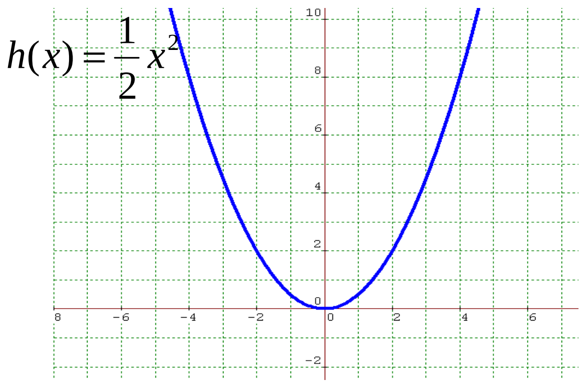
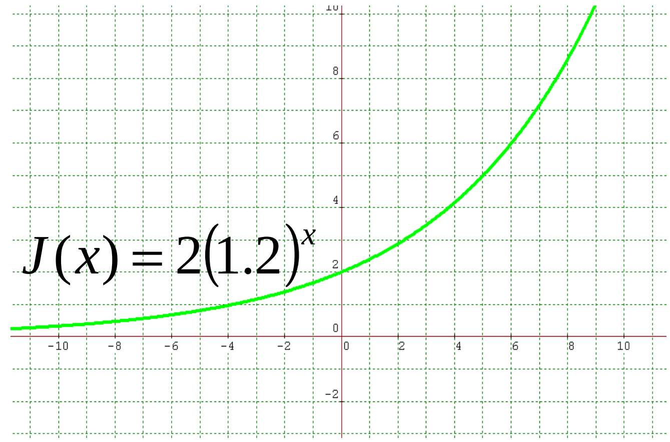
Another "Existence Theorem" **Name:**

AP Calculus

1a) Find the average rate of change over the interval (0, 4) for each function below.





b) Now find the instantaneous rates of change at different x-values within the interval (0, 4).
Can you find an x-value where the instantaneous rate of change = average rate of change on the interval?

2a) Draw the graph of any continuous and differentiable function you want in the interval [-5 , 5]

b) Draw the line that connects the end-points of the function. (By the way, what is the **name of that line**?)
Find the slope of this line. What does the slope of that line represent?

c) Is there at least one x-value in the interval [-5,5] whose tangent line is parallel to that **secant line**?

Let's discover another "existence theorem" and come up with a good name for it!

MEAN VALUE THEOREM

The instantaneous rate of change of a function, F'(x), will equal that function's average rate of change over some interval [a,b] , at least once at x = c as long as the function is continuous and differentiable in that interval (a,b) and c is in the interval [a,b]. Symbolically it can be written as

$$F'(c) = \frac{F(b) - F(a)}{b - a}$$

1) Find the c value(s) guaranteed by the mean value theorem given each function and interval below.

a) $f(x) = 2 - 3x^2$ [-1,2]

b) $f(x) = \sqrt{2 - x}$ [-7,2]

c) $f(x) = \ln(2x+1)$ $[0, \frac{e-1}{2}]$

d) a. Why wouldn't the mean value theorem apply to $f(x) = \frac{x+1}{x-1}$ on [-1,2]?