

Problem 1. Compute the following limits by **showing all your work**. If the answer is $+\infty$, specify which one.

(a) (5 pts.) $\lim_{x \rightarrow 2^-} \frac{x^2+x-6}{x-2}$

(b) (5 pts.) $\lim_{x \rightarrow 0} \frac{\sqrt{1+x}-1}{x}$

Problem 2. Compute the followings limits by **showing all your work**. If the answer is $\pm\infty$, specify which one.

(a) (5 pts) If we know that $4x - 9 \leq f(x) \leq x^2 - 4x + 7$, for all $0 \leq x$, find

$$\lim_{x \rightarrow 4} f(x).$$

(b) (5 pts) $\lim_{x \rightarrow -\infty} \frac{-2x^3 + 2x + 5}{6x^2 - 5x + 3}$.

Problem 3. Show that there is an α such that $-1 \leq \alpha \leq 2$ and $\alpha^4 - 2\alpha^2 + 6\alpha + 4 = 0$.

Problem 4. Find the equation of the line that is tangent to the curve $y = x^3$ at $x = 1$.

Problem 5. Find the points at which the following function is discontinuous, **showing all your work**:

$$f(x) = \begin{cases} e^x, & \text{if } x < 0 \\ x^2, & \text{if } x \geq 0 \end{cases}$$

Problem 6.

(a) (5 pts) Compute $\ln(e^{\sqrt{2}})$.

(b) (5 pts) Compute $\log_{10} 1.25 + \log_{10} 80$.

(c) (5 pts) Solve the following equation for x :

$$\ln(x) + \ln(x - 1) = 1.$$

Problem 7. Find the intervals on which the function $f(x) = x^3 - 6x^2 + 9x + 2$ is increasing/decreasing and concave up/down.

Problem 8. Find the derivative of each of the following functions:

(a) (5 pts) $\frac{e^x}{\sin(x)}$

(b) (5 pts) $2x^3 + \sqrt{x} + 3$

Problem 9. Using the definition of the derivative determine whether the function $f(x)$ given by

$$f(x) = |x - 2| - 4$$

has a derivative at $x = 2$.