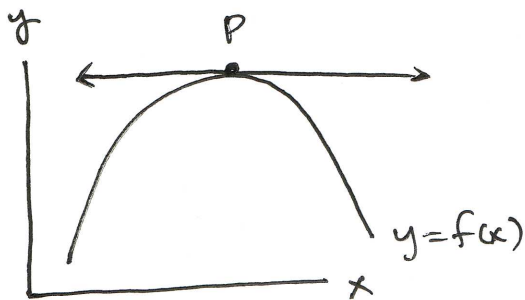
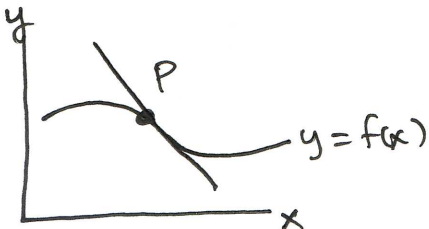


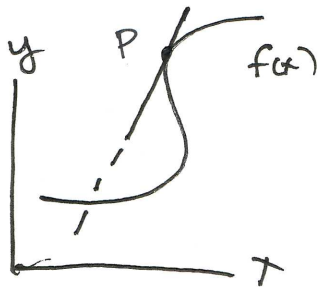
# The Derivative and the Tangent Line Problem



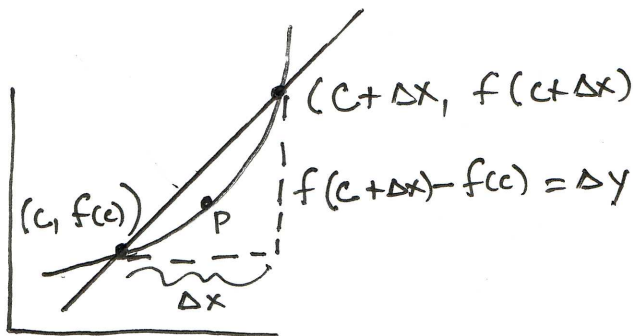
For this  $f(x)$ , the tangent line at  $P$  provides a slope at  $P$ .



For this  $f(x)$ , a tangent line at  $P$  intersects  $f(x)$  which causes difficulty as tangents do not cross function lines.



For this  $f(x)$ , the tangent line at  $P$  is effective at  $P$ , but intersects the function twice, causing difficulty as tangents intersect at one point.



The slope of the secant line leads to an acceptable technique for solving for slope of the tangent line at  $P$ .

$$m = \frac{f(c+\Delta x) - f(c)}{\Delta x}$$

with an increasingly smaller value for  $\Delta x$ , we approach a limit that results in the slope of the tangent at  $P$ .

\* Definition of a Tangent Line with slope  $m$ .

If  $f$  is defined on an open interval containing  $c$ , and if  $\lim_{\Delta x \rightarrow 0} \frac{\Delta y}{\Delta x} = \lim_{\Delta x \rightarrow 0} \frac{f(c+\Delta x) - f(c)}{\Delta x} = m$

the limit exists, then the line passing through  $(c, f(c))$  with slope  $m$  is the tangent line to the graph of  $f$  at the point  $(c, f(c))$ .

