Math 1131
Autumn 2015
Midterm 2
Form A

Name: _____

Name.nn: _____

Lecturer: _____

Rec. Instructor: _____

Rec. Time: _____

Instructions:

- You have **55 minutes** to complete this exam. It consists of 7 questions on 8 pages including this cover sheet and is worth a total of 100 points. The value of each question is listed below and with each question. Partial credit might not be awarded on some questions.
- You may not use any books or notes during this exam.
- Calculators are permitted EXCEPT those calculators that have symbolic algebra or calculus capabilities. In particular, the following calculators and their upgrades are not permitted: TI-89, TI-92, and HP-49. In addition, neither PDAs, laptops nor cell phones are permitted.
- Make sure to read each question carefully.
- Please **write clearly** and make sure to **justify your answers**. Correct answers with no supporting work may receive no credit. Unless otherwise stated, solutions found by graphing will receive no credit.
- Unless otherwise specified, make sure your answers are in **exact form** (i.e. not decimal approximations).
- Please write your answers on the indicated lines.
- A random sample of graded exams will be xeroxed before being returned.

Question	Point Value	Score
1	20	
2	10	
3	20	
4	13	
5	12	
6	10	
7	15	
Total	100	

(1). (20 points) Find the indicated derivatives (You do not need to simplify your answers):

(**a**) (5 points) Find $\frac{dy}{dx}$ where $y = 6^{\log_5(x^4+7)}$

Answer (1a): $\frac{dy}{dx} =$ _____

(**b**) (8 points) Find $\frac{dy}{dx}$ where $y = (3x^2+1)^{x^3}$

Answer (1b): $\frac{dy}{dx} =$ _____

Problem (1.) cont.

(c) (7 points) Find $f''(x)$ where $f(x) = \ln(x^2 + 3x + 10)$

Answer (1c): $f''(x) =$ _____

(2). (10 points) Use logarithmic differentiation to find $\frac{dy}{dx}$ where

$$y = \frac{\left(\sqrt[6]{x-3}\right)(x+2)^4}{(x-5)^3}$$

(You do not need to simplify your answer)

Answer (2): $\frac{dy}{dx} =$ _____

(3). (20 points) A function and its first and second derivatives are as follows:

$$f(x) = \frac{-x}{x^2+9} \qquad f'(x) = \frac{x^2-9}{(x^2+9)^2} \qquad f''(x) = \frac{2x(27-x^2)}{(x^2+9)^3}$$

(**a**) (10 points) Use a sign graph or chart to determine all intervals on which $f(x)$ is increasing and on which $f(x)$ is decreasing AND find all values of x at which $f(x)$ has relative maximum point and at which $f(x)$ has a relative minimum point. (If there are none, please say so).

Answer (3a): increasing on: _____

decreasing on: _____

rel. max. points(s) at $x =$ _____

rel. min. point(s) at $x =$ _____

(**b**) (10 points) Use a sign graph or chart to determine all intervals on which $f(x)$ is concave up and on which $f(x)$ is concave down AND find all values of x at which $f(x)$ has an inflection point. (If there are none, please say so).

Answer (3b): concave up on: _____

concave down on: _____

inflection point(s) at $x =$ _____

(4). (13 points) Use implicit differentiation to find $\frac{dy}{dx}$ for the equation

$$x^3 + e^{7xy} + y^2 = 10$$

(You do not need to simplify your answer)

