1.1 Secant Lines

Example 1.1.1 Given the function $f(x) = x^2$, do the following:

a. Determine an equation for the slope between the point $P = (1, 1)$ and any other point on the function.

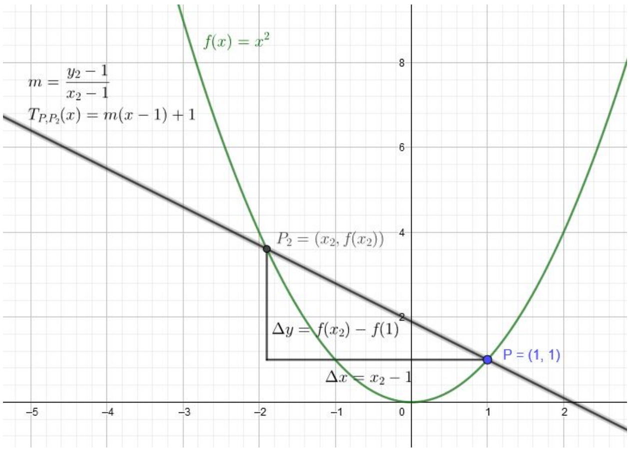

Figure 1.1.1: View Graph Using Geogebra https://www.geogebra.org/classic/sjvcdvfq

b. Create a table showing the slopes of secant lines near P using the formula determined.

c. What is the point-slope form of an equation of a line? What is the slope-intercept form of an equation of a line? Determine the equation of the secant line between the points $P = (1, 1)$ and $P_2 = (-2, 4)$ on f.

1.2 Tangent Lines

Example 1.2.1 Given the function $f(x) = x^2$, do the following:

a. Investigate the table found in the previous example. Create a new table if necessary to find slopes between P and points very close to P. What do you think the slope *at* the point $P = (1, 1)$ should be?

b. What is the equation of the tangent line to the function f at the point $(1, 1)$? What is a good name for this function for easy reference? Use this in your notation!

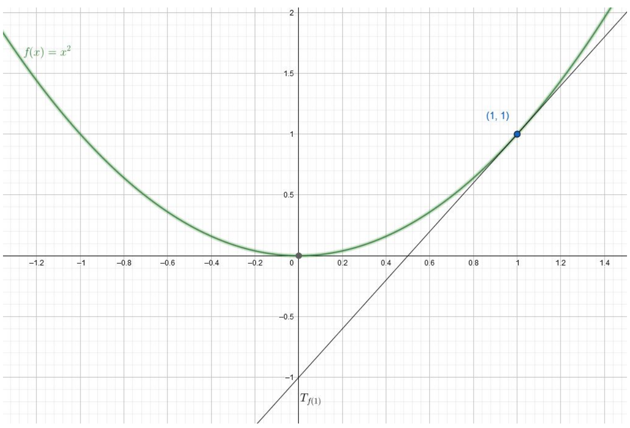

Figure 1.2.1: View Graph Using Geogebra
https://www.geogebra.org/graphing/uuxbk9yn

1.3 The Difference Quotient

Example 1.3.1 Find and simplify the difference quotient for the function $f(x) = x^2$.

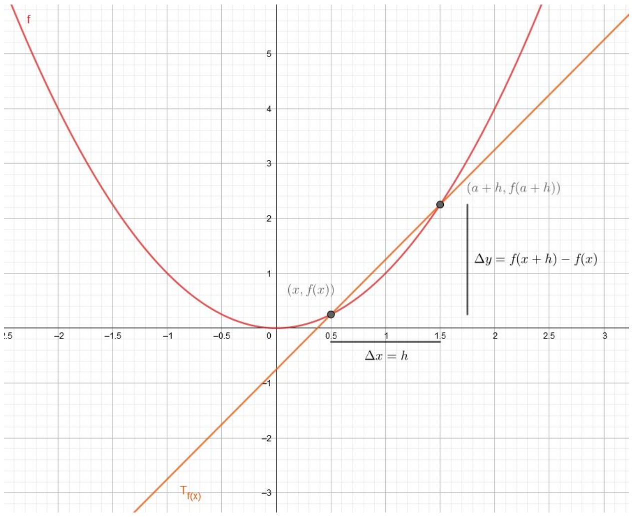

Figure 1.3.1: View Graph Using Geogebra
https://www.geogebra.org/graphing/jkt7tujm

Example 1.3.2 Find and simplify the difference quotient for the function $g(x) = 2x^2 + 3$. What does this represent?

1.4 Instantaneous Rates of Change

Example 1.4.1 Suppose that a ball is dropped from the upper observation deck of the CN Tower in Toronto, 450 meters above the ground. The distance that such a ball has fallen is given by the function $s(t) = 4.9t^2$. Find the *velocity* of the ball at the moment exactly 5 seconds after it has been dropped.

a. Do this first by making a table of values for the balls position at 5 seconds and at times near 5 seconds and its average velocity over those time periods to then infer the instantaneous velocity at 5 seconds.

b. Use the difference quotient to find the instantaneous velocity.