NEWTON'S METHOD OF FINDING ZEROES OF FUNCTIONS:

ITERATIVE SOLUTION...

$$x_{i+1} = x_i - \text{error}_i$$

WHERE $\text{error}_i = f(x_i) / f'(x_i)$

THIS METHOD CAN BE USED TO FIND DEW POINT.

RECALL $\log p_w = A + \frac{B}{T} + C \log T + DT + ET^2$

OR $f(T) = A + \frac{B}{T} + C \log T + DT + ET^2 - \log p_w$

WE WANT TO FIND T WHEN $f(T) = 0$!

$$f'(T) = -\frac{B}{T^2} + \frac{0.43431C}{T} + D + 2ET$$

FOR WATER ($D \sim 0$):

$$f(T) = 29.8605 - \frac{3152.2}{T} - 7.3037 \log(T) + 1.809 \times 10^{-6} T^2 - \log(p_w)$$

$$f'(T) = \frac{3152.2}{T^2} - \frac{3.172043}{T} + 3.618 \times 10^{-6} T$$

SO, LET'S FIND DEW POINT WHEN $p_w = 18.0$ mmHg
THIS IS EXAMPLE PROBLEM FROM LECTURE!

GUESS! $T_0 = 303.15$ K (POOR GUESS... I KNOW THIS TEMP IS GOING TOO HIGH)

$f(T_0) = 0.24804$

$f'(T_0) = 0.02493$

$\text{error}_0 = f(T_0)/f'(T_0) = 0.24804/0.02493$

$\text{error}_0 = 9.95$

SO $T_1 = T_0 - \text{error}_0 = 303.15 - 9.95 = 293.20$

ITERATION #2

$T_1 = 293.20\,K$

$f(T_1) = -0.00965$ ← NOTE THAT THIS NUMBER IS BECOMING SMALLER!

$f'(T_1) = 0.02691$

$error_1 = -0.00965 / 0.02691 = -0.358$

$T_2 = T_1 - error_1 = 293.20 + 0.36 = 293.56$ ← NOTE SIGN

$T_2 = 293.56\,K$

ITERATION #3

$T_2 = 293.56\,K$

$f(T_2) = -0.000013$ ← SMALLER!

$f'(T_2) = 0.026835$

$error_2 = -0.000013 / 0.026835 = -0.0005$!

$T_3 = 293.56\,K$ ← CONVERGED!

$= 68.7°F$