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Definition: Derivatives of the Inverse Trigonometric Functions		
• $\sinh x = \frac{1}{2}(e^x - e^{-x})$	• $\cosh x = \frac{1}{2}(e^x + e^{-x})$	
• $\tanh x = \frac{\sinh x}{\cosh x}$	• $\operatorname{coth} x = \frac{\cosh x}{\sinh x}$	
• $\operatorname{sech} x = \frac{1}{\cosh x}$	• $\operatorname{csch} x = \frac{1}{\sinh x}$	
Theorem: Derivatives of the Inverse Trigonometric Functions		
• $(\sinh x)' = \cosh x$	• $(\cosh x)' = \sinh x$	
• $(\tanh x)' = \operatorname{sech}^2 x$	• $(\coth x)' = -\operatorname{csch}^2 x$	
• $(\operatorname{sech} x)' = -\operatorname{sech} x \tanh x$	• $(\operatorname{csch} x)' = -\operatorname{csch} x \operatorname{coth} x$	

1. Use the definitions of $\sinh x$ and $\cosh x$ to show that $\cosh^2 x - \sinh^2 x = 1$.

2. Find the derivative of $f(x) = \sinh(x^2)(7x - \ln(x))$.

3. A telephone line hangs between two poles 14m apart in the shape of a catenary $y = 20 \cosh\left(\frac{x}{20}\right) - 15$, where x and y are measured in meters. Find the slope of the curve where it meets the left pole.



Definition: Linear Approximation

The **linear approximation** of f(x) at x = a is

$$f(x) \approx f(a) + f'(x)(x-a).$$

4. Use a linear approximation of \sqrt{x} at an appropriate value *a* to estimate $\sqrt{100.5}$.