Autonomous Differential Equations

Bernd Schröder

Autonomous Differential Equations

Autonomous Differential Equations

1. A differential equation of the form $y' = F(y)$ is autonomous.

Autonomous Differential Equations

1. A differential equation of the form $y' = F(y)$ is autonomous.
2. That is, if the right side does not depend on x, the equation is autonomous.

Autonomous Differential Equations

1. A differential equation of the form $y' = F(y)$ is autonomous.
2. That is, if the right side does not depend on x, the equation is autonomous.
3. Autonomous equations are separable, but ugly integrals and expressions that cannot be solved for y make qualitative analysis sensible.

Autonomous Differential Equations

1. A differential equation of the form $y' = F(y)$ is autonomous.
2. That is, if the right side does not depend on x, the equation is autonomous.
3. Autonomous equations are separable, but ugly integrals and expressions that cannot be solved for y make qualitative analysis sensible.
4. The slopes in the direction field will only depend on y.

Autonomous Differential Equations

1. A differential equation of the form $y' = F(y)$ is autonomous.
2. That is, if the right side does not depend on x, the equation is autonomous.
3. Autonomous equations are separable, but ugly integrals and expressions that cannot be solved for y make qualitative analysis sensible.
4. The slopes in the direction field will only depend on y.
5. Solutions are invariant under horizontal translations.

Equilibrium Solutions of Autonomous Differential Equations

Equilibrium Solutions of Autonomous Differential Equations

1. Values y_0 with $F(y_0) = 0$ give rise to constant solutions $y(x) = y_0$.

Equilibrium Solutions of Autonomous Differential Equations

1. Values y_0 with $F(y_0) = 0$ give rise to constant solutions $y(x) = y_0$. These solutions are called **equilibrium solutions**.

Equilibrium Solutions of Autonomous Differential Equations

1. Values y_0 with $F(y_0) = 0$ give rise to constant solutions $y(x) = y_0$. These solutions are called **equilibrium solutions**.
2. Equilibrium solutions $y(x) = y_0$ are called **stable** if and only if solutions near them converge to $y(x) = y_0$.

Equilibrium Solutions of Autonomous Differential Equations

1. Values y_0 with $F(y_0) = 0$ give rise to constant solutions $y(x) = y_0$. These solutions are called **equilibrium solutions**.
2. Equilibrium solutions $y(x) = y_0$ are called **stable** if and only if solutions near them converge to $y(x) = y_0$. Otherwise they are called **unstable**.

Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

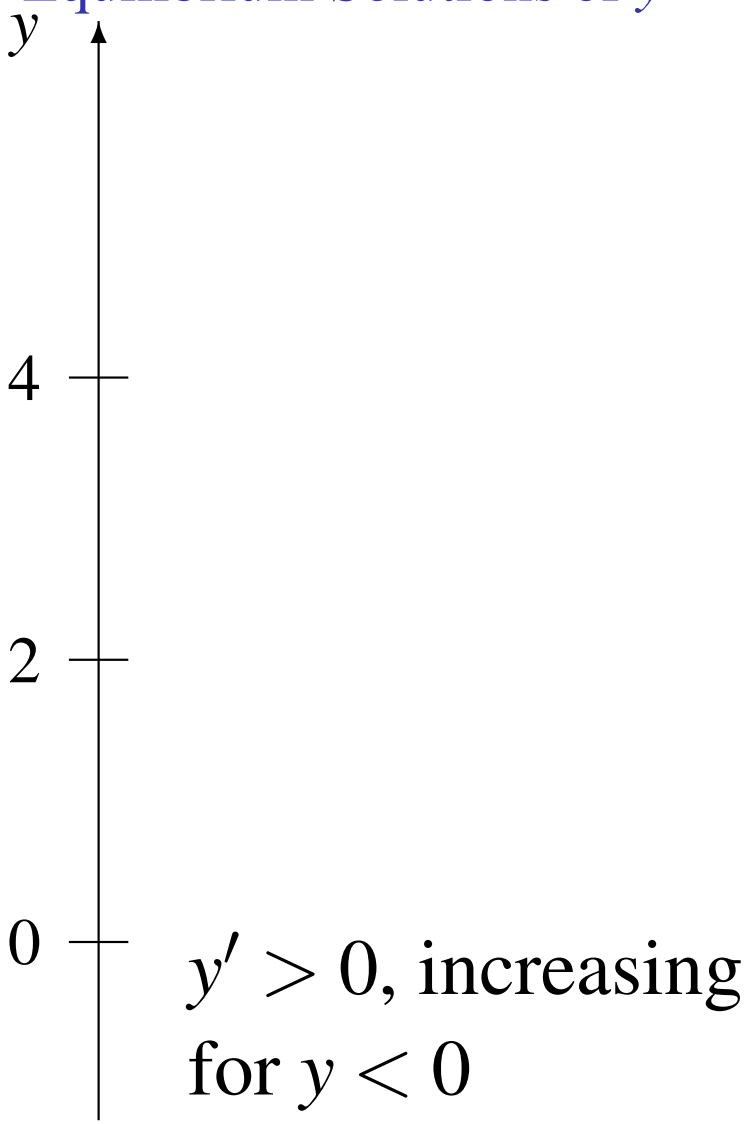
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

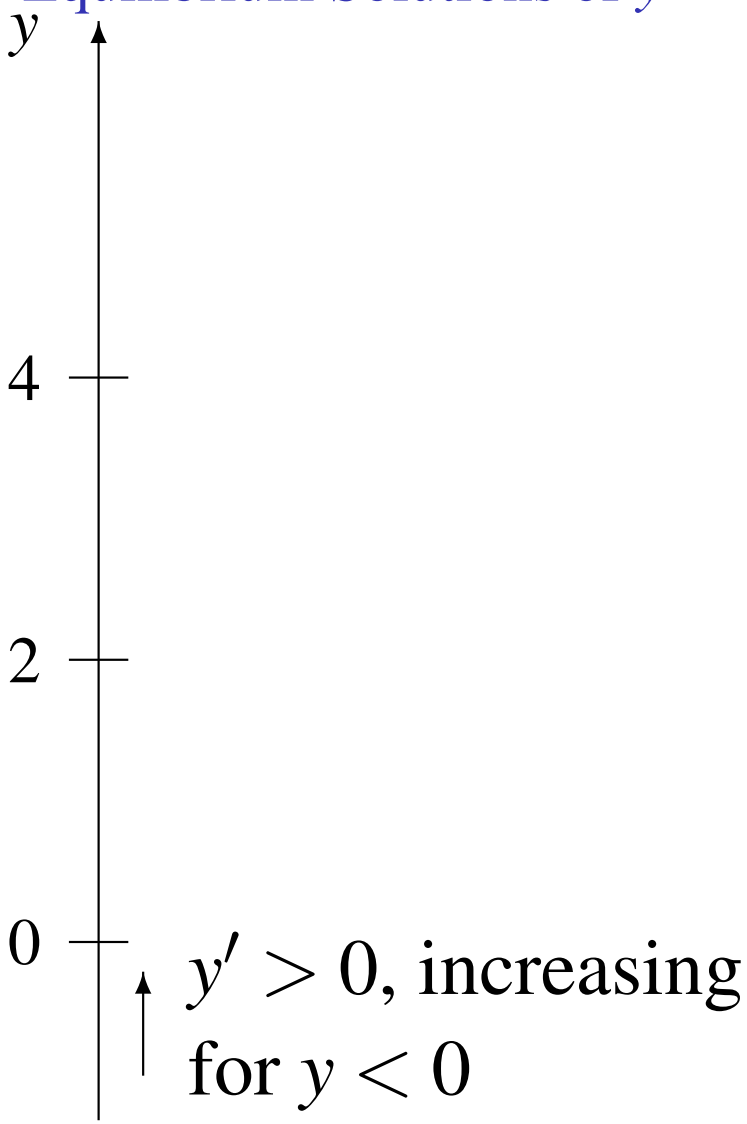
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

