Chapter 1

Functions and Limits

1.4 The Tangent and Velocity Problems

Example. What is the tangent to a circle?

Illustration: https://www.desmos.com/calculator/7qflpgcuay

In Geometry, a TANGENT LINE at a given point on a a circle is a line that touches the circle only at that point.

Problems with this definition:

- 1) Not all curves are circle!
- 2) For other curves, the tangent line may intersect at several points!



EXAMPLE 1 Find an equation of the tangent line to the parabola $y = x^2$ at the point P(1, 1).

Go play around with this problem: https://www.desmos.com/calculator/kbfn4ptdop



The Velocity Problem.

EXAMPLE 3 Suppose that a ball is dropped from the upper observation deck of the CN Tower in Toronto, 450 m above the ground. Find the velocity of the ball after 5 seconds.

 $\label{eq:Galileo:s} \text{Galileo:} \ s(t) = 4.9t^2$

Relation to the secant line.



Instantaneous Velocity.

Relation to the tangent line.

