Direction Fields

Bernd Schröder

The Idea for Direction Fields

The Idea for Direction Fields

1. The direction field is a visualization of the differential equation $y' = F(x, y)$.

The Idea for Direction Fields

1. The direction field is a visualization of the differential equation $y' = F(x,y)$.
2. At each point (x,y) in the plane, we sketch a line segment with slope $y' = F(x,y)$.

The Idea for Direction Fields

1. The direction field is a visualization of the differential equation $y' = F(x,y)$.
2. At each point (x,y) in the plane, we sketch a line segment with slope $y' = F(x,y)$.
3. Because we cannot sketch a slope at every point, we sketch slopes on a sufficiently fine grid.

The Idea for Direction Fields

1. The direction field is a visualization of the differential equation $y' = F(x,y)$.
2. At each point (x,y) in the plane, we sketch a line segment with slope $y' = F(x,y)$.
3. Because we cannot sketch a slope at every point, we sketch slopes on a sufficiently fine grid.
4. The solutions must fit smoothly into the direction field.

The Idea for Direction Fields

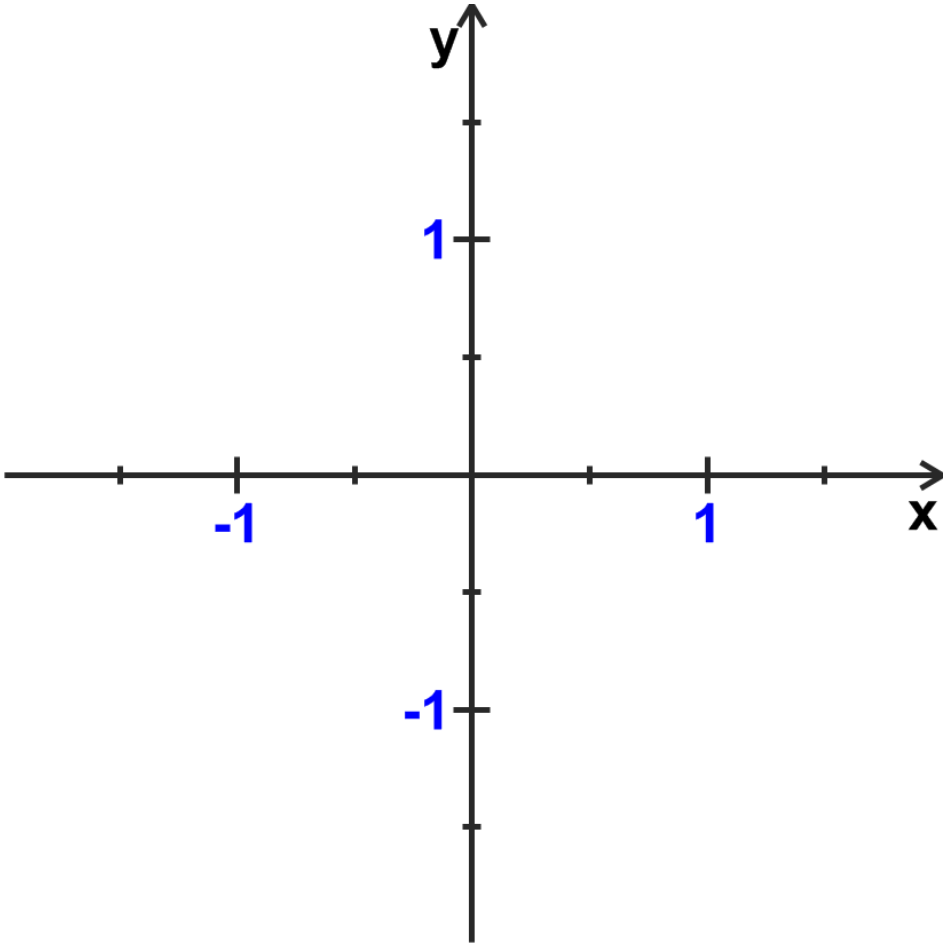
1. The direction field is a visualization of the differential equation $y' = F(x,y)$.
2. At each point (x,y) in the plane, we sketch a line segment with slope $y' = F(x,y)$.
3. Because we cannot sketch a slope at every point, we sketch slopes on a sufficiently fine grid.
4. The solutions must fit smoothly into the direction field.
5. So we can sketch solutions by following the slopes of a direction field.