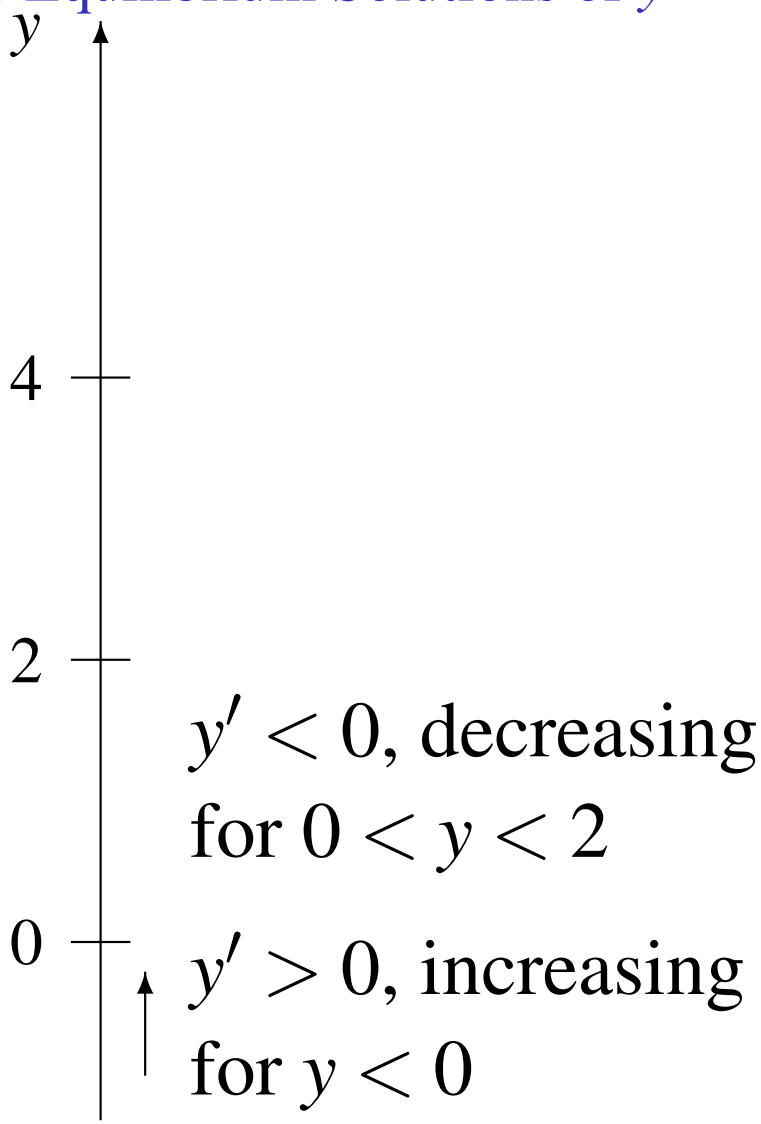
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



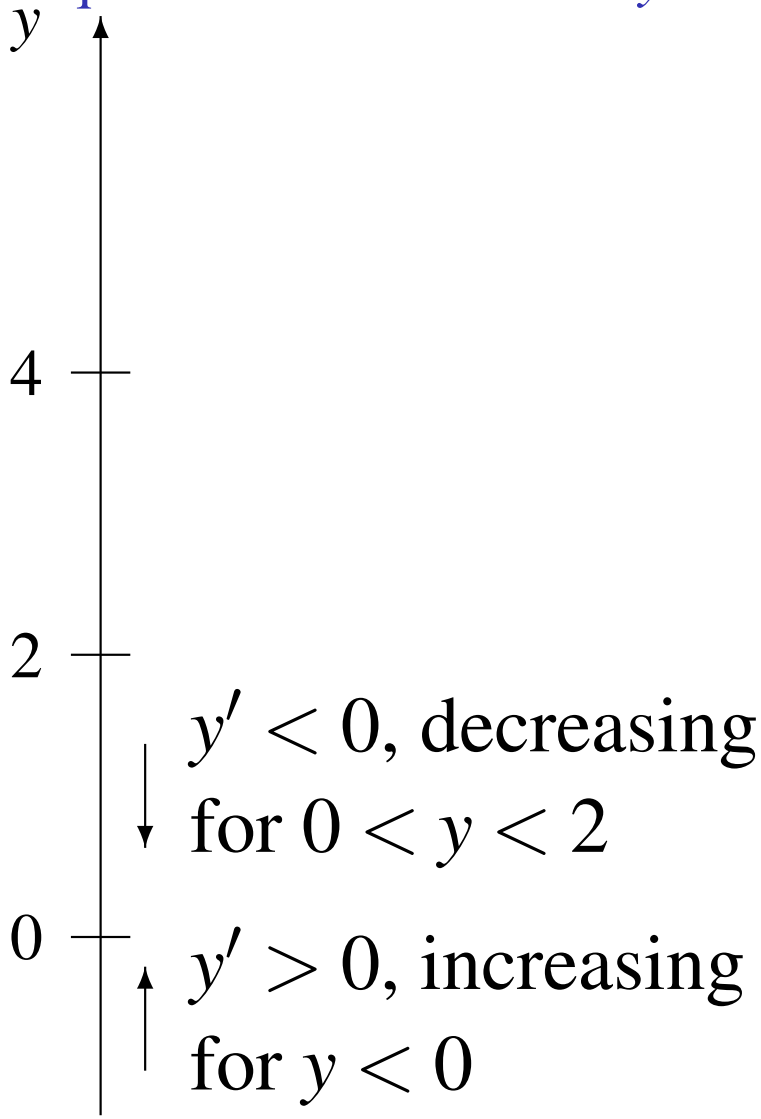
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



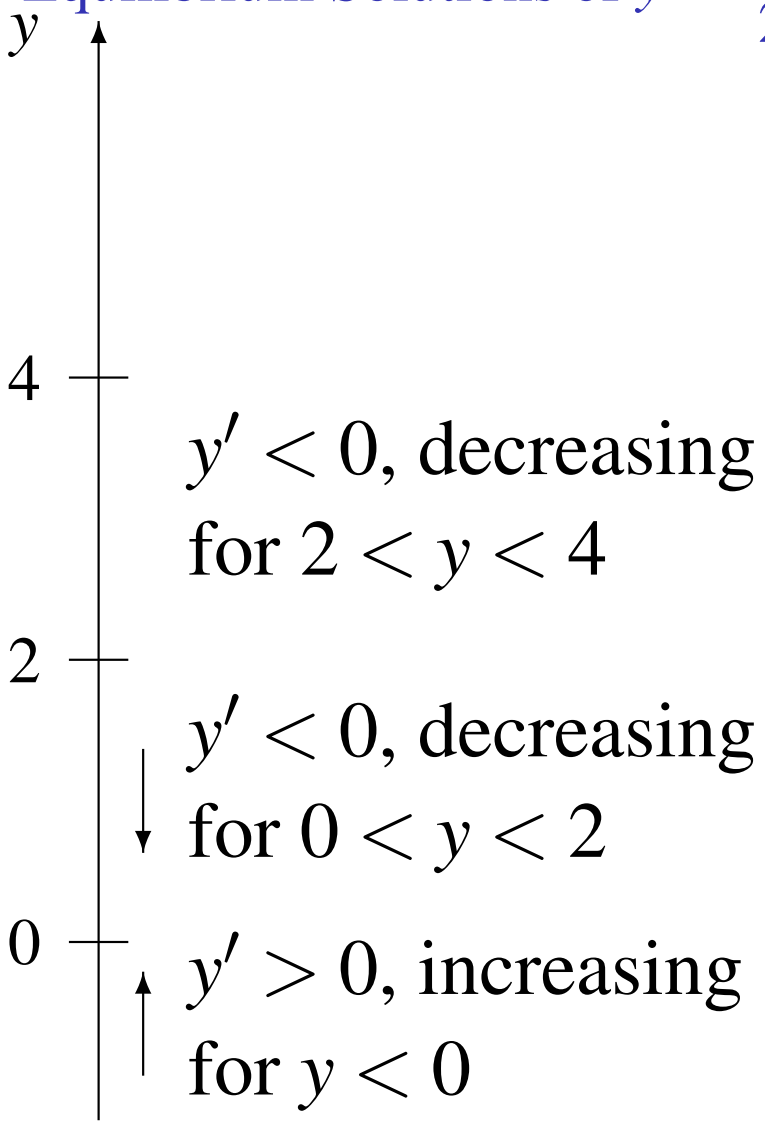
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



