Practice Exam 3

You should work through this as you would an actual exam. Time yourself, and try to solve each problem alone without using your notes or your book.

1. Find
$$\frac{\mathrm{d}}{\mathrm{d}x} \sin e^{\sin x}$$

2. Find an equation for the tangent line to the parametric equation
$$\begin{aligned} x &= 2^t \\ y &= \tan t^2 \end{aligned}$$
when $t = 2$.

3. Find an equation for the tangent line to $r = \cos\theta$ when $(r, \theta) = (-1, \pi)$.

4. Find y' if $xe^y = y \sin x$.

5. State and prove the differentiation rule for
$$\frac{\mathrm{d}}{\mathrm{d}x} \sec^{-1} x$$

6. Find
$$\frac{\mathrm{d}}{\mathrm{d}x} \ln \frac{x^2}{x+1}$$

7. Find
$$\frac{\mathrm{d}}{\mathrm{d}x} \sqrt{x}^{\sqrt[3]{x}}$$

8. Use local linear approximation to approximate $\sin 3$. Perform all arithmetic by hand.

9. A galley trapped in a whirlpool follows a path given in polar coordinates by $r = \frac{1}{\sqrt{\theta}}$, where the radius is measured in furlongs. Find how quickly the ship is moving toward the center of the whirlpool if it is half a furlong from the center and circles the vortex 6 times per minute.

10. The height of a weight attached to the end of a spring t seconds after release is given by $4 - 4e^{-t}\cos t$. Find the maximum and minimum height of the weight.