The Idea for Direction Fields

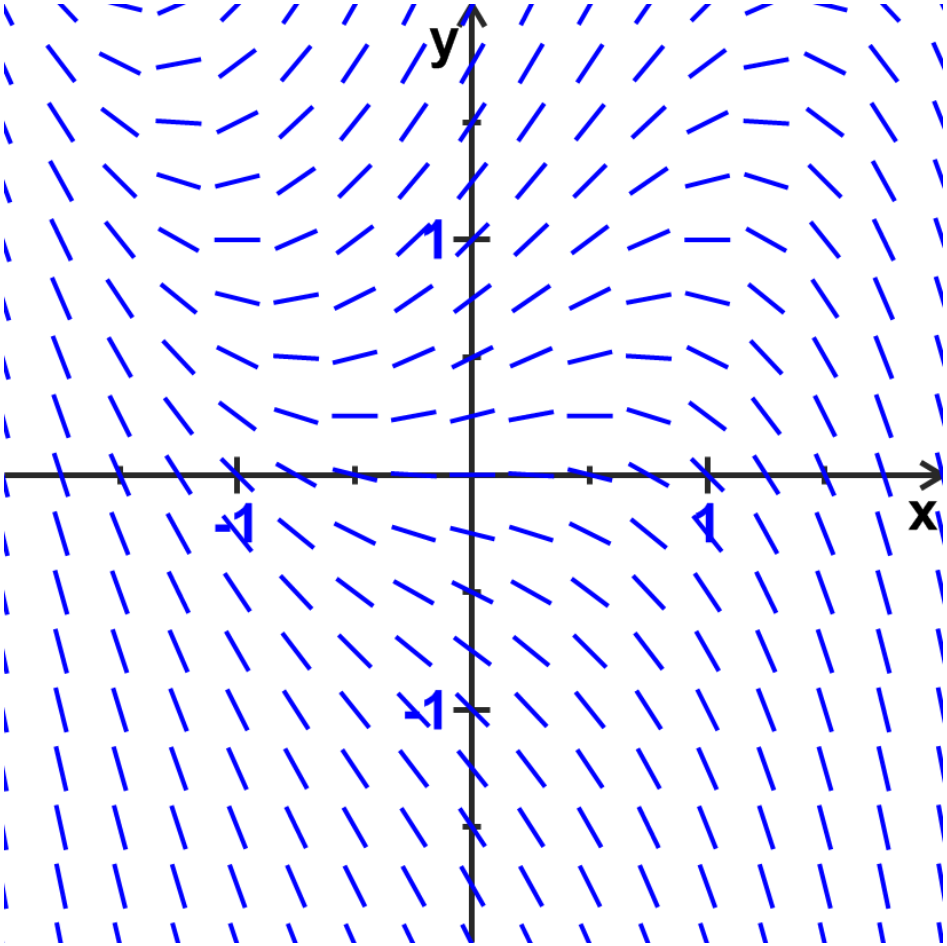
1. The direction field is a visualization of the differential equation $y' = F(x,y)$.
2. At each point (x,y) in the plane, we sketch a line segment with slope $y' = F(x,y)$.
3. Because we cannot sketch a slope at every point, we sketch slopes on a sufficiently fine grid.
4. The solutions must fit smoothly into the direction field.
5. So we can sketch solutions by following the slopes of a direction field.
6. Experimentally, streaks of dye in a fluid flow or streaks of smoke in a wind tunnel do exactly that.