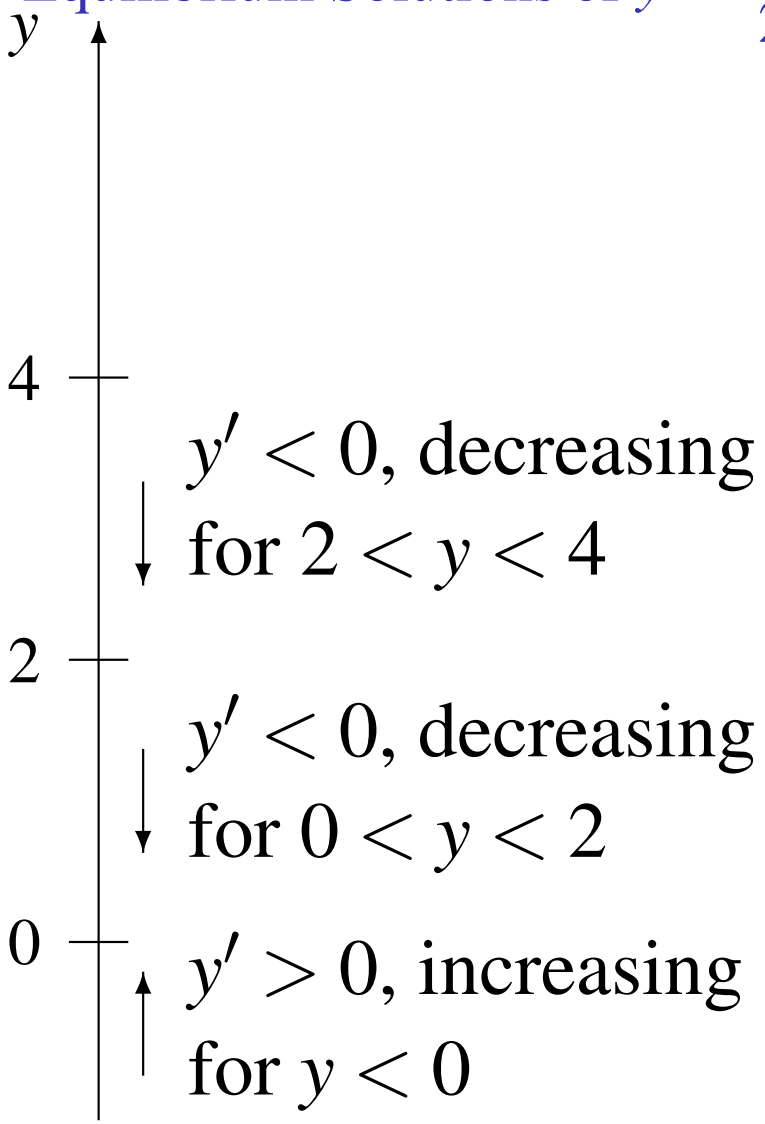
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



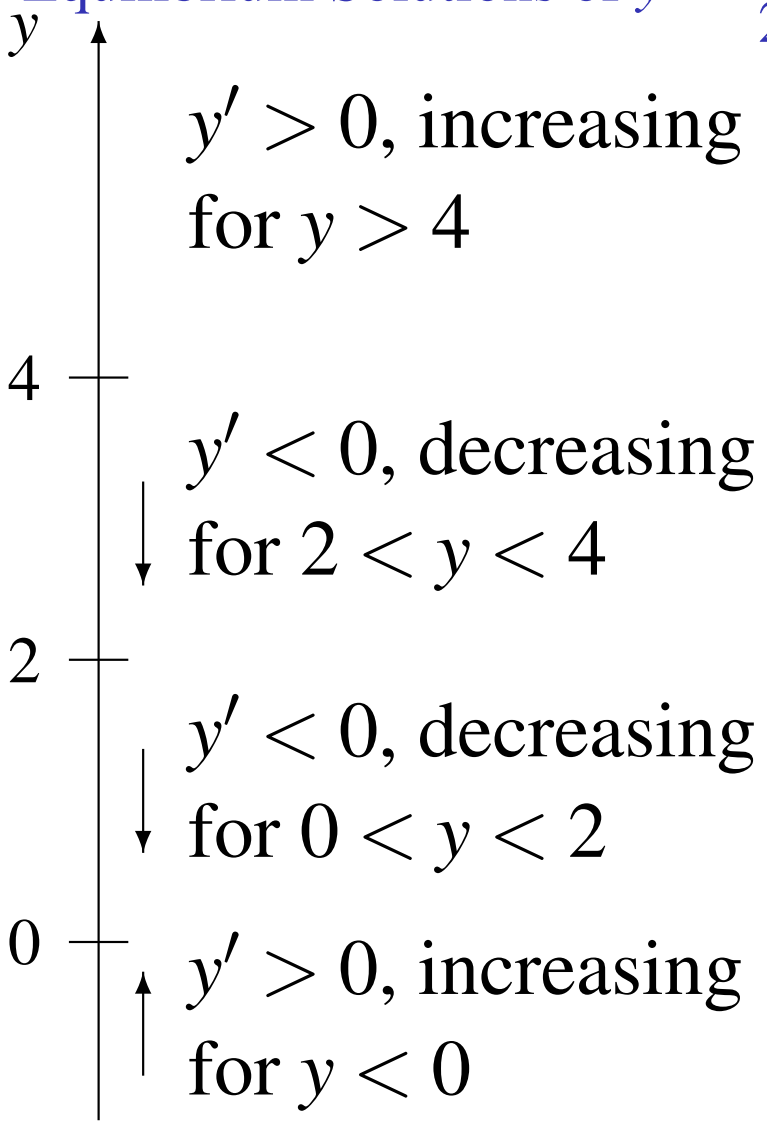
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



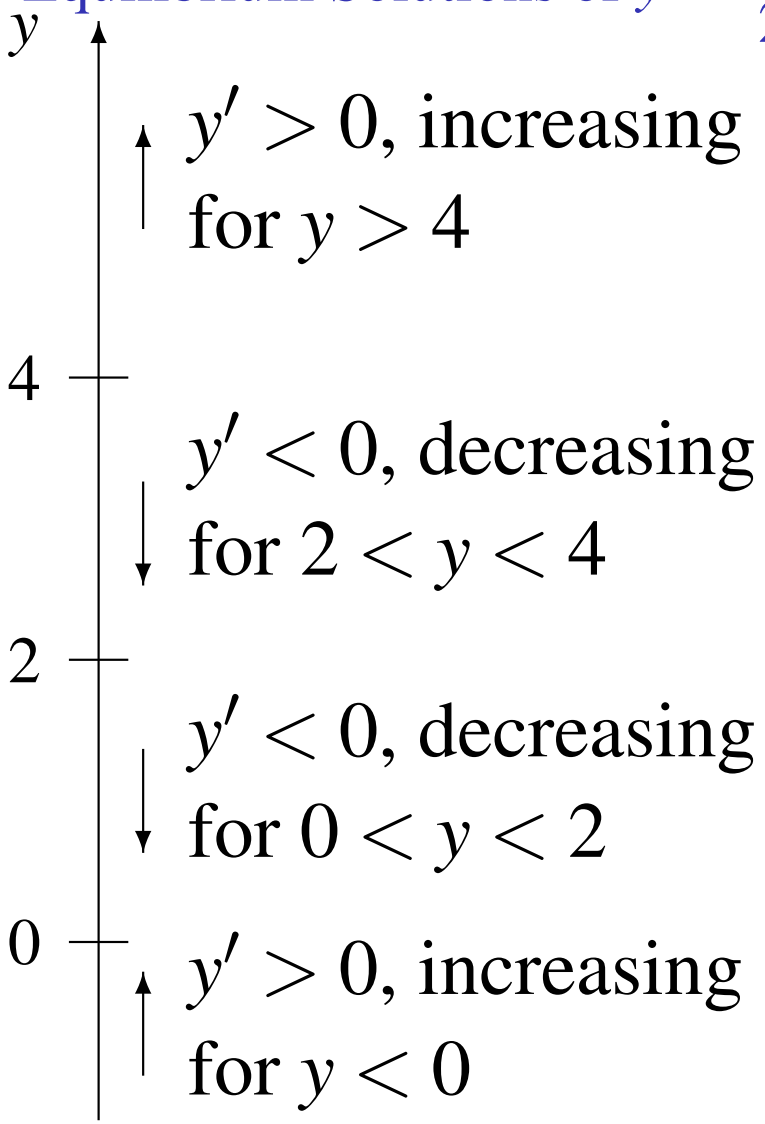
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



