Some corrections to the original, written in blue.

Review problems

Part I: fast recall

1. Differentiate:
   a) $x^2$
   b) $\sqrt{x}$
   c) $\sqrt[3]{x}$
   d) $e^x$
   e) $\ln x$
   f) $\cos x$
   g) $\tan x$
   h) $\tan^{-1} x$
   i) $\ln(\sin x)$
   j) $xe^x$

2. Estimate $\sin(0.02)$ with linear approximation.

3. Find the minimum of $f(x) = e^x - x$ on $(-\infty, \infty)$.

4. Find the maximum and minimum of $f(x) = x^2 - 3x$ on $[0, 2]$.

5. Sketch the graph of $f(x) = x^2 - 3x$.

6. Evaluate $\lim_{x \to -\infty} \frac{e^x + 1}{e^x - 1}$ and $\lim_{x \to 0} \frac{e^x + 1}{e^x - 1}$.

7. Suppose $f, g$ are functions such that $f(t)g(t) = t$ for all $t$,
   $f(0) = 2^7$, $g(0) = 8$, and $f'(0) = 1$. Find $g'(0)$.
Part II: long problems.

8) (Differentiation) Find derivatives:
   a) \( \ln(\ln(\ln(x))) \)
   b) \( \frac{e^x \sqrt{\sin x}}{(x+1)^3 (x-2)^3} \)
   c) \( \sec^{-1} x \) for \( x > 0 \) only
   d) \( e^{x^3} \ln(7x+1) \)

9) (optimization)
   a) Find the maximum area of a right triangle with hypotenuse of length 1.
   b) Find the maximum perimeter of a right triangle with hypotenuse of length 1.
10 (optimization)
Find the minimum perimeter of a slice of pie of area 50 cm².

11 (linear approximation)
a) Approximate \( \tan^{-1}(1.03) \) (answer in terms of \( \pi \)).

b) Find the tangent line to \( y^2 = x^2 - x \) at the point \((2, \sqrt{6})\).
12) (graphing) Sketch the graph of \( f(x) = x \cdot e^{-x^2} \). You may assume that \( \lim_{x \to \infty} f(x) = 0 \) (we haven't covered how to evaluate these limits in detail).

- Find all local extrema, and determine where the function is increasing and decreasing.
- Determine where it is concave up or down.
- Give a rough sketch from this information.

13) (graphing) Sketch the graph of \( f(x) = \frac{-3x^2 + 4x}{x^2 - 4} \).

- Find all vertical asymptotes, with the limits on both sides.
- Find all horizontal asymptotes.
- Give a rough sketch from this information.
(Related rates)
A certain town has a workforce of 50,000 people, of whom 10% are unemployed. Suppose that the workforce is growing at a rate of 900 people per month, and 400 new jobs are being created per month. What is the rate of change of the unemployment rate (expressed in percent per month)?