Math 120 C - Autumn 2017
Midterm Exam Number Two
November 16th, 2017

Name: _____ Student ID no. : _____

Signature: _____ Section: _____

1	15	
2	15	
3	15	
4	15	
Total	60	

- This exam consists of FOUR problems on FIVE pages, including this cover sheet.
- Show all work for full credit.
- You may use a TI-30X IIS calculator during this exam. Other calculators and electronic device are not permitted.
- You do not need to simplify your answers.
- If you use a trial-and-error or guess-and-check method when a more rigorous method is available, you will not receive full credit.
- If you write on the back of the page, please indicate that you have done so!
- Draw a box around your final answer to each problem.
- You may use one hand-written double-sided 8.5" by 11" page of notes.
- You have 50 minutes to complete the exam.

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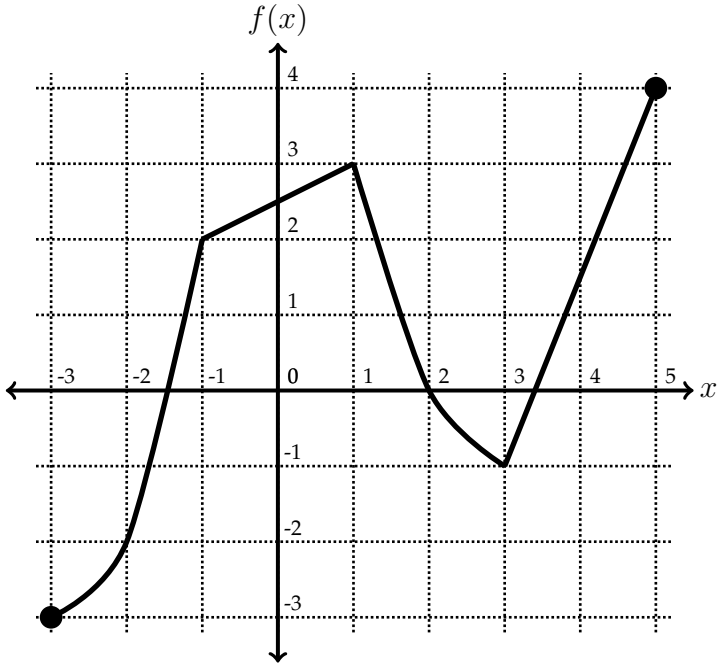
1. **[5 points per part]** Hey, check out this awesome graph!



Use the graph to answer the following questions.

(a) Find $f(f(f(f(f(f(f(f(f(f(-2))))))))))$. Explain, briefly.

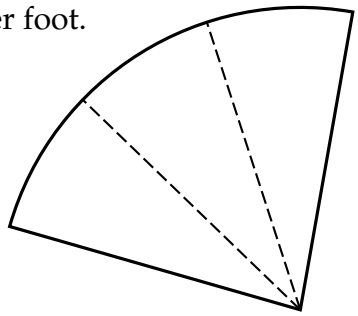
(b) Oh no, f isn't one-to-one!
Please break its domain into three intervals so that f is one-to-one on each piece.

(c) Take the graph of $y = f(x)$. Shift it 3 units to the right, then scale it vertically by a factor of 2, then shift it 5 units down. Let the result be $y = g(x)$.
Find $g(0)$.

2. **[15 points]** I have $\$4000$ with which I'd like to build a fence in the shape of a sector, with two internal partitions each running from the arc to the opposite corner, as shown below.

   The outside fence costs $\$5$ per foot, and the partitions cost $\$3$ per foot.

   What is the **maximum possible total area** inside the fence?



3. Here are some facts about $f(x)$, a linear-to-linear rational function:

   - The domain of f is $(-\infty, 2) \cup (2, \infty)$.
   - The graph $y = f(x)$ has a y-intercept of 5.
   - $f(10) = 3$.

   (a) **[8 points]** Write a formula for $f(x)$.

   (b) **[7 points]** Write a formula for $f^{-1}(x)$.

4. **[5 points per part]**

Some bad things happened to the moon, and now it's in several pieces. The number of pieces is an exponential function of time.

Right now, there are 7 pieces.

In five months, there will be 130 pieces.

(a) Write a function $f(t)$ for the number of pieces t months from now.

(b) When will there be 1 million pieces?

(c) The mass of the whole moon is 73 yottagrams.

Write a function $g(t)$ for the average mass of each piece, t years from now.

Write your answer in standard exponential form.

(Leave your answer in yottagrams. Don't worry about what a yottagram is.)