

Math 1432

Pam Balthazar

pamb@math.uh.edu

Homepage

www.math.uh.edu/~pamb

Test 2 will take place in the CASA Testing Center in less than 2 weeks. Starts Thursday, February 16. Schedule your time on Courseware.

$$\int \frac{\arctan\left(\frac{x}{2}\right)}{4+x^2} dx$$

Popper

1. Give the derivative of $f(x) = \arcsin(x)$.
2. Give the derivative of $f(x) = \arctan(x)$.
3. The function f is invertible. Also,
 $f(2) = 3$, $f(3) = 2$, $f'(2) = -2$, $f'(3) = -1$.
Find $(f^{-1})'(2)$.

7. Compute $\int_0^1 2^{-x} dx$.

8. Give the slope of the tangent line to the graph of $f(x) = \arctan(4 - 2x)$ at $x = \frac{3}{2}$.

Hyperbolic Functions

Section 7.8

Primary Definitions

Hyperbolic cosine: $\cosh(x) = \frac{e^x + e^{-x}}{2}$

Hyperbolic sine: $\sinh(x) = \frac{e^x - e^{-x}}{2}$

$$\tanh(x) = \frac{\sinh(x)}{\cosh(x)}$$

$$\coth(x) = \frac{\cosh(x)}{\sinh(x)}$$

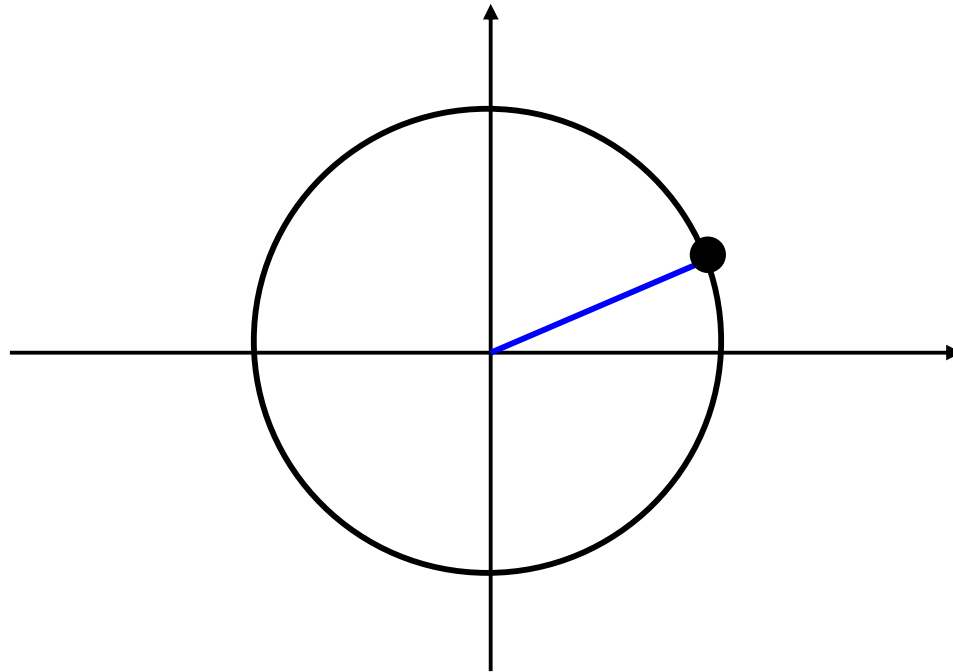
$$\operatorname{sech}(x) = \frac{1}{\cosh(x)}$$

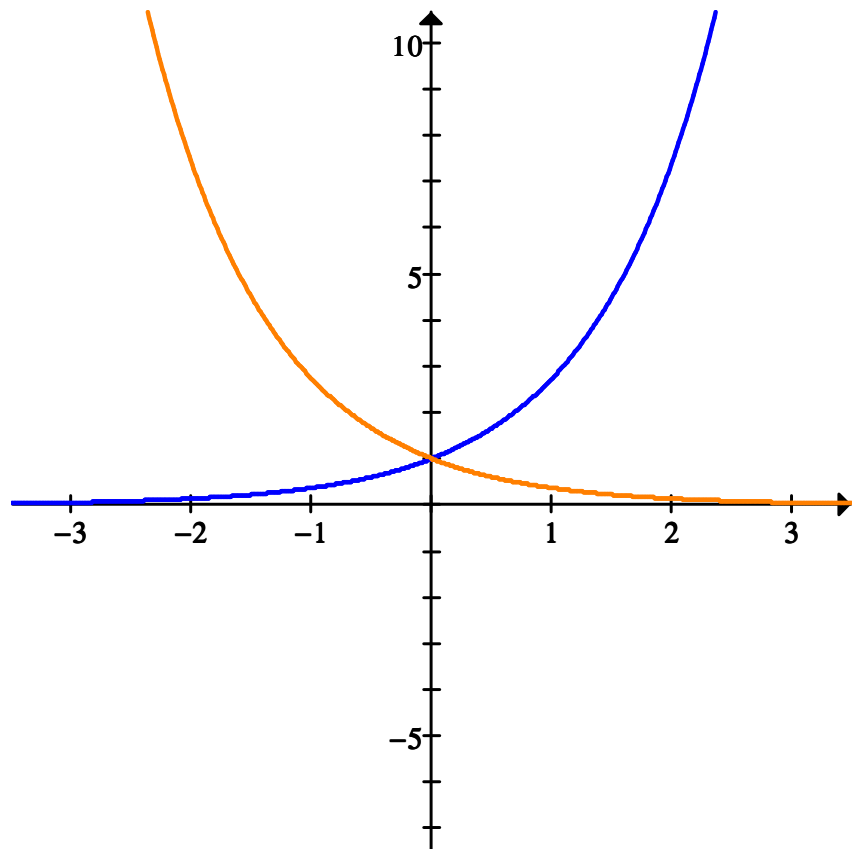
$$\operatorname{csch}(x) = \frac{1}{\sinh(x)}$$

Why are these called Hyperbolic Functions?

Recall that sine and cosine are called circular functions.

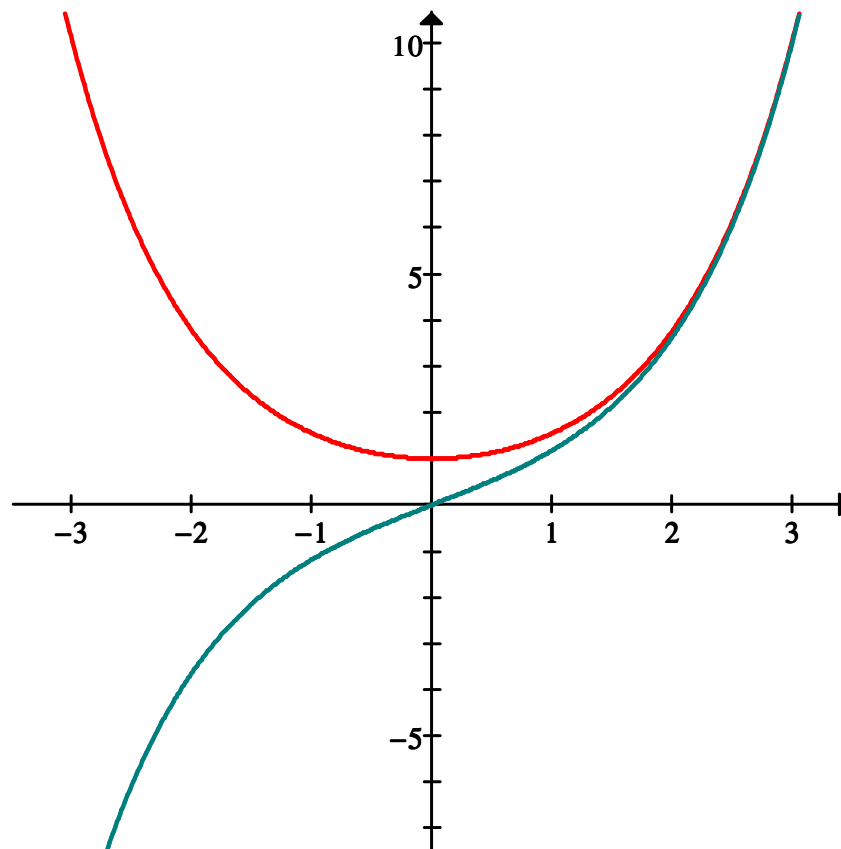
Remember the unit circle?





$$f(x) = e^x$$

$$g(x) = e^{-x}$$



$$\cosh(x) = \frac{e^x + e^{-x}}{2}$$

$$\sinh(x) = \frac{e^x - e^{-x}}{2}$$

Hyperbolic Identity

Show that $\cosh^2(t) - \sinh^2(t) = 1$

$$\sinh(-x) = -\sinh x \quad (\text{odd})$$

$$\cosh(-x) = \cosh x \quad (\text{even})$$

$$\cosh x + \sinh x =$$

$$\cosh x - \sinh x =$$

$$\frac{d}{dx} \cosh(x) =$$

$$\frac{d}{dx} \sinh(x) =$$

Derivatives and Integral formulas: $\frac{d}{dx} \sinh x = \cosh x$

$$\frac{d}{dx} \cosh x = \sinh x$$

$$\frac{d}{dx} \tanh x = \operatorname{sech}^2 x$$

$$\frac{d}{dx} \operatorname{sech} x = -\tanh x \operatorname{sech} x$$

$$\frac{d}{dx} \coth x = -\operatorname{csch}^2 x$$

$$\frac{d}{dx} \operatorname{csch} x = -\coth x \operatorname{csch} x$$

Chain Rule Formula and Consequences

$$\begin{array}{c|c} \frac{d}{dx} \cosh(u) = \sinh(u) \frac{du}{dx} & \int \cosh(u) du = \sinh(u) + C \\ \hline \frac{d}{dx} \sinh(u) = \cosh(u) \frac{du}{dx} & \int \sinh(u) du = \cosh(u) + C \end{array}$$

**Learn the derivative formulas
for tanh, coth, sech and csch!!**

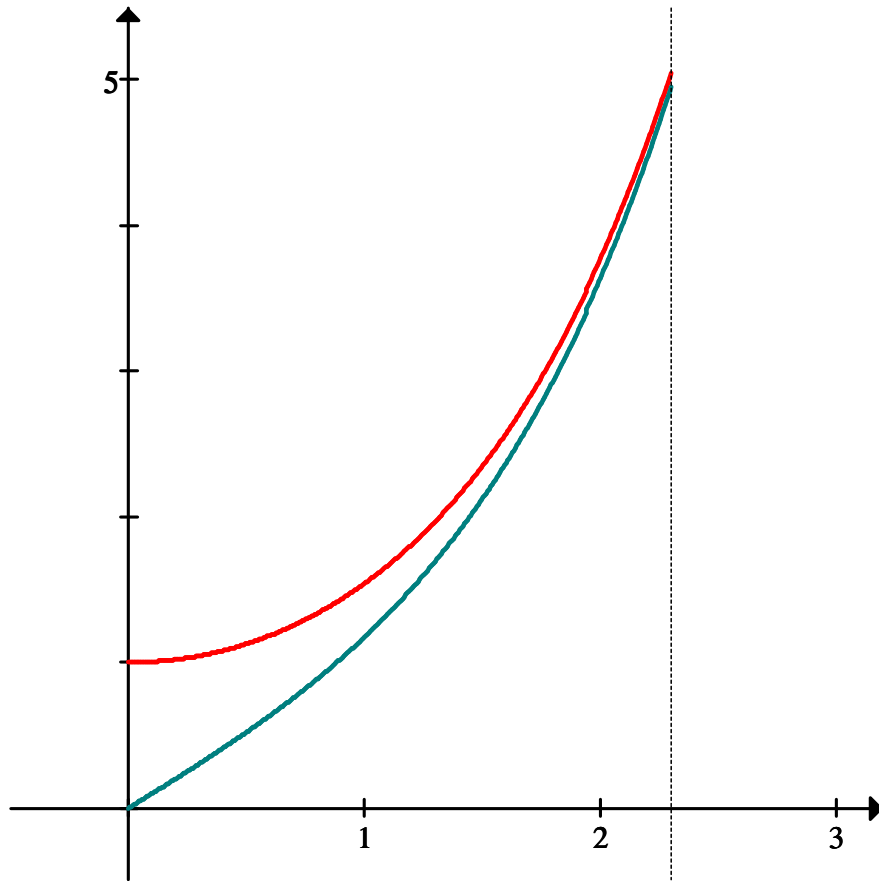
$$1. \frac{d}{dx} \left[\tanh(\ln(x)) \right]$$

$$2. \frac{d}{dx} \left[\frac{\cosh(x)}{1 + \operatorname{sech}(x)} \right]$$

3. $\int \tanh(x) \ln(\cosh(x)) dx =$

4. $\int x \operatorname{sech}^2(x^2) dx =$

5. Find the area bounded by the graphs of $f(x) = \sinh x$ and $g(x) = \cosh x$ for $0 \leq x \leq \ln 10$.



6. $\int \cosh^2(3x) dx$

Differentiate:

31. $f(x) = \sqrt{c^2 - x^2} + c \sin^{-1} \left(\frac{x}{c} \right), c > 0.$

45. $\int_0^{3/2} \frac{dx}{9 + 4x^2}$.