Answer (4): $\frac{dy}{dx} =$ _____

(5). (12 points) The demand equation for a product is

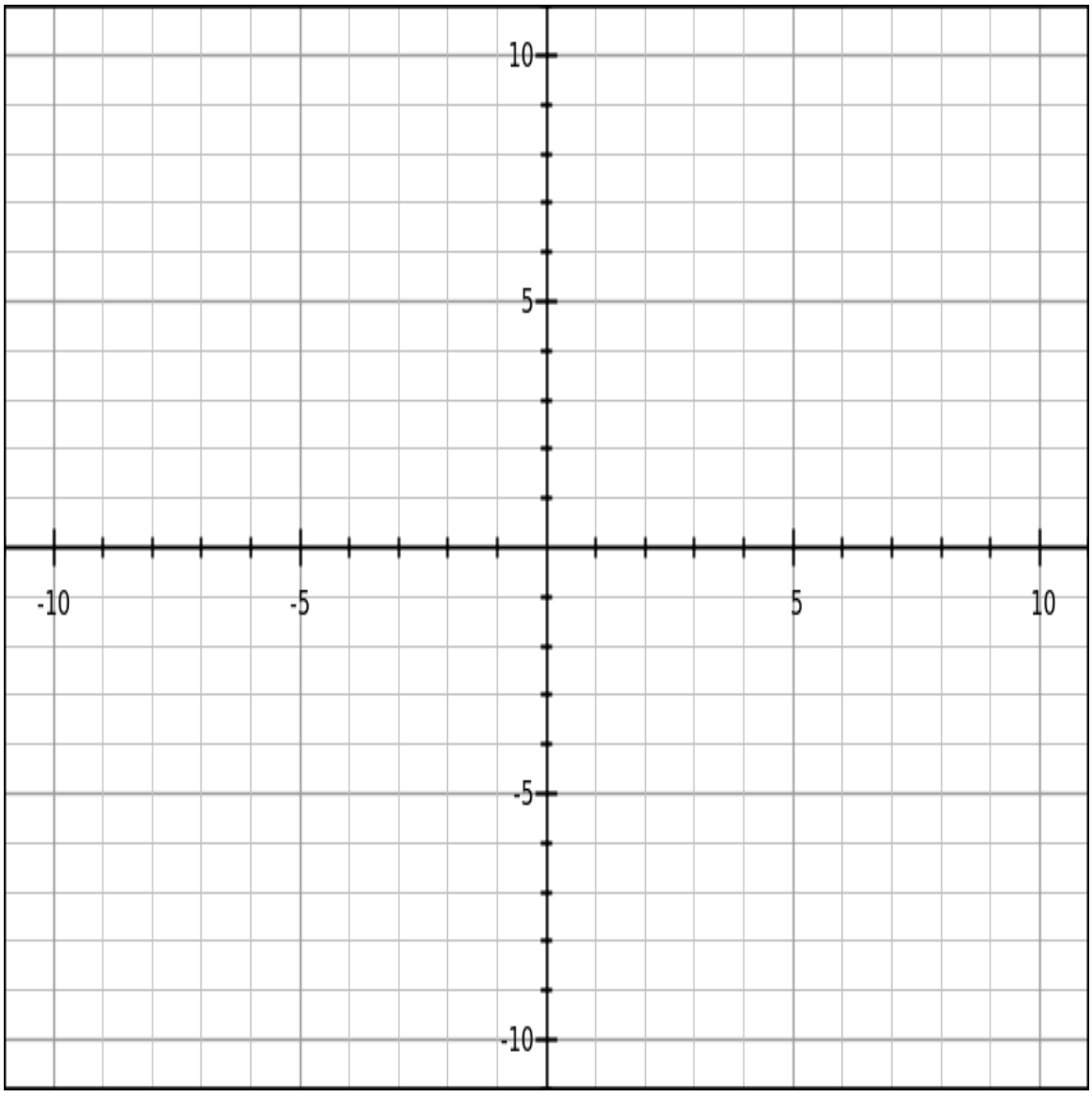
$$p = 1000 - 80\sqrt{q+3}$$

Using differentials, approximate the price when 24 units are demanded.

