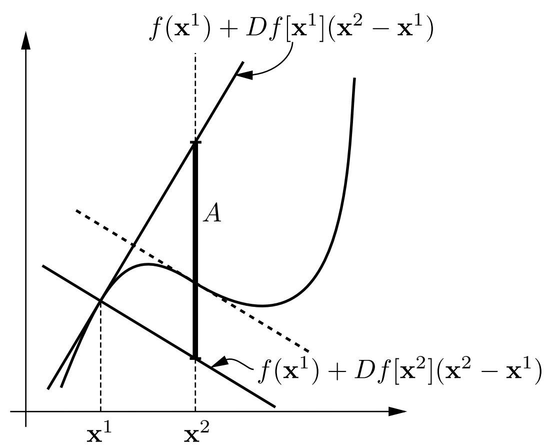


Figure 4.8: The mean value inclusion theorem

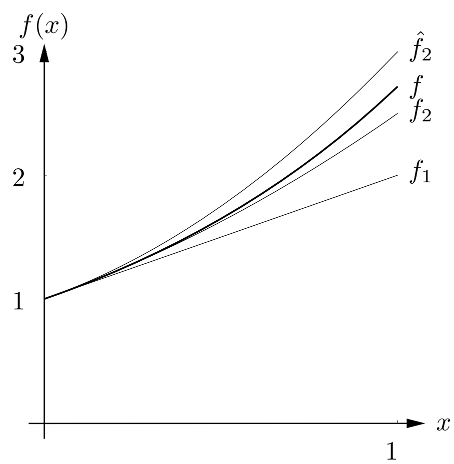


Figure 4.9: Approximating the exponential function

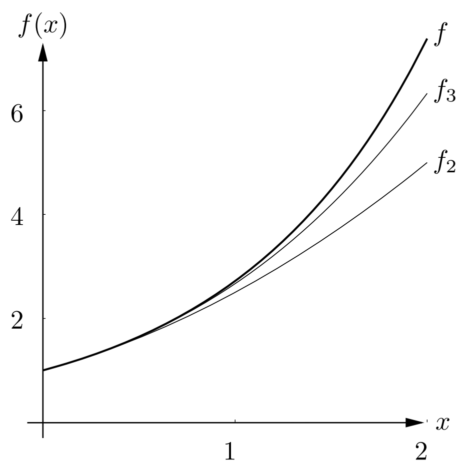


Figure 4.10: Adding another term extends the range of useful approximation

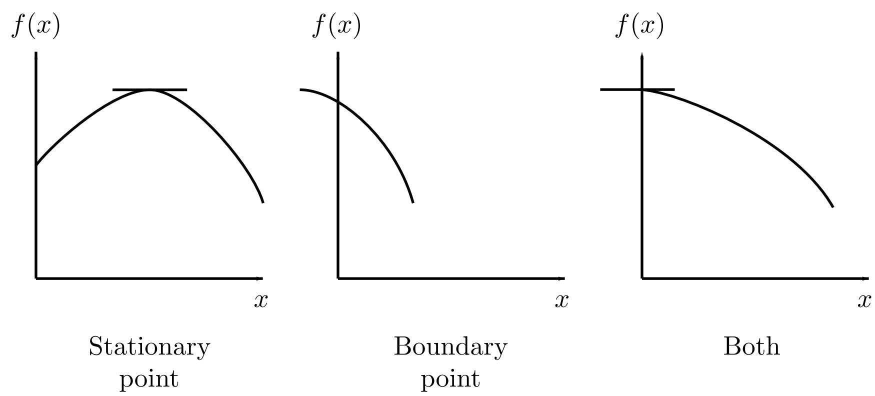


Figure 5.1: A maximum must be either a stationary point or a boundary point or both

