Calculus

Date:

Items Needed: .Book, Newton's Chart handout, Newton's method program for calculator.

Objective: The students will learn how to use Newton's method and be able to find algebraic solutions for algebraic problems.

Lesson:

- Newton's Method – uses tangent lines to approximate the graph of the function near its x-intercepts.
- Consider a function that is continuous on the interval [a,b] and differentiable on the interval (a,b). If *f(a)* and *f(b)* differ in sign then by the Intermediate Value Theorem *f* must have at least one zero.
- Newton's method is based on the assumption that the graph of *f* and the tangent line at *(x1,f(x1))* both cross the x-axis at about the same point.
- It is easier to calculate the x intercept of the tangent line then it is the function itself.
- Put up the picture from page 229 to help explain.
- The tangent line passes through the point (x1, f(x1)) with a slope of f'(x1). In point-slope from, the equation of the tangent line is therefore:

  $$y - f(x_1) = f'(x_1)(x - x_1)$$

  Solve for y and then find the x-intercept by putting in a 0 for y and then solving for x.

  $$x = x_1 - \frac{f(x_1)}{f'(x_1)}$$
- This is your initial estimate and you keep doing this and you will get closer and closer to the desired x value.

- Steps to use Newton's method for approximating the zeros of a function.
  1. Make an initial estimate x1 that is close to the actual zero value.
  2. Determine a new approximation by using the formula

     $$x_{n=1} = x_n - \frac{f(x_n)}{f'(x_n)}$$
  3. If the absolute value of the first estimate, minus the second estimate, is within the desired accuracy, quit.
  4. If not, do another iteration.

- Look at the chart on page 230.
- Hand out my Newton's chart.

- Look at the bottom of the chart to help explain how they can use their calculator in an easier fashion then by typing in the equation every time.
- Do example 2 using the y1 and y2 method on the calculator.

- Look at example 3 p. 231 to determine that Newton's Method doesn't always work.

- Talk about the algebraic solutions of polynomial equations. Page 232
  1. Graph equation.
  2. Determine how many zeros you are looking for.
  3. Use Zeros

- Look at the problem $4x^3 - 12x^2 + 16 = 0$ or $4x^3 - 24x^2 + 36x - 16 = 0$

Assignment: . Have students do 7, 8, 14, 19, 20, 21, 29 a-c & e, 32 (Capstone), 39, 40 p. 233.

Evaluation: (Could be from any one/several of the following)

Responses from classroom questions
Results of classroom sample problems
Homework responses
Check answer with Calculator
End of the section exam

Enrichment: