Worksheet 8

Exercise 1 *Find the limit.*

a) $\lim_{x\to 1^+} e^{\frac{2}{1-x}}$

b) $\lim_{x\to 0^+} \ln(\sin x)$

c) $\lim_{x\to\infty} \dfrac{e^x - e^{-x}}{e^x + e^{-x}}$

d) $\lim_{x\to 2^+} \ln(x^2 - 4)$

e) $\lim_{x\to\infty} \ln(1 + x^2) - \ln x$

f) $\lim_{x\to\infty} e^{-x} \sin x$

Exercise 2 *Differentiate the following functions.*

a) $f(x) = e^{4x+1}$

b) $g(x) = \ln(e^x)$

c) $h(x) = 10^{-\frac{1}{x}}$

d) $a(x) = \log_{10}(x \sin x)$

e) $b(x) = e^{e^x}$

f) $c(x) = \ln\left(\dfrac{2x+1}{x^2+1}\right)$

Exercise 3 *Differentiate the following functions.*

a) $f(x) = \sqrt{x}\, e^{x^2-x}(x+1)^{2/3}$

b) $g(x) = \sqrt{\dfrac{x-1}{x^4-1}}$

Exercise 4 *In a murder investigation, the temperature of the corpse was* 32.5°C *at 1:30 PM and* 30.3°C *one hour later. Normal body temperature is* 37.0°C *and the temperature of the surroundings was* 20.0°C. *When did the murder take place?*

Hint: we recall the law of cooling (T_s is the temperature of the surroundings)

$$\frac{dT}{dt} = -a(T - T_s)$$

which gives

$$T(t) = T_s + \big(T(0) - T_s\big)e^{-at}$$