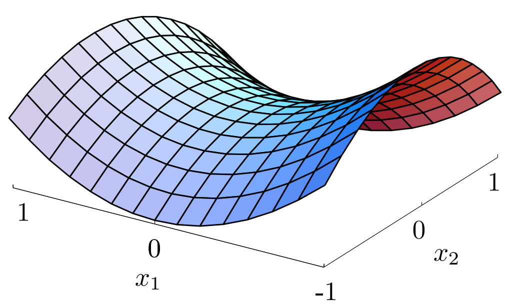


Figure 5.2: A saddle point

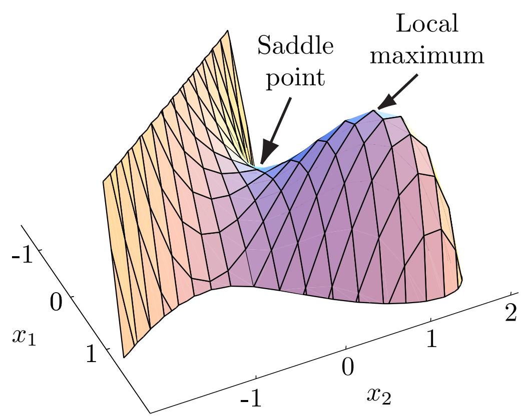


Figure 5.3: A local maximum which is not a global maximum

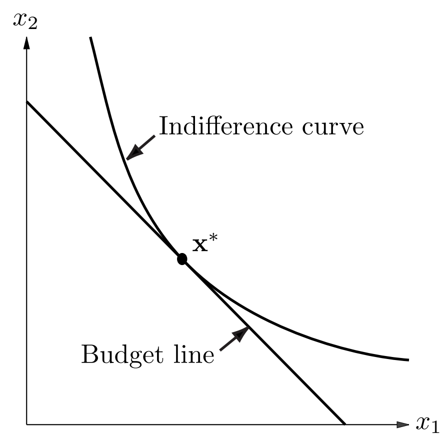


Figure 5.4: Optimum consumption occurs where the indifference curve is tangential to the budget line

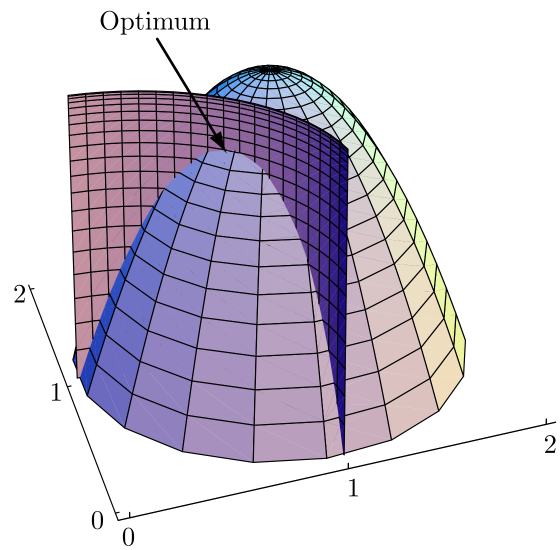


Figure 5.5: The optimum is the highest point which is common to the objective surface and the constraint

