$$y' = \sqrt{x-y} = f(x,y)$$

existence $\rightarrow$ $y \geq 2$

$$\frac{\partial f}{\partial y} = \frac{1}{2}(x-y)^{-1/2} - 1 = \frac{1}{2\sqrt{x-y}} - 1$$

uniqueness $\rightarrow$ $y > 2$

existence and uniqueness must both be true

$\therefore$ use stricter condition

$f(x,y)$ exists and is unique at $y > 2$

$\therefore$ theorem can't prove existence/uniqueness at $y \leq 2$

Consider the initial value problem

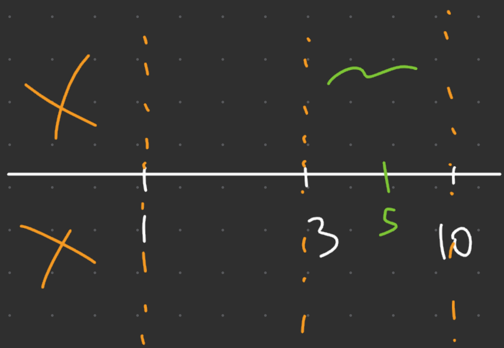
$$y' = \sqrt{x-y}, \quad y(2) = y_0$$

Find all values of y_0 for which the existence and uniqueness theorem cannot be used to guarantee the existence of a unique solution in an open interval containing 2.

- Ⓐ $y_0 = 2$
- Ⓑ $y_0 \leq 2$
- Ⓒ $y_0 \geq 2$
- Ⓓ $y_0 > 2$

$$y' + \frac{\sqrt{t-1}}{6(t-3)}\, y = \frac{2}{(t-3)(t-10)}$$

undef @ $t = 3, 10, < 1$



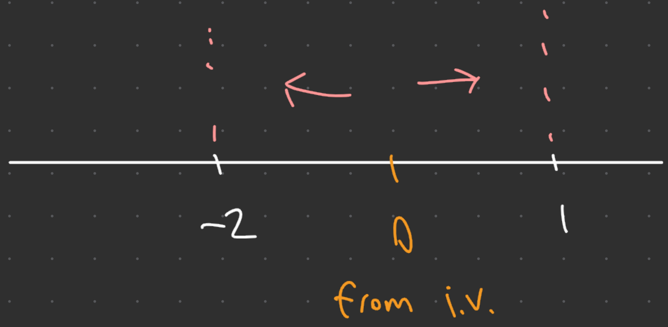
What is the largest open interval in which the solution of the initial value problem

$$(t-3)y' + \frac{\sqrt{t-1}}{6} y = \frac{2}{t-10},$$
$$y(5) = 2$$

is guaranteed to exist by the Existence and Uniqueness Theorem?

- Ⓐ (1, 10)
- Ⓑ (3, 10)
- Ⓒ (1, 3)
- Ⓓ $(10, \infty)$
- Ⓔ All real numbers except 10

$$y' + \frac{1}{t+2} y = \frac{1}{(t-1)(t+2)}$$



Determine the interval where the solution guaranteed to exist for the following initial value problem

$$(t+2)y' + y = \frac{1}{t-1}, \quad y(0) = \frac{1}{2}$$

- Ⓐ $(1, +\infty)$
- Ⓑ $(-2, 1)$
- Ⓒ $(-2, +\infty)$
- Ⓓ $(-\infty, -2)$
- Ⓔ $(-\infty, 1)$

$$y' - \frac{1}{(x^2+4)(x)}\,y = \frac{e^x}{(x^2-4)(x-5)}$$

undef @ $x = 0, \pm 2, 5$

What is the largest open interval in which the solution of the initial value problem

$$(x^2-4)\frac{dy}{dx} - \frac{y}{x} = \frac{e^x}{x-5},$$
$$y(1) = 3$$

is guaranteed to exist by the existence and uniqueness theorem.

- (A) $(0, 5)$
- (B) $(0, 2)$
- (C) $(-2, 2)$
- (D) $(-2, 5)$