

Homework 1

PS 2010

Due: : Sep 8th, 8:59:59am

Notice: The grading will mainly focus on the steps not the final results. This means even your final results are wrong but you follow the correct steps, you will be given the full score.

1 Tangent Lines and Rates Of Change (10 Points)

For the function $f(x) = 3(x + 2)^2$ and the point P given by $x = -3$ answer each of the following questions:

- For the points Q given by the following values of x compute the slope m_{PQ} of the secant line through points P and Q.
– 1) -3.1, 2)-3.01, 3) -3.0001, 4)-2.9, 5)-2.999, 6)-2.9999
- Use the information from above to estimate the slope of the tangent line to $f(x)$ at $x = -3$ and write down the equation of the tangent line.

2 Limit (12 Points)

Compute the limit for the following functions, you can just pick two points from each side to show your results

- $\lim_{x \rightarrow 2} 3x^2 + 5x - 9$
- $\lim_{x \rightarrow 1} \frac{x^2 + 2x - 3}{x - 1}$
- $\lim_{x \rightarrow a} \frac{x^3 - a^3}{x - a}$
hint: You need to factor the numerator first
- $\lim_{x \rightarrow 1} \begin{cases} x - 5 & x \neq 1 \\ 7 & x = 1 \end{cases}$

3 Numerical Derivative (16 Points)

Use the definition of derivative:

$$f'(x) = \lim_{h \rightarrow 0} \frac{f(x+h) - f(x)}{h}$$

calculate $f(x) = x^2$ and $f(x) = 10 + 5x - x^2$

4 Differentiation (30 Points)

Find the derivative for the following:

- $f(x) = 6x^3 - 9x + 4$
- $f(x) = \frac{4x^3 - 7x + 8}{x}$
- If $f(2) = -8$, $f'(2) = 3$, $g(2) = 17$, $g'(2) = -4$, then determine the value of $\frac{d}{dx}[f(2)g(2)]$
- $f(x) = (4x^2 - x)(x^3 - 8x^2 + 12)$
- $f(x) = \frac{6x^2}{2-x}$
- $f(x) = 2e^x - 8^x$
- $f(x) = 4 \log_3(x) - \ln(x)$
- $f(x) = (4x^2 - 3x + 2)^{-2}$
- $f(x) = \ln(1 - 5x^2 + x^3)$

5 Extrema (20 Points)

Find the local and global extrema for $f(x) = 8x^3 + 81x^2 - 42x - 8$ on $[-8, 2]$

6 Bonus Question (3 POINTS)

Find the derivative for $f(x) = \frac{(x^3+4)^5}{(1-2x^2)^3}$