1. Suppose that $y'(x) = \cos^2 x$, and that $y(0) = 42$. Find $y(x)$. Hint: Use the double angle formula.

2. If it is known that
$$\frac{d}{dx}(f(3x-2)) = x^2 + 1$$
find $f'(x)$.

3. A rock is thrown upwards with initial velocity v_0 and achieves a maximum height of h meters. How high would the rock go if the initial velocity is $2v_0$? How fast must it be thrown to achieve a maximum height of $2h$?

4. If $y = f(x) = (3x-2)/(5-2x)$, find
   (a) $f^{-1}(2)$
   (b) $(f^{-1})'(2)$

5. If
$$y = z(x) = \frac{1}{1+3f(2x-1)}$$
and f is an invertible function, express $x = z^{-1}(y)$ in terms of f^{-1}.

6. Find the derivative of the following
   (a) $y = \sec(\sec x)$ when $x = \pi/4$.
   (b) $y = e^{3x-4x^2} \ln ex$ when $x = 1$.
   (c) $y = 3^x \log_3 3x$ when $x = 3$.

7. Find the inverse function $x = f^{-1}(y)$ if
$$y = f(x) = \tanh x = \frac{e^x - e^{-x}}{e^x + e^{-x}}.$$

8. If the half-life of a radioactive element is 1 year, what is the third-life? (The third life is the time it takes one-third of the sample to decay.)