

*Review Exercises for Exam 2!*

The following exercises should help you further prepare for the exam on Thursday.

1. Find the derivative of each function below!

(a)  $f(x) = x^{x^2}$

(b)  $g(s) = \ln(\tan(s))$

(c)  $h(x) = \frac{x^2 e^x - x}{\sin(x)}$

(d)  $T(r) = e^{r^2} \cos(r)$

(e)  $P(x) = \cos(\tan(\ln(\sin(e^{x^3}))))$

(f)  $R(r) = 1000r^{1000}$

(g)  $f(x) = \sqrt{\pi e^\pi}$

2. Use implicit differentiation to find the equation of the tangent line to the graph of the expression  $y^2 e^x = x + y$  at the point  $(0, 1)$ .
3. Suppose that a spherical balloon is being inflated so that its radius grows at a rate of 10 cm/sec. How fast is air being pumped into the balloon when its diameter is 30 cm?
4. Find the derivative of the function  $g(x) = \frac{1}{\sqrt{x}}$  using the *definition* of the derivative, and *not* shortcut formulas!
5. Use the Quotient Rule to show that  $\frac{d}{dx}(\csc(x)) = -\csc(x) \cot(x)$ .
6. Suppose  $f(x) = x + \ln(x)$ , and suppose that  $g(x) = f^{-1}(x)$ . Find the derivative  $g'(e + 1)$ .