Each problem is worth 10 points. For full credit provide good justification for your answers.

 $1. \ \,$  State the formula for Newton's Method.

2. Use interval notation to express where  $f(x) = x^3 - 6x + 5$  is increasing.

3. Use interval notation to express where  $f(x) = x^3 - 3x^2 + 5$  is concave up.

4. Let  $f(x) = 2x^3 - 15x^2 + 24x + 1$ . Find the absolute minimum and absolute maximum values of f on the interval [0,3].

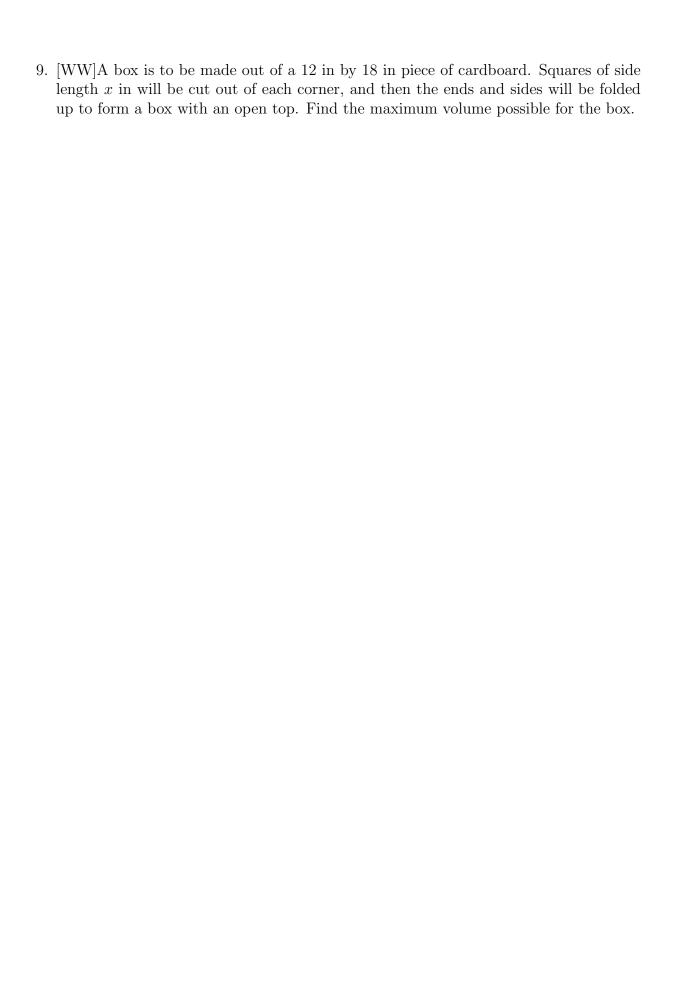
5. Use Newton's Method with the function  $f(x) = x^3 - 5$  and initial value  $x_0 = 1.6$  to calculate  $x_1$ .

6. Evaluate  $\lim_{x \to 0^+} \frac{\ln x}{1 + (\ln x)^2}.$ 

7. Bunny is a calculus student at Enormous State University, and she's having some trouble. Bunny says "OMG! Why do they make it so unfair? I really like the Hospital Rule thingy, but then the test question was totally messed up! It was like cos over x-1, and I did the derivatives just like you're supposed to, but they said I got the wrong answer and got no partial credit at all because I was invalid. How can they call me invalid?"

Help Bunny by explaining as clearly as you can why her approach might not have been a good choice for a problem like this.

8. [WW]A 12 foot ladder is leaning against a wall. If the top slips down the wall at a rate of 3 ft/s, how fast will the foot be moving away from the wall when the top is 11 feet above the ground?



10. A smokestack deposits soot on the ground with a concentration inversely proportional to the square of the distance from the stack. With two smokestacks d miles apart, the concentration of the combined deposits on the line joining them, at a distance x from one stack, is given by

$$S = \frac{c}{x^2} + \frac{k}{(d-x)^2}$$

where c and k are positive constants which depend on the quantity of smoke each stack is emitting. If k = 4c, find the point on the line joining the stacks where the concentration of the deposit is a minimum.

Extra Credit (5 points possible): Where does the function  $f(x) = \frac{x^2}{x^2 + (1 - nx)^2}$  have its maximum value?