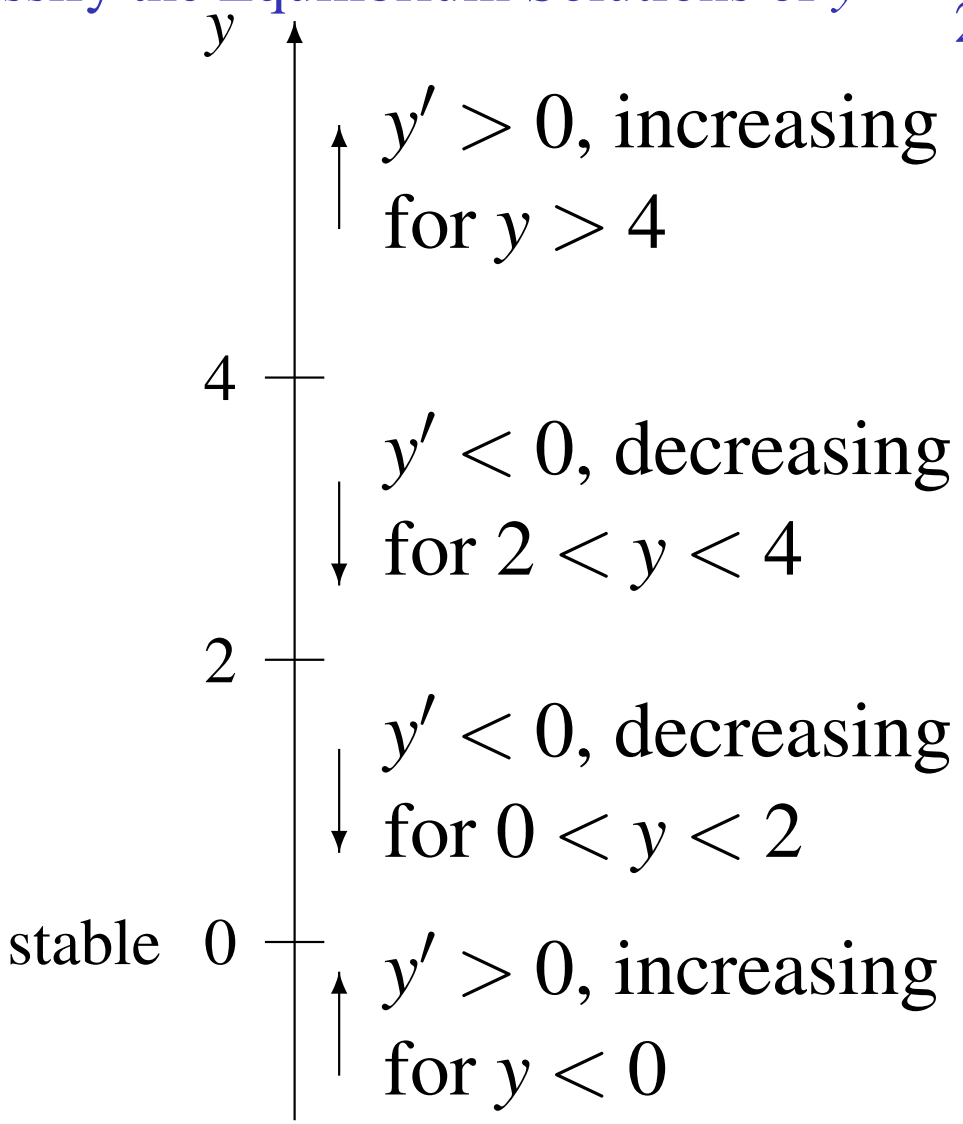
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



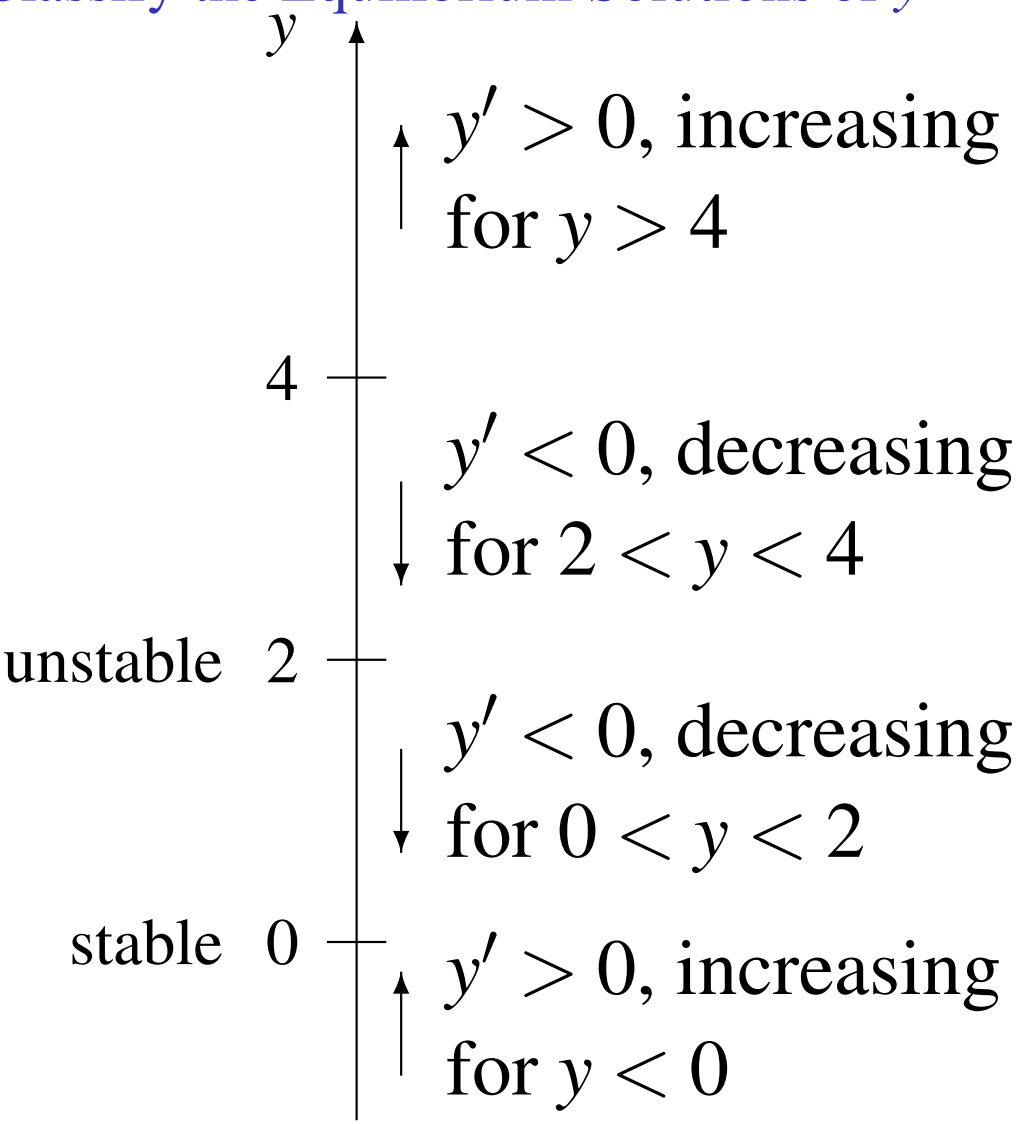
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



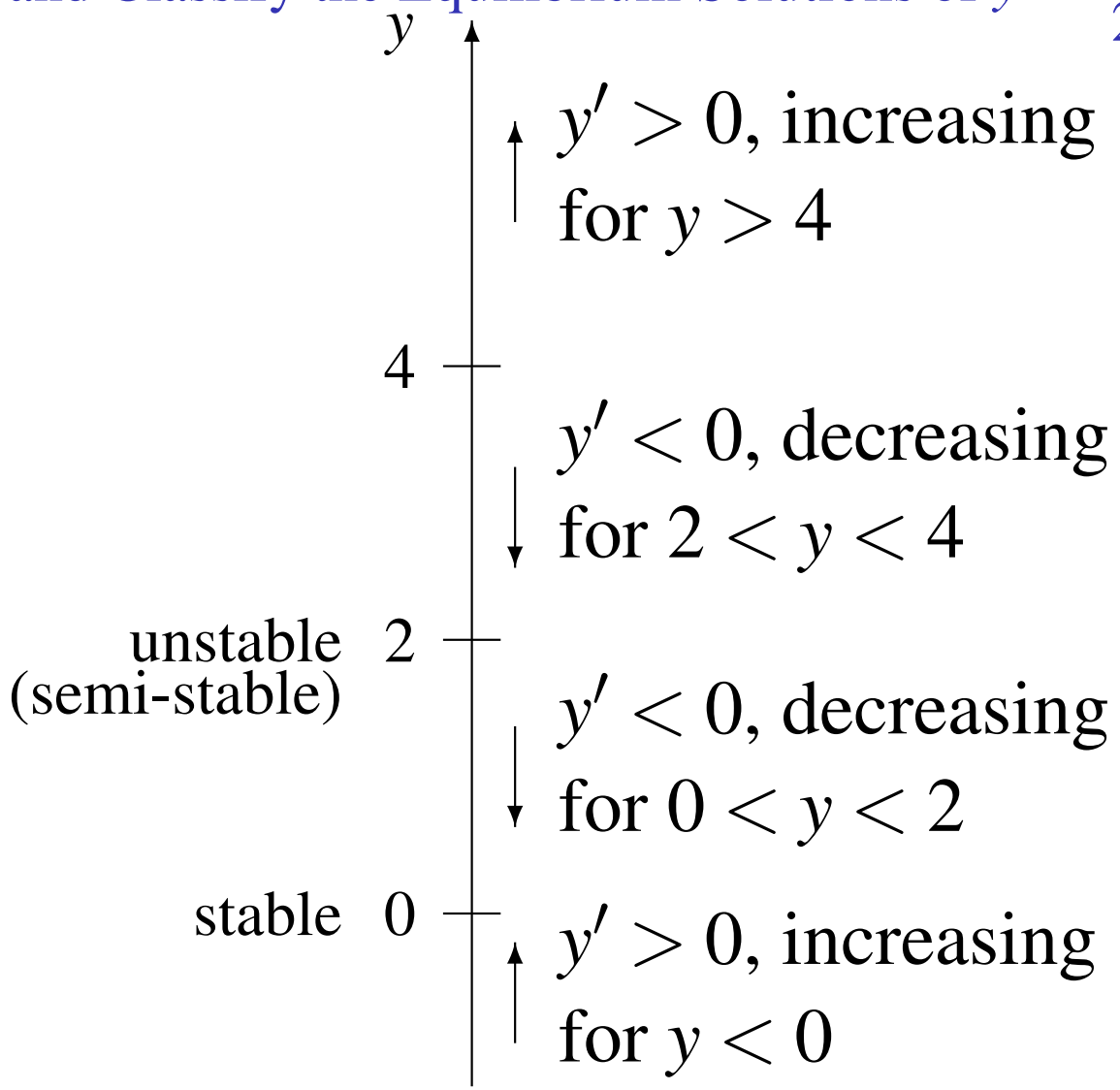
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



