2.5 Solving Inequalities

Example 1 (Linear Inequalities)

Solve: \(-4 \leq \frac{3 - 2x}{3} < 5\)
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**Example 2 (Absolute Value Inequalities)**

Solve: \(|2x - 15| \leq 3\)
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Example 3 (Absolute Value Inequalities)

Solve: $|x + 7| > 6$
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**Example 4** *(Absolute Value Inequalities)*

Solve: $|x^2 + 5x - 4| \leq 6$
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**Example 5 (Absolute Value Inequalities)**

Solve: $|3x + 1| < 5 - 2x$
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Example 6 (Polynomial and Fractional Inequalities – SIGN GRAPH)

Solve: \(2x^3 + 5x^2 > 12x\)
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Example 7 (Polynomial and Fractional Inequalities – SIGN GRAPH)
Solve: \( x^2 - 4x - 1 \leq 0 \)
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Example 8 (Polynomial and Fractional Inequalities – SIGN GRAPH)

TRY IT! Solve: $x^3 - x^2 - 2x \geq 0$

ANS: $[-1, 0] \cup [2, +\infty)$
2.5 Solving Inequalities

Example 9 (Polynomial and Fractional Inequalities – SIGN GRAPH)

Solve: \( \frac{x+12}{x+2} \geq 3 \)

\[
\frac{x+12}{x+2} - \frac{3}{1} \geq 0
\]

\[
\frac{x+12 - 3(x+2)}{x+2} \geq 0
\]

\[
\frac{x+12 - 3x-6}{x+2} \geq 0
\]

\[
\frac{-2x+6}{x+2} \geq 0
\]

\[
-2x+6 = 0
\]

\[
-2x = -6
\]

\[
x = 3
\]

\[
x = \frac{2}{3}
\]

\[
x = -2
\]

\[
x = -2
\]

\[
\frac{-2}{1} \to -2, 0, 3, 4, \ldots
\]

\[
(-2, 3]
\]
\[
\frac{x-5}{x-3} \geq 5 \\
\frac{x-5}{x-3} - 5 \geq 0 \\
\frac{x-5 - 5(x-3)}{x-3} \geq 0 \\
\frac{x-5 - 5x + 15}{x-3} \geq 0 \\
\frac{-4x + 10}{x-3} \geq 0
\]

\(f(x) = 0\)
- \(4x + 10 = 0\) \quad \Rightarrow \quad x = \frac{5}{2}
- \(x - 3 = 0\) \quad \Rightarrow \quad x = 3

\[
\begin{array}{c}
\text{Interval} \\
(\frac{5}{2}, 3) \\
(-\infty, \frac{5}{2} ] \cup (3, \infty)
\end{array}
\]

Title: Mar 23-11:31 AM (10 of 13)
\[
\frac{1}{x+2} \geq \frac{1}{x-2}
\]

\[
\frac{1}{x+2} - \frac{1}{x-2} \geq 0
\]

\[
\frac{x-2 - (x+2)}{(x+2)(x-2)} \geq 0
\]

\[
\frac{x-2 - x-2}{(x+2)(x-2)} \geq 0
\]

\[
\frac{-4}{(x+2)(x-2)} \geq 0
\]

where is undefined
\[
x = \pm 2
\]

\[
(-\infty, -2) \cup (-2, 2) \cup (2, \infty)
\]
2.5 Solving Inequalities

Example 10 (Domain Questions – AGAIN)

Find the domain of the function: \( f(x) = \sqrt{\frac{x-2}{x^2-9}} \)

\[
\begin{align*}
\frac{x-2}{x-9} & \geq 0 \\
\theta(x) & = \sqrt{x} \\
x & \geq 0
\end{align*}
\]

\[
\begin{align*}
\delta(x) & = 0 \\
x - 2 & = 0 \\
x & = 2 \\
\therefore & = 0
\end{align*}
\]

\[
\begin{align*}
x^2 - 9 & = 0 \\
(x+3)(x-3) & = 0 \\
x & = \pm 3
\end{align*}
\]

\[
\begin{align*}
\frac{4}{x} & > 3 \\
\bigcirc & > 0 \\
2 & \bigcirc \frac{2}{x} \\
3 & \bigcirc 1 \\
4 & \bigcirc \frac{1}{x}
\end{align*}
\]

\((-3, 2] \cup (3, \infty) \quad \text{Domain}\)
2.5 Solving Inequalities

Example 11 (Domain Questions – AGAIN)

Find the domain of the function: \( f(x) = \sqrt{2x^3 - 4x^4} \)

\[
2x^3 - 4x^4 \geq 0
\]

\[
2x^3(1 - 2x) \geq 0
\]

\[x = 0 \quad 1 - 2x = 0 \quad 1 = 2x \quad \frac{1}{2} = x\]

\[\frac{0}{1} \]

\[\begin{array}{c}
0 \quad \frac{1}{2} \quad 1
\end{array}\]

\[0, \frac{1}{2}\]
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