



Prince Sultan University

Math 111

Major Exam 1

First Semester, Term 141

Sunday, November 02, 2014

Time Allowed: 90 minutes

Student Name: _____

Student ID #: _____

Serial Class #: _____

Section #: 224, 225, 226, 227

Instructor's Name: Dr. Aiman Mukheimer, Dr. Jamiiru Luttamaguzi

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. Talking during the examination is NOT allowed.
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 12 problems, some with several parts. Make sure your paper has all these problems.

Problems	Max points	Student's Points
1	20	
2,3,4	16	
5	20	
6,7	19	
8,9,10	13	
11,12	12	
Total	100	

Q1 (20 points) Find the domain of the following:

i. $f(x) = \frac{1+\sqrt{2x-4}}{x-3}$

ii. $h(t) = \frac{\sqrt{6-3t}}{\sqrt{t-1}}$

iii. $f(x) = \frac{1-e^{x^2}}{1-e^{1-x^2}}$

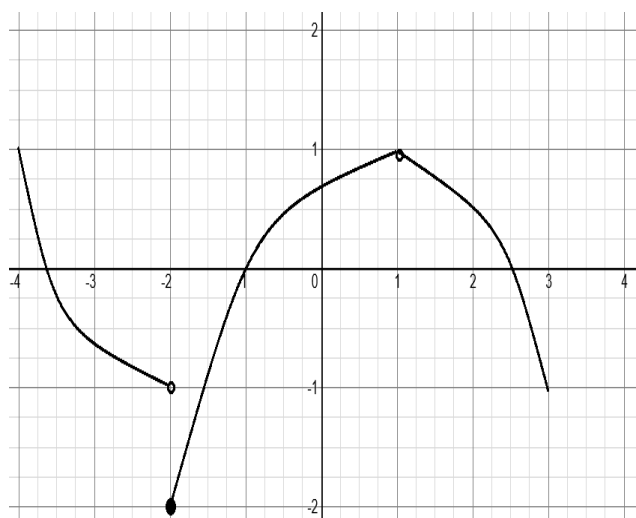
iv. $g(x) = \sqrt{1-5^{3x}}$

v. $h(x) = \ln\left(\frac{x+1}{1-3x}\right)$

Q2 (4 points) Find a formula for the inverse of the function $f(x) = \ln(5^x - 7)$.

Q3 (8 points) The piecewise defined function f as graphed. Use it to write down each of the limits or evaluations

- a) $\lim_{x \rightarrow -2^-} f(x) =$
- b) $\lim_{x \rightarrow -2} f(x) =$
- c) $f(-2) =$
- d) $\lim_{x \rightarrow 1^+} f(x) =$
- e) $\lim_{x \rightarrow 1} f(x) =$
- f) $f(1) =$
- g) Why is f not continuous at $a = 1$?



- h) Why is f continuous at $a = 2$?

Q4 (4 points) Find all the value(s) of the constant c (if possible), to make the given function f continuous everywhere.

$$f(x) = \begin{cases} cx^2 + 2x & \text{if } x < 3 \\ x^3 - cx & \text{if } x \geq 3 \end{cases}$$

Q5 (20 points) Evaluate the limit, if it exists.

i. $\lim_{x \rightarrow 0^+} \tan^{-1}(\ln x)$

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

iii. $\lim_{x \rightarrow 2} \frac{x^2 - 7x + 10}{x - 2}$

iv. $\lim_{x \rightarrow 1} \frac{\frac{1}{\sqrt{x}} - 1}{x - 1}$

v. $\lim_{x \rightarrow 0} \frac{\sqrt{2} - \sqrt{2 - x}}{x}$

Q6 (15 points) Evaluate the limit, if it exists, **and** write down the equation of the resulting horizontal asymptote. (**Show your work in details**)