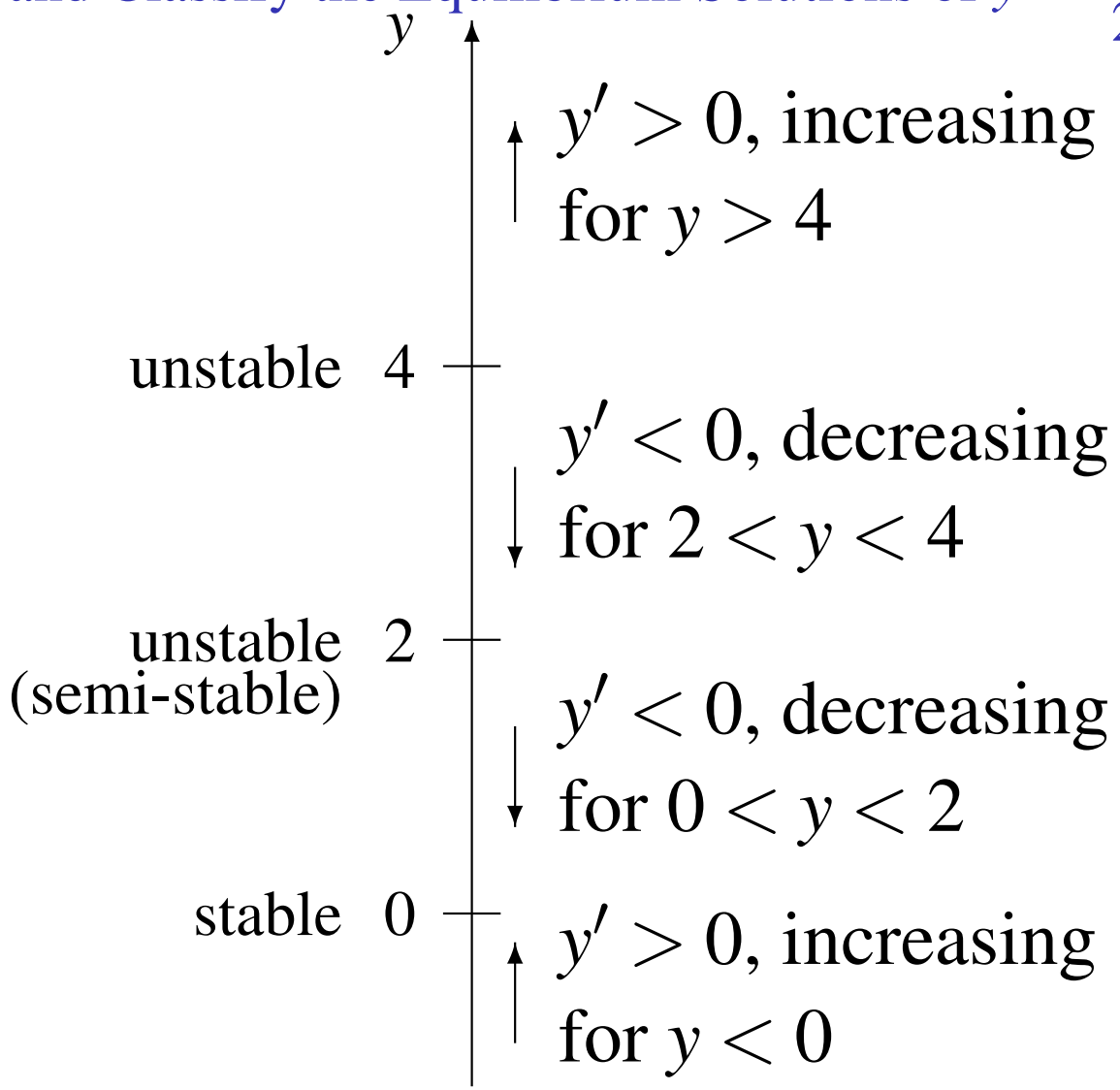
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

