Section 2.7: Derivatives and Rates of Change

(1) In this section, we focus on finding the slope of the tangent line to a curve $f(x)$ at a point $x = a$. There are two different (but equivalent) limit definition we can use to do this. What is the limit definition that has both an x and an a in it? Draw a graph to illustrate how this definition works.

(2) What is the limit definition that has both an a and an h in it? Draw a graph to illustrate how this definition works.

(3) What other term do we use for the slope of the tangent line of a curve $f(x)$ at $x = a$?

(4) If our function is a position function, then what is another term for the slope of the tangent line or derivative at a?

(5) Write down the average rate of change for a function $f(x)$ on the interval from $[x, a]$ and also on the interval $[a, a+h]$. How do these compare to the formulas for the slope of the tangent lines. Relate instantaneous rate of change and slope of the tangent line and the derivative.

Formulas/Ideas to Know

$$\begin{aligned}
\text{Slope of the tangent line at } (x = a) &= \text{derivative at } x = a \\
&= f'(a) \\
&= \lim_{x \to a} \frac{f(x) - f(a)}{x - a} \\
&= \lim_{h \to 0} \frac{f(a+h) - f(a)}{h} \\
&= \text{instantaneous rate of change at } x = a \\
&= \text{instantaneous velocity at } x = a \text{ (if } f \text{ is a position function)}
\end{aligned}$$

Extra Practice in Book: 2.7: 7, 9, 11, 12, 15, 17, 35, 37, 53