Show all work. Answers given with incomplete reasoning will not receive full credit.

Question 1 (3 points) Sketch a graph of the function

\[ f(x) = -x(x + 1)^2(x - 2) \]

- \( f(x) \) is of (even) degree \( 1 + 2 + 1 = 4 \)
- Since \( f(x) \) is of even degree with a negative leading coefficient, \( f(x) \) is the end behavior.
- The zeros of \( f(x) \) are \( x = 0, -1, 2 \).
- The zero \( x = -1 \) is repeated twice, so the graph of \( f(x) \) "bounces" at \( x = -1 \).

Thus, 

\[ \begin{array}{c}
\begin{array}{cccccc}
& & & & & \\
-1 & 0 & 2 & - & + & \rightarrow \\
& & & & & \\
& & & & & \downarrow \leftarrow f(x)
\end{array}
\end{array} \]
Question 2 (2 points) What is the remainder when the polynomial
\[ f(x) = 5x^3 - 2x^2 + \pi \]
is divided by \( x + 1 \)? State the theorem you used to solve this problem.

The remainder is \( f(-1) = 5(-1)^3 - 2(-1)^2 + \pi \)

\[ = -5 - 2 + \pi = \boxed{-7 + \pi} \]

We used the Remainder Theorem here.

Question 3 (2 points) Use synthetic division to find the quotient and remainder when \( f(x) = 2x^3 + 7x^2 - 6x - 8 \) is divided by \( x + 4 \).

\[
\begin{array}{c|cccc}
-4 & 2 & 7 & -6 & 1 \\
& & -8 & 4 & 1 \\
\hline
& 2 & -1 & -2 & 0 \\
\end{array}
\]

So, the quotient is \( 2x^2 - x - 2 \)

and the remainder is 0.