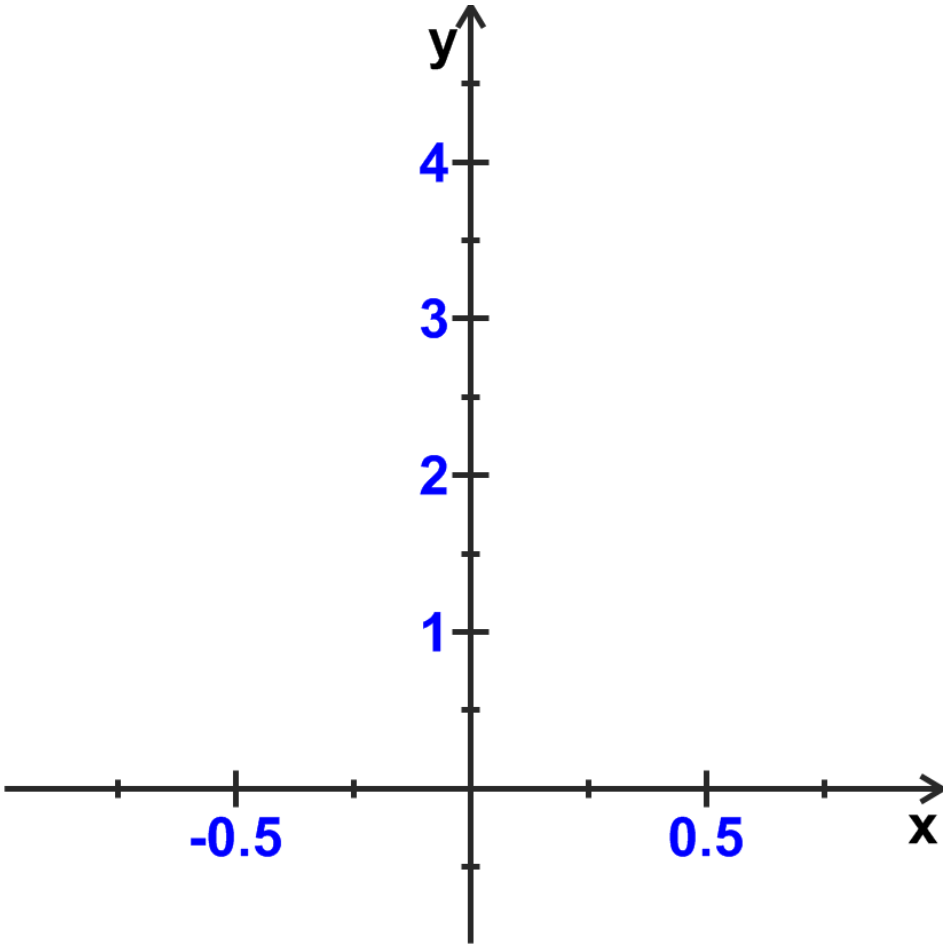


Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

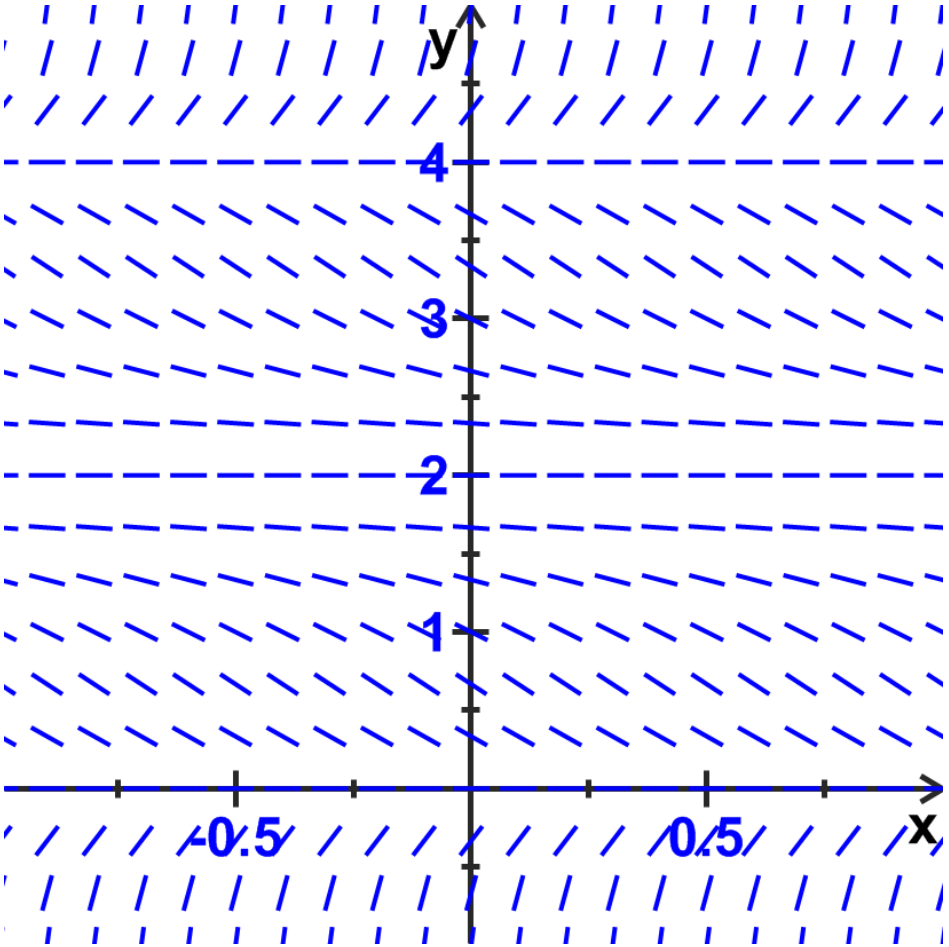


Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$

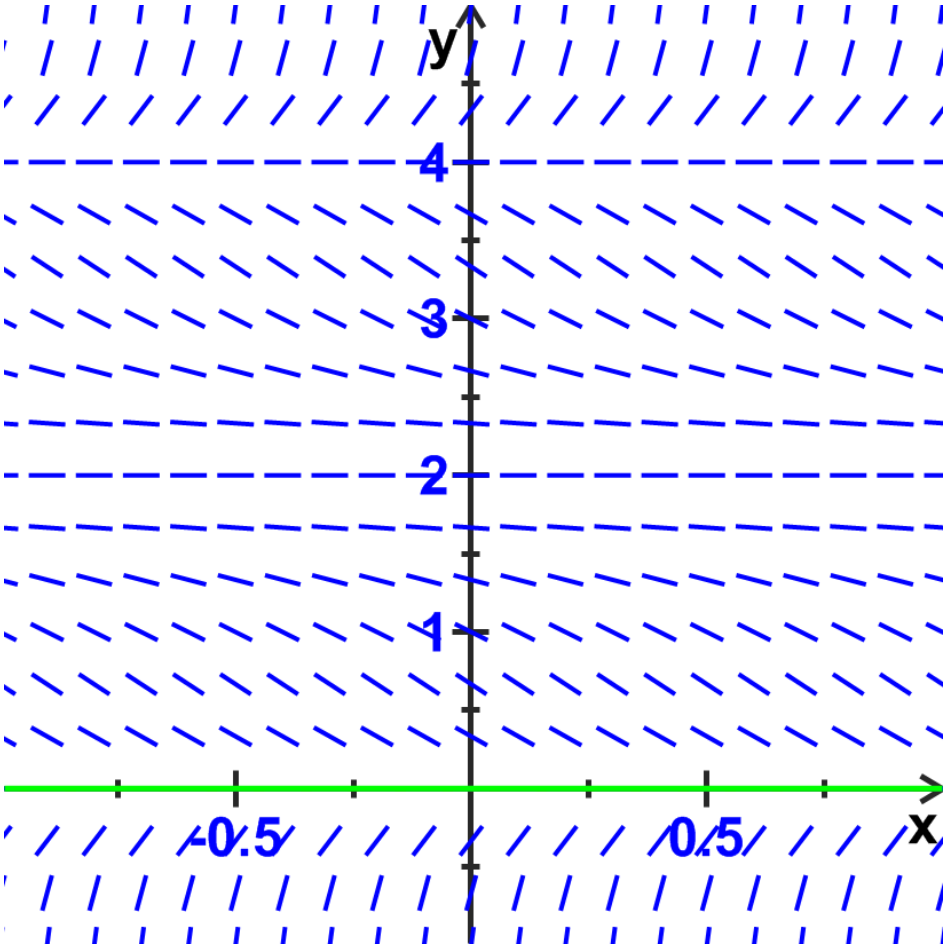
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



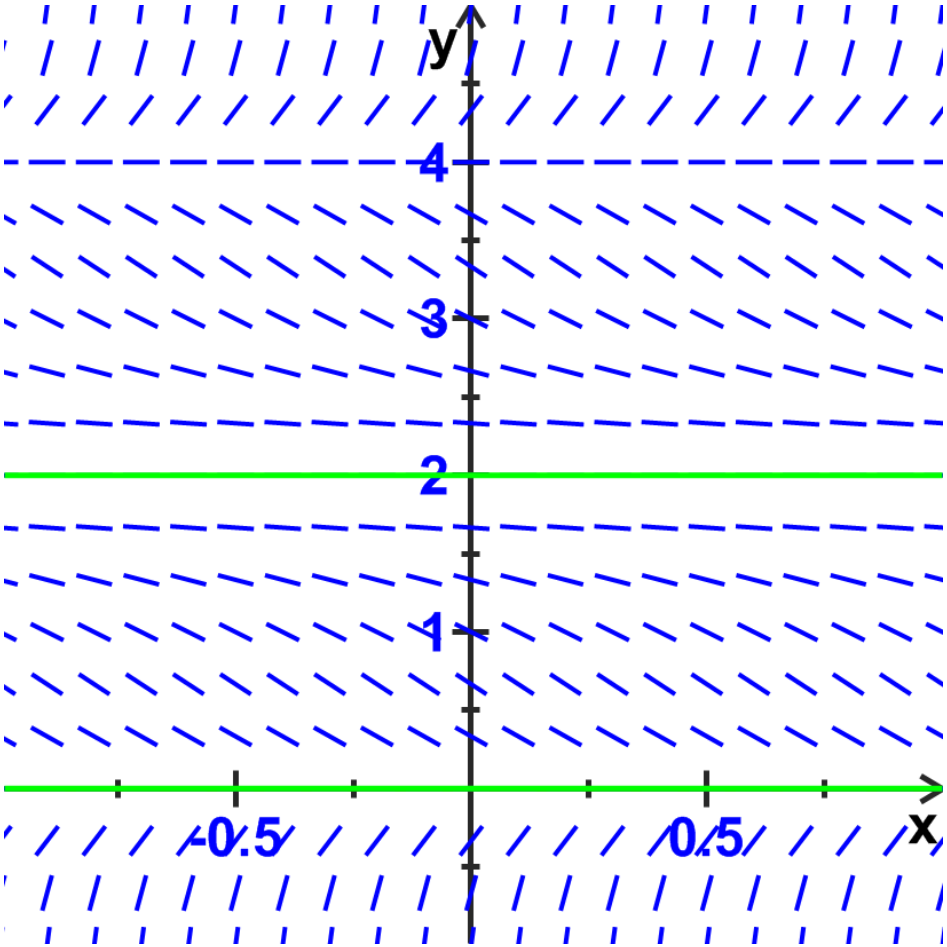
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



