1. Find the inverse functions of the following functions:

(a) \( f(x) = 2x + 5 \)

(b) \( f(x) = x^2 - 8 \)

(c) \( f(x) = \sin(x) \)

(d) \( f(x) = \tan(x) \)

2. Split up in two groups. One draws the inverse to the first graph and the other for the second graph and then compare your answers.

3. Does every function has an inverse? If not then please give an example.
4. Let $f$ have an inverse. Then $f(f^{-1}(x)) = \underline{\hspace{1cm}}$.  
Taking derivative of both sides we get:

$$\underline{\hspace{1cm}} \cdot f'(f^{-1}(x)) = \underline{\hspace{1cm}}$$

and so we get:

$$(f^{-1}(x))' = \underline{\hspace{1cm}}$$

Let us use the rule from the previous question

5. Find the derivative of $\ln(x)$ using the fact that $\ln(x)$ is the inverse of $e^x$.

6. Find the derivative of $\arctan(x)$ going through the following steps:

   (a) Use the rule above to show that

   $$(\arctan(x))' = \frac{1}{\sec^2(\arctan(x))}$$

   (b) Draw a right triangle with angle $\theta = \arctan(x)$ and determine the length of the sides.

   (c) Use the triangle to determine

   $$\sec^2(\arctan(x)) = \sec^2(\theta)$$

   (d) Plug your answer into part (a).

   Voilà, there you have it. That’s the derivative of $\arctan(x)$!

7. Use the technique described above to find the derivative of $\arcsin(x)$ and $\text{arcsec}(x)$. 
8. What is L'Hospital’s Rule? Specify the two situations where it applies.

9. Find the limit using L’Hospital’s Rule if appropriate. If L’Hospital’s Rule does not apply, say "Does not apply", and explain why. Then compute the limit using using an appropriate method.

(a) \( \lim_{x \to \infty} \frac{e^x}{x} \)

(b) \( \lim_{x \to 0} \frac{\sin(x)}{x} \)

(c) \( \lim_{x \to \infty} \frac{\ln \sqrt{x}}{x^2} \)

(d) \( \lim_{\theta \to \pi/2} \frac{1 - \sin \theta}{\csc \theta} \)
(e) \( \lim_{x \to 0^+} (\tan(2x))^x \)

10. Sometimes you have to use L’Hospital’s Rule twice to get an answer:

(a) \( \lim_{x \to \infty} \frac{2^x}{x^2} \)

(b) \( \lim_{x \to 0} \frac{\cos mx - \cos nx}{x^2} \)

11. (a) Solve the following limit using L’Hospital’s Rule.

\( \lim_{x \to 0^+} \frac{\cos(x)}{x} \)

(b) Is your answer correct? If not what is the correct answer?