MATH 311 FINAL SHOW ALL WORK; BE NEAT AND ORDERLY; USE ONE SIDE OF EACH PAGE ONLY

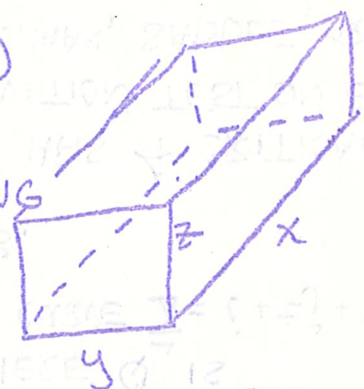
1 FIND AN EQUATION OF THE PLANE WHICH PASSES THROUGH THE POINT $(2,1,3)$ WITH NORMAL $\vec{i} + 3\vec{j} - 2k$.

2. FIND THE DISTANCE BETWEEN THE PLANES $\longrightarrow$ $\begin{cases} 2x+y-2z=14 \\ 2x+y-2z=-13 \end{cases}$

3. WHERE IS $F(x,y) = \ln(y+2)\sqrt{x+1}\,(x^2+y^2)^{-1} + e^{x^2 y} + 7$ CONTINUOUS?

4. GRAPH IN 3-SPACE: $z = -y(y-2)$

5. FIND HOW FAST THE SURFACE AREA OF THE RECTANGULAR BOX IS INCREASING WHEN $x=5$ $y=4$ & $z=3$ if $\frac{dx}{dt} = 2$ $\frac{dy}{dt} = -1$ & $\frac{dz}{dt} = \frac{1}{3}$.



6. USE THE TOTAL DIFFERENTIAL TO APPROXIMATE $\sqrt{(3.03)^2 + (4.02)^2}$

7. USE THE CHAIN RULE TO FIND $\frac{\partial z}{\partial s}$ AND $\frac{\partial z}{\partial t}$ IF $z = wx^2y^3 + e^w \ln x \sin y$ $x = s^3 - st^2$ $y = s^2t + st^2$ & $w = e^{st}$

8. FIND THE RECTANGULAR CO-ORDINATES (x,y,z) AND THE SPHERICAL CO-ORDINATES (ρ, θ, φ) OF THE POINT WHOSE CYLINDRICAL CO-ORDINATES ARE $(r,\theta,z) = (2, -\frac{\pi}{4}, 2\sqrt{3})$.

9. FOR $x^2 + xyz + z^3y^2 = 7$, IMPLICITLY FIND $\frac{\partial z}{\partial x}$ AND $\frac{\partial z}{\partial y}$. ALSO FIND THE EQUATION OF THE TANGENT PLANE AT $(1,1,2)$.

10. FIND A VECTOR EQUATION OF THE LINE WHICH IS THE INTERSECTION OF THE TWO PLANES $\begin{cases} x+y+z=2 \\ 3x+2y-z=6 \end{cases}$

11. FOR $F(x,y,z) = x^3y^2\cos z$, FIND $\vec{\nabla} F$, F_v IN DIRECTION $v = \frac{1}{9}(7\vec{i} - 4\vec{j} + 4\vec{k})$ AND THE DIRECTION IN WHICH F INCREASES THE FASTEST AT THE POINT $(1,2,0)$.

12. FIND TAYLOR'S POLYNOMIAL FOR $f(x,y) = (1+x+2y)^{-1}$ $n=3$ $(a,b)=(0,0)$. IGNORE THE REMAINDER TERM.