

# Advanced Placement Calculus

Name \_\_\_\_\_

Copy original problem.

Per \_\_\_\_\_

Date \_\_\_\_\_

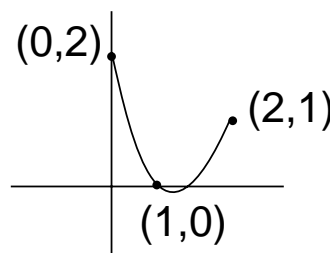
Convince *me* that **you** understand the concept!**No Calculators!** Each section is worth 20 points.

*Hint: Draw properly labeled, useful figures. Be very clear in your reasoning and answer with a concise, meaningful sentence which indicates that you understand all the concepts involved. Finally, don't waste time justifying mathematics which are incomplete and rambling. Do the job requested and move on.*

## Chapter 6 Applications Exam

**I**

A cable of a suspension bridge hangs in the shape of a parabola (which is the graph of a second-degree polynomial). Consider a cable that joins two points at  $(0, 2)$  and  $(2, 1)$ , and passes through the point  $(1, 0)$ .



A) Let  $f(x) = ax^2 + bx + c$  be the "second-degree polynomial". Obviously,  $f(0) = 2$  means  $c = 2$ . Solve for the values of  $a$  and  $b$ .

B) Let  $\ell$  be the line joining  $(0, 2)$  and  $(2, 1)$ . Write the equation of  $\ell$ .

C) Find the point on the cable whose vertical distance from  $\ell$  is the greatest.

**II**

In a certain community a certain epidemic spreads in such a way that  $x$  months after the start of the epidemic,  $p$  percent of the population is infected where,  $p = \frac{30x^2}{(1+x^2)^2}$ . In how many months will the most people be infected and what percent of the population is this?

**III**

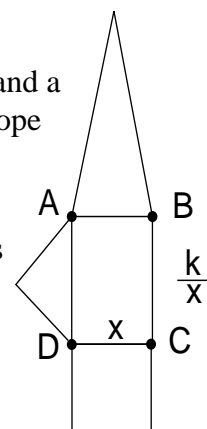
A horse breeder plans to set aside a rectangular region of one square kilometer for horses and wishes to build a wooden fence to enclose the region. since one side will run along a well-traveled highway, the breeder decides to make the side more attractive, using wood that costs 3 times as much per meter as the wood for the other sides. What dimensions will minimize the cost of the fence?

**IV**

A right triangle is formed in the first quadrant by the positive  $x$ -axis, the positive  $y$ -axis and a line which passes through the point  $(2, 5)$ . Of all possible right triangles, what is the slope of the line which makes up the hypotenuse of the triangle which contains the least area?

**V**

The figure consists of a rectangle labeled  $ABCD$  which has a fixed area  $k$ , an isosceles triangle with base  $AB$  and height six times the base, the square with side  $DC$  and the isosceles right triangle with hypotenuse  $AD$ . Determine the maximum or minimum possible area of the entire figure relative to the area of the rectangle. Identify whether the area found is a maximum or minimum. (Justify, of course.)

**Extra Credit** ----- **5 pts** -----

Jake, Jasper, and Jed went on a picnic. Jake brought two sandwiches and Jasper brought 3 sandwiches, but Jed forgot to bring any sandwiches. The three shared the food equally and Jed paid Jake and Jasper a total of five dollars for the sandwiches that they all shared. How much money did Jake get? How much money did Jasper get? Explain.