 Unless explicitly stated, full credit will be awarded only if the solution is correct and the steps leading up to it are correct.

1. Calculate the following:
   
   (a) \[
   \lim_{x \to -1} \frac{x^2 - 4x - 5}{x + 1}
   \]

   (b) \[
   \lim_{x \to 3} \frac{5x^2}{2x - 1}
   \]

   (c) \[
   \lim_{x \to 2} \frac{4 - x^2}{|2 - x|}
   \]

   (d) \[
   \lim_{x \to 1} \sqrt{\frac{2x^3 - 3x + 5}{2 - x}}
   \]

   (e) \[
   \lim_{x \to 3} f(x) \quad \text{where} \quad f(x) = \begin{cases} 
   x^2 & \text{if } x > 3 \\
   8 & \text{if } x = 3 \\
   12 - x & \text{if } x < 3
   \end{cases}
   \]

   (f) \[
   \lim_{x \to 3} \frac{x + 3}{x^2 - 9}
   \]

2. Consider the function
\[
f(x) = \begin{cases} 
   x - c, & \text{if } x > 2; \\
   3x^2, & \text{if } x \leq 2
   \end{cases}
\]

   where \( c \) is a real number.
   
   (a) What value of \( c \) makes the function \( f \) continuous everywhere?
   
   (b) Calculate \( f'(7) \)
   
   (c) Calculate \( f'(-1) \)
   
   (d) Calculate \( f'(2) \)

3. Compute the derivative of the following functions:
   
   (a) \[
   f(x) = \pi^4
   \]

   (b) \[
   f(x) = 3x^5 - x^2 + 9
   \]
(c)  
\[ f(x) = \frac{2}{x^2} - 3\sqrt{x} \]

(d)  
\[ f(x) = \frac{x^2}{2x - 3} \]

(e)  
\[ f(x) = x^2 e^x \]

(f)  
\[ f(t) = t \sin t \]

4. Find the equation for the tangent line to the curve \( y = f(x) \) where through the point \((1, -3)\) where \( f(x) = x^8 - 4x \).

5. Suppose an object is moving along the real line with its position at time \( t \) given by the function \( s(t) = \frac{1}{3}t^3 - 3t^2 - 7t + 10 \).
   (a) When is the object at rest?
   (b) When is the object decelerating?
   (c) Find the velocity of the object at time \( t = 2 \).

6. Consider the function  
\[ f(x) = x^2 - \sin x \]
   Using your calculator, find the approximate value(s) of \( x \) (out to two decimal places) at which the tangent line to the graph \( y = f(x) \) is horizontal.

7. Consider the graph of \( y = f(x) \) on the next page.
   (a) Where is \( f \) undefined?
   (b) Where is \( f \) not continuous?
   (c) Where is \( f \) not differentiable?
   (d) On what interval(s) is \( f' \) positive? Where does \( f' \) vanish?
   (e) On what interval(s) is \( f \) concave down?
   (f) What are  
   i.  
   \[ f'(6) \]
   ii.  
   \[ \lim_{x \to 6^+} f(x) \]
   iii.  
   \[ \lim_{x \to -1} f(x) \]
   iv.  
   \[ \lim_{x \to -\infty} f(x) \]