1. a. The slope of a function $f(x)$ at $x=c$ is estimated by taking a nearby point, then calculating the slope from these 2 points. This can be done with point slope form, $m=\frac{(y-y_1)}{(x-x_1)}$.

   b. An estimate is improved by taking points of smaller gaps from the original x value, such as taking $x-.0000001$, and taking the slope. The real slope is calculated using derivatives.

2. $\lim_{h \to 0} \frac{f(c+h)-f(c)}{h}$ is connected to the way the slope of the tangent to $f(x)$ at $x=c$ is estimated because both answers use the concept of $m=\frac{\Delta y}{\Delta x}$, and both compare a point close to $x=c$.

3. $\lim_{h \to 0^+} \frac{f(c+h)-f(c)}{h}$ means the value of h is positively (infinitesimally small), and we are approaching $h=0$ from the right. It is a right hand limit.

   $\lim_{h \to 0^-} \frac{f(c+h)-f(c)}{h}$ means the value of h is negatively (infinitesimally small), and we are approaching $h=0$ from the left. It is a left hand limit

4. $\lim_{h \to 0} \frac{f(h+c)-f(c)}{h}$ means the derivative of the function "f" at $x=c$.

   $\lim_{h \to 0} \frac{f(h+x)-f(x)}{h}$ returns a function to find the derivate at any point.

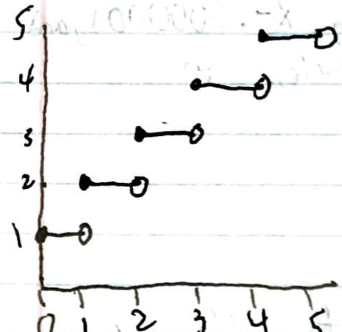
They both allow you to find the derivative.

Other explanation for

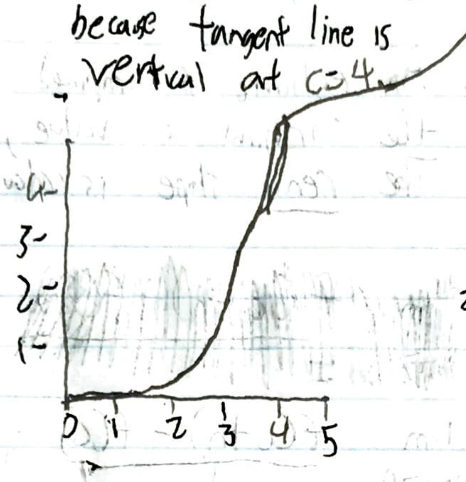
7. f(x) behaves similarly to it's derivative at x=c while it's still near but behaves less similarly as we go further away because we usually have changing derivative.

5.

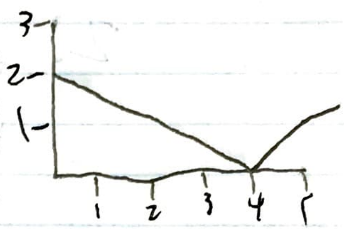
f'(c) is not differentiable because f(c) is not continuous at c=4



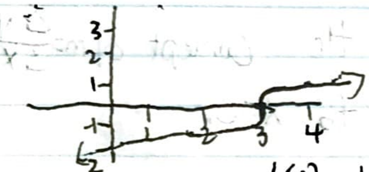
f'(c) is not differentiable because tangent line is vertical at c=4.



f'(c) is not differentiable because left hand derivative is not equal to right hand derivative.

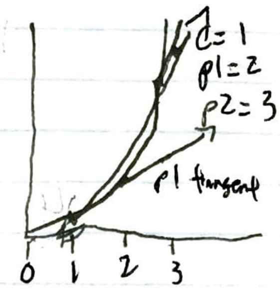


6. $y = (x-3)^{\frac{1}{3}}$



7b. if you know f'(1), then a good estimate would be to continue on the tangent line at x=2. So add f'(1) to f(1).

7. The line tangent to the function f(x) at x=c is a good linear approximation for values close to c because the slope is more accurate when you take a point infinitesimally small far away from c. That way you can find the instantaneous rate of change. The further the point is away from c, the less accurate the instantaneous slope is.



Using these graph, when we took p1 instead of p2, the slope was more accurate.

$\frac{d}{dt}$ ranks go
position
↓
velocity
↓
acceleration
↓
jerk

8. The units of a derivative of a function f(x) are determined mainly by the y axis. The x-axis is usually time. Since you want to find the instantaneous rate of change, the y axis unit changes.

In this graph, since the y axis is distance, $\frac{d}{dt}$ f(t) is velocity. velocity represents the rate of change of distance.