THE UNIVERSITY OF AKRON
Theoretical and Applied Mathematics

Solving Equations Numerically
by Newton's Method

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1. Instructions

- Use +, -, / for addition, subtraction and division, respectively. Thus $3 + \frac{x}{2}$ is typed as `3 + x/2`. Use parentheses to delimit the scope of your operations, type `x/(2+x)` to mean $\frac{x}{2+x}$. Without the parentheses, the computer would interpret `x/2 + x` as $\frac{x}{2}+x$.

- Multiplication can be denoted either by `*` or by juxtaposition: Type `4*x` or `4x` for $4x$.

- Use `^` to indicate powers: Type `4x^3` for $4x^3$; `12x^-6` for $12x^{-6}$. For more complex exponents, use parentheses to characterize the exponent, type `4^(x+1)` to mean 4^{x+1}.

- Use parentheses to delimit the argument of a function; i.e., type `sin(x)` rather than `sin x`.

- Use parentheses to define the *scope* of an operation: For example, type `4x(x^2+1)^3` for $4x(x^2 + 1)^3$; `4^(2x+1)` for 4^{2x+1}.

- To raise a function to a power, such as $\sin^2(x)$, type either `(sin(x))^2` *or* `sin^2(x)`.

- You can also use brackets [ ] or braces { } to delimit a mathematics expression.

- Functions you may use:

  - Trig: sin, cos, tan, cot, sec, csc;

  - Inverse Trig: asin, acos, atan;

  - Log: ln (natural log), or use log; e.g. ln(x) or log(x), both of these refer to the natural logarithm.

  - Exponential: The natural exponential function, e^x, can be entered as exp(x) or as e^x.

  - The absolute function, abs($\cdot$) can also be written in the usual way $|\cdot|$; thus, you can type either abs(x) or |x|.

  - Misc.: sqrt, usage sqrt(x) for $\sqrt{x}$ (or, use exponential notation: x^(1/2)).

- Spaces in answers are ignored, e.g., 4 x is the same as 4x; use spacing, however, to improve readability.

When you enter your response, some attempt will be made to determine whether the response is a valid one. For example, if you say `san(x)`, the function 'san' will not be recognized as a valid mathematical function; an error message is generated, and the user is not penalized for a possible typing error. The JavaScript routines will also check for unbalanced parentheses; thus, `((x^4+1) + sin(x)^2` will be flagged as a syntax error.

Newton's Method: Instructions. We want to solve the equation $f(x) = 0$ by specifying an initial value of x_0. As you know, Newton's Method is based on the following formula:

$$x_{n+1} = x_n - \frac{f(x_n)}{f'(x_n)} \quad n = 0, 1, 2, 3, \ldots$$

On the next page, enter the function $f(x)$, its derivative $f'(x)$ and an initial guess, x_0, then click on the "Solve!" button.

► ► ► Turn to next page, please. ► ► ► ►

Solving Equations Numerically by Newton's Method

Enter: $f(x) =$

Enter: $f'(x) =$

Initial Guess: $x_0 =$

$n =$

$x \approx$