The Direction Field of $y' = y - x^2$

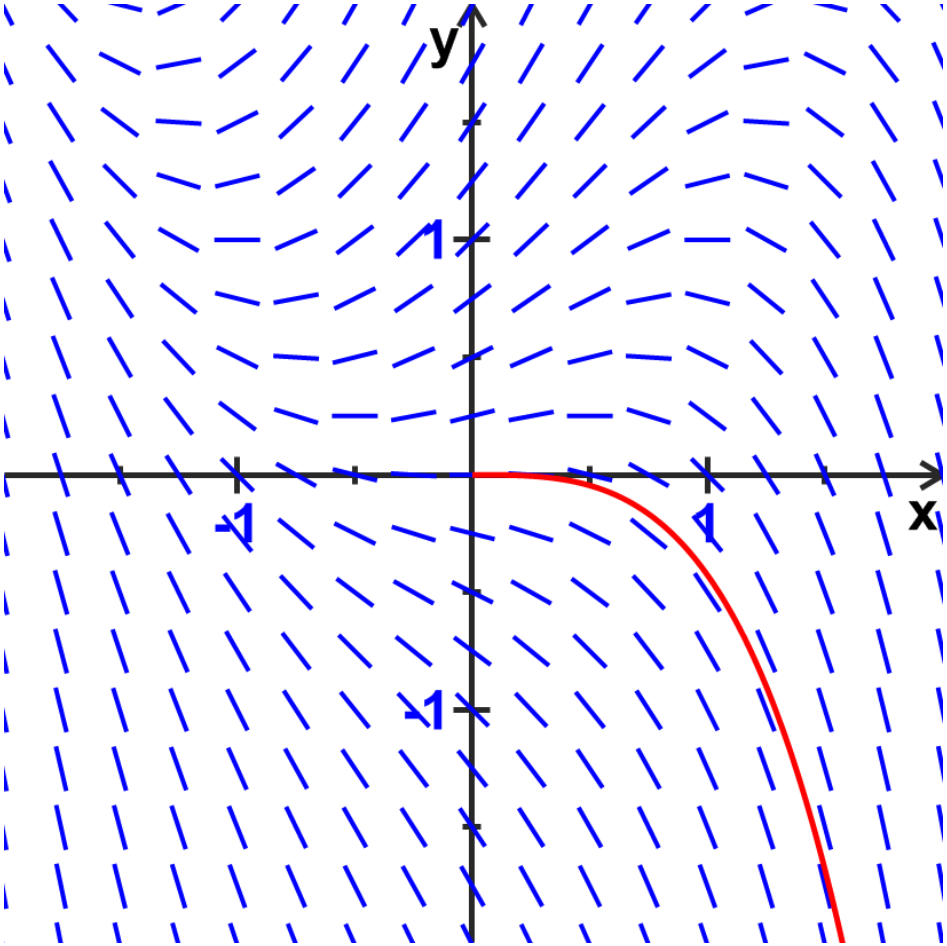
The Direction Field of $y' = y - x^2$



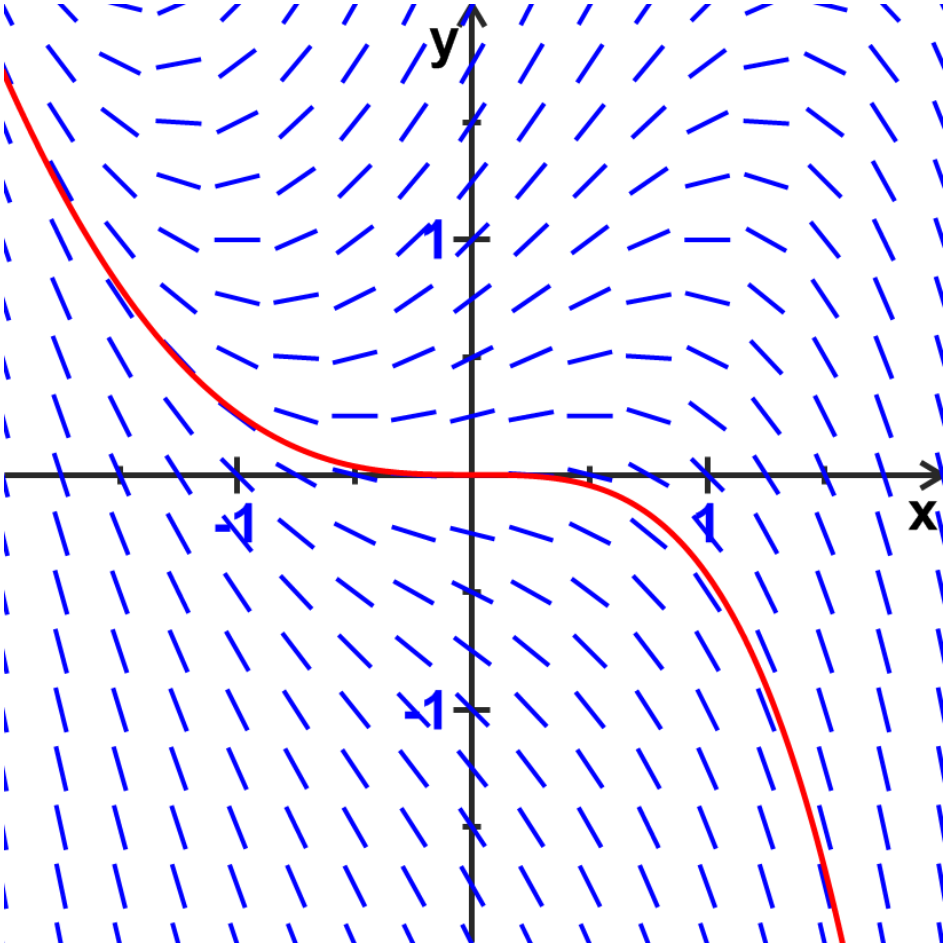
