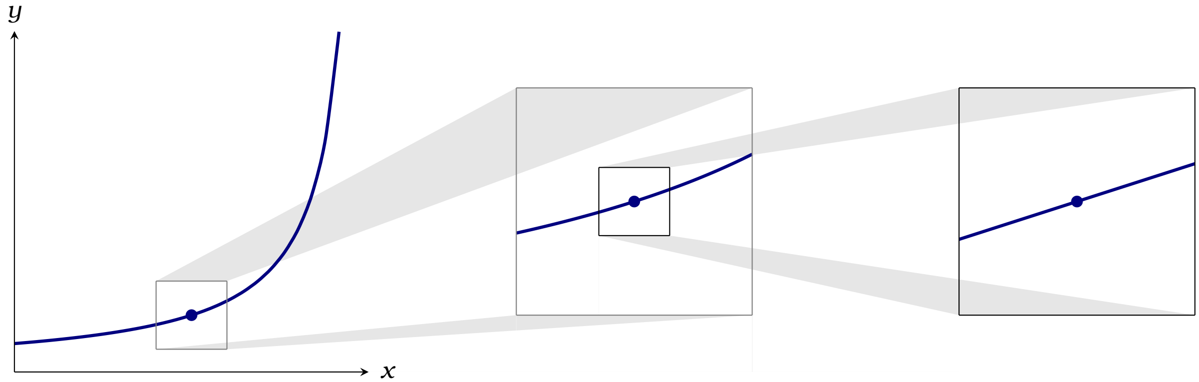


Figure 2.1: Given a function $f(x)$, if one can "zoom in" on $f(x)$ sufficiently so that $f(x)$ seems to be a straight line, then that line is the **tangent line** to $f(x)$ at the point determined by $x$.

at two points. The slope of any secant line that passes through the points $(x, f(x))$ and $(x+h, f(x+h))$ is given by

$$\frac{\Delta y}{\Delta x} = \frac{f(x+h) - f(x)}{(x+h) - x} = \frac{f(x+h) - f(x)}{h},$$

see Figure 2.2. This leads to the *limit definition of the derivative*:

**Definition of the Derivative** The **derivative** of $f(x)$ is the function

$$\frac{d}{dx} f(x) = \lim_{h \to 0} \frac{f(x+h) - f(x)}{h}.$$

If this limit does not exist for a given value of $x$, then $f(x)$ is not **differentiable** at $x$.

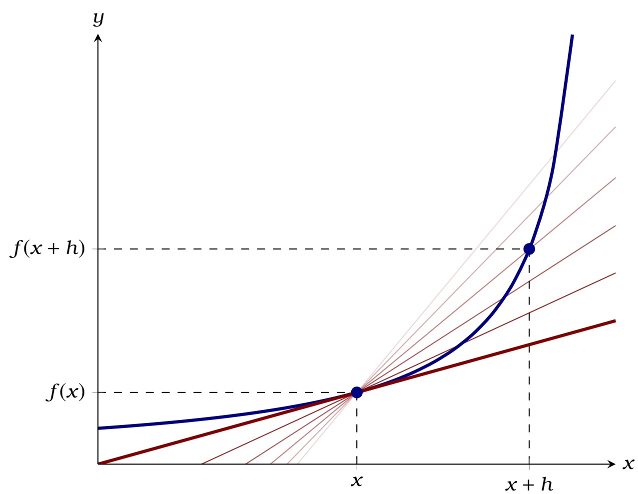


Figure 2.2: Tangent lines can be found as the limit of secant lines. The slope of the tangent line is given by $\lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$.