MATH 220 Midterm I Sample 2

1) Find the equation of the line tangent to \( y = \sin(2x) \) at the point where \( x = -\frac{\pi}{3} \).

2) Find the derivative \( f'(x) \) of the function \( f(x) \). DO NOT SIMPLIFY.

\[
f(x) = \frac{\sin^4(\sqrt{x + x^2})}{\sqrt{x} \cdot \cos x}
\]

3) Find all vertical and horizontal asymptotes of the function

\[
f(x) = \frac{\sin x}{x}
\]

4) Use limit definition of the derivative to find the derivative of \( f(x) = \frac{1}{x+7} \) at \( a = -4 \).

5) Find all the points at which \( f(x) \) is continuous.

\[
f(x) = \begin{cases} 
\frac{2}{x^2+x-2}, & \text{if } x < -1 \\
2, & \text{if } x = -1 \\
x, & \text{if } -1 < x < 0 \\
\sin(2x + \pi), & \text{if } 0 < x 
\end{cases}
\]

6) Find the limit (possibly infinite). If the limit is infinite, indicate \(+\infty\) or \(-\infty\).

\[
\lim_{x \to +\infty} \left( \sqrt{4x^2 - 3x + 1} - \sqrt{4x^2 + 5} \right)
\]

7) Find the limit (possibly infinite). If the limit is infinite, indicate \(+\infty\) or \(-\infty\).

\[
\lim_{x \to -2} \frac{|x^2 - x - 6|}{x^2 - 4x + 4}
\]

8) Find the limit (possibly infinite). If the limit is infinite, indicate \(+\infty\) or \(-\infty\).

\[
\lim_{x \to 1^-} \frac{x^2 - 1}{\sqrt{x + 3} - 2}
\]
9) Evaluate the limit:
\[ \lim_{{x \to -3}} \frac{1}{x} + \frac{1}{3} \]

10) The graph of \( f(x) \) is given below.

   a) Indicate \( x \)-coordinates of the points where \( f(x) \) is not continuous.

   b) Indicate \( x \)-coordinates of the points where \( f(x) \) is not differentiable.