i. $\lim_{x \rightarrow \infty} (x+3)^{-2}$

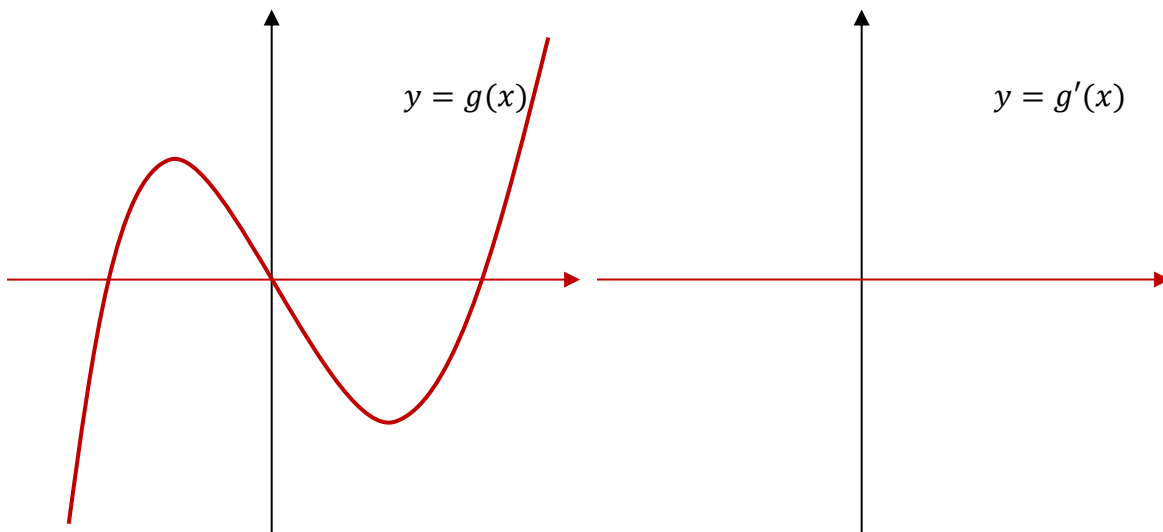
ii. $\lim_{x \rightarrow -\infty} (x + \sqrt{x^2 + 2x})$

iii. $\lim_{x \rightarrow \infty} \frac{9x^4 + 7x^2 + 8x}{4x^5 + 3x - 12}$

Q7 (4 points) Use the Intermediate Value Theorem to show that there is a root of the equation $x^4 = 3 - x$ in the interval $(1, 2)$.

Q8 (5 points) Find the equation of the tangent line in slope-intercept form slope for the the function $f(x) = x + \sqrt{x}$ at the point $P(1,2)$ **using the Definition** of the derivative.

Q9 (4 points) Given the graph of $y = g(x)$, draw the graph of $y = g'(x)$



Q10 (4 points) Each limit represents the derivative of some function f at some number a . State such an f and a in each case

i. $\lim_{h \rightarrow 0} \frac{(-2+h)^5 + 32}{h}$

ii. $\lim_{t \rightarrow 1} \frac{t^4 + t - 2}{t - 1}$

Q11 (6 points) Sketch the graph of

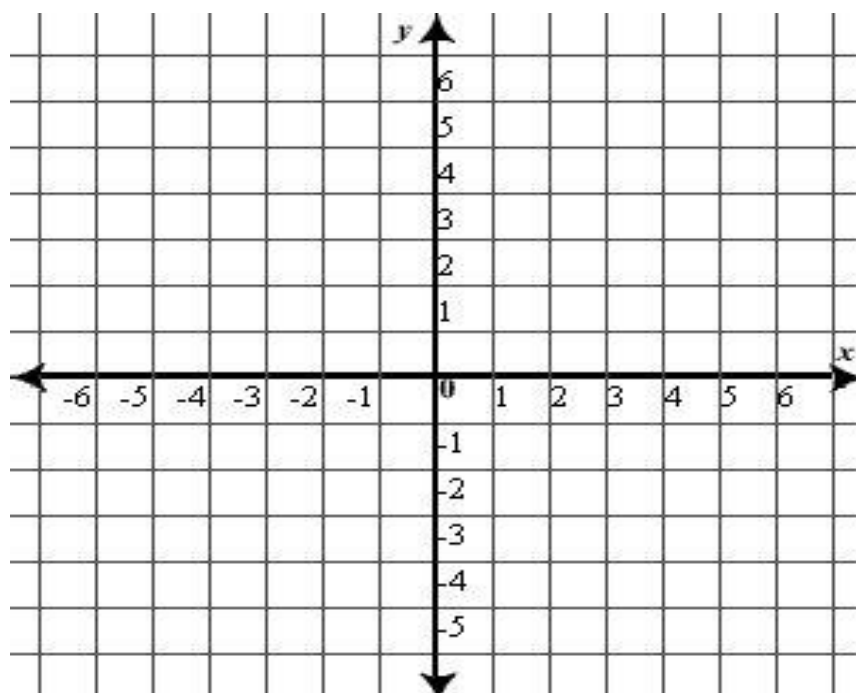
a function f for which

$$f(-3) = f(1) = f(4) = 0,$$

$$f'(-1) = f'(2) = 0,$$

$$f'(-3) = f'(4) = -1, \quad f'(1) = 1,$$

$$\lim_{x \rightarrow \infty} f(x) = -\infty, \text{ and } \lim_{x \rightarrow -\infty} f(x) = \infty.$$



Q12 (6 points) The graph f is given. State, with reasons, the numbers at which f is not differentiable

