MAC 2313 Calculus 3 **Test 1** 27 Jan 2000

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.

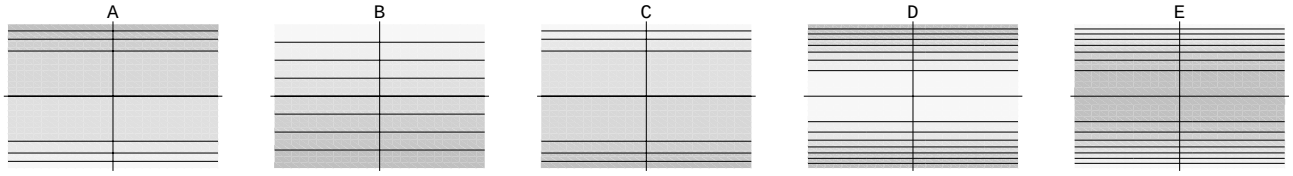
1. For the vector $\mathbf{n} = \langle 4, -4, 2 \rangle$
   a. Find a unit vector pointing the same direction.
   b. Find the equation of the plane normal to $\mathbf{n}$ and passing through the point (1,2,-3).

2. Find the center and radius of the sphere with equation $x^2 + 4x + y^2 - 6y + z^2 + 12z = 0$.

3. Consider the plane $5x - y + 7z = 21$.
   a. Find a point on the x-axis on this plane.
   b. Find two other points on this plane.
   c. Find a vector perpendicular to this plane.
   d. Find a vector parallel to this plane.

4. Find the equation of the plane through the points (1,1,1), (1,4,5) and (-3,-2,0).

5. The following are filled contour plots of $f(x,y) = y, f(x,y) = y^2, f(x,y) = -y^2, f(x,y) = y^3$ and $f(x,y) = -y^3$. Lighter regions have higher z values. Match the plot to the function.



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

$z = 1$	$x = 3$	$x = 5$
$y = 0$	2	
$y = 1$		0

$z = 4$	$x = 3$	$x = 5$
$y = 0$		
$y = 1$	15	9

7. An airport is at the point (200,10,0) and an approaching plane is at the point (550,60,4). Assume the xy-plane is hortizontal, with the x-axis pointing eastward and the y-axis pointing northward. Also assume the z-axis is pointing upward and that all distances are measured in kilometers. The plane flies due west at a constant speed of 500 km/hr for half an hour. It then decends at 200 km/hr, heading straight for the airport.
   a. Find the velocity vector of the plane while it is flying at a constant altitude.
   b. Find the coordinates of the point at which the plane starts to descend.
   c. Find a vector representing the velocity of the plane when it is descending.

8. Find the 7 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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▷ L:8;plot3D((x-pi)(y-3x),x=-L..L,y=L..-L,z=-L..L,color=red);
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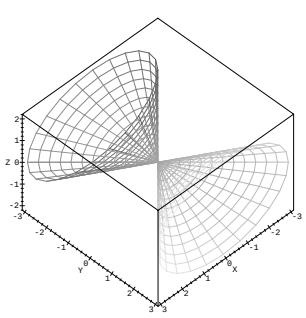
9. A 100-meter dash is run on a track in the direction of the vector $\mathbf{v} = 2\mathbf{i} + 6\mathbf{j}$. The wind velocity $\mathbf{w} = 5\mathbf{i} + \mathbf{j}$ km/hr. The rules say that a legal wind speed measured in the direction of the track must not exceed 5 km/hr. Will the race results be disqualified due to an illegal wind? Justify your answer.

There is more test on the otherside

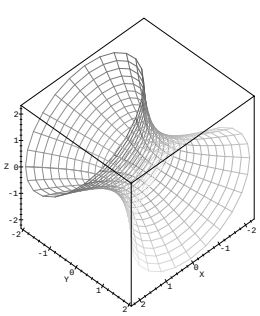
10. Match the equation with its graph below (labeled I-VIII). Give reasons for your choices.

A. $x^2 + 4y^2 + 9z^2 = 1$
B. $9x^2 + 4y^2 + z^2 = 1$
C. $x^2 - y^2 + z^2 = 1$
D. $-x^2 + y^2 - z^2 = 1$
E. $y^2 = 2x^2 + z^2$
F. $y = x^2 + 2z^2$
G. $x^2 + 2z^2 = 1$
H. $y = x^2 - z^2$

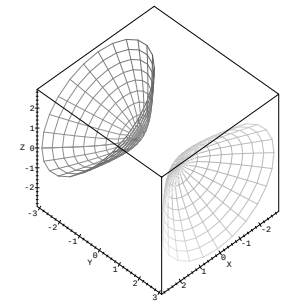
Plot I



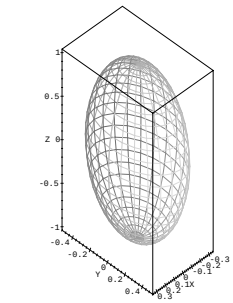
Plot II



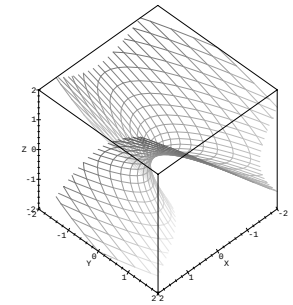
Plot III



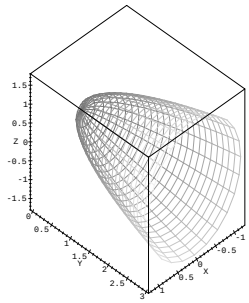
Plot IV



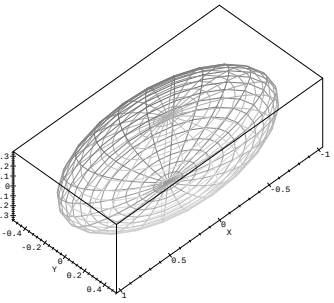
Plot V



Plot VI



Plot VII



Plot VIII