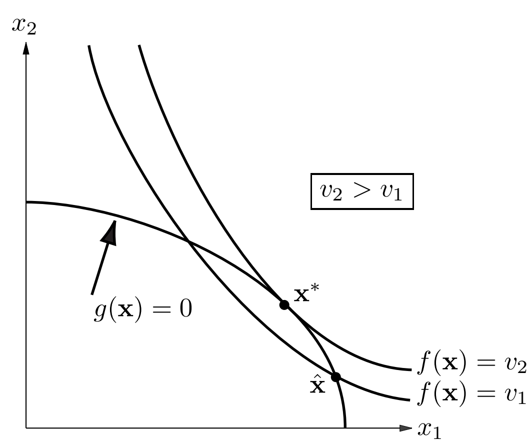


Figure 5.6: Tangency between the constraint and the objective function

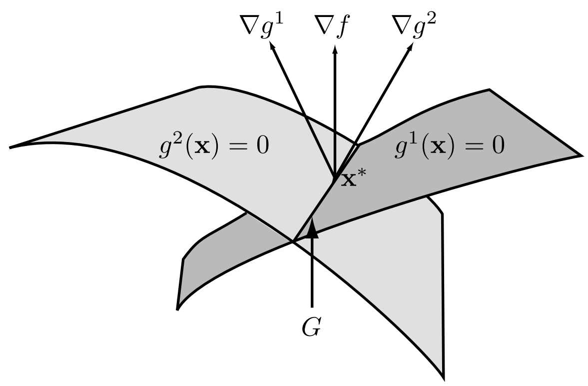


Figure 5.7: A problem with two constraints

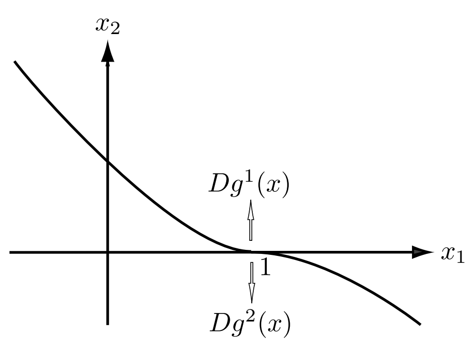


Figure 5.8: Kuhn and Tucker's example

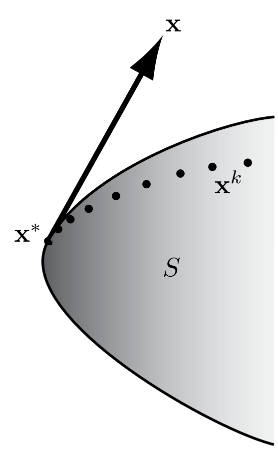


Figure 5.9: $\mathbf{x}^k$ converges to $\mathbf{x}^*$ from direction $\mathbf{x}$

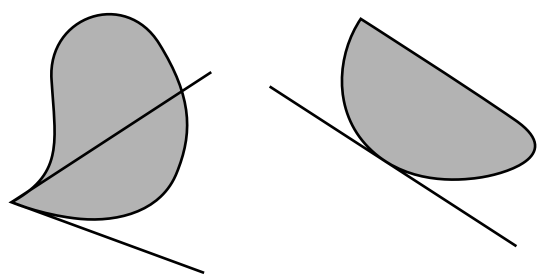


Figure 5.10: Examples of the cone of tangents

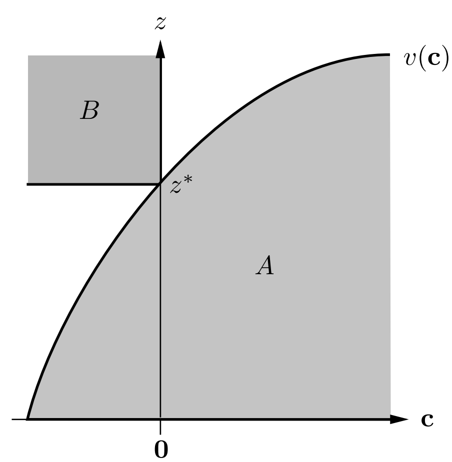


Figure 5.11: Concave programming

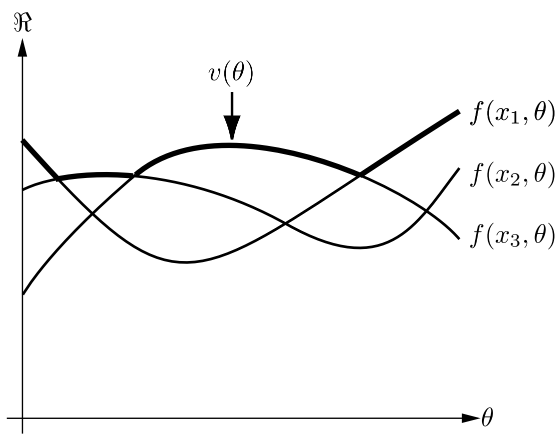


Figure 6.1: The value function is the upper envelope of the objective functions

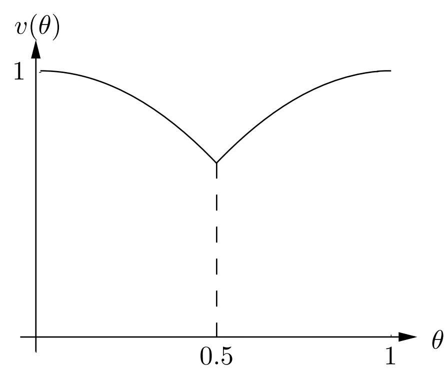


Figure 6.2: The value function is differentiable except at $\theta = 0.5$