University of California, San Diego
Department of Mathematics

Instructions

1. **Write your *Name*, *PID*, *Section*, and *Exam Version* on the front of your Blue Book.**
2. **No calculators or other electronic devices are allowed during this exam.**
3. **You may use one page of notes, but no books or other assistance during this exam.**
4. **Write your solutions clearly in your Blue Book.**
   (a) **Carefully indicate the number and letter of each question and question part.**
   (b) **Present your answers in the same order they appear in the exam.**
   (c) **Start each problem on a new page.**
5. **Show all of your work. No credit will be given for unsupported answers (even if correct).**
6. **Turn in your exam paper with your Blue Book.**

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0. (1 point) Carefully read and complete the instructions at the top of this exam sheet and any additional instructions written on the chalkboard during the exam.

1. (6 points) Let F be the function defined by $F(x, y) = e^{(x-1)^2+y}$.
   (a) Compute algebraically the partial derivatives F_x and F_y.
   (b) What is the equation of the plane tangent to F at the point $(1, 0)$?

2. (6 points) A plane is traveling due north with an airspeed of 725 km/hr while descending at a rate of 75 km/hr. There is a 60 km/hr wind blowing from 30 degrees south of due west. What is the ground speed of the airplane?

3. (6 points) Let $f(x, y) = 2x^2 + 3xy + 5y^2$. At the point $(-2, 1)$:
   (a) Find a unit vector $\vec{u}$ so that the directional derivative $f_{\vec{u}}(-2, 1)$ is maximum.
   (b) Find a unit vector $\vec{u}$ so that the directional derivative $f_{\vec{u}}(-2, 1)$ is minimum.
   (c) Find a unit vector $\vec{u}$ so that the directional derivative $f_{\vec{u}}(-2, 1)$ is zero.

4. (6 points) Let $f(x, y) = x^3 + y^2 - 3x^2 - 2y + 10$. Find and critical points and classify each as a local maximum, local minimum, or saddle point.

(This exam is worth 25 points.)