1. Determine the inverse of \( h(x) = (x-4)^2 + 3; x < 4 \).

2. Suppose that the bacteria in a colony can grow unchecked, by the law of exponential change. The colony starts with 1 bacterium and doubles every half hour. In about how many hours will the population grow to 65,536?

3. Evaluate
   
   a. \( \lim_{x \to 1} \frac{\ln(x)}{3 - 3^x} \)
   
   b. \( \lim_{x \to 0} \frac{\tan(x)}{\cos(x)} \)
   
   c. \( \lim_{x \to 2} \frac{x^2 + 2}{x^2 - 4} \)
   
   d. \( \lim_{x \to \infty} (x + 1)^{\frac{1}{x}} \)

4. Let \( f(x) = 15x^2 \) and \( g(x) = e^{3x} \). Which grows faster?

5. Without using your calculators, find the exact value or write undefined, if impossible. Concisely explain your answer.
   
   a. \( \cos \left( \sec^{-1} \left( -\frac{\sqrt{3}}{2} \right) \right) \)
   
   b. \( \sin^{-1} \left( \sin \left( \frac{3\pi}{2} \right) \right) \)

6. Differentiate the following:
   
   a. \( y = \sec^{-1}(e^{3x}) \)
   
   b. \( y = (x^4 - 1)^{2x} \)
c. \( y = \sin^{-1}(\ln(5x^2 - 6x + 1)) \)

7. Evaluate the following:

a. \( \int \frac{(2^x)dx}{(4 + 8^x)} \)

b. \( \int_1^{10} \frac{\log^3(x^2)}{x} dx \)

c. \( \int_{\sqrt{3}}^{1} \frac{dy}{\sqrt{4 - y^2}} \)

d. \( \int_0^1 4x e^{x^2 + 1} dx \)

e. \( \int \frac{45t^2 dt}{4 + 9t^6} \)

8. Find the volume of the solid of revolution that is formed by revolving the region bounded by the graph of \( 2x^2 \), \( y = 0 \), \( x = 0 \), and \( x = 1 \) about the y-axis