Homework 5

by Aram Dermenjian

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An exercise marked with the symbol $\star$ is considered more difficult and will not be an exam question.

Exercise 1 Differentiate the following functions

(1) $f(x) = e^5$

(2) $g(x) = \frac{7}{4}x^2 - 3x + 12$

(3) $f(t) = 1.4t^5 - 2.5t^2 + 6.7$

(4) $H(u) = (3u - 1)(u + 2)$

(5) $B(y) = y^-6$

(6) $y = x^{5/3} - x^{2/3}$

(7) $h(t) = \sqrt[4]{t} - 4e^t$

(8) $y = \sqrt[3]{x}(2 + x)$

(9) $S(R) = 4\pi R^2$

(10) $y = \frac{\sqrt{x}+x}{x^2}$

(11) $G(t) = \sqrt{5}t + \frac{\sqrt{7}}{t}$

(12) $k(r) = e^r + r^e$

(13) $F(z) = \frac{A+Bz+Cz^2}{z^2}$

(14) $D(t) = \frac{1+16t^2}{(4t)^3}$

(15) $y = e^{x+1} + 1$

Exercise 2 Suppose we are looking at a population growth where the growth rate by year is given by $f(t) = 3e^t + 7t$. What is the instantaneous rate of growth at years 1, 2 and 3?

Exercise 3 Differentiate the following functions:

(1) $g(x) = (x + 2\sqrt{x})e^x$

(2) $y = \frac{e^x}{1-e^x}$

(3) $G(x) = \frac{x^2-2}{2x+1}$

(4) $J(v) = (v^3 - 2v)(v^{-4} + v^{-2})$

(5) $f(z) = (1 - e^z)(z + e^z)$

(6) $y = \frac{\sqrt{x}}{2+x}$

(7) $y = \frac{1}{t^3+2t^2-1}$

(8) $h(r) = \frac{ae^3}{b+e^r}$

(9) $y = (z^2 + e^z)\sqrt{z}$

(10) $V(t) = \frac{4+t}{te^2}$

(11) $F(t) = \frac{At}{Bt^2+Ct^3}$

(12) $f(x) = \frac{ax+b}{cx+d}$

Exercise 4 Find the first and second derivatives of the following functions:

(1) $f(x) = \sqrt{x}e^x$

(2) $f(x) = \frac{x}{x^2-1}$

Exercise 5 Suppose that we are using Ohm's law to calculate the instantaneous voltage at a given time measured in minutes. Suppose that the current at any time is given by $i(t) = 3t^2 + t$ and the resistance at any time is given by $r(t) = e^t$. What is the instantaneous voltage at 1, 2 and 3 minutes from the start?