The Direction Field of $y' = y - x^2$



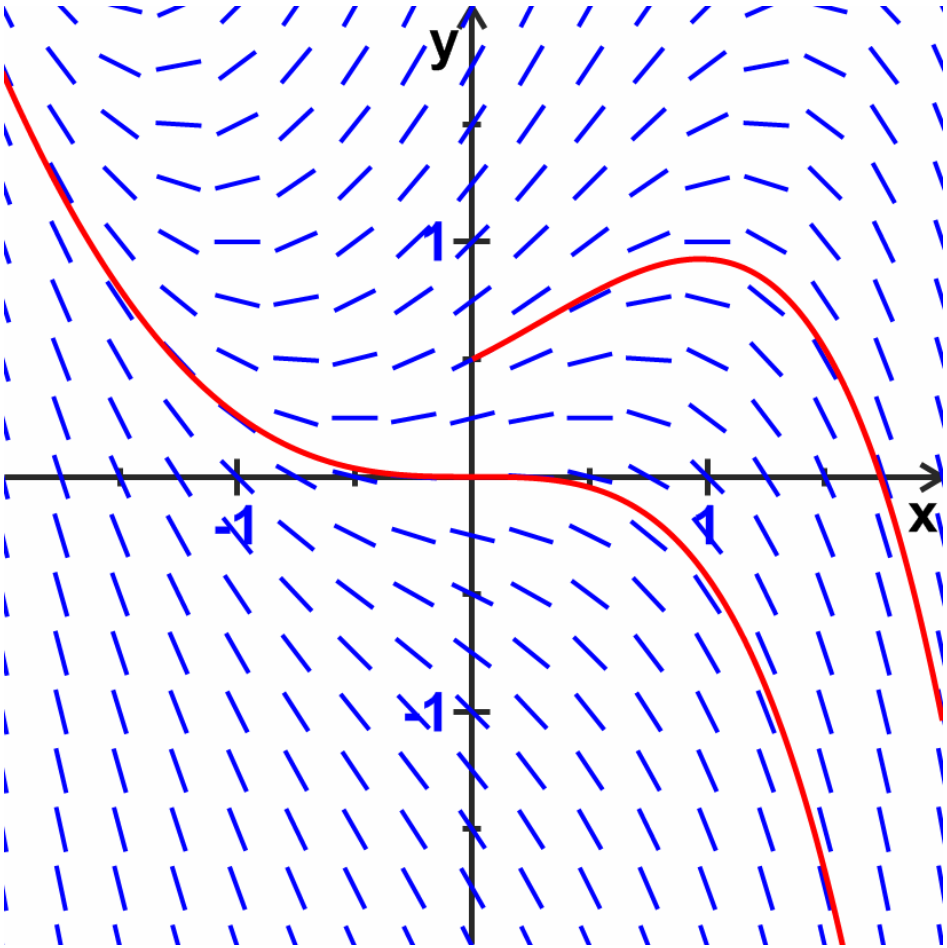
Sketching Solutions of $y' = y - x^2$



