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- 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.

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- 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**.

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

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Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$ $\begin{array}{c} 4 \\ y' < 0, \text{ decreasing} \\ \text{for } 2 < y < 4 \\ 2 \\ y' < 0, \text{ decreasing} \\ \text{for } 0 < y < 2 \\ 0 \\ y' > 0, \text{ increasing} \\ \text{for } y < 0 \end{array}$

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

4 + $y' < 0$, decreasing
for $2 < y < 4$
2 + $y' < 0$, decreasing
for $0 < y < 2$
0 + $y' > 0$, increasing
for $y < 0$

Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$ y' > 0, increasing for y > 4 $4 + y' < 0, \text{ decreasing} \\ \downarrow \text{ for } 2 < y < 4$ 2 + y' < 0, \text{ decreasing} \\ \downarrow \text{ for } 0 < y < 2 0 + y' > 0, increasing \\ \downarrow \text{ for } y < 0

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Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$ y' > 0, increasing for y > 44 - y' < 0, decreasing 4 - y' < 0, decreasing

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Find and Classify the Equilibrium Solutions of $y' = \frac{1}{2}y(y-2)^2(y-4)$ y' > 0, increasing for y > 44 - y' < 0, decreasing y' < 0, decreasing for 2 < y < 4 2 - y' < 0, decreasing for 0 < y < 2 y' > 0, increasing for y < 0

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