

Secants to Tangents

A **secant** is a line that intersects a curve _____

_____.

A **tangent** is a line that most resembles the curve near that point. It

_____ but does not _____ the curve near that point.

1. Find the slope of the tangent line to the parabola $y = x^2$ at the point $P(3,9)$.

a) Let Q be a point on $y = x^2$ close to P

$$m_{PQ} =$$

NOTE: A tangent line has only ONE ordered pair. We need TWO ordered pairs to use the formula:

$$m = \frac{y_2 - y_1}{x_2 - x_1}$$

b) Let's try another point even closer to P...

$$m_{PQ} =$$

c) Let's try another point close to P, on the other side:

$$m_{PQ} =$$

d) Estimate the value of the slope of tangent at $x = 3$. Justify your answer:

In general, let Q be a point on $y = x^2$ close to P.

The coordinates for Q are:

The slope of the secant PQ is given by:

NOTE: Point Q cannot be exactly point P, or

$$m = \frac{0}{0}!$$

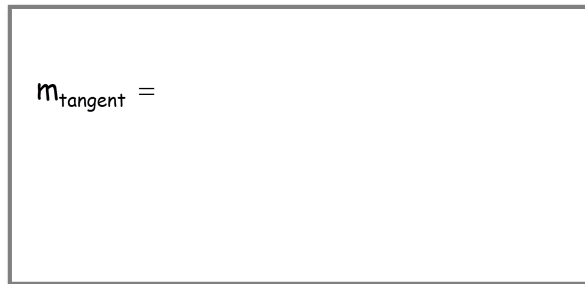
But the closer Q is to P, the more accurate our tangent slope calculation is.

New notation:

"The limiting value as h approaches 0 of the function $f(x)$ " is written as:



The slope of the tangent line at point P is the slope of the secant line PQ as Q moves closer and closer to P .



So, the slope of the tangent at $x = 3$ on the graph $y = x^2$ is:

$m =$

(because as $h \rightarrow 0$, then $6 + h \rightarrow$, _____)