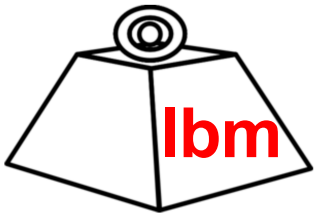
Take the Learning Suite Quiz

Unit conversion

2.20462 lbm/kg



Linear Equations

- Linear equations
  - m and b are constant
  - Additive terms involving x are linear in x.

$$f(x) = mx + b$$

- Question: how do you solve this for some given f(x), say f(x)=1, solve for x?

$$f(x) = m(x)x + b(x)$$

- What about this?

- Two equations in two unknowns

$$f_1(x_1, x_2) = a_1 x_1 + b_1 x_2 + c_1$$
$$f_2(x_1, x_2) = a_2 x_1 + b_2 x_2 + c_2$$

Nonlinear Equations

- Additive terms involving x are not linear in x

$$f(x) = x^3 - 10(x-1)^2 + 1$$

- Two equations in two unknowns

$$f_1(x_1, x_2) = x_1^2 + 3x_1 + 2$$
$$f_2(x_1, x_2) = 2x_1 + 3$$

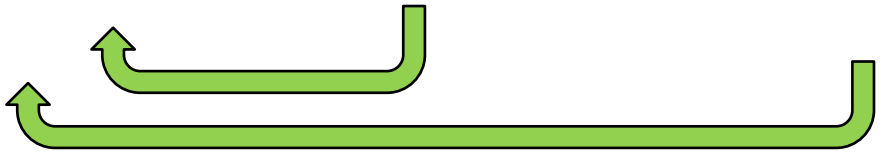
- Question: how do you solve the first equation for some given f(x), say f(x)=1, solve for x?

- ***Solve analytically (if possible),***
- ***Plot the function***
- ***Guess and check***
- ***Others?***

Note

- By convention, we put all nonlinear equations in the form f(x) = 0 before solving.

$$x^3 = 10(x-1)^2 + 1$$



$$x^3 - 10(x-1)^2 - 1 = 0$$

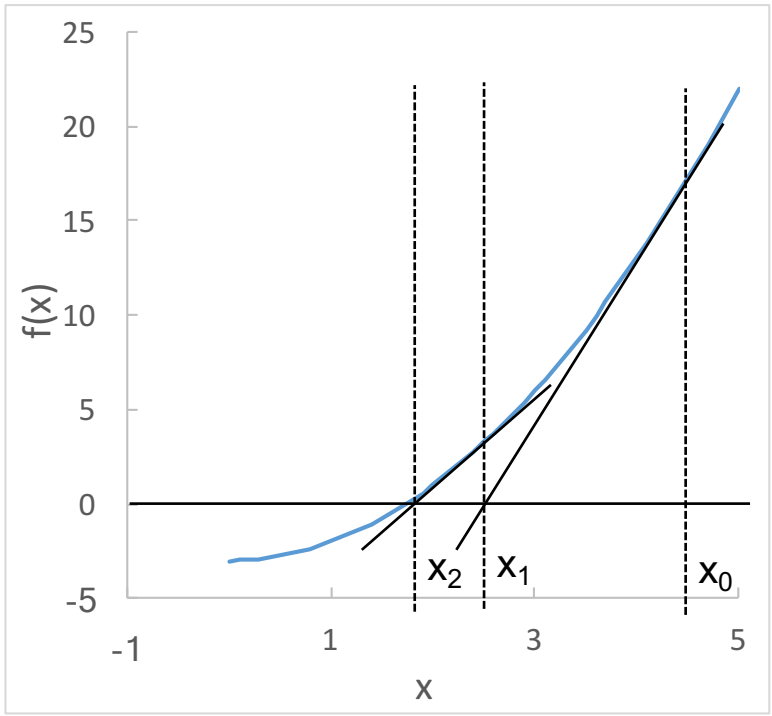
Or this

$$f(x) = x^3 - 10(x-1)^2 - 1 = 0$$

Newton's Method

$$f(x) = 0$$

- If you can't solve your problem, solve and easier problem
  - Guess the answer.
  - Assume the function is linear about your guess.
  - Solve the linear approximation to get a better guess.
  - Repeat.



Newton's Method

- Equation for the line

$$f_l(x) = f(x_0) + f'(x_0)(x - x_0)$$

- Solve for $f_l(x)=0$

$$x_1 = x_0 - \frac{f(x_0)}{f'(x_0)}$$