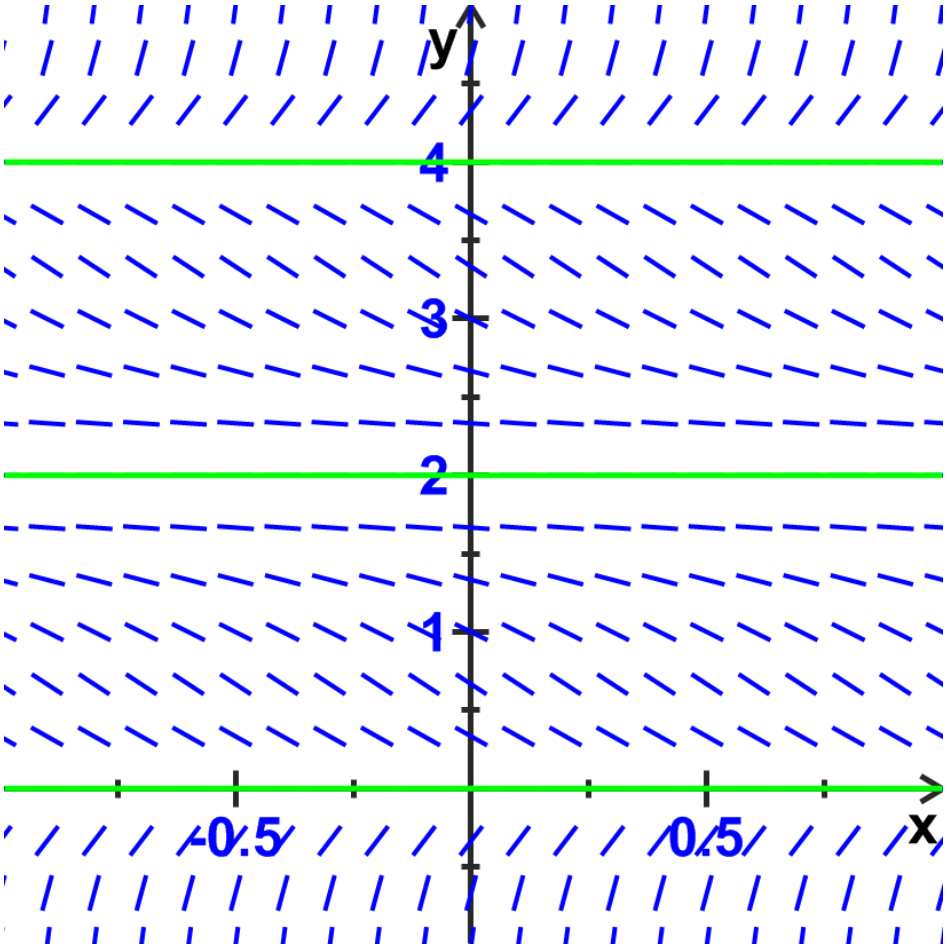
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



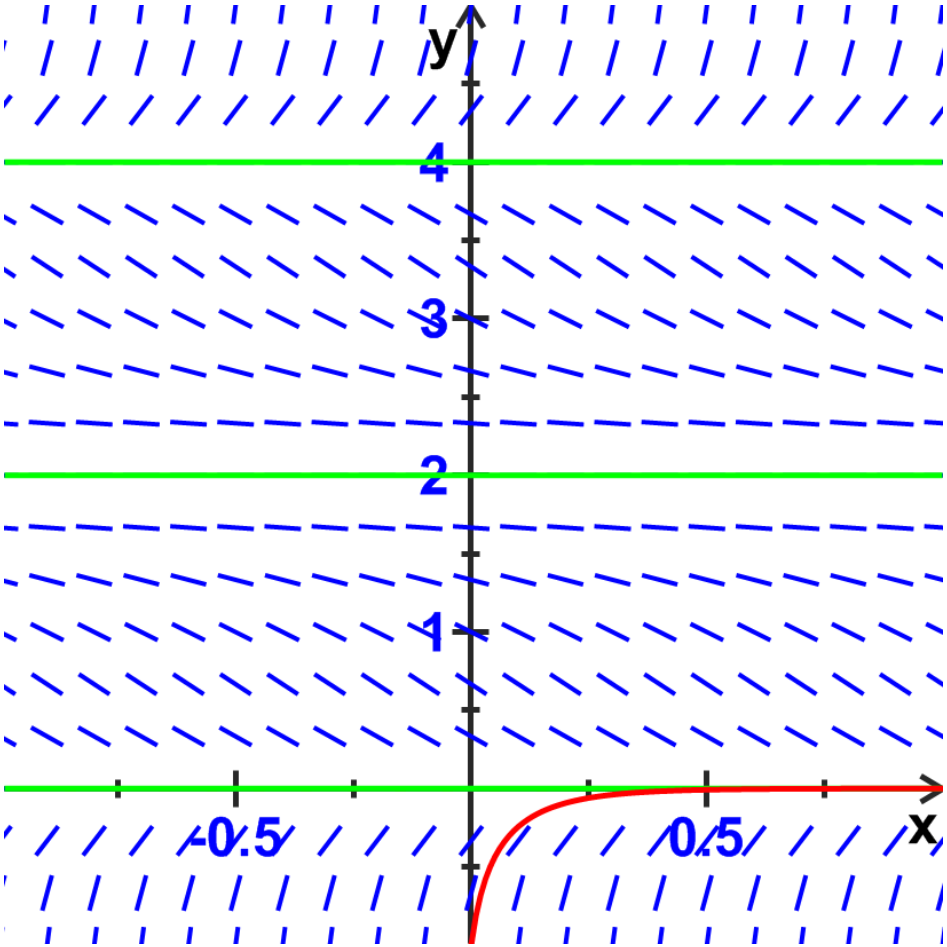
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



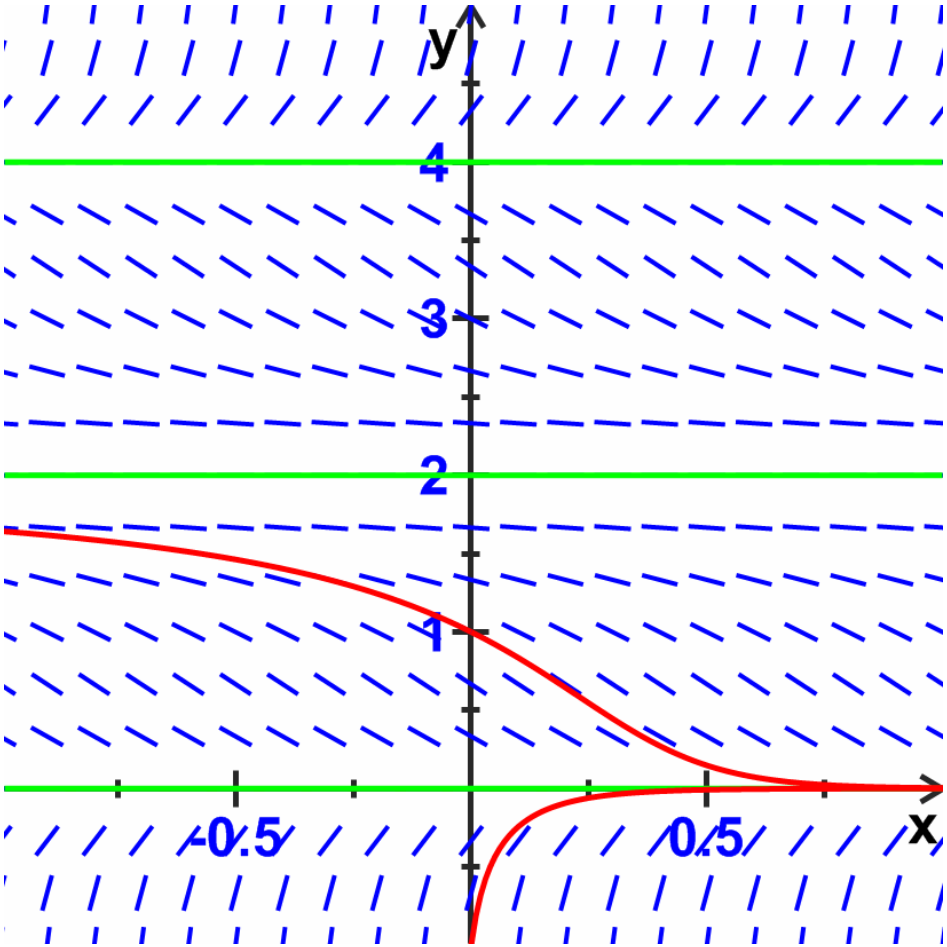
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



