Total: 100 points

1. (**30** points) For what value of a and b is

$$f(x) = \begin{cases} ax + 2b & x \leq 0 \\ x^2 + 3a - b & 0 < x \leq 2 \\ 3x - 5 & 2 < x \end{cases}$$

continuous at every x.

2. (**30** points) Find the limit or show that it does not exist.

$$\lim_{x \to -\infty} \frac{\sqrt{1 + 4x^6}}{2 - x^3}$$

3. (**20** points) A function is expressed as $f(x) = \dfrac{\sqrt{x^2+4}}{x}$. Use various limits to find all of its asymptotes.

4. (**20** points) Use the Intermediate Value Theorem to show that there is a solution of the given equation in the specified interval.

   Equation : $\sin x = x^2 - x$ Interval : $(1, 2)$

   Note: $\sin 1 \approx 0.84,\ \sin 2 \approx 0.91$