Lecture 36: Worksheet

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1 Differentiate the following functions: Level 1

a) $f(x) = x + \sqrt{x}$
b) $f(x) = e^x$
c) $f(x) = x - \sqrt{x}$
d) $f(x) = -2x$
e) $f(x) = x + \sin(x)$

2 Integrate the following functions: Level 1

a) $f(x) = 5x^4$
b) $f(x) = 1$
c) $f(x) = 3x^2$
d) $f(x) = -\frac{2}{x^3}$
e) $f(x) = 3x^2$

[1] Written in the academic year 2003/2004, thanks to a grant from the Harvard Provost together with **Johnny Carlsson**, **Andrew Chi** and **Mark Lezama**. Sofia was a chat bot which would use computer algebra systems to solve calculus problems while chatting, similar to Wolfram Alpha now. The later is of course much more sophisticated. This entire LaTeX file was generated automatically.

3 Differentiate the following functions: Level 2

a) $f(x) = (x - \sin(x))\sec(x)$
b) $f(x) = -x^3$
c) $f(x) = 1 - 3x$
d) $f(x) = e^{-x}\sqrt{x}$
e) $f(x) = \frac{1}{x}$

4 Integrate the following functions: Level 2

a) $f(x) = -\frac{2\sec^2\left(\frac{1}{x^2}\right)}{x^5} - \frac{2\tan\left(\frac{1}{x^2}\right)}{x^3}$
b) $f(x) = e^x - e^x \sec^2(e^x)$
c) $f(x) = \frac{1-\frac{1}{2\sqrt{x}}}{x} - \frac{x-\sqrt{x}}{x^2}$
d) $f(x) = -\frac{1}{x} + \cos(x) + 1$
e) $f(x) = -2$

5 Differentiate the following functions: Level 3

a) $f(x) = e^{-x}$
b) $f(x) = \frac{1}{x^{3/2}\log(\sqrt{x})}$
c) $f(x) = x - \log(x)$
d) $f(x) = x^4 - \frac{1}{x^3} + \cos(x)$
e) $f(x) = x^4 + \sqrt{x} - e^x$

6 Integrate the following functions: Level 3

a) $f(x) = \frac{x+1}{x^4} - \frac{3(x+1)\log(x)}{x^4} + \frac{\log(x)}{x^3}$
b) $f(x) = \frac{-3x^2+e^x x+e^x}{x-3} - \frac{e^x x-x^3}{(x-3)^2}$
c) $f(x) = (2x-1)\cos(x) - \left(x^2 - x + 3\right)\sin(x)$
d) $f(x) = \frac{3}{2}\left(e^x\right)^{3/2} - e^x \sin\left(e^x\right)$
e) $f(x) = \frac{\frac{2}{x^3}+\sec^2(x)+1}{x^3} - \frac{3\left(-\frac{1}{x^2}+x+\tan\ (x)\right)}{x^4}$

7 Differentiate the following functions: Level 4

a) $f(x) = e^{x+e^x}\sec(x) - \tan(x)$
b) $f(x) = \sqrt{x+2}(x+4) + \sqrt{x}$
c) $f(x) = \tan(x)\left(-\sqrt{x} + 2\tan(x) - 3\right)$
d) $f(x) = (x+4)x + 2x - e^x + \tan(x)$
e) $f(x) = -\sqrt{x} + \sin^3(x) + \sin(x)\csc(\sin(x))$

8 Integrate the following functions: Level 4

a) $f(x) = \sec^2(4-x) + 1$
b) $f(x) = \sin^3(x)\left(2\cos(x) + e^{\sin(x)}\cos(x)\right) + 3\left(2\sin\ (x) + e^{\sin(x)} - 4\right)\sin^2(x$
c) $f(x) = -\frac{2}{x^3} + \left(\frac{1}{2\sqrt{x}} - 3\right)\sin(x) + \left(\sqrt{x} - 3\ x\right)\cos(x)$
d) $f(x) = \left(3x + e^{\sin(x)}\right)\cos(x) + \sin(x)\left(e^{\sin(x)}\cos\ (x) + 3\right)$
e) $f(x) = \cos(x) + (1-e^x)\tan(x) + (x-e^x)\sec^2(x) - 1$