2.7: Tangents, Velocities, and Rates of Change

We are now ready to find a formal way of computing the slop of a line tangent to a curve at a point. Re-view the animation from 2.1 posted on my webpage. What happens as the second x coordinate moves closer to the given tangent-line point?

Each secant line above passes through the point (1, 1). If x is the x-coordinate of the second point, write an expression for the slope of the line between the two points.

Write and solve a limit problem which allows us to find the slope of the tangent line at $x = 1$.

More General: Draw any function, a tangent line, and a secant line in the space below. Label the tangent-line point $(a, f(a))$ and the second point on the secant line $(x, f(x))$.

$m_{sec} =$

What should happen as the point $(x, f(x))$ moves closer to the tangent-line point $(a, f(a))$? Write a limit which explains this mathematically:
$m_{tan} =$

Most General: Draw any function, a tangent line, and a secant line again in the space below. Label the tangent-line point $(a, f(a))$ and let h be the distance bewteen the x values on the secant line. View the new animation posted under today's notes for a visual understanding of this).

$m_{sec} =$

$m_{tan} =$

The *derivative* of a function at $x = a$ is given by

Examples: Use a limit definition to find the equation of the line tangent to the curve $f(x) = x^2 + x$ at the point where $x = 2$.

Use a limit definition to find the derivative of the function $f(x) = \dfrac{1}{2x+1}$. Compute the slopes of the lines tangent to this graph at $x = 0$, $x = 1$, and $x = -2$.

Secant and Tangent Vectors-an Introduction

Illustration of Velocity Vectors (Secant and Tangent):

Example: Find a vector tangent to the curve $\mathbf{r}(t) = (3t^2 + 4)\mathbf{i} + \sqrt{t}\,\mathbf{j}$ at the point (7,1). Then find parametric equations of the line tangent to the curve at this point.