Prof. S. Brick **Math 120**
Fall '02 **Applied Calculus; Final Exam Review** **section 52**

1. You leave home for calculus, driving slowly when you realize that you forgot your brownies. You turn around and drive faster and faster until a cop pulls you over. Luckily, you use Calculus to avoid a ticket. But you get so depressed from it that you decide to spend the day in bed. Sketch a graph of the distance you are from class as a function of time.

2. You have a budget for textbooks and social events of $1400. Textbooks cost $100 each. A night out costs $70. Find and graph the equation of your budget constraint. Shade in the region of living within your means. What do points on the axes represent ?

3. The half-life of Mobilium is 6.6 hours. How long before 16 grams decays into 11 grams

4. Find $\int_2^4 x^3\,dx$

5. Let $f(v)$ be the fuel efficiency of a car in mpg that is driven at an average speed v mph. What are the units of $f'(v)$? What would $f'(70) = -.5$ tell you ?

6. Sketch the graph of a function defined for whose first derivative is always positive but whose second derivative starts out positive and changes it sign twice.

7. Suppose $MR(100) = 95$ and $MC(100) = 72$. Estimate what happens to the profit if the production is changed to a level of $q = 104$.

8 A ball is tossed up in the air. A total of 6 seconds elapses from the moment it is tossed until it hits the ground. Sketch a graph of the velocity as aa function of time for $0 \leq t \leq 6$.

9 Find the present value of an income stream of one million dollars a year over 5 years assuming an annual interest rate of 10%.

10. Find the equation of the line tangent to $y = \sqrt{x^2 + 7}$ at $x = 3$. On a single graph sketch both the original function and the tangent line.

11. Using the left-hand rule with 4 evenly-spaced rectangles set up (but do not compute) the Riemann sum for $\int_1^2 \ln(x)\,dx$. Sketch a graph showing the rectangles.

12. Suppose $f(5) = 119.1$ and $f(25) = 31.7$. Find two possible values for $f(45)$, one if f is linear and the other if f is exponential. Explain your calculation.

13. A population of rabbits are introduced to an island. Suppose initially there are 3000 rabbits and that the population grows at an annual rate of 20.25%. Using a non-logistic exponential model, find the time it takes for the population to reach 100,000. Why would a logistic model be better to use ?

14. A frozen pizza takes a trip from the freezer, to the oven, and then to your plate. Let $T(t)$ be its average internal temperature. On a single graph, sketch the curves $y = T(t)$ and $y = T'(t)$. Be sure to label which is which, as well as the relevant sections of the graphs.

15. Suppose demand for zombiepills is given by the equation $q = 500 - 10p$. Is demand elastic or inelastic at $p = \$30$? What should you do if you want to increase revenue ?

16. A driver of a car steps on the brakes. Let $v(t)$ denote its speed in feet per second, t seconds after the brakes are applied. If $v(0) = 100$, $v(1) = 60$, $v(1.75) = 20$ and $v(2) = 0$, then give an underestimate and an overestimate for how far the car travels as it comes to a stop. What integral would give the exact stopping distance ?

17. Find the average value of $y = x^2$ over $[-1, 3]$. Sketch a graph representing it. What does Goldilocks and the 3 Bears have to do with average values ?

18. Use the second derivative test to classify the critical points of $y = x^3 - 75x - 231$.

19. At a price of \$1, sales for math-cola are 1500 per week. An increase in price of a dime causes a drop of 100 sales. If the equilibrium price is \$1, find the consumer surplus (assume a linear demand).

20. Suppose equilibrium price for mathpills is ten dollars with sales of 500, but raising the price by a dollar results in a loss of 50 sales. Assume a linear demand curve. Sketch a graph showing demand and the consumer surplus. Calculate the surplus.

21. What two properties must density function have ? Define the terms median and mean.

22. Find $\displaystyle\int 2x\sqrt{x^2+1}\,dx$

23. What is a surge function and what is it used for ?

24. Review all the quizzes, lectures, homework, and everything else.