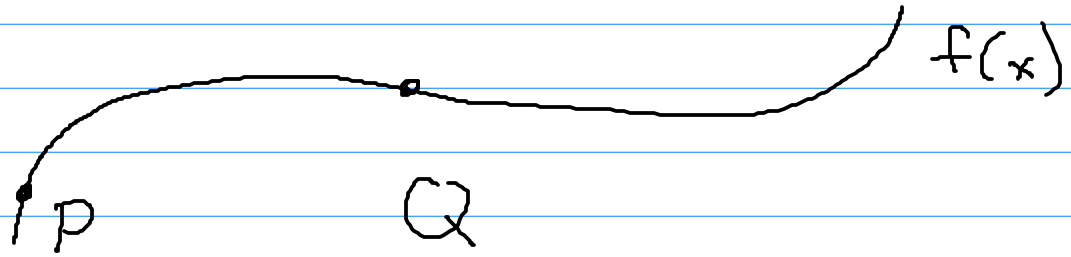
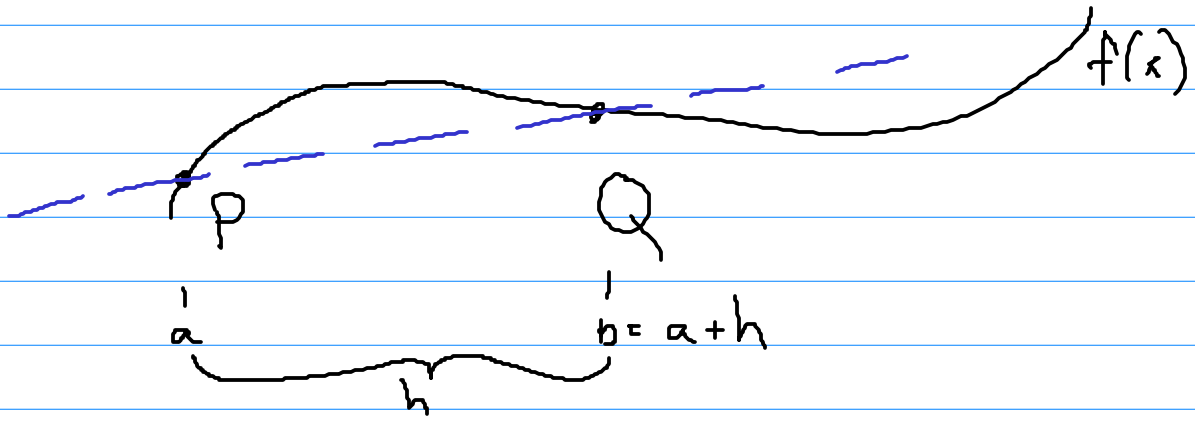
1.4 Differentiation Using Limits of Difference Quotients (part 1)

Let $f(x)$ be a function and P, Q be points on the function.



The line through P and Q is called the secant line.



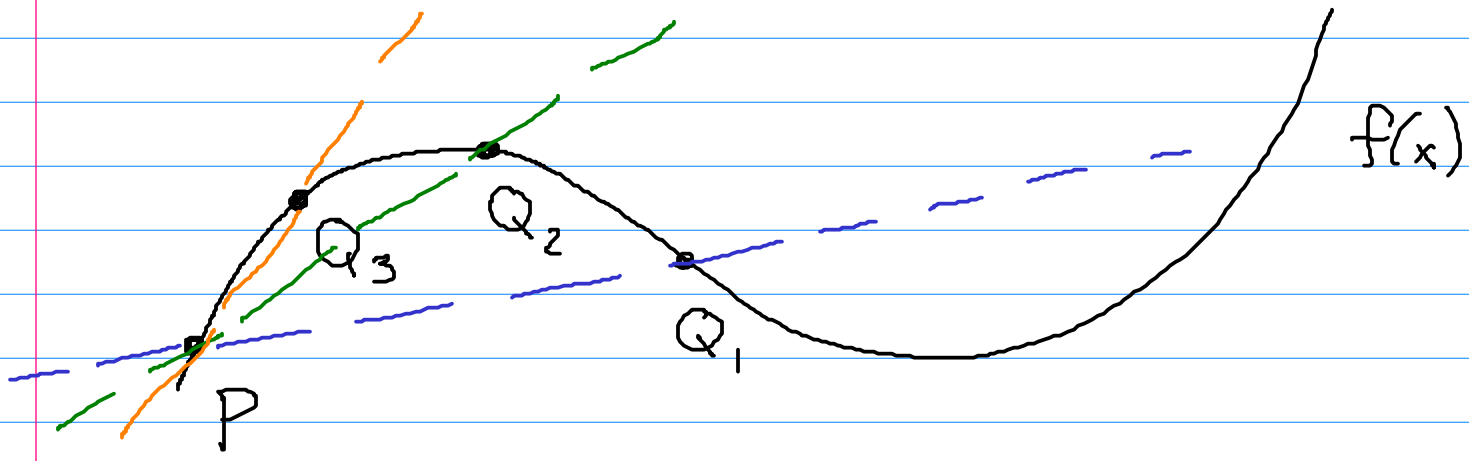
If $P = (a, f(a))$
and $Q = (a+h, f(a+h))$

then the slope of the secant line is

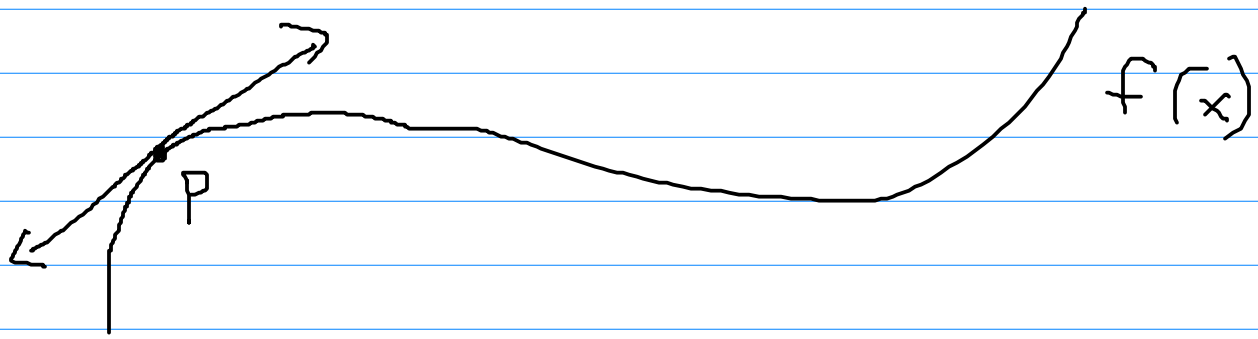
$$m = \frac{f(a+h) - f(a)}{h}$$

Let Q approach P

$Q \to P$, so $h \to 0$



These secant lines approach the tangent line at P.



The tangent line touches the graph only once.

Limit of secant lines = tangent line.

Limit of the slope of secant lines = slope of tangent line.

The slope of the tangent line to $y = f(x)$ at $x = a$ is

$$\lim_{h \to 0} \frac{f(a+h) - f(a)}{h}$$