

Answer all of the following questions. 8 points for each question.

Calculators are not allowed

1. Evaluate the following limits (if they exist)

$$(a) \lim_{x \rightarrow 2} (x-2)^2 \sin\left(\frac{1}{x-2}\right).$$

$$(b) \lim_{x \rightarrow 0} x^2 \sqrt{1 + \frac{1}{x^2}}$$

$$2. \text{ Let the function } f \text{ be given by } f(x) = \begin{cases} \frac{\sqrt{6x-5} - \sqrt{3x-2}}{x^2 + 4x - 5} & \text{if } x > 1, \\ \frac{A}{4} & \text{if } x = 1, \\ \frac{5|x-1|}{x^2 - 3x + 2} + B & \text{if } x < 1. \end{cases}$$

Find the values of  $A$  and  $B$  so that  $f$  is continuous for every  $x \in (-\infty, \infty)$ .

3. (a) Find the horizontal and vertical asymptotes (if any) for the function  $f$  given by

$$f(x) = \frac{5x^2 + x}{|x|(x-3)}.$$

(b) Use the definition of the derivative to find  $\frac{ds}{dt}$ , where  
 $s = t^2 + 1$ .

(a) Show that the equation  $2x^3 - 5x^2 + 11 = 0$ , has at least one real root.

(b) If  $y = \sin^2 \sqrt{5x^3 - 2x} + \tan\left(\frac{x-1}{x-2}\right)$ . Find  $y'$ .

(a) Let  $f(x) = (x-2)^{\frac{2}{3}}$ . Determine whether  $f$  has a cusp, explain.

(b) Find the  $x$ -coordinates of the points on the graph of  $y = x + \sin^2 x - \cos x$ , at which the tangent line is parallel to the line  $y - x + 2 = 0$ , and  $x$  is in the interval  $[0, 2\pi]$ .

Best of Luck