(**10pts**)**Problem 1.**
Evaluate the following limits

1. $\lim_{x \to 1} \dfrac{1 - \sqrt{8x - 7}}{x - 1}$

2. $\lim_{x \to -2^+} \dfrac{4 + x\,|x|}{x + 2}$

(10pts)Problem 2.
Find the values of a and b for which the function

$$f(x) = \begin{cases} 3x^2 - a & \text{if } x > 1 \\ -a + b & \text{if } x = 1 \\ x - 2b & \text{if } x < 1 \end{cases}$$

is continuous at $x = 1$.

(10pts)Problem 3

Find the equation of the tangent line to the graph of $f(x) = \dfrac{xe^x}{x+1}$ at $x = 0$.

(10pts)Problem 4.

A) Find $\frac{dy}{dx}$ if

$$y^2 \ln x + x\sqrt{y} = 2.$$

B) One side of a rectangle is increasing at a rate of 3 cm/sec and the other side is decreasing at a rate of 4 cm/sec. How fast is the area of the rectangle changing when the increasing side is 12 cm long and the decreasing side is 10 cm long?

(10pts)Problem 5.
Find all the critical numbers of the function

$$f(x) = \sqrt[3]{2x - x^2}.$$

(10pts)Problem 6.
Find the absolute extrema of the function $g(x) = e^{x^4-2x^2}$ on $[-1,\ 1]$.

(10pts)Problem 7.
Find the open intervals on which the function $f(x) = 1 + 2x + 6x^2 - x^4$ is concave up or down.

(10pts)Problem 8.
Use definite integrals to evaluate

$$\lim_{n\to\infty}\sum_{i=1}^{n}\frac{1}{n}\sqrt[3]{-1+\frac{2i}{n}}.$$

(10pts)Problem 9.
Find the local extrema of the function

$$F(x) = \int_1^x t\,(2-t)\,dt$$

(10pts)Problem 10.
Use u-substitution to evaluate

$$\int x^3\sqrt{x^2-10}dx$$