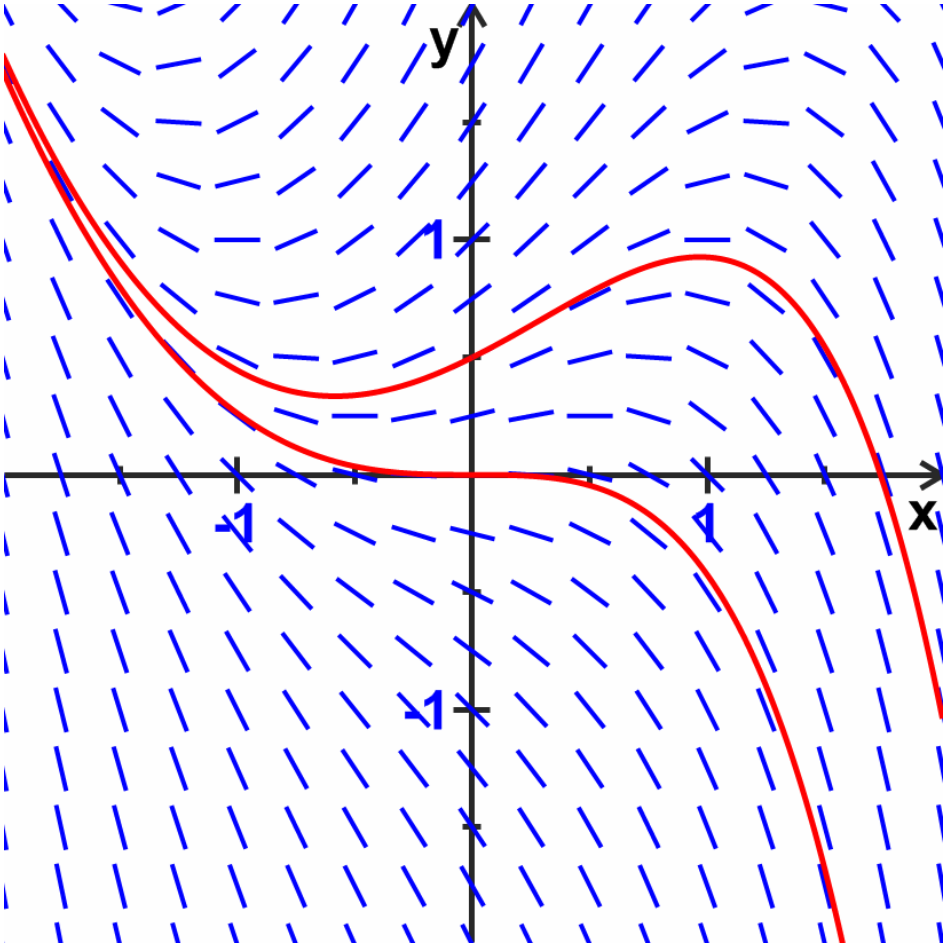
Sketching Solutions of $y' = y - x^2$



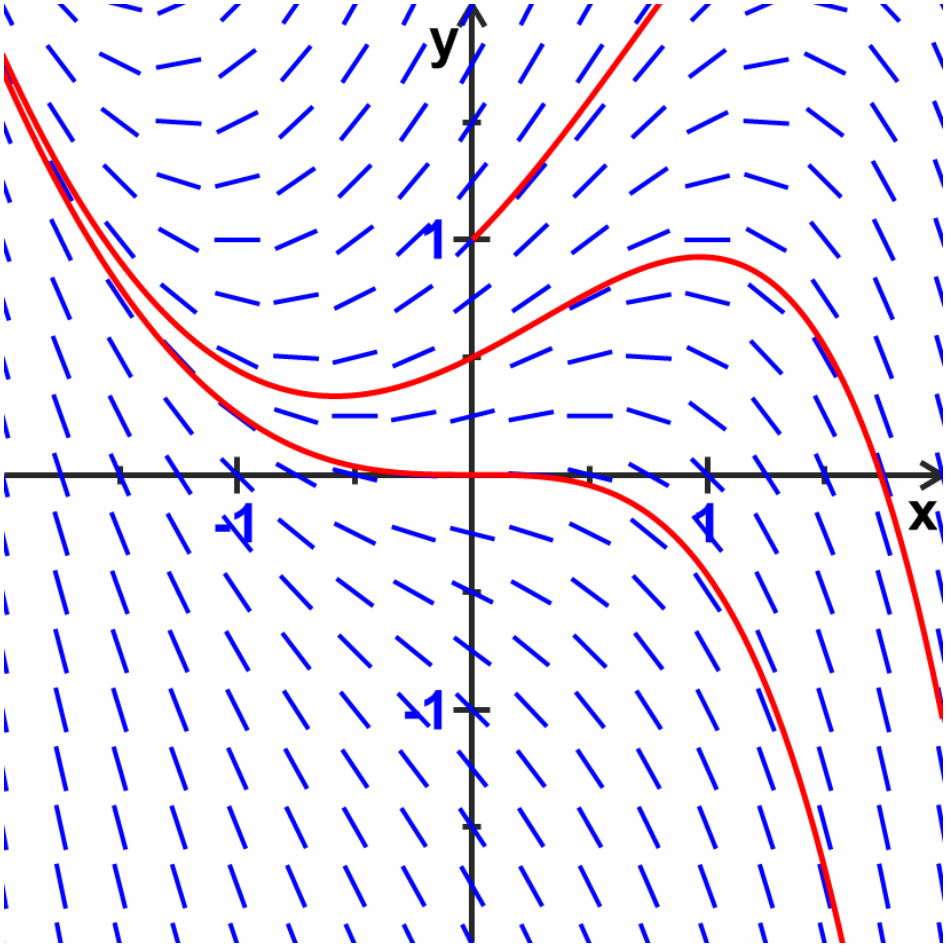
Sketching Solutions of $y' = y - x^2$



