

Math 120 - Summer 2006
Midterm 1
July 13, 2006

Name: _____

Section: C

1	10	
2	10	
3	10	
4	10	
5	10	
Total	50	

- You may use a calculator during this examination. Other electronic devices are not allowed, and should be turned off for the duration of the exam.
- If you use a trial-and-error or guess-and-check method, or read a numerical solution from a graph on your calculator when an algebraic method is available, you will not receive full credit.
- You may use one hand-written 8.5 by 11 inch page of notes.
- Show all work for full credit.
- You have 60 minutes to complete the exam.
- Good luck!

1. (a) Let $f(x) = \sqrt{x^2 + 3x + 5}$, $g(x) = \frac{1}{x-1}$ and $h(x) = 2x$.

Compute the composition $f(g(h(x)))$. **Do not simplify your answer.**

- (b) Let $r(x) = 2x^2 + 7$. Simplify the expression $\frac{r(x+h) - r(x)}{h}$ so that h is no longer a factor in the denominator.

2. According to the US Bureau of the Census, the population of the US at the end of the year 2005 (at December 31, midnight, the instant before January 1st) was 297,534,317. After births, deaths, and immigration is taken into account, there is a net gain of one person every 10 seconds.

(a) Find a linear function $P(t)$ that gives the US population as a function of days since the new year. (So that $P(0) = 297,534,317$ and $P(1) =$ the population at the end of the day January 1st, etc.)

(b) What is the population at the end of today? (Hint: today is the 194th day of the year).

(c) What day will the population reach exactly 300 million people?

3. Sylvia started a microbrewery and is trying different prices to sell her beer. During the first month she charges \$10 per six-pack and sells 100. During the second month she charges \$12 per six-pack and sells 70.

(a) Assume the number of six-packs sold each month is a linear function of the price. Find this function.

(b) Assume that it costs Sylvia to \$5 to make each six-pack. Then the total revenue, the total cost, and the profit that Sylvia makes are given by:

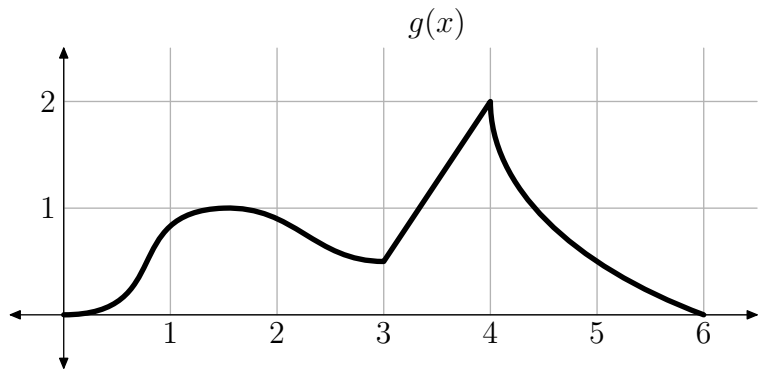
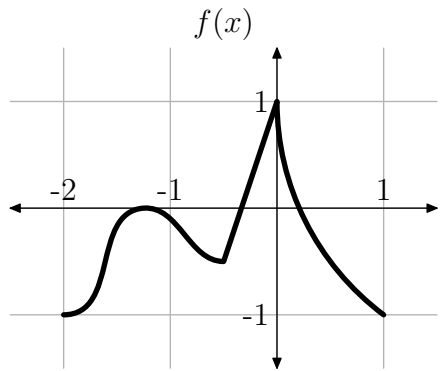
$$\text{total revenue} = \text{price} \times \text{quantity}$$

$$\text{total cost} = 5 \times \text{quantity}$$

$$\text{profit} = \text{total revenue} - \text{total cost}.$$

What price should Sylvia charge to maximize her profit?

4. The graphs of $f(x)$ and $g(x)$ are shown below:



$g(x)$ is a scaled and translated version of $f(x)$, so $g(x) = af(b(x-c))+d$, for some constants a , b , c , and d . Find a , b , c , and d .

5. A truck driver is driving at 50 miles per hour along a (straight) highway from the town of Adillup to the city Beduga. Beduga is located 50 miles east and 100 miles north of Adillup. There is a circular thunderstorm 60 miles north of Adillup with radius 40 miles, covering part of the road.

(a) Where does the driver first enter the thunderstorm? Where does he exit the storm?

(b) How long does he spend driving through the thunderstorm?