

**date:** the 17<sup>th</sup> of December, 1998

**place:** room 221 Hayes

**time:** 8:00-10:00

**111 - Final**

This final contains 15 problems worth 10 points each. You may use only a blank sheet of paper, a pencil, a rubber gum, a ruler and a small calculator. You can use your calculator only to add, subtract, multiply or divide two numbers. This final is taken under the honor code.

**Name:**

**Recommendation**

*Never give a "solitary" answer without justifying it by previous calculations or reasoning.*

$$\ln .34 = -1.0788$$

$$\ln 1.6 = 0.47$$

$$\ln 4 = 1.38$$

$$\ln 4.5 = 1.50$$

## Problems<sup>1</sup>

1. Find the equation and sketch the graph of the line through  $(2, 0)$ , with slope 5.
2. Compute  $\frac{d}{dP}(\sqrt{1 - 3P})$ .
3. What is the slope of the graph of  $f(x) = x^3 - 4x^2 + 6$  at  $x = 2$ ? Write the equation of the tangent line to this curve at  $x = 2$ .
4. A rectangular garden of area 75 square feet is to be surrounded on three sides by a brick wall costing \$10 per foot and on one side by a fence costing \$5 per foot. Find the dimensions of the garden such that the cost of materials is minimized.
5. Properties of a function  $h$  are described next. Draw some conclusions about the graph of the function.

$$h(-3) = 4, \quad h'(-3) = 1, \quad h''(-3) = 0.$$

6. Sketch the parabola  $y = -2x^2 + 10x - 10$ . Include its  $x$ - and  $y$ -intercepts.
7. Sketch the curve  $y = x^3 - 3x^2 - 9x + 7$ .
8. Differentiate the function  $(4x - 1)(3x + 1)^4$ .
9. Find  $\frac{dy}{dx}$  where  $y$  is a function of  $u$  such that  $\frac{dy}{du} = \frac{u}{u^2+1}$  and  $u = \frac{5}{x}$ .
10. Differentiate  $y = e^{-2x} - 2x$ .
11. Differentiate the function  $\ln\left(\frac{x}{x-3}\right)$ .
12. The size of a certain insect population is given by  $P(t) = 300e^{0.1t}$ , where  $t$  is measured in days. At what time will the population equal 1200?
13. Sandals woven from strands of tree bark were found recently in Fort Rock Creek Cave in Oregon. The bark contained 34% of the level of  $^{14}\text{C}$  found in living bark. Approximately how old are the sandals? (Recall that the decay constant for  $^{14}\text{C}$  is .00012.)
14. A parcel of land bought in 1985 for \$10,000 was worth \$16,000 in 1990. If the land continues to appreciate at this rate, in what year will it be worth \$45,000?
15. Determine  $\int (x^2 - x - 1)dx$ .

**Good luck!**

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<sup>1</sup>For some useful numerical values of  $\ln$  see the front page