General Stuff

- Office Hours

  Happening: Wednesday 5/5 from 12 noon - 2pm

  Maybe Happening: Tuesday 5/4 from 12 noon - 2pm

  TAs may be coordinating offic hours, so more info to come
- Final Exam May 6th from 12:00pm - 3:00pm
- Announcement: Lab 12 is the last lab, and we will only count your best 9 labs.
- Today for lab period, we will be doing review!
- Please fill out my SRT (evals) when you get a chance. You can access it through through canvas or have received an email invitation.
- If you have DRC accomodations please let me know ASAP!
- Shout out to you all for making it through the semester!

1. Consider the function $f(x, y) = \sin(xy) + e^{x+y}$. a) Find the Hessian matrix for f. b) Compute the second order Taylor polynomial for f expanded at the origin.

2. Let $g(x, y) = 1 + x + 2y - x^2 - 2xy + y^2$. Re-center $g(x, y)$ from the origin to the point $(a, b) = (1, 2)$.

3. a) Find the critical points of the function $g(x, y) = 1 + x + 2y - x^2 - 2xy + y^2$. b) Use the Hessian matrix to determine whether the critical points are minima or maxima.

4. Find the local minima and maxima of the function $h(x, y) = \frac{1}{3}x^3 + xy^2 - x + y$.

5. Let P be the parallelogram formed by the vectors $(1,1,-1),(1,-1,1)$, and $(-1,1,1)$. Suppose ∂P has inward normal. Evaluate the surface integral

$$\iint_{\partial P} (x+y^3, y-x^3, z+2)\cdot dS.$$

6. Find the total derivative of the function $F(x, y, z) = (xz + e^y, x + y^2 - \cos(z))$ at the point $(x_0, y_0, z_0) = (1, 0, 0)$

7. Let $F(x, y, z) = (xz + e^y, x + y^2 - \cos(z))$ as before and $G(u, v) = (2u - v, uv, e^u)$. Calculate $D(G \circ F)(1, 0, 0)$ using the chain rule.

8. Let W be the region bounded by $z^2 = 3x^2 + 3y^2$ and the sphere $x^2 + y^2 + z^2 = 4$. Evaluate the triple integral $\iiint_W x - 1\, dV$

9. Let a particle p be moving along the trajectory $r(t) = (t, t-1, t^2-2)$ from $t = 0$ to $t = 2$. a) How far does the particle travel in those 2 seconds? b) Find the acceleration of the particle as a function of time. c) Find the total amount of work done by the $F = (x, y^2, -z)$ on p.

10. Find an equation for the plane which contains the point $(1,2,3)$ and the line $\ell(t) = (0,0,1) + (1,1,0)t$.

11. Show that the vector field

$$F = (\sin(y) + 2, x\cos(y) + 1)$$

is conservative. b) Find a potential function $\phi(x, y)$ such that $\nabla\phi = F$. c) Evaluate the integral $\int_c F \cdot ds$ where $c(t) = (-1 + t^2, 4t^2 - 1)$ from $t = -1/2$ to $t = 1/2$.

12. Let R be the region bounded between $x \leq 0$, $y = \cos(x)$, and $y = \sin(x)$. a) Determine whether the region is x-simple or y-simple. b) Find the area of R. Write out the integrals for both $dx\,dy$ and $dy\,dx$ but only solve one of them.