$$
f^{\prime}(a)=\lim _{h \rightarrow 0} \frac{f(a+h)-f(a)}{h}
$$

Part of this assignment is to see symbols and think meaning on a graph.
The visual or geometric representation is what line can represent the value on the graph. The value can be the length or slope of the line. $f^{\prime}(a)$ is the slope of the tangent line at $a$. Just draw the tangent line and say it is the slope of this line.
Average Rate of Change between two points $(a, b)=\frac{f(b)-f(a)}{b-a}$. Representation is the slope of the line that connects the two points $(a, f(a))$ and $(b, f(b))$
If $b-a=1$ (there are one unit apart) then the average rate of change $=f(b)-f(a)$.
It is still the slope of the line that connects the two points $(a, f(a))$ and $(b, f(b))$
$f(b)-f(a)$ also can have a vertical length interpretation.
If you are comparing slopes you need the slope of the line versus the vertical length interpretation.
Need to write a ratio as a slope of a line. (This line does not have to be a secant line on the curve)
$\frac{f(a)}{a}=\frac{f(a)-0}{a-0}=$ The average rate of change between two points, which is the slope of the line that joins the two points
The two points are $(a, f(a))$ and $(0,0)$
When finding $f^{\prime}(a)$ the derivative at a point, start with the definition: $f^{\prime}(a)=\lim _{h \rightarrow 0} \frac{f(a+h)-f(a)}{h}$. You are going to evaluate the limit of the difference quotient. You must learn all the interpretations of derivative, table, graph, formula/expression, and words.

From a formula or expression: If the function is polynomial or rational function, then one should use algebra to simplify and evaluate. If the function is exponential then make a table of values of the difference quotient as $h$ approaches zero. If ever stuck on algebra make a table to see what the difference quotient is approaching.
From a given table: The best we can do is the average rate of change. Use the smallest interval available to evaluate the derivative. Best is the average of the left and the right average rate of change.
From a graph: Draw the tangent line. The slope of this line is the derivative at that point. Find the slope of the line. Make sure you indicate which to points you are using to find the slope.

Interpret the derivative: Same as how you interpret slope of a line in word problems. Difference is at a particular input this is the rate of change.

## 2.2 webassign

Question 1
What does the derivative mean? slope
What does slope mean? change in function value when input changes by 1
example slope $=3 / 2 \quad$ means the function adds 3 when input adds 2 or the function adds 1.5 when input adds 1
My example: given $f^{\prime}(5)=1.5$ and $f(5)=20$ estimate $f(8)$ ?
method 1 interpret slope and estimate
at 5 the function is increasing at a rate of 1.5
must go 3 units (8-5) so the function will increase by $3(1.5)=4.5$
$\mathrm{f}(5)+$ increase $=20+4.5=24.5$
method two: write the equation of the tangent line and then plug in 8 for x and evaluate $\mathrm{y}=1.5(\mathrm{x}-5)+20$
$1.5(8-5)+20=24.5$ estimate based on rate of change at 5 . The best we can do with the information given
Question 5, 6, 10
Start with the definition and then evaluate the limit using a table.
Find the rate of change near those points
Can't do algebraically, so make a table of values of the difference quotient at each of the points in question.
You are asked to find the rate of change (ESTIMATE - table of value as $h$ approaches 0)

