Math 104 Alternate Final Exam

April 29, 2019

Name: _____ NU ID Number: _____

Indicate your section/instructor.

☐	8:30	Kane	Sec 001	☐	9:30	Larios	Sec 002	☐	10:30	Gonzales	Sec 003
☐	11:30	Kane	Sec 005	☐	12:30	Larios	Sec 006	☐	1:30	Larios	Sec 007
☐	11:30	Hopkins	Sec 181	☐	6:30	Reinke	Sec 101				

Question	Points	Score
1	12	
2	10	
3	8	
4	8	
5	10	
6	12	
7	12	
8	8	
9	10	
10	8	
11	8	
12	15	
13	13	
14	8	
15	8	
Total:	150	

Instructions:

1. <u>No</u> books or notes may be used on the exam.

2. You may not use graphing calculators for this exam. Only approved scientific and four function calculators may be used for this exam.

3. Credit or partial credit will be given only when both algebra and calculus work are shown.

4. Express all answers in <u>simplified form</u> unless explicitly told you do not need to simplify your answer.

5. The exam has a total of 15 questions on 9 pages (not including this page). Make sure you have them all.

6. You will have <u>1 hour and 30 minutes</u> to complete the exam.

7. Having a cellphone or smart watch out during the exam will be considered cheating and will result in receiving a 0 on the exam.

DO NOT OPEN THE EXAM UNTIL INSTRUCTED!!

1. (12 points) Consider the function $f(x)$ graphed below:

(a) $\lim\limits_{x \to 0^+} f(x) =$

(b) $f(0) =$
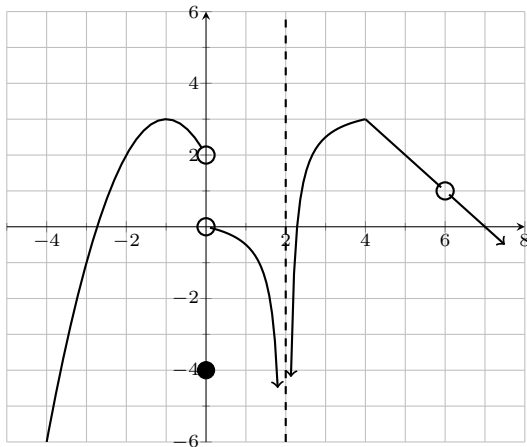
(c) $\lim\limits_{x \to 2^+} f(x) =$

(d) $\lim\limits_{x \to 6} f(x) =$

(e) $\lim\limits_{x \to 0^-} f(x) =$

(f) $\lim\limits_{x \to 4} f(x) =$

(g) $\lim\limits_{x \to 2} f(x) =$

(h) $f(6) =$

(i) For what value(s) of x is $f(x)$ discontinuous? Explain why, using your answers above.

(j) Determine the value(s) of x for which $f(x)$ is not differentiable.

2. (10 points) Evaluate the following limits:

(a) $\lim\limits_{x \to 2} \dfrac{x^2 - 4}{x^2 - 5x + 6}$

(b) $\lim\limits_{x \to \infty} \dfrac{2x^2 + 5}{3x^2 - x + 1}$

3. (8 points) Consider the piecewise function:

$$f(x) = \begin{cases} \dfrac{x^2 - x - 6}{x + 2}, & \text{for } x \neq -2 \\ k, & \text{for } x = -2 \end{cases}$$

Find the value of the constant k that makes $f(x)$ continuous on the interval $(-\infty, \infty)$.

4. (8 points) Find the equation of the line tangent to $y = (1 + x^2)^4$ at $x = 1$.

5. (10 points) Given the function $f(x) = e^{-x^2 + 4}$,

   (a) Find $\dfrac{df}{dx}$, the first derivative of $f(x)$.

   (b) Find $\dfrac{d^2 f}{dx^2}$, the second derivative of $f(x)$.

6. (12 points) Consider the function $f(x) = 2x^3 - 3x^2 - 12x + 1$.

    (a) Find the open interval(s) on which $f(x)$ is increasing _____.
        Show all work below.

