Talis Biomedical Statistics Course - Homework 0

Due: 20 November 2019 11:59 PM

Name: [your first and last name]
Collaborators: [list all the people you worked with]
Date: [date of submission]

By turning in this assignment, I agree by the **Stanford honor code** and declare that all of this is my own work.

Algebra

Problem 1

Simplify/factor the following expressions.

(a) Simplify $5z^2(7z^2 + 3z - 1)$

(b) Simplify $(1 + x)(x^2 - 5x - 6)$

(c) Simplify $(x + 2x^2)^2$

(d) Simplify $\frac{2x^3 - x^2 - 12}{x+3}$

(e) Factor $(x - 5)^2 + 2y^3(x - 5) + y^6$

(f) Factor $16x^3 + 24x^2 + 9x$

(g) Factor $x^2 - 49y^2$

(h) The polynomial $3x^3 - 20x^2 + 37x - 20$ has a known factor of $(x - 4)$. Factor it.

Problem 2

Logarithms and exponents.

(a) $3^a = \sqrt[5]{3^2}$. Solve for a.

(b) $26^{9x+5} = 1$. Solve for x.

(c) $2^{3x+5} = 64^{x-7}$. Solve for x.

(d) Rewrite $\log_3 27x$ as a sum of a constant and (a function of) a variable.

(e) Rewrite $\log_5 \frac{25^x}{y}$ as a sum of functions of two variables.

(f) Solve $\log_c 16 \cdot \log_2 c$ where c is an unknown constant.

(g) Solve the equation for t and express the answer in terms of base 10 logarithm.

$$10^{2t-3} = 7 \tag{1}$$

Multivariable calculus

Problem 3

Calculate the following gradients.

(a) Let $f(x, y) = x^2 - xy$. What is $\nabla f(x, y)$?

(b) What is the gradient of $f(x, y) = -x^4 + 4(x^2 - y^2) - 3$?

(c) What is the gradient of $f(x, y, z) = x - xy + z^2$?

(d) Find $\frac{\partial}{\partial} = (\cos(t))^2 \sin(t)$.

(e) Find the Jacobian of $\begin{bmatrix} f_1(x, y) \\ f_2(x, y) \end{bmatrix} = \begin{bmatrix} x + \sin(y) \\ y + \sin(x) \end{bmatrix}$

(f) Let $f(a, b, c) = \cos(ab)\sin(b) + c$. Evaluate $\frac{\partial f}{\partial a}(\frac{1}{2}, \frac{\pi}{3}, 7)$

Problem 4

Calculate the following integrals.

(a) $\int x \log(x) dx$

(b) $\int x^2 \sin(x) dx$

(c) $\int_{0.5}^{2.5} \int_{0.5}^{3.5} \sin(xy) + \frac{6}{5} dx dy$

(d) $\int_0^1 \int_0^{x^2} x + 2y^2 dy dx$