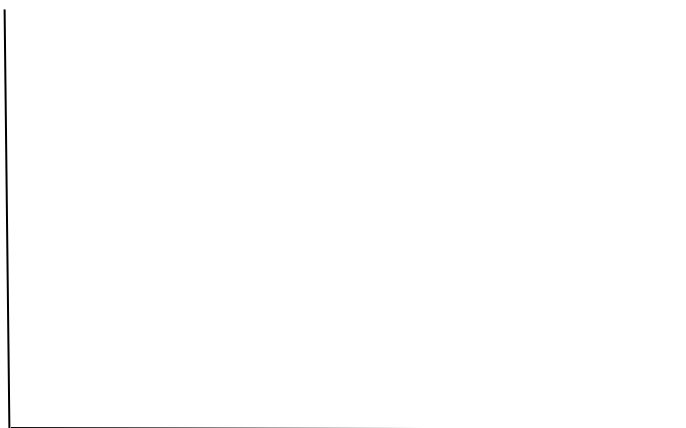# Slopes of Secants and Tangents

- **The slope of the secant is also the average rate of change (AROC). (From an application point of view it is often referred to "average velocity" or "average speed").**

- **The slope of the tangent is also the instantaneous rate of change (IROC). (From an application point of view it is often referred to "instantaneous velocity" or "instantaneous speed").**

Slope of the secant line PQ is given by $\qquad m_{PQ} = \dfrac{f(x+h) - f(x)}{h}$.

Sometimes called the "Newton Quotient" or the "difference quotient".

Slope of the tangent line is given by $\qquad m_t = \lim\limits_{h \to 0} \dfrac{f(x+h) - f(x)}{h}$.

Example 1: **Determine the slope of the tangent to the curve**

$$f(x) = x^2 + 1 \text{ at the point where } x = 2.$$

Example 2: **Determine the equation of the tangent to the curve**

$$f(x) = \sqrt{x+3} \text{ at the point where } x = 1.$$

Example 3: At what point on the curve $f(x) = -2x^4$ is the tangent line perpendicular to the line $x - y + 1 = 0$?

Note: the line that is perpendicular to the tangent line at the point of tangency, P is called the "normal line".