MAT 261 Exam I Sample **Name** _____

1. (36 pts) Let $\mathbf{u} = \mathbf{i} - \mathbf{j} + \mathbf{k}$ and $\mathbf{v} = -\mathbf{i} - \mathbf{j} + 2\mathbf{k}$. Determine the following:

a. $\mathbf{u} \cdot \mathbf{v}$.

b. $\mathbf{v} \times \mathbf{u}$.

c. The angle between $\mathbf{u}$ and $\mathbf{v}$.

d. Normalize $\mathbf{u}$.

e. Find the parametric equations, $\{x(t), y(t), z(t)\}$, for the line passing through (1,2,1) in the direction of $\mathbf{v}$.

f. A wagon is pulled a distance of 100 m along a horizontal path by a constant force of 50 N. The handle of the wagon is at an angle of 60°. Find the work done on the box.

Problem	Score
1 (36 pts)	
2 (20 pts)	
3 (26 pts)	
4 (18 pts)	
Total (100 pts)	

2. (20 pts) Consider the plane passing through the three points (1,0,0), (0,1,0), (0,0,1).

a. Give a normal vector to the plane.

b. What is the equation of the plane?

c. What is the area of the triangle having these points as its vertices?

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3. (26 pts) Do the following:

a. Find the volume of the parallelepiped that is formed by
$\mathbf{a} =< 1, 0, 0 >,\ \mathbf{b} =< 0, 1, 0 >,\ \mathbf{c} =< 1, 2, 3 >.$

b. Find the equation of the sphere for which the line segment from (1,0,1) to (1,1,1) is a diameter.

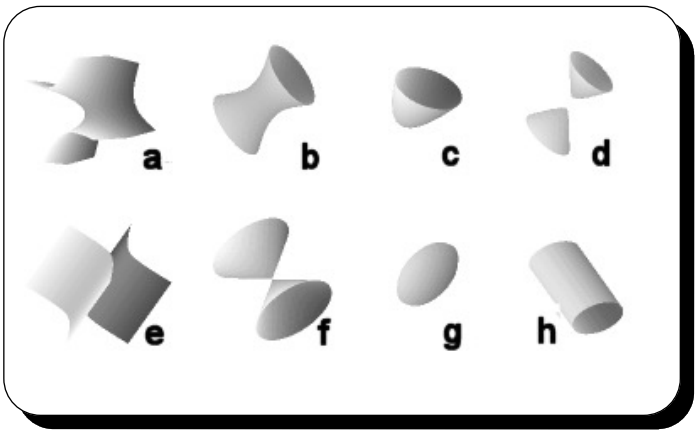
c. Consider the surface described by the equation $z^2 - y^2 - \frac{x}{2} - 6 = 0$. Sketch and label the intersections of this surface with planes parallel to the *yz*-plane.

d. For the sphere $x^2 + y^2 + z^2 + 4x - y - 1 = 0$ determine the radius and center.

4. (18 pts) **Match** the surface by placing the letter in the table corresponding to the figures and equations below. If there is no match to the name, write "none" in the space.

Name	Figure	Equation
Hyperbolic Cylinder		
Ellipsoid		
Hyperbolic Paraboloid		
Hyperboloid of One Sheet		
Elliptic Cylinder		
Cone		
Elliptic Paraboloid		
Parabolic Cylinder		
Hyperboloid of Two Sheets		

The Surface Plots:



The Equations:

a. $z^2 + y^2 - x^2 = 0$

b. $x^2 - y^2 + z = 0$

c. $\frac{1}{2}y^2 - x^2 - 2z^2 = 0.1$

d. $z^2 + 2y^2 = 5$

e. $x^2 + 2z = 0$

f. $x^2 + \frac{1}{2}z^2 - y = 0$

g. $x^2 + \frac{1}{4}y^2 + \frac{1}{2}z^2 = 1$

h. $z^2 - x^2 = 1$