First Name:_____   Last Name: _____   Student ID: _____

Derivatives and Their Applications (1)

1. For each case, find the critical points.

a. $f(x) = x^3 + 6x^2 + 9x + 2$	b. $f(x) = x^3$
c. $f(x) = \sqrt[3]{x}$	d. $f(x) = \dfrac{x^4+1}{x^2+1}$

2. For each case, find any local extremum using the first derivative test.

a. $f(x) = |x^2 - 4|$ b. $f(x) = x^3 + 3x - 1$

c. $f(x) = \left(\dfrac{1+x}{1-x}\right)^2$

3. For each case, find the absolute extrema (maximum or minimum) points.

a. $f(x) = -2x + 3$,   for $x \in [-1, 2]$ b. $f(x) = \sqrt{x - 2}$,   for $x \in [2, 6]$

4. Let $f(x) = ax^4 + bx^2 + cx + d$. Find such that has a local maximum at $(0, -6)$ and a local minimum at $(1, -8)$.

5. Find the LM and Lm for $f(x) = x^n$, n is natural.

6. For each case, use the first derivative sign to find the intervals of increase or decrease.

a. $f(x) = x^2 - 2x$ b. $f(x) = \sqrt{x}(x - 1)$

c. $f(x) = x^3(x-1)^4$

d. $f(x) = \begin{cases} \frac{x}{2} + 2, & x < 1 \\ x^3, & x \geq 1 \end{cases}$

7. Determine the coordinates of the point P on the parabola $y = 9 - x^2$ that is closest to the point $A(3, 9)$.

8. Determine the maximum and minimum values of the function $f(x) = sin^2 x$ on the interval $0 \leq x \leq 2\pi$.

9. Find all the critical points of the function $f(x) = cos(x + \frac{1}{x})$.