# Guided Practice for 2.6: Derivatives of Inverse Functions

## Overview

The goal of this section is to develop derivative rules for the functions ( y = (x)), ( y = (x)), and (y = (x)). These are very important functions in their own rights, and they are all defined as **inverses** of existing functions. The fact that they are inverse functions provides a one-size-fits-all method for determining their derivatives. We will briefly review the basic precalculus concepts about inverse functions and then see how the definition of an inverse function – in addition to the Chain Rule – leads to these three derivative rules as well as a general rule for differentiating *any* inverse function.

## Learning objectives

### BASIC learning objectives

Each student will be responsible for learning and demonstrating proficiency in the following objectives PRIOR to the class meeting.

* (*Review*) State the basic facts about inverse functions given on page 121.
* (*Review*) State the definition of the natural logarithm, arcsine and arctangent functions.
* (*Review*) Calculate basic values of the natural logarithm, arcsine, and arctangent functions without a calculator. (For example, ( (e^5)) and ((1/2) ).)
* State the derivative of the natural logarithm function.
* State the derivative of the arcsine function.
* State the derivative of the arctangent function.

**Reminder**: [Wolfram|Alpha](http://www.wolframalpha.com) gives you the ability to practice differentiation rules as much as you want. Make up a function to differentiate, take its derivative by hand, then check with W|A.

### ADVANCED learning objectives

The following objectives should be mastered by each student DURING and FOLLOWING the class session through active work and practice:

* Mimic the derivative of the arcsine function derivative to build a differentiation rule for the arctangent function.
* Differentiate functions involving the natural logarithm, arcsine and arctangent functions.
* Solve problems in context that involve the natural logarithm, arcsine and arctangent functions.
* If g is the inverse of a differentiable function f, give a general formula for the derivative of g in terms of the derivative of f.

## Resources

*Reading*: **Read Section 2.6 in Active Calculus**. Please note, here are the main points to focus on during your reading:

* The formula for the derivative of y = ln(x) and its derivation just above where the formula is stated
* Activity 2.6.2 which uses the formula for the derivative of y = ln(x) with other rules we learned earlier
* The formula for the derivative of y = arcsin(x) and its derivation — this involves some trigonometry obviously, so mark any trig questions you have that arise as you read.

*Viewing*: Watch the following videos at the MTH 201 YouTube Playlist, which have a combined running time of 14 minutes, 24 seconds:

* [Quick Review: Derivatives of inverse functions](http://www.youtube.com/watch?v=chdkxtt8XQo&list=PL9bIjQJDwfGuXQHuS5Jkmum_CFILoCZX-&index=46) (3:25)
* [Examples of derivatives with the natural logarithm](http://www.youtube.com/watch?v=jhBhSerqbyU&list=PL9bIjQJDwfGuXQHuS5Jkmum_CFILoCZX-&index=47) (6:30)
* [Derivatives involving ((x))](http://www.youtube.com/watch?v=pEEQNdttZsw&list=PL9bIjQJDwfGuXQHuS5Jkmum_CFILoCZX-&index=48) (5:27)

The following videos are optional but **strongly recommended** if you need a refresher on inverse functions or logarithms. In class we will assume fluency in working with these concepts.

* [Inverse functions, part 1](http://www.youtube.com/watch?v=tf-R8T2oyr4&list=PL476C3C1676343E03&index=18) (5:02)
* [Inverse functions, part 2](http://www.youtube.com/watch?v=KUmWVQc999g&list=PL476C3C1676343E03&index=17) (8:45)
* [Introduction to logarithms](http://www.youtube.com/watch?v=hWw_YQ21xU8&list=PL476C3C1676343E03&index=16) (9:41)
* [Using logarithms to solve exponentials](http://www.youtube.com/watch?v=YbSOUE2Xdpw&list=PL476C3C1676343E03&index=14) (12:07)

More such videos can be found at the [MTH 110 (Intermediate Algebra) playlist](http://www.youtube.com/playlist?list=PL476C3C1676343E03).

## Exercises

These exercises can be done during or after your reading and video watching. They are intended to help you make examples of the concepts you are reading and viewing. Work these out on scratch paper, and then you will be asked to submit the results on a web form at the end.

## Turn-in instructions

Go to the web form located at the following link and type in your answers: <http://bit.ly/1902ilg>

Responses are due at 11:59pm Eastern time the day before the class. If you do not have access to the internet where you live, please let me know in advance and we will make alternative arrangements.