Recall the TANGENT LINE PROBLEM: Given a curve $y = f(x)$ and a point $P(a, f(a))$ on the curve, find the equation for the tangent line to the curve $y = f(x)$ at the point P.

In order to write the equation of a line, we need

(1).

(2).

If x is the x-coordinate of point Q, then the y-coordinate is _____ . ie.

So the slope of the secant line through $P(a, f(a))$ and $Q(x, f(x))$ is given by

$$m_{PQ} =$$

The approximated slope m_{PQ} will get closer to the slope m of the tangent line as:

i.e. $m_{PQ} \to m$ as $x \to a$

Def. The TANGENT LINE to the curve $y = f(x)$ at the point $P(a, f(a))$ is the line

Ex Given $f(x) = x^2$ at $x = 2$

(a). Approximate the slope of the tangent line at $x = 2$ by making a table of values for the slope of the secant line m_{PQ} near $x = 2$.

P: At $x = 2$, $y =$

Q: Any point on $y = x^2$ $\Rightarrow$

So $m_{PQ} =$

x	1.5	1.75	1.9	1.99	2	2.01	2.1	2.5	2.75
$m_{PQ} =$	3.50	3.75	3.90	3.99	??	4.01	4.1	4.25	4.5

From the table of values, guess the slope of the tangent line to be $m =$ _____.

i.e. $\lim_{x \to 2} m_{PQ} = m =$ _____

(b). Verify your guess in part (a) by calculating the limit analytically.

$m =$

(c). Find the equation of the tangent line to $f(x) = x^2$ at $x = 2$

(d). Sketch the tangent line from part (c) on the graph of $f(x) = x^2$ below. Does this line appear to be the tangent line (just barely touching) at P?