DigiPen Institute of Technology Singapore

IBF– Day 6 Exericise
Vector Calculus

Instructor: Yilin Wu

Jan 26 2020

Name: _____

This exercise contains 7 pages (including this cover page) and 10 questions. Total of points is 100. Good luck and Happy reading work!

Distribution of Marks

Question:	1	2	3	4	5	6
Points:	10	10	10	10	10	10
Score:						

Question:	7	8	9	10		Total
Points:	10	10	10	10		100
Score:						

1. (10 points) Find the Taylor polynomials of degree **Two** for

$$f(x) = 1 + x + x^2 \qquad \text{at} \qquad a = 1$$

2. (10 points) Find the Taylor polynomial of degree **Four** for

$$f(x) = \cos(2x) \qquad \text{at} \qquad a = \pi$$

3. (10 points) Determine the 1st and 2nd degree Taylor polynomial approximations for the following function of x and y near the given point

$$f(x, y) = x\sqrt{y} \qquad \text{near} \qquad (1, 4)$$

4. (10 points) Find all the 1st order partial derivatives

$$f(x, y, z) = 4x^3y^2 - e^z y^4 + \frac{z^3}{x^2} + 4y - x^{16}$$

5. (10 points) Find the Jacobian Matrix and the Hessian Matrix of

$$f(u, v) = u^2 \sin(u + v^3) - \sec(4u) \arctan(2v)$$

6. (10 points) Find the linearization of $f(x) = \sqrt{x + 10}$ and at $a = 1$, use it to approxiamate the value $\sqrt{10.04}$ and $\sqrt{9.97}$

7. (10 points) Find the linearization of $f(x, y) = x^2 y$ at the point $(3, 8)$.

8. (10 points) Find the derivative of

$$\begin{bmatrix} x_1 x_2 & x_3 & x_2 + x_3 \\ x_1 & x_2 & x_3 \\ x_1 + x_3 & x_1 & x_1^2 x_2 \end{bmatrix}$$

Respect to $\mathbf{x}$

9. (10 points) Find the partial derivative

$$R(x, y) = \frac{x^2}{y^2 + 1} - \frac{y^2}{x^2 + y}$$

10. (10 points) A company is selling cell phones and the monthly demand x is the following function of the price \$p:

$$x = f(p) := 300000 - 400p + 0.2p^2$$

The current price is \$300. How much will demand drop if the price is increased by 10 cents?

This page is intentionally left blank to accommodate work that wouldn't fit elsewhere and/or scratch work.