1. For the quadratic function \( f(x) = 2x^2 + 8x + 7 \)
   (a) determine the vertex of the parabola;
   
   (b) determine all \( x \)-intercepts (with exact values).

2. Graph the function \( f(x) = x^4 - 5x^2 + 4 \) with the following steps:
   (a) (3pts) Find all zeros of the function.
   
   (b). (3pts) Plot the following points.
   
<table>
<thead>
<tr>
<th>( x )</th>
<th>-2.5</th>
<th>-1.5</th>
<th>0</th>
<th>1.5</th>
<th>2.5</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

   (c) (4pts) Graph the function to indicate the properties in (a) and (b) and the left-hand and right-hand behavior.

3. (a) (6pts) Use long division to find the quotient and remainder when \( 2x^4 - 4x^3 - 5x^2 + 3x - 2 \) is divided by \( x^2 - 2x - 3 \).

   (b) (4pts) Use result in (a) to write the improper fraction as a sum of a polynomial and a proper fraction.
   
   \[
   \frac{2x^4 - 4x^3 - 5x^2 + 3x - 2}{x^2 - 2x - 3} =
   \]
4. (10pts) For the polynomial \( f(x) = x^4 - x^3 + x^2 - 3x - 6 \),
(a). list all possible rational zeros using the rational zero test and find all rational zeros;

(b). find all remaining zeros (in addition to those in (a)) of \( f(x) \) including complex zeros.

5. (10pts) For each of the following functions, find its domain and all vertical, horizontal, and slant asymptotes (write down their equations).
(a). \( f(x) = \frac{5}{(x - 3)^3} \) domain v. asymp. h. asymp. slant asymp.

(b). \( f(x) = \frac{x^2 - 2x}{x + 1} \)

6. (10pts) Graph the function \( f(x) = \frac{2(x^2 - 9)}{x^2 - 4} \) and provide the following information:

(a). \( y \)-intercepts: ______________________

(b). \( x \)-intercepts: ______________________

(c). Vertical asymptotes:__________________

(d). Horizontal asymptotes:______________

(e). Symmetry:__________________________

(e). Values of the function:

<table>
<thead>
<tr>
<th>( x )</th>
<th>0.5</th>
<th>1.5</th>
<th>2.5</th>
<th>7</th>
</tr>
</thead>
<tbody>
<tr>
<td>( f(x) )</td>
<td></td>
<td></td>
<td></td>
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</tbody>
</table>
7. (10pts) Write the partial fraction decomposition for \( \frac{x + 7}{x^2 - x - 6} \).

8. (10pts) Find the number of units sold that produces a maximum revenue \( R = 900x - 0.1x^2 \), where \( R \) is the total revenue (in British Pounds) and \( x \) is the number of units sold.

9. (10pts) Convert the logarithm equation to an equivalent exponential equation, and vice versa.
   (a). \( \log_{32}(4) = \frac{2}{5} \), the equivalent exponential equation is

   (b). \( 9^{\frac{2}{3}} = 27 \), the equivalent logarithm equation is

10. (10pts) Given that \( x^2 + 4 \) is a factor, factor the polynomial \( x^4 - 3x^3 - x^2 - 12x - 20 \) in completely factored form using complex coefficients if necessary.