

## CDGT Dual Program Math Level 1, Part II

### Homework 1 : Due Feb 23

1. Sketch the graph of the function  $f(x) = \frac{(x+1)^2}{1+x^2}$ . Show any possible asymptote, interval of increase/decrease, concave up/down intervals, local maximum/minimum and inflection points. Show your reasoning.
2. Design a rectangular poster to contain 50 in.<sup>2</sup> of printing area, with a 4 in. margin at the top and bottom and a 2 in. margin at each side, which minimizes the amount of paper used. (See Figure 1.)
3. A right triangle has legs of length  $h$  and  $r$ , and a hypotenuse of length 4 (see Figure 2). It is revolved about the leg of length  $h$  to sweep out a right circular cone. What values of  $h$  and  $r$  maximize the volume of the cone?

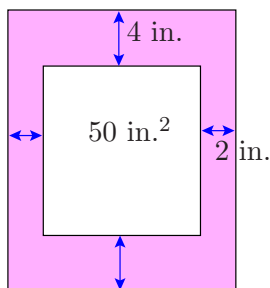


Figure 1

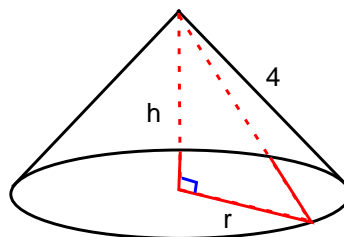


Figure 2

4. Apply the Mean Value Theorem to show the inequality  $|\sin b - \sin a| \leq |b - a|$ .
5. Find a cubic polynomial approximation to  $f(x) = \tan^{-1} x$  at  $x = 0$ ; i.e., a degree 3 polynomial  $p(x) = a + bx + cx^2 + dx^3$  satisfying  $p(0) = f(0)$ ,  $p'(0) = f'(0)$ ,  $p''(0) = f''(0)$  and  $p'''(0) = f'''(0)$ .