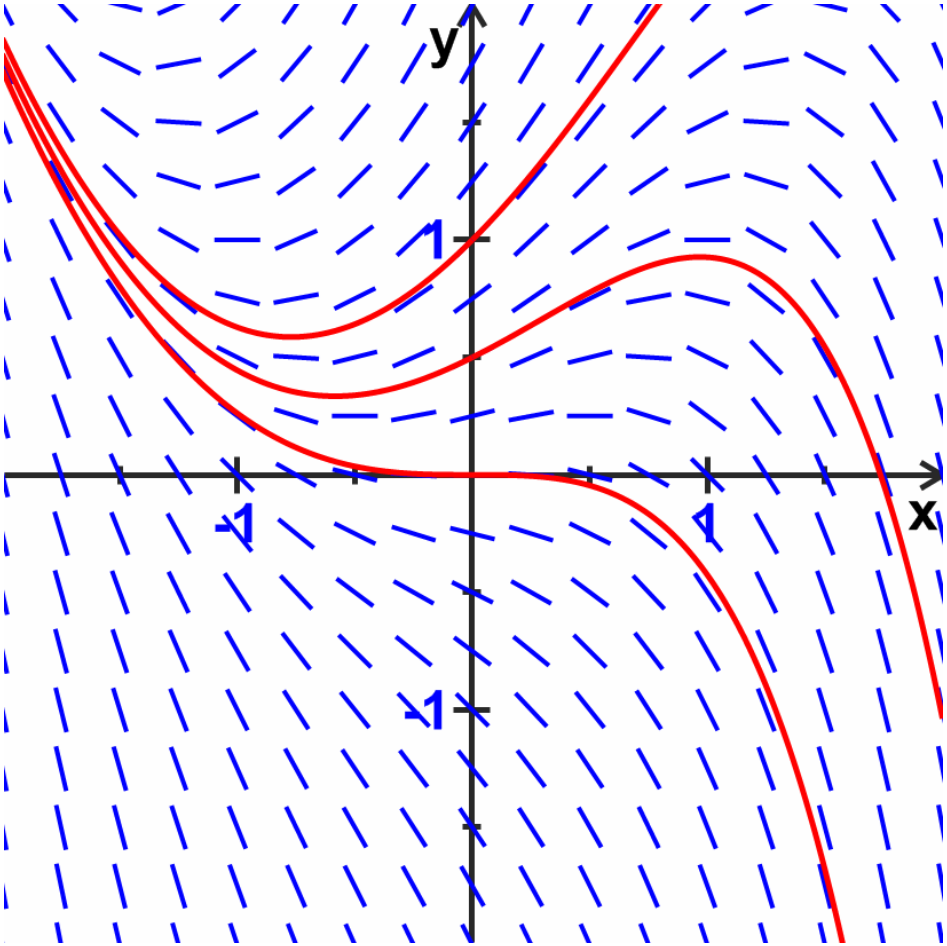
Sketching Solutions of $y' = y - x^2$



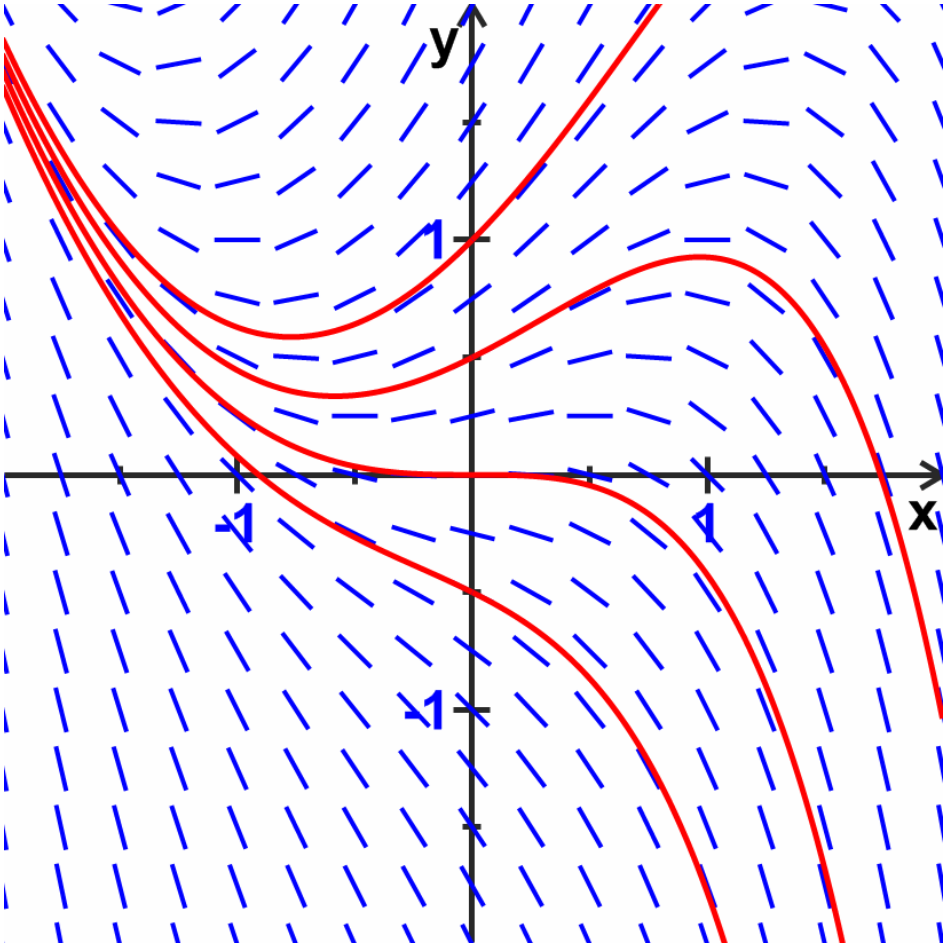
Sketching Solutions of $y' = y - x^2$



Sketching Solutions of $y' = y - x^2$



Sketching Solutions of $y' = y - x^2$



Sketching Solutions of $y' = y - x^2$