



Prince Sultan University

MATH 111

Major Exam I

First Semester Term 171

Sunday, October 29, 2017

Time Allowed: **100 minutes**

Student Name: _____

Student ID #: _____

Teacher's Name: _____ Section #: _____

Serial #: _____

Important Instructions:

1. You may use a scientific calculator that does not have programming or graphing capabilities.
2. You may NOT borrow a calculator from anyone.
3. You may NOT use notes or any textbook.
4. There should be NO talking during the examination.
5. Your exam will be taken immediately if your mobile phone is seen or heard
6. Looking around or making an attempt to cheat will result in your exam being cancelled
7. This examination has 16 problems, some with several parts. Make sure your paper has all these problems.

Questions #	points	Total Points
1,2,3	17	
4,5,6,7	14	
8,9,10,11	16	
12	17	
13,14,15,16	16	
Total	80	

Q1. [9 pts] Find the domain of the following functions:

(Show your work in details)

a) $f(x) = \ln(2x^2 + 5x - 3)$

b) $f(t) = \sqrt{3-t} - \sqrt{2+t}$

c) $g(x) = \frac{7x^2}{\sqrt{e^{5x} + 4}}$

Q2. [4 pts] Let $f(x) = -4x + 2$ and $g(x) = \sqrt{x-8}$, find $(g \circ f)(x)$, and the domain of $g \circ f$

Q3. [4 pts] Find the inverse of the function $f(x) = \frac{4x-1}{2x+3}$

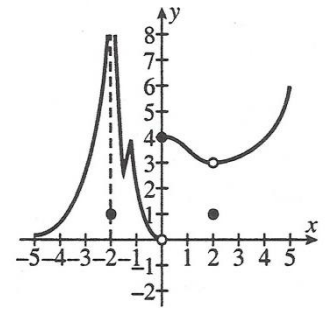
(Show your work in details)

Q4. [3 pts] Generate a table of values to find the limit of $\lim_{y \rightarrow -\infty} \frac{\sqrt{y^2 + 2}}{2y - 6}$

(Show your work in details)

Q5. [4 pts] Find the horizontal and vertical asymptotes of each curve $y = \frac{2x - 7}{3x^2 - 27}$ (Show your work in details)

Q6. [3 pts] At which points is the graph discontinuous? (Give a reason for each)



Q7. [4 pts] Let g be the function defined by $g(x) = \begin{cases} \frac{4 - 2x}{4 - x^2} & \text{if } x < 2 \\ 0.5 & \text{if } x = 2 \\ 5 - 2^x & \text{if } x > 2 \end{cases}$ (Show your work in details)

a. Is the function g continuous from the left at $x = 2$? Justify your answer?

b. Is the function g continuous from the right at $x = 2$? Justify your answer?

Q8. [2 pts] If $f(x) = 2x^2 + 1$, Find $\lim_{x \rightarrow 0} \frac{f(x) - f(0)}{x^2}$

Q9. [4 pts] Use the Intermediate Value Theorem to show that there is a root of the equation $\ln x = e^{-x}$ in the interval $(1, 2)$.
(Show your work in details)

Q10. [6 pts] Let f be the function defined by $f(x) = \begin{cases} \sqrt{10-x} & \text{if } x \leq 1 \\ x^2 & \text{if } 1 < x < 2 \\ \frac{4}{x} & \text{if } x \geq 2 \end{cases}$

a. [4 pts] Evaluate each limit, if it exists.

(i) $\lim_{x \rightarrow 1^-} f(x) =$

(ii) $\lim_{x \rightarrow 1^+} f(x) =$

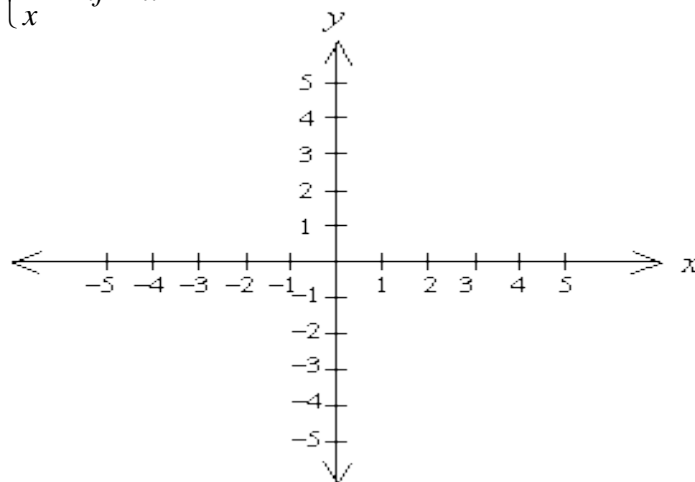
(iii) $\lim_{x \rightarrow 1} f(x) =$

(iv) $\lim_{x \rightarrow 2^-} f(x) =$

(v) $\lim_{x \rightarrow 2^+} f(x) =$

(vi) $\lim_{x \rightarrow 2} f(x) =$

b. [2 pts] **Sketch the graph of the function f**



Q11. [4 pts] Show that the function $f(x) = -3 + \sqrt{81 - x^2}$ is continuous on its domain by using the definition of the continuity.

Q12. [2+3+3+3+3+3=17 pts] Evaluate the limit, if it exists.

(Show your work in details)

a. $\lim_{x \rightarrow 6^+} \log_7(x^2 - 36)$

b. $\lim_{x \rightarrow 3} \frac{x-3}{x^3-27}$

c. $\lim_{x \rightarrow 2} \frac{x^2 - 4x + 4}{x^4 - 3x^2 - 4}$

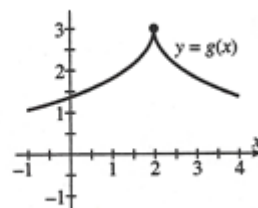
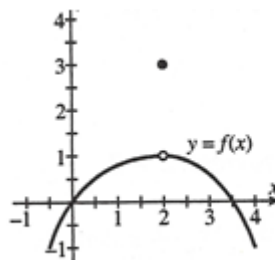
d. $\lim_{x \rightarrow 0^+} \left(\frac{1}{x} - \frac{1}{|x|} \right)$

e. $\lim_{x \rightarrow -\infty} (x + \sqrt{x^2 + 2x})$

f. $\lim_{x \rightarrow -\infty} \frac{\sqrt{21 + 9x + 16x^2}}{2 - x}$

Q13. [3 pts] Use the graph to find the following:

$$f(2) + g(2) + f(0) + \lim_{x \rightarrow 2} (f + g)(x) =$$



Q14. [4 pts] Find the values of c that make $f(x) = \begin{cases} 2(cx)^3 + x - 1 & \text{for } x < 1 \\ 2cx + (x - 1)^2 & \text{for } x \geq 1 \end{cases}$ continuous everywhere.

Q15. [4 pts] Find the derivative of the function $f(x) = 4 + 8x - 5x^2$ using the definition of derivative.

Q16. [5 pts] Compute the derivative of the function $f(x) = \frac{2}{x}$ using Definition of the derivative and then find an equation of the tangent line to the curve $f(x)$ at $x = 2$.