



Prince Sultan University

MATH 111

Major Exam I

Semester I, Term 162

Tuesday, March 21st, 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 13 problems, some with several parts. Make sure your paper has all these problems.

Page #	Max points	Student's Points
1	15	
2	15	
3	20	
4	14	
5	16	
Total	80	
Total	20	

Q1. [12 pts] Find the domain of the following functions:

a) $f(x) = \frac{\ln(2x^2 + 5x - 3)}{x^2 - 16}$

b) $f(t) = \frac{\sqrt{9 - 2t}}{\sqrt{t - 2}}$

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

Q2. [3 pts] Show that the equation $e^{x^2-2} = 1 - x$ has a root in the interval (0,1)

Q3. [5 pts] Find the horizontal and vertical asymptotes of each curve $y = \frac{1+e^x}{1-2e^x}$ (Show your work in details)

Q4. [5 pts] Use the graph of the function to find the following:

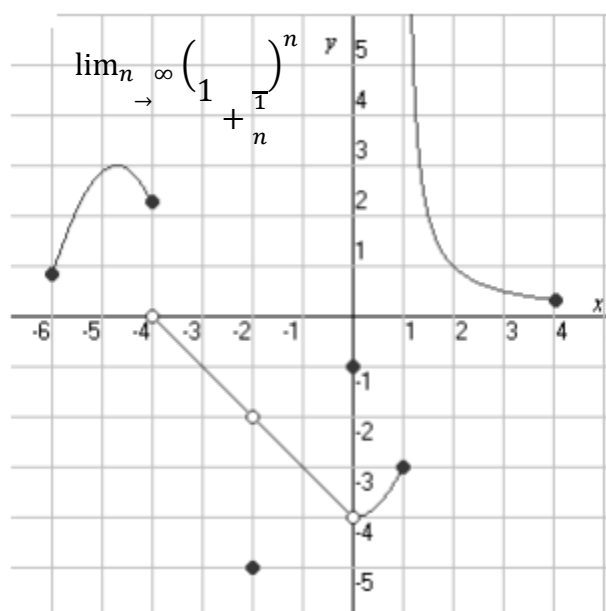
a) For what values of x is $f(x) = -1$

b) $\lim_{x \rightarrow -4} f(x) =$

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

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

e) $f(-2) =$



Q5. [5 pts] Find the inverse of the function $f(x) = \frac{3-2^x}{5+2^x}$

Q6. [20 pts] Evaluate the limit, if it exists. **(Show your work in details)**

a. $\lim_{x \rightarrow 1} \frac{x^4 - 1}{x^3 - 1}$

b. $\lim_{x \rightarrow 16} \frac{4 - \sqrt{x}}{16x - x^2}$

c. $\lim_{x \rightarrow 0^+} \sqrt{x} \cdot e^{\sin\left(\frac{\pi}{x}\right)}$

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

e. $\lim_{x \rightarrow -\infty} \frac{\sqrt{1 + 4x^6}}{2 - x^3}$

Q7. [6 pts] a) Use the definition to find the derivative of the function $f(x) = \frac{2}{1-3x}$

b) Find the equation of the tangent line to the curve $f(x)$ at $x = -1$

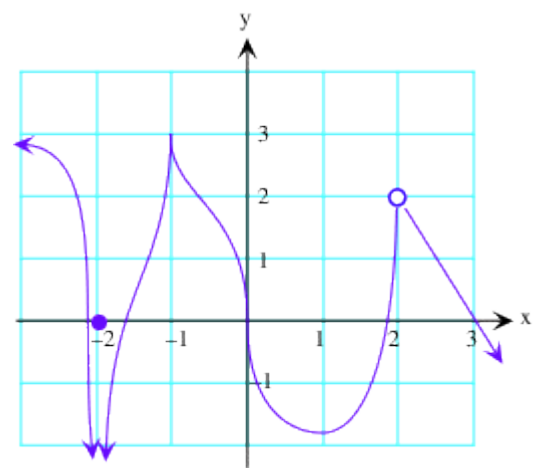
Q8. [2 pts] If an equation of the tangent line to the curve $y = f(x)$ at $x = 3$ is $y = 6x - 8$, find $f(3)$ and $f'(3)$.

Q9. [2 pts] Find a function “ f ” and a number “ a ” such that $f'(a) = \lim_{h \rightarrow 0} \frac{(2+h)^6 - 64}{h}$

Q10. [4 pts] Given that $x^3 - x^2 + 4x - 8 \leq f(x) \leq \frac{x^2 - 4}{x - 2}$ find the value of $\lim_{x \rightarrow 2} f(x)$

Q11. [6 pts] Find a and b such that $f(x)$ is continuous everywhere $f(x) = \begin{cases} \frac{x^2-1}{|x-1|} & \text{if } x < 1 \\ ax+b & \text{if } 1 \leq x < 4 \\ 10 & \text{if } x \geq 4 \end{cases}$

Q12. [4 pts] Determine the numbers at which the following graph of f is not differentiable. Give the reasons.



Q13. [6 pts] a) Show that $f(x) = |x-6|$ is continuous at $x=6$

b) Show that $f(x) = |x-6|$ is not differentiable at $x=6$