King Fahd University of Petroleum & Minerals

Math 101 - 14 & 18

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First Major Exam **Semester 041**

Name: **ID #:** **Section #:**

Q1. (10 Points - Suggested time: 5 minutes) State if each of the following statements is true or false:

1. If $\lim_{t\mapsto\infty} f(t) = 2$, then $\lim_{x\mapsto 0} f(\frac{1}{x}) = 2$.
2. If $f(x)$ and $g(x)$ are continuous at $x = a$ then $\frac{f(x)}{g(x)}$ is continuous at $x = a$.
3. The composition of any two continuous functions is continuous.
4. There exists a function $f(x) : [0, 2\pi] \to \mathbb{R}$, whose graph have infinite number of vertical asymptotes.
5. If $\lim_{x\mapsto a} f(x) = 0$ and $\lim_{x\mapsto a} g(x) = 0$ then $\lim_{x\mapsto a} \frac{f(x)}{g(x)}$ does not exists.

Q2. (20 Points - Suggested time: 15 minutes) Consider the function:

$$f(x) := \begin{cases} \frac{x^3-1}{x-1}, & x < 3 \\ \sqrt{\frac{x}{-}} & i \neq j \end{cases}$$

1. Find the points at which the function is continuous.
2. Find the horizontal asymptotes of the function (if any)
3. Find the vertical asymptotes of the function (if any)

Q3. (40 Points - Suggested time: 20 minutes) Find the following limits, if they exist (Showing all details):

1. $\lim_{x \mapsto -\infty} \frac{2x^{777}-x^3+2}{x^3-x^{777}+1} =$

2. $\lim_{x \mapsto -\infty} \frac{\sqrt{x^2+3x-3}-x}{x-1} =$

3. $\lim_{x \mapsto 1}$

4. $\lim_{x \mapsto 0} \frac{\sin(3x)}{4x} =$

Q4. (10 Points - Suggested time: 10 minutes) Find the horizontal and the vertical asymptotes of

$$f(x) = \frac{x^4 - 6x^2 + 8x - 3}{x^4 + 4x^3 - 2x^2 - 12x + 9}.$$

Q5. (10 Points - Suggested time: 10 minutes) Show (using the definition) that

$$\lim_{x \mapsto -1} (2x - 3) = -5$$