

Calculators and Mobile Phones are not allowed.

1. Evaluate each of the following limits, if it exists:

a)  $\lim_{x \rightarrow 1} \frac{x-1}{\sqrt{2x}-\sqrt{3-x}}$  (3 Points)

b)  $\lim_{x \rightarrow 0} \frac{\sin x}{\sqrt{x^3+x^2}}$  (3 Points)

2. Use the  $\epsilon, \delta$  definition of limit to show that:  $\lim_{x \rightarrow 2} (5-2x) = 1$ . (3 Points)

3. Let

$$f(x) = \frac{(x^2 - 2x + 1)|x|}{(x^2 - 1)x}$$

a) Find all points of discontinuity of  $f$  and classify each discontinuity as removable, infinite, or a jump. (3 Points)

b) Find the vertical and horizontal asymptotes for the graph of  $f$ , (if any). (3 Points)

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

5. Assume  $\lim_{x \rightarrow -1} f(x)$  exists and

$$\frac{x^2 + x - 2}{x + 3} \leq \frac{f(x)}{(x - 1)^2} \leq \frac{x^2 + 2x - 1}{x + 3}$$

Find  $\lim_{x \rightarrow -1} f(x)$ . (4 Points)

6. Let  $f(x) = (x^2 - 1)\sec(\sqrt{x-1}) + \tan(x^3 - 1)$ . Find  $f'(x)$  (3 Points)