MAC 2313 Calculus 3 **Test 1** 29 Jan 2002

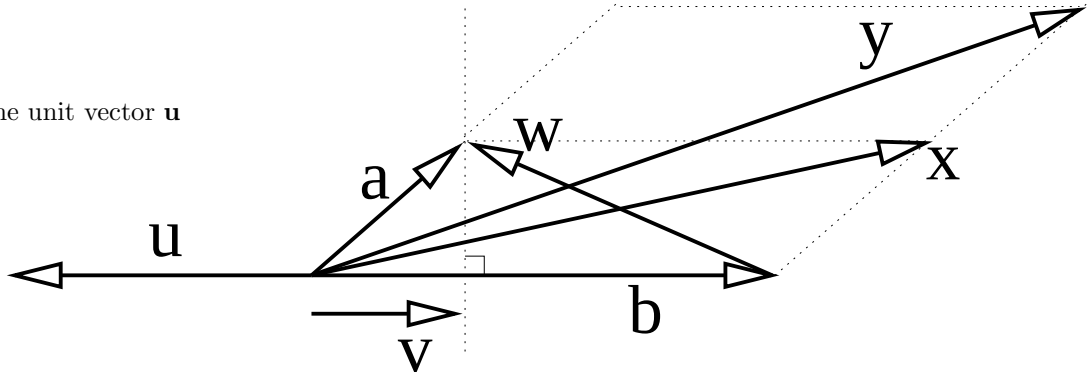
Show **ALL** work for credit; be neat; and use only **ONE** side of each page of paper. Do **NOT** write on this page. Calculators can be used for graphing and calculating only. Give exact answers when possible.

1. Find the equation of the plane perpendicular to the vector $\mathbf{n} = \langle 5, 6, -2 \rangle$ and passing through the point $(-1, 2, -3)$.

2. Find the equation of the plane through the points (1,1,1), (3,3,-3) and (4,6,2).

3. For the given vector, write it as an expression in terms of the vectors **a** and **b** suggested by the picture below.

A. **x**
B. **w**
C. **y**
D. The unit vector **u**
E. **v**



4. Use your TI-89 to show a contour plot of the function $x^3 - 3xy^2$ for the window $x = -2..2, y = -2..2, z = -2..2$ and for the contours $z = 0, 1, -1$. Be sure to label each contour with its value.

5. Find the equation of the linear function $f(x, y, z) = ax + by + cz + d$ that has the given values for the cross-sections with $z = 1$ and $z = 4$

Cross section $z = 1$

	x=3	x=5
$y = 0$	4	8
$y = 1$		

Cross section $z = 4$

	x=3	x=5
$y = 0$		14
$y = 1$		9

6. For each equation, give type of graph (i.e. cone, elliptical paraboloid, etc) and find its point(s) of intersection with the y-axis (or if there is no intersection say none).
(a) $x + 2y + 4z = 8$.
(b) $x^2 + y^2/16 + z^2/9 = 1$
(c) $x^2 - y^2 + z^2 = 1$
(d) $x^2 + y^2 - z^2 = -1$

7. Consider the lines given by the parametric equations below. (The first uses t as the parameter, the second uses s as the parameter.)

$$\ell_1 : x = 3 + 2t \quad y = -1 - t \quad z = 2 + 3t \quad \text{and} \quad \ell_2 : x = 3s \quad y = 1 + 2s \quad z = -2 + s$$

(a) Find the point P_1 on line ℓ_1 and the xz-plane and find the point P_2 on line ℓ_2 and the xy-plane.
(b) Find a vector **n** perpendicular to both lines.
(c) Find the scalar projection of the vector $\mathbf{u} = \overrightarrow{P_1P_2}$ in the direction of **n**.
(d) Find the distance from ℓ_1 to ℓ_2.

8. Find the 9 errors in the following Maple command. Assume that a restart command has just been given or equivalently that this is the very first line typed into Maple. (No "with(plots);" is not one of them.)

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▷ a=0;b:5;PLOT3D(x sin(x) + 3x^2,x=a..b,y:=3..pi);title=How many errors?";
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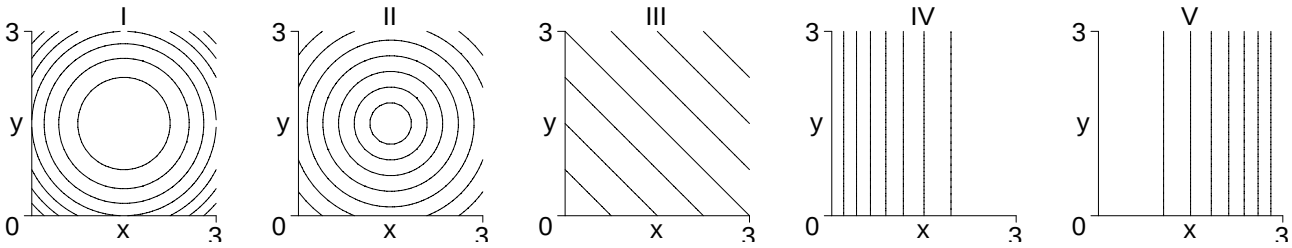
9. The tables below give the values for $x = 0, 1, 2, 3$ going left to right horizontally and for $y = 0, 1, 2, 3$ going from top to bottom vertically. Match each of the tables A–E to the matching contour plot among I–V.

$$A = \begin{vmatrix} 0 & 1 & 3 & 6 \\ 0 & 1 & 3 & 6 \\ 0 & 1 & 3 & 6 \\ 0 & 1 & 3 & 6 \end{vmatrix} \quad B = \begin{vmatrix} 0 & 1 & 2 & 3 \\ 1 & 2 & 3 & 4 \\ 2 & 3 & 4 & 5 \\ 3 & 4 & 5 & 6 \end{vmatrix} \quad C = \begin{vmatrix} 0 & 3 & 5 & 6 \\ 0 & 3 & 5 & 6 \\ 0 & 3 & 5 & 6 \\ 0 & 3 & 5 & 6 \end{vmatrix} \quad D = \begin{vmatrix} 6 & 4 & 4 & 6 \\ 4 & 1 & 1 & 4 \\ 4 & 1 & 1 & 4 \\ 6 & 4 & 4 & 6 \end{vmatrix} \quad E = \begin{vmatrix} 6 & 5 & 5 & 6 \\ 5 & 2 & 2 & 5 \\ 5 & 2 & 2 & 5 \\ 6 & 5 & 5 & 6 \end{vmatrix}$$



10. The line ℓ and the sphere $\mathcal{S}$.

A. The equation of the sphere $\mathcal{S}$ is $x^2 + y^2 + z^2 - 4x - 2z - 9 = 0$, find its center and radius.

B. Give the vector equation of the line ℓ which goes through the origin and moves in the direction of $(\mathbf{i} - \mathbf{j}) \times (\mathbf{j} - \mathbf{k})$.

C. Find the point(s) of intersection of ℓ and $\mathcal{S}$ (or if there is no intersection say none).