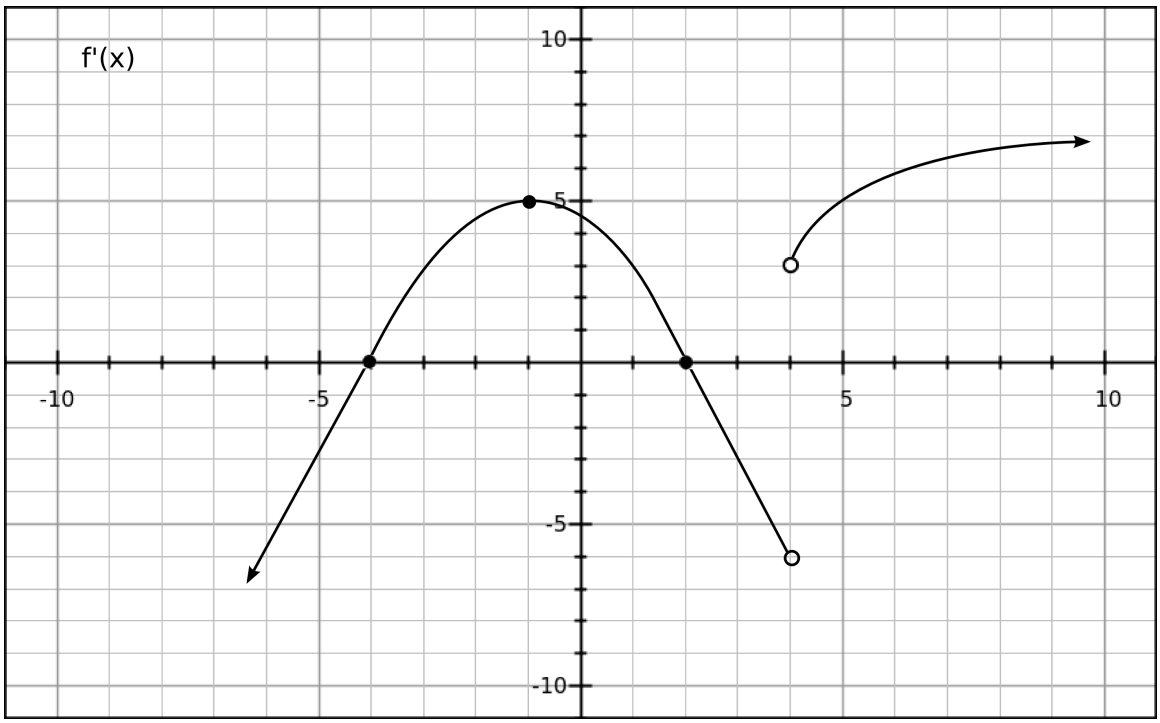
Answer (5): _____

(6). (10 points) Use the given information to sketch a graph of $f(x)$:

- $f(x)$ is continuous at all x except $x = -4$ and $x = 2$.
- $f(-7) = 0$, $f(-6) = -4$ and $f(-1) = -2$.
- $f(x)$ has a vertical asymptote at $x = -4$ and at $x = 2$.
- $\lim_{x\to\infty} f(x) = 4$ and $\lim_{x\to-\infty} f(x) = 4$.
- $f'(x) > 0$ on the intervals $(-6, -4)$, $(-4, 2)$ and $(2, \infty)$.
- $f'(x) < 0$ on the intervals $(-\infty, -6)$.
- $f''(x) > 0$ on the intervals $(-7, -4)$ and $(-1, 2)$.
- $f''(x) < 0$ on the intervals $(-\infty, -7)$, $(-4, -1)$ and $(2, \infty)$.



(7). (15 points) Below is the graph of the $f'(x)$ (the derivative of $f(x)$). Assume that $f(x)$ is **continuous** for every real number.



Use the graph of $f'(x)$ to answer the following questions. You do not need to explain your answers. No partial credit will be awarded on each part.

(**a**) (3 points) Find all intervals on which $f(x)$ is increasing.

(**b**) (3 points) Find all values of x at which $f(x)$ has a relative maximum.

(**c**) (3 points) Find all values of x at which $f(x)$ has an inflection point.

(**d**) (3 points) Find all intervals on which the graph of $f(x)$ is concave down.

(**e**) (3 points) Find all values of x at which $f(x)$ has a relative minimum.