HW Review

Given: \( f(x) = 2x^3 + 5x^2 - x - 3 \)

a.) What is the degree?  \(3\)

b.) What is the leading coefficient? \(2\)

c.) How many real zeros does the function have? \(3\)

d.) Describe the end behavior of the function.

\[
f(x) \to -\infty \quad \text{as} \quad x \to -\infty
\]

\[
f(x) \to \infty \quad \text{as} \quad x \to \infty
\]
Analyzing Graphs of Polynomial Functions

In today’s lesson you will:
• graph polynomial functions and locate their zeros.
• find the relative maxima and minima of polynomial functions.
Graph of a Polynomial Function

Graph $f(x) = -x^3 - 4x^2 + 5$ by making a table of values.

<table>
<thead>
<tr>
<th>x</th>
<th>f(x)</th>
<th>x</th>
<th>f(x)</th>
</tr>
</thead>
<tbody>
<tr>
<td>-4</td>
<td>5</td>
<td>1</td>
<td>0</td>
</tr>
<tr>
<td>-3</td>
<td>-4</td>
<td>2</td>
<td>-19</td>
</tr>
<tr>
<td>-2</td>
<td>-3</td>
<td>3</td>
<td>-58</td>
</tr>
<tr>
<td>-1</td>
<td>2</td>
<td></td>
<td></td>
</tr>
<tr>
<td>0</td>
<td>5</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

**Zeros:**
- $x = -3.6$
- $x = -1.4$
- $x = 1$

**Rel. Minimum:** (-2.7, -4.5)

**Rel. Maximum:** (0, 5)

**Domain:** All real numbers

**Range:** All real numbers

**End behavior:**
- $f(x) \to -\infty$ as $x \to -\infty$
- $f(x) \to \infty$ as $x \to \infty$
Locate Zeros of a Function

Determine consecutive integer values of $x$ between which each real zero of $f(x) = x^4 - x^3 - 4x^2 + 1$ is located. Then draw the graph.

$$\begin{array}{|c|c|}
\hline
x & f(x) \\
\hline
-3 & 73 \\
-2 & 9 \\
-1 & -1 \\
0 & 1 \\
1 & -3 \\
2 & -7 \\
3 & 19 \\
\hline
\end{array}$$

Zeros:

- $x = -1.4$
- $x = -0.6$
- $x = 0.5$
- $x = 2.5$

Relative Max: $(0, 1)$
Relative Min: $(-1.1, -1)$
$(1.8, -7.3)$

End behavior:
- $f(x) \to -\infty$ as $x \to -\infty$
- $f(x) \to \infty$ as $x \to \infty$

Domain: All real numbers
Range: $y \geq -7.3$
**relative minimum**
a point on the graph of a function where no other nearby points have a lesser $y$-coordinate

**extrema**
the maximum and minimum values of a function

**relative maximum**
a point on the graph of a function where no other nearby points have a greater $y$-coordinate
Maximum and Minimum Points

Graph \( f(x) = x^3 - 3x^2 + 5 \). Estimate the \( x \)-coordinates at which the relative maxima and relative minima occur.

<table>
<thead>
<tr>
<th>( x )</th>
<th>( f(x) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>-3</td>
<td>-49</td>
</tr>
<tr>
<td>-2</td>
<td>-15</td>
</tr>
<tr>
<td>-1</td>
<td>1</td>
</tr>
<tr>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>1</td>
<td>3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
</tr>
<tr>
<td>3</td>
<td>5</td>
</tr>
</tbody>
</table>

Real Zeros: \( x = -1.1 \)
Rel. Max: \( (0,5) \)
Rel. Min: \( (2,1) \)

End Behavior:
\[ f(x) \to -\infty \text{ as } x \to -\infty \]
\[ f(x) \to \infty \text{ as } x \to \infty \]

Domain: All real numbers
Range: All real numbers