Increasing and Decreasing Functions

Lecture 23
Section 3.1

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Reminder

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- Test #2 is this Friday, March 3.

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- Be there.

Objectives

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- Find the critical points of a function.
- Use “test points” to find where a function is increasing or decreasing.

Increasing and Decreasing Functions

Definition (Increasing and Decreasing Functions)

Let $f(x)$ be a function defined on an interval $a < x < b$. Then

- $f(x)$ is **increasing** on the interval if $f(x_2) > f(x_1)$ whenever $x_2 > x_1$.
- $f(x)$ is **decreasing** on the interval if $f(x_2) < f(x_1)$ whenever $x_2 > x_1$.

Increasing and Decreasing Functions

Increasing and Decreasing Functions

Let $f(x)$ be a function and let c be a point in the domain of $f(x)$.

- If $f'(c) > 0$, then $f(x)$ is increasing at $x = c$.
- If $f'(c) < 0$, then $f(x)$ is decreasing at $x = c$.

Critical Point

Definition (Critical Point)

A **critical point** of a function $f(x)$ is a point where $f'(x) = 0$ or where $f'(x)$ does not exist.

Example

Example

Find the intervals over which $f(x) = x^3 - 3x$ is increasing and decreasing.

Example 3.1.2

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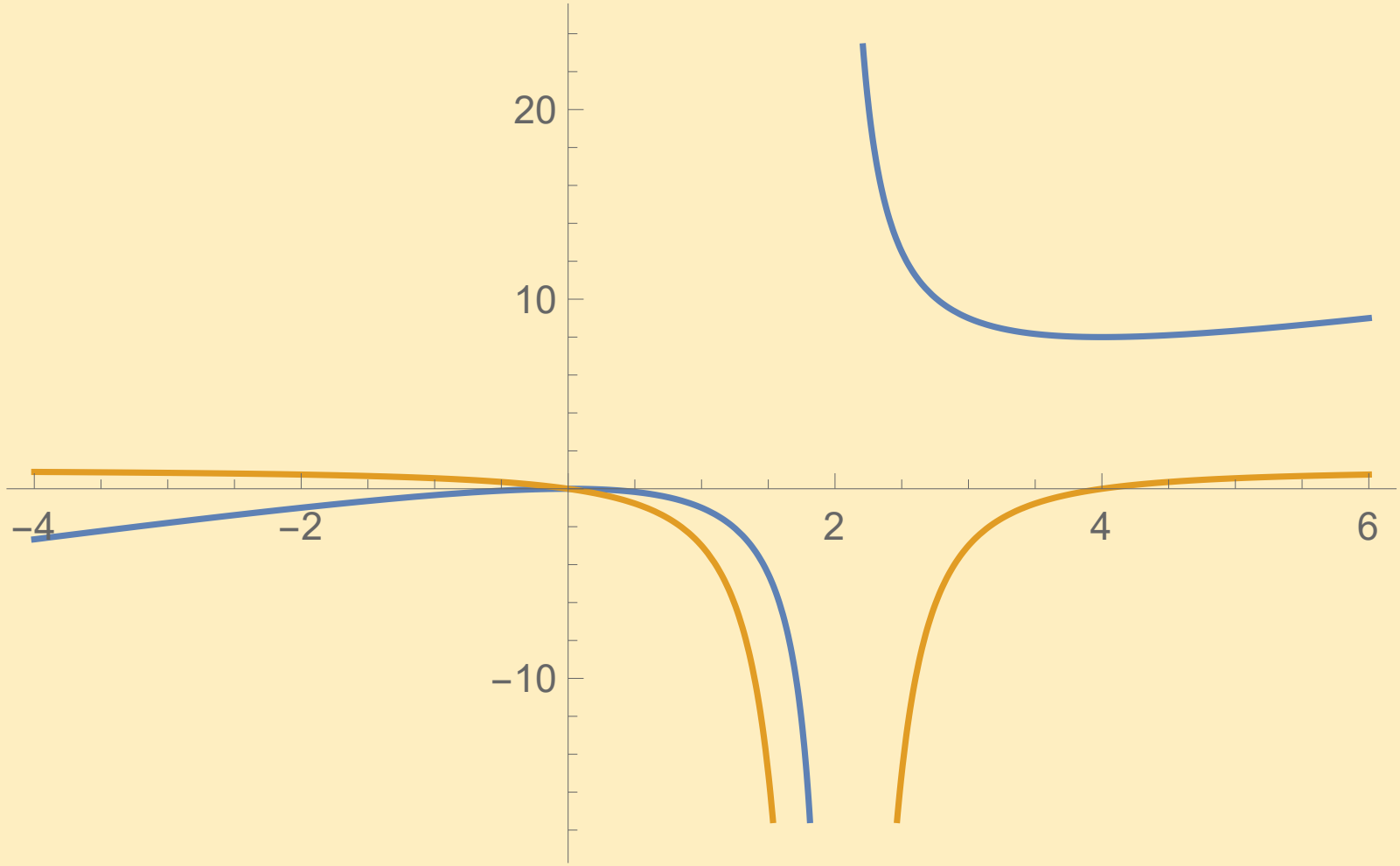
Find the intervals over which $f(x) = \dfrac{x^2}{x-2}$ is increasing and decreasing.

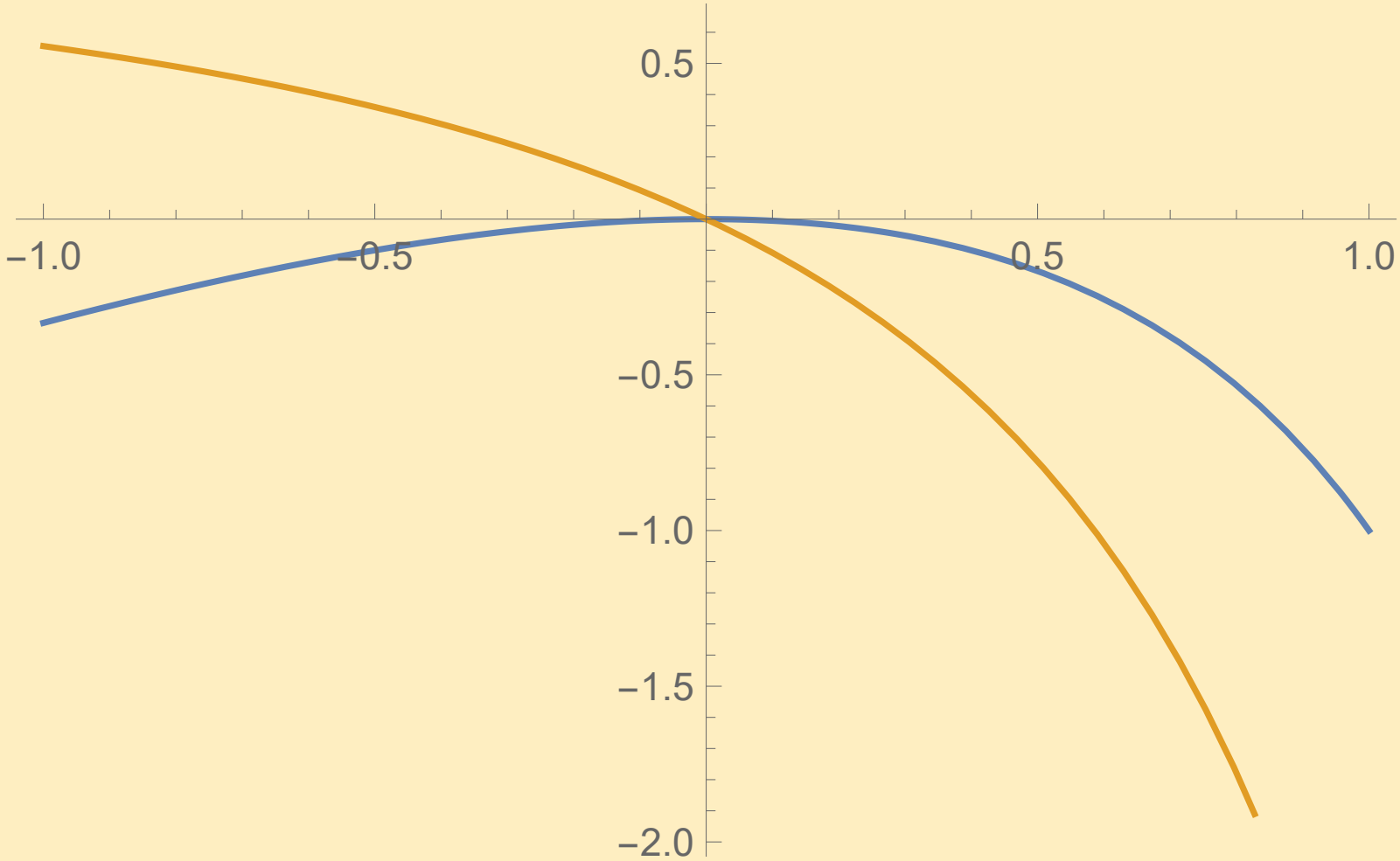
Example 3.1.2

The graph of $f(x) = \dfrac{x^2}{x-2}$ and $f'(x)$



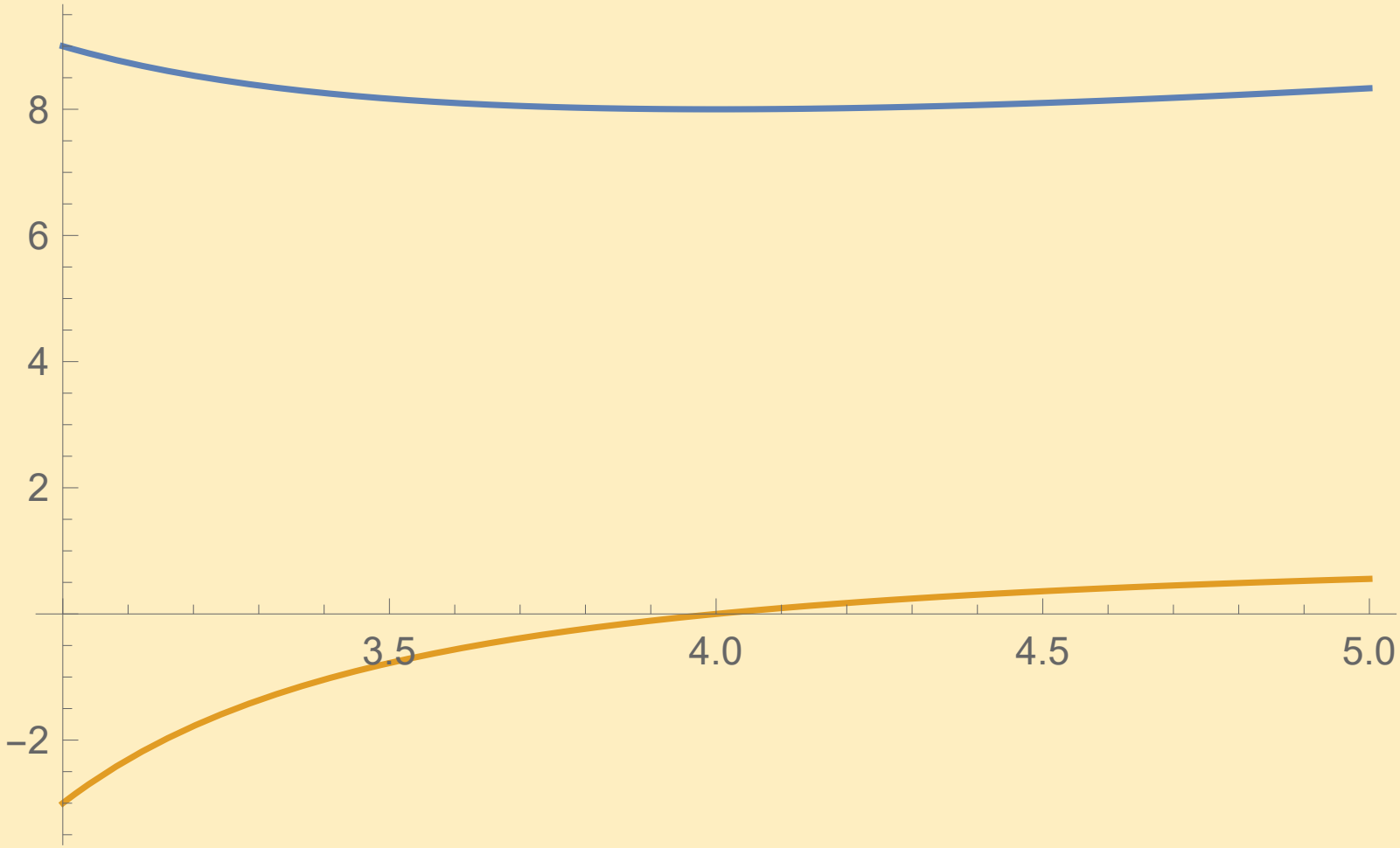
Example 3.1.2

The graph of $f(x) = \dfrac{x^2}{x-2}$ and $f'(x)$ near $x = 0$



Example 3.1.2

The graph of $f(x) = \dfrac{x^2}{x-2}$ and $f'(x)$ near $x = 4$



Example 3.1.7

The revenue, in millions of dollars, derived from the sale of a new kind of motorized skateboard t weeks after its introduction is given by

$$R(t) = \frac{63t - t^2}{t^2 + 63},$$

for $0 \leq t \leq 63$. Find the intervals of time over which revenue is increasing and over which it is decreasing.

Example 3.1.7

The graph of $R(t) = \dfrac{63t - t^2}{t^2 + 63}$