ASSIGNMENT 14

Practice with inverse functions

Memorize the following:

- $\frac{d}{dx}\left[\sin x\right] = \cos x$
- $\frac{d}{dx}\left[\cos x\right] = -\sin x$
- $\frac{d}{dx}\left[\tan x\right] = \frac{1}{\cos^2 x} = \sec^2 x$
- $\frac{d}{dx}\left[\sin^{-1} x\right] = \frac{1}{\sqrt{1-x^2}}$
- $\frac{d}{dx}\left[\tan^{-1} x\right] = \frac{1}{1+x^2}$

You should also know where to look up the derivatives of other trig functions. . .

Exercise 14.1. Compute the derivative of the following functions

(1) $f(x) = \tan^{-1}\left(\frac{1}{x}\right)$

(2) $g(x) = e^{\sin^{-1} x}$

(3) $f(t) = \tan\left(e^t\right)$

(4) $f(t) = \tan^2\left(e^t\right)$

(5) $f(x) = e^{2x}\sin^{-1} x$

(6) $g(x) = e^{-3x}\tan^{-1}(\pi x)$

Exercise 14.2. (The famous inflating balloon problem.) In this problem we consider a perfectly spherical balloon that is being inflated. We assume that the volume of the balloon is constantly increasing at a rate of 7 cubic meters per minute.

(1) Suppose at some moment that the balloon has a volume of 5 cubic meters. At that moment, at what rate is the radius increasing?

(2) At the moment when the volume is 9 cubic meters, at what rate is the surface area of the balloon increasing?