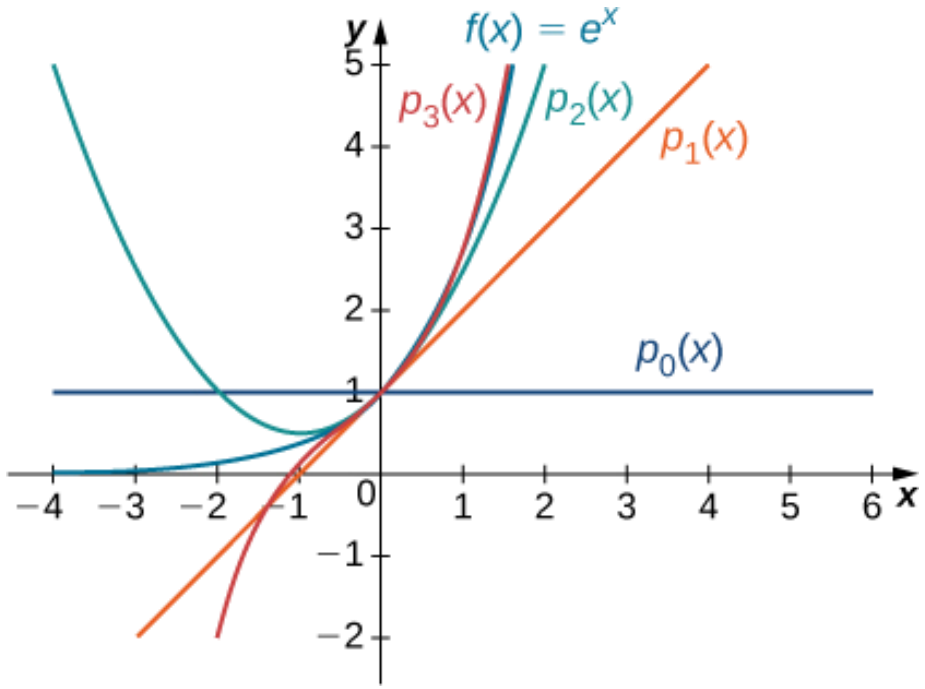
Taylor Series

$$f(x) = f(x_0) + f'(x_0)(x - x_0) + \frac{1}{2}f''(x_0)(x - x_0)^2 + \frac{1}{6}f'''(x_0)(x - x_0) + \dots$$



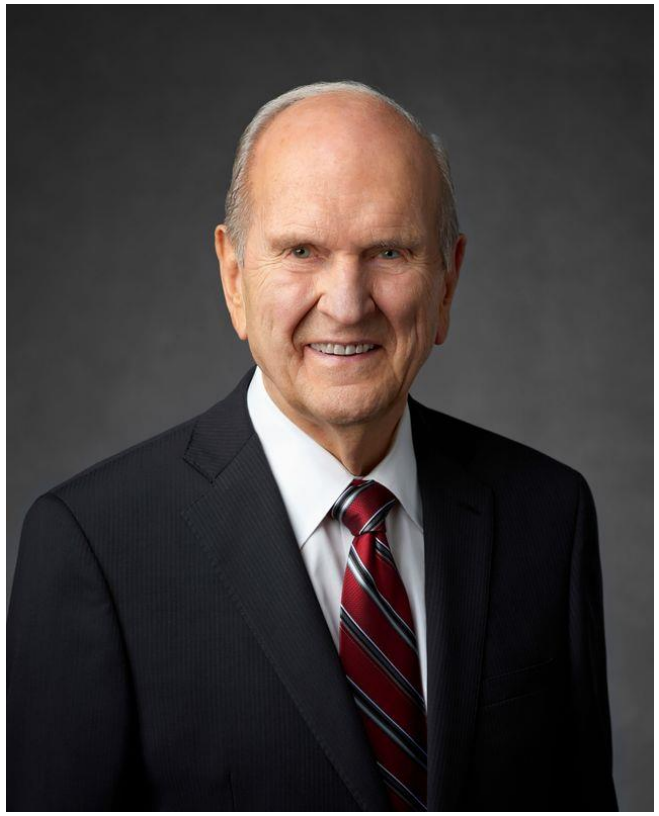
Soccer Offsides "Explained" like a Taylor Series expansion, with the most important terms coming first:

1. *You can't Be Closer to their goal than they are.*
2. *Actually, you can't Have the ball when you are closer to their goal than they are.*
3. *Actually, you can't Get the ball when you are closer to their goal than they are.*
4. *Actually, you can't get the ball when you are closer to their goal than they are, unless you weren't closer to their goal than they were when the ball was kicked.*

You are many things, but the first term of your Taylor series is Child of God

put your grades and your comparison to others where they belong…way down the line!

$$f(x) = f(a) + f'(a)(x-a) + \frac{f''(a)}{2!}(x-a)^2 + \frac{f^{(3)}(a)}{3!}(x-a)^3 + \ldots + \frac{f^{(n)}(a)}{n!}(x-a)^n + \ldots.$$



"Know the truth about who you are. First and foremost, you are a child of God. Second, as a member of the Church, you are a child of the covenant. And third, you are a disciple of Jesus Christ."

"…I plead with you not to replace these three paramount and unchanging identifiers with any others, because doing so could stymie your progress or pigeonhole you in a stereotype that could potentially thwart your eternal progression."

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?

- What about this?

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

- 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

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

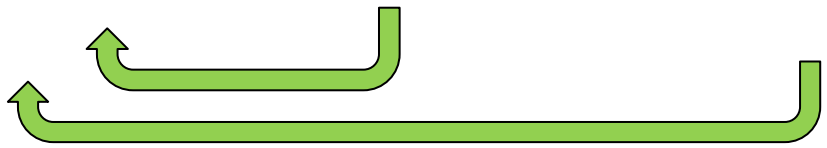
- Question: how do you solve the first equation for some given f(x), say f(x)=1, solve for x?

- ***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.

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



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

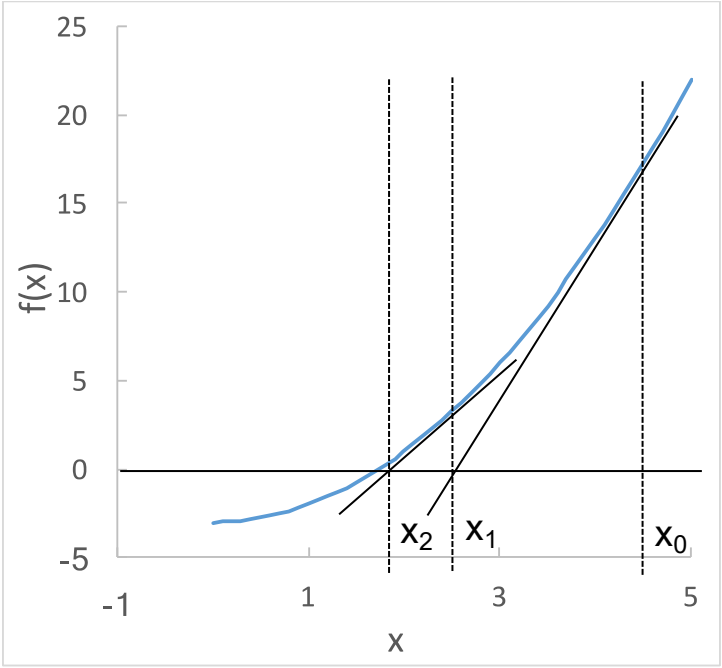
Or this

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

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 $f_l(x)=0$

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