

## 6 Math101 exercises

6.1 Differentiate the functions:

$$f_1(x) = \sqrt{x^2 + 1}, \quad f_2(x) = \frac{x}{2x + 1}, \quad f_3(x) = x \sin(x).$$

6.2 Differentiate the functions:

$$f_1(x) = xe^x, \quad f_2(x) = 2x^2 \cos(x), \quad f_3(x) = \ln(x)e^x, \quad f_4(x) = \sin(x) \cos(x).$$

6.3 Differentiate the functions:

$$f_1(x) = \frac{x}{x - 1}, \quad f_2(x) = \frac{x^2 - x + 1}{3x + 2}, \quad f_3(x) = \frac{x^2}{x^3 - 2x^2}.$$

6.4 Differentiate the functions:

$$f_1(x) = (3x - 1)^{\frac{4}{3}}, \quad f_2(x) = \ln(x^2 + 3x), \quad f_3(x) = e^{2-x}, \quad f_4(x) = \sin(x^3).$$

6.5 Determine the derivative of  $f(x) = (x - 1)e^x$ .

6.6 Determine the derivative of  $f(x) = x \ln(x) - x$ .

6.7 Differentiate the functions:

$$f_1(x) = e^{x^3}, \quad f_2(x) = \cos^2(x), \quad f_3(x) = \sin^3(x) \quad f_4(x) = 2 \tan(x^2).$$

6.8 Show that

$$\frac{d}{dx} \tan x = 1 + \tan^2 x.$$

(Hint: Use that  $\tan x = \frac{\sin x}{\cos x}$ )

6.9 Differentiate the function  $f(x) = \frac{xe^x}{\cos(x)}$ .

6.10 Differentiate the function

$$f(x) = \cos^2(\sqrt{x^2 + 1}).$$

6.11 Differentiate the functions:

$$f_1(x) = \frac{\cos^2(x)}{\sin(x)}, \quad f_2(x) = \frac{e^{x^2}}{x}, \quad f_3(x) = \frac{x \cos(x)}{e^x}$$

6.12 Differentiate the functions:

$$f(x) = \frac{x^2 e^x}{-x \ln(x)}, \quad g(x) = xe^x \ln x, \quad h(x) = \tan(x)e^x \cos(x)x^2$$