

Name: _____

Vector Calculus

Exam 1

September 27th

There are 11 questions and 144 points total. The point value of each question is indicated. *Read each question carefully!*

1. (24 points.) Let $\vec{u} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{v} = \hat{k} - 6\hat{i}$ Perform the indicated operations.

a. $\vec{u} + \vec{v} =$

b. $\vec{u} - \vec{v} =$

c. $\vec{u} \cdot (3\vec{v}) =$

2. (18 points.) What is the area of the parallelogram formed by the vectors $\vec{u} = 2\hat{i} - 2\hat{j} + \hat{k}$ and $\vec{v} = \hat{k} - 6\hat{i}$?

3. (16 points.) Write the equation for a plane which is perpendicular to $\vec{u} = 2\hat{i} - 2\hat{j} + \hat{k}$ and which passes through the point (-6,0,1).

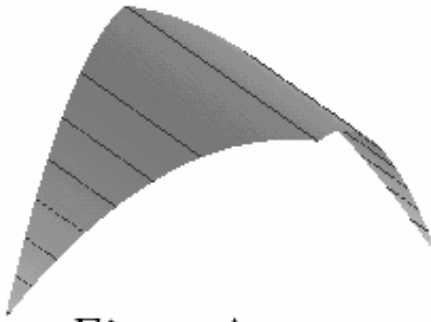


Figure A

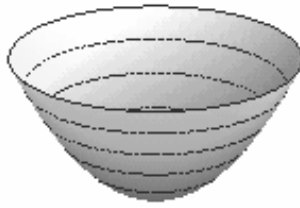


Figure B

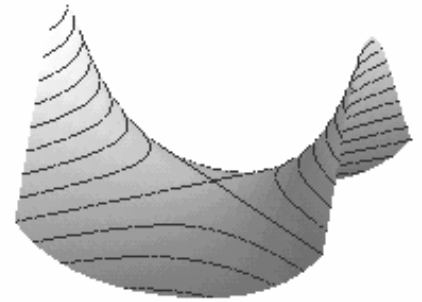


Figure C

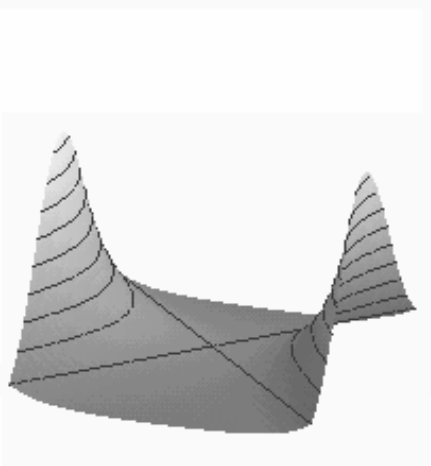


Figure D

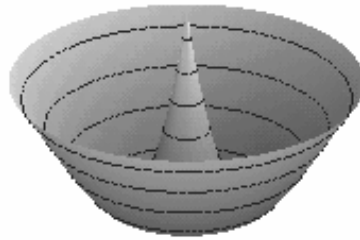


Figure E

