Question 1 Determine the following limits (if they exist):

a) \( \lim_{x \to -2} \frac{x - |x^3 - 4|}{|x| + 3} \)

b) \( \lim_{x \to 4} \frac{x^2 - 16}{\sqrt{x} - 2} \)

c) \( \lim_{x \to 4^-} \frac{\sqrt{x + 5} - 4}{x^2 - 2x - 8} \)

d) \( \lim_{x \to 0} \frac{\sin 2x}{4x} \)

e) \( \lim_{x \to 0} \frac{1 - \cos 3x}{2x^2} \)

f) \( \lim_{x \to \pi} \frac{\sin x}{x - \pi} \)

Question 2 Find a value of \( A \) so that the function \( f(x) \) is continuous for all values of \( x \).

\[ f(x) = \begin{cases} \cos(\pi x) + \sqrt{4 - x} & \text{if } x \leq 2 \\ \sqrt{2 + \sin (A \pi x)} & \text{if } x > 2 \end{cases} \]

Question 3 Show that the equation \( 3^x = 2 - x^2 \) has at least one solution on the interval \([0, 1]\).

Question 4 Prove that \( \lim_{x \to -2} 3x + 7 = 1 \).

Question 5 Prove that \( \lim_{x \to 3} x^2 - 1 = 8 \)

Question 6

a) Use the (limit) definition of derivative to compute the derivative \( f'(x) \) for the function \( f(x) = \frac{3x - 1}{2x + 3} \).

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

Question 7 Compute the derivatives of the following functions (do not simplify):

a) \( f(x) = 4x^3 - \sqrt{x} \)

b) \( f(x) = \left(3x^2 - \frac{4}{x^2}\right) \left(3x^7 - 8x^4 + 2x^{-1/4}\right) \)

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

d) \( f(x) = (3x^3 - 4x + 9)^{7/3} \)

e) \( f(x) = \cos^7 \left(4x^2 - \frac{5}{\sqrt{x}}\right) \)

Question 8 Find the value(s) of \( x \) where the graph of \( y = 3x^{2/3} + 4x \) has a horizontal tangent line.

Question 9 For the function \( g(t) = 4 - 3t + t^3 \). Find the average rate of change of \( g(t) \) over the interval \([-2, 3]\). What is the instantaneous rate of change of \( g(t) \) at \( t = 1 \)?