

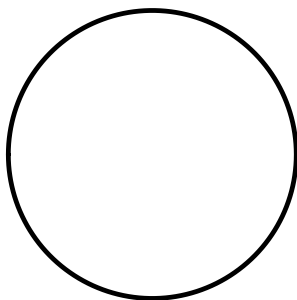
Chapter 1

Functions and Limits

1.4 The Tangent and Velocity Problems

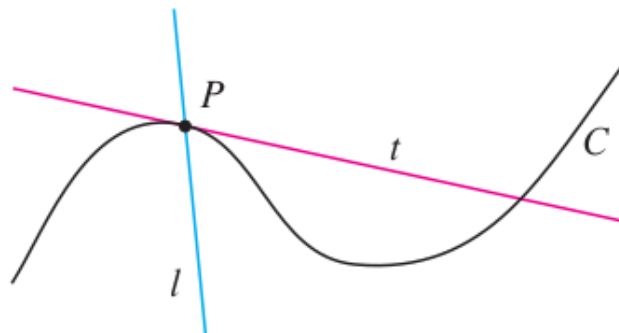
The Tangent problem.

Def. In geometry, a tangent line at a given point on a curve is a line that brushes against the curve.



Tangent to a circle

<https://www.desmos.com/calculator/itwxpbdwoe>



What is the tangent line?

EXAMPLE 1 Find an equation of the tangent line to the parabola $y = x^2$ at the point $P(1, 1)$. <https://www.desmos.com/calculator/5eyhh9tfkg>

EXAMPLE 2 The flash unit on a camera operates by storing charge on a capacitor and releasing it suddenly when the flash is set off. The data in the table describe the charge Q remaining on the capacitor (measured in microcoulombs) at time t (measured in seconds after the flash goes off). ~~Use the data to draw the graph of this function and~~ estimate the slope of the tangent line at the point where $t = 0.04$. [Note: The slope of the tangent line represents the electric current flowing from the capacitor to the flash bulb (measured in microamperes).]

t	Q
0.00	100.00
0.02	81.87
0.04	67.03
0.06	54.88
0.08	44.93
0.10	36.76

The Velocity Problem.

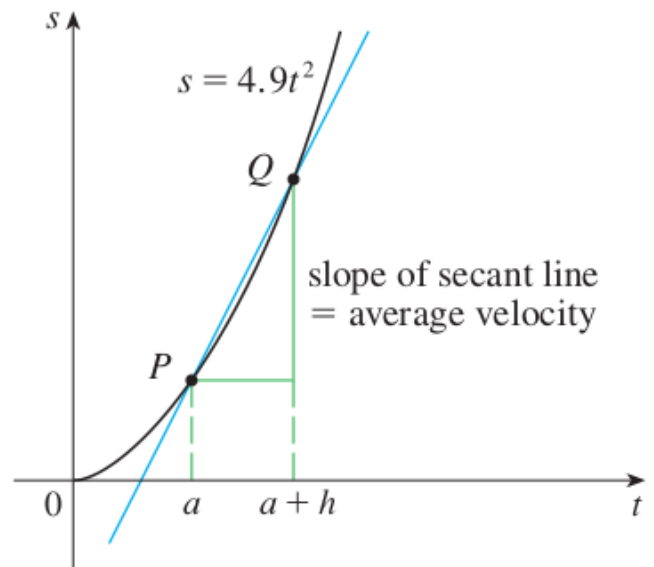


EXAMPLE 3 Suppose that a ball is dropped from the upper observation deck of the CN Tower in Toronto, 450 m above the ground. Find the velocity of the ball after 5 seconds.

Galileo: $s(t) = 4.9t^2$

Average velocity.

Relation to the secant line.



Instantaneous Velocity.

Relation to the tangent line.