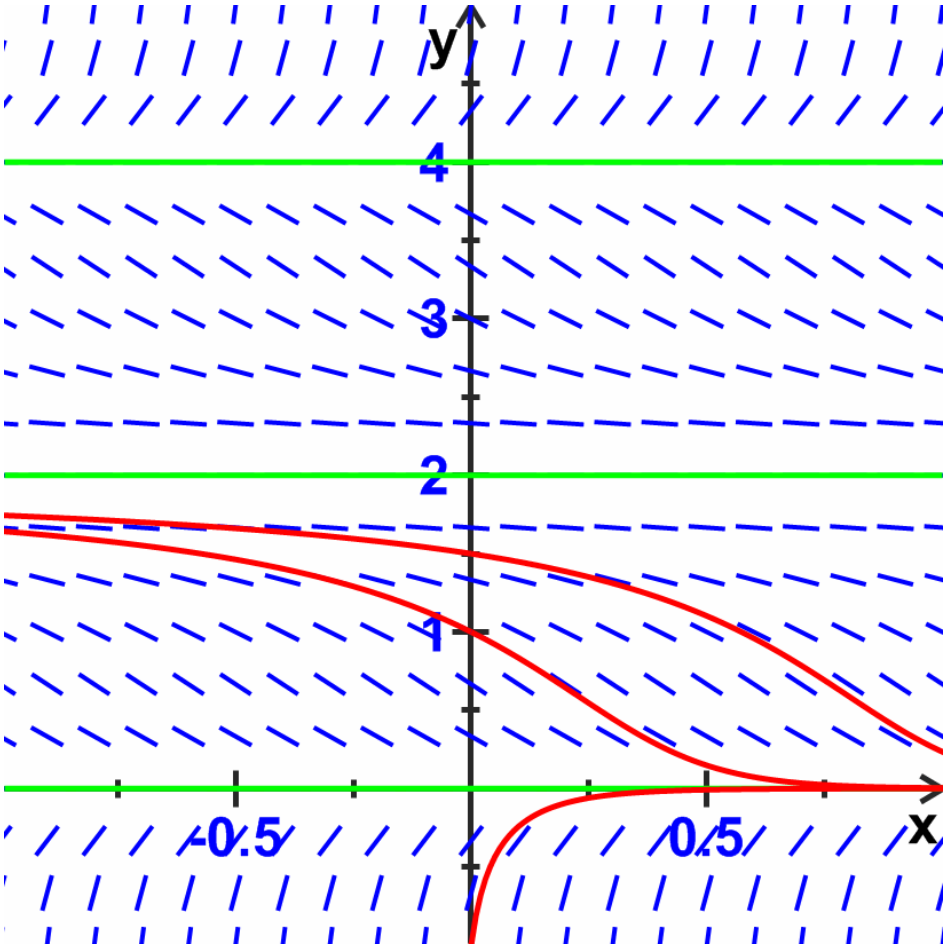
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



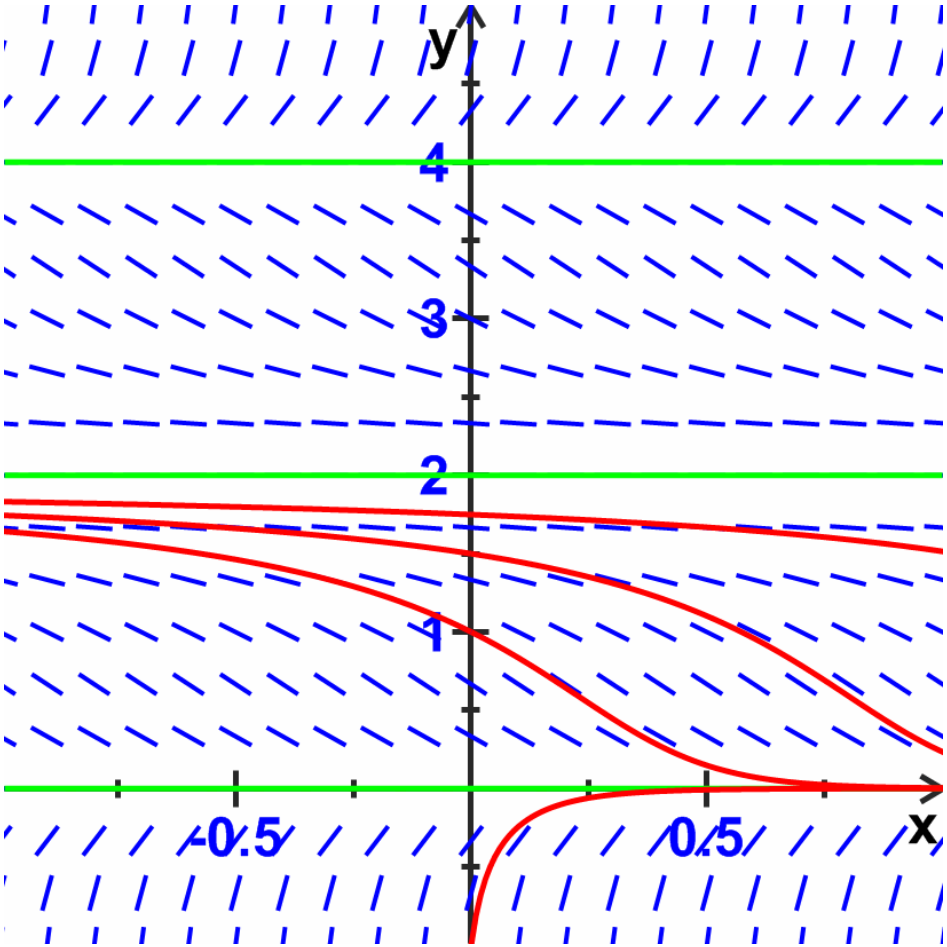
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



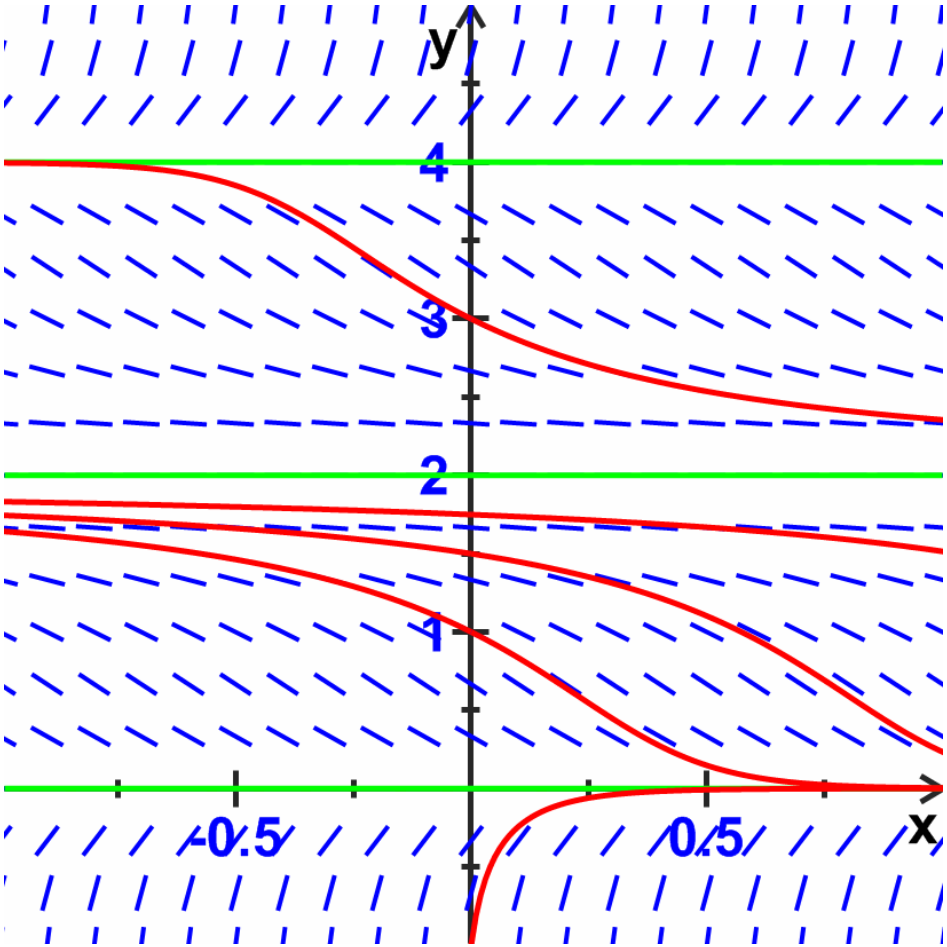
Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$



Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$