    (b) Find the open interval(s) on which $f(x)$ is decreasing _____.
        Show all work below.

    (c) $f(x)$ has a relative minimum of _____ at $x =$_____.

    (d) $f(x)$ has a relative maximum of _____ at $x =$_____.

7. (12 points) Given $g''(x) = x^3 + 4x^2$,

    (a) Find the open interval(s) on which $g(x)$ is concave up _____.
        Show work below.

    (b) Find the open interval(s) on which $g(x)$ is concave down _____.
        Show work below.

    (c) Find the $x-$coordinates of the inflection points of $g(x)$.

8. (8 points) A lawn mower company estimates the cost of producing x mowers to be

$$C(x) = 9x + 100$$

when the revenue from the sale of x mowers is

$$R(x) = -0.02x^2 + 21x$$

. How many mowers must the company sell to maximize their profit? What is the maximum profit?

9. (10 points) A gadget store determines that the demand for gizmos can be given by $q = D(x) = 16 - \dfrac{2}{5}x$.

   (a) Calculate the elasticity of demand, $E(x)$, for the product.

   (b) At a price of $2, should the price be increased or decreased to maximize revenue?

10. (8 points) Consider the function $f(x) = x^4 - 8x^2 - 26$. Find the absolute extrema of $f(x)$ on the interval $[-1, 3]$.

11. (8 points) Find the slope of the tangent line to the curve $2xy - x = y^2 + 6y$ at the point $(7, 1)$.
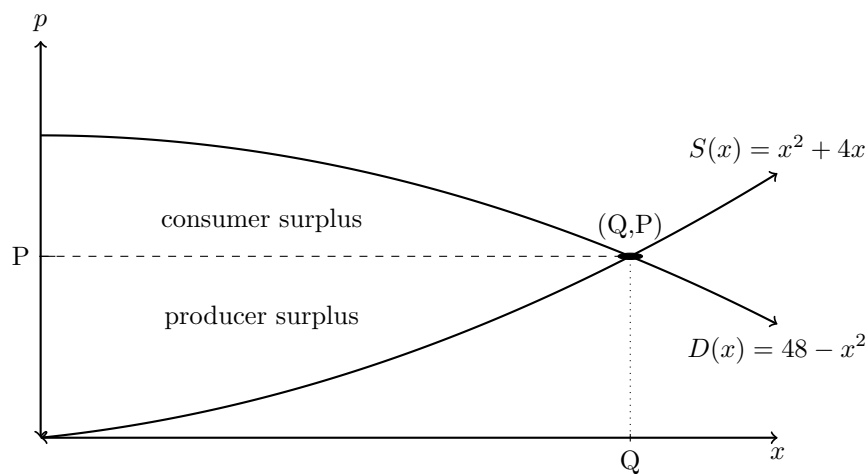
12. (15 points) Evaluate the following integrals. You do not have to simplify.

(a) $\displaystyle\int \left(\frac{2}{x} + e^{2x} - 4\sqrt{x}\right)\, dx$

(b) $\displaystyle\int \frac{12x^2}{4x^3 - 10}\, dx$

(c) $\displaystyle\int 6xe^{x^2}\, dx$

13. (13 points) $D(x)$ is the price, in dollars per unit, that consumers are willing to pay for x units of an item, and $S(x)$ is the price, in dollars per unit, that producers are willing to accept for x units.
$D(x) = 48 - x^2$ and $S(x) = x^2 + 4x$.

(a) Find the equilibrium point (Q, P).

(b) Find the producer's surplus at the equilibrium point.

(c) Find the consumer's surplus at the equilibrium point.

14. (8 points) Find the area between the curve $f(x) = x^2 + 3x$ and the x-axis on the interval $[-1, 2]$.

15. (8 points) The rate of change of a tree's height (in feet per year) after t years can be modeled by

$$G'(t) = 1 + \frac{1}{\sqrt{t}}$$

. Find $G(t)$, the tree's height, if the height is 15 feet after 9 years.