MA 211: Module 3 Notes

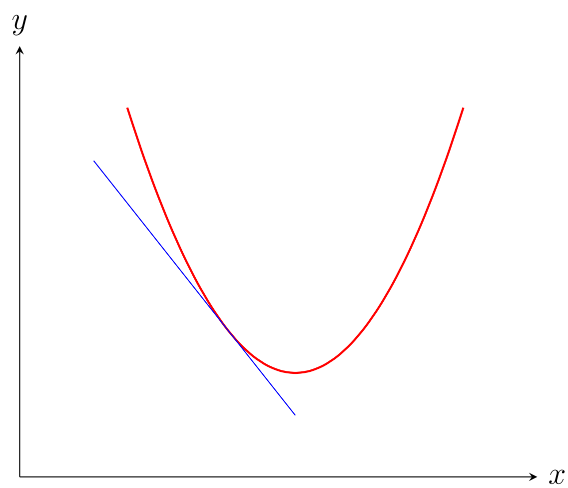
Patrick Rall

October 31, 2022

1 Introducing the Derivative

The problem of finding the slope of the tangent to a curve is important for several reasons.

- We identify the slope of the tangent with the *instantaneous rate of change* of a function.



(1)

- The slopes of the tangent lines as they change along a curve are teh values of a new function called the *derivative*.
- If a curve represents the trajectory of a moving object, the tangent at a point on a curve indicates the direction of motion at that point.

If $s(t)$ is the position of the object at time t, then the average velocity of the object over the time interval $[a, b]$ is

$$v_{av} = \frac{s(t) - s(a)}{t - a}.$$

The instantaneous velocity at time $t = a$ is the limit of the average velocity as $t \to a$:

$$v_{inst} = \lim_{t \to a} \frac{s(t) - s(a)}{t - a}.$$

1.1 Tangent Lines and Rates of Change

Consider the curve $y = f(x)$ and a secant line intersecting the curve at points $P(a, f(a))$ and $Q(x, f(x))$. The difference $f(x) - f(a)$ is the change in the value of f on the interval $[a, x]$, while $x - a$ is the change in x.