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

1. $\lim_{x\to 3} \dfrac{\sqrt{2x+3}-3}{x-3}$
2. $\lim_{x\to -1^+} \dfrac{2\,|x|-2}{x+1}$
3. $\lim_{x\to -\infty} \dfrac{3\,|x|-1}{2x+7}$

(10pts)Problem 2.
Given that $f(2) = 3$, find the values of a and b for which the function

$$f(x) = \begin{cases} \ln x & \text{if } 0 < x \leq 1 \\ ax^2 + b & \text{if } 1 < x \leq 5 \end{cases}$$

is continuous at $x = 1$.

(10pts)Problem 3

Find the equation of the tangent line to the graph of $f(x) = \dfrac{1 + \ln x}{x^2 + 1}$ at $x = 1$.

(10pts)Problem 4.

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

$$y \sin x + y^3 = 2x + 1.$$

B) The radius of a cylinder is increasing at a rate of 3 cm / sec and the height is increasing at a rate of 2 cm / sec. How fast is the volume changing when the radius is 1 cm and the height is 4 cm? (The volume of a cylinder is $V = \pi r^2 h$).

(10pts)Problem 5.
Find the absolute extrema of the function $g(x) = \sqrt{x}\,(x-3)$ on $[0,\ 4]$.

(10pts)Problem 6.
Find the smallest possible perimeter of a rectangle of area 50 cm^2.

(10pts)Problem 7.
Find the open intervals on which the function $f(x) = 2x - 3x^{2/3}$ is concave up or down.

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

$$\lim_{n\to\infty} \sum_{i=1}^{n} \frac{2\pi}{n} \cos\left(-\frac{\pi}{2} + \frac{\pi i}{n}\right).$$

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

$$F(x) = \int_0^x \left(t^2 - 3t + 2\right) dt$$

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

$$\int x^2 \left(1 - x^3\right)^5 dx$$