

# Lecture 32: Worksheet

This worksheet as well as the solutions was generated by Sofia, a bot written in the academic year 2003/2004 using grant from the Harvard Provost together with Harvard students **Johnny Carlsson**, **Andrew Chi** and **Mark Lezama**. At that time, people have laughed at the chat bot idea. Now it is big business: Google, Siri, Cortana, Wolfram alpha: these are all AI bots which constantly become more and more sophisticated.

1 Differentiate the following functions:

- a)  $f(x) = x$
- b)  $f(x) = 4(x - \cos(x))$
- c)  $f(x) = \frac{2x}{\log(x)}$

2 Integrate the following functions:

- a)  $f(x) = -3e^{-x}(x - 1)$
- b)  $f(x) = 3 - \frac{3}{x^2}$
- c)  $f(x) = -\frac{3}{x^2}$

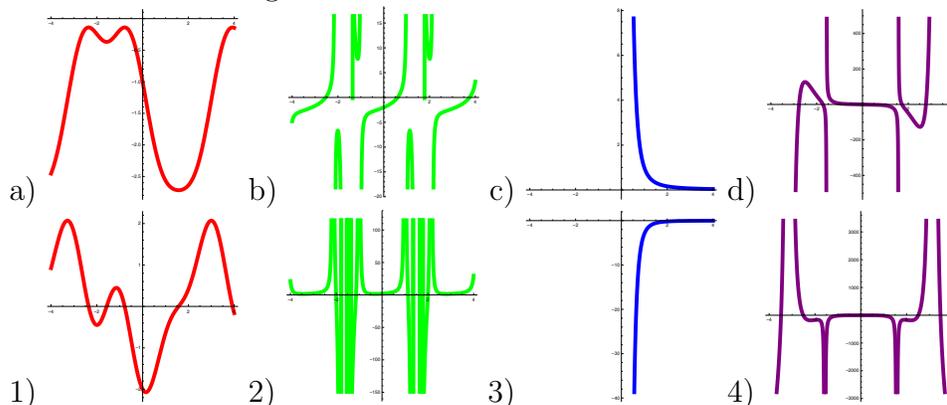
3 Differentiate the following functions:

- a)  $f(x) = \frac{4x^2}{x+3}$
- b)  $f(x) = \frac{2}{x^8}$
- c)  $f(x) = 2(x^3 + \cos(x))$

4 Integrate the following functions:

- a)  $f(x) = 3 \sin(x) (4 \cos^3(x) - 1)$
- b)  $f(x) = 2 (\cot^2(x) + \csc(x) - x \cot(x) \csc(x) + 1)$
- c)  $f(x) = -2 \sin(x) e^{\cos(x)}$

5 Match the following functions with derivatives:



6 Find the critical points of the following functions:

- a)  $f(x) = (x - 9)(x - 7)(x - 6)$
- b)  $f(x) = (x - 9)^2(x - 8)$
- c)  $f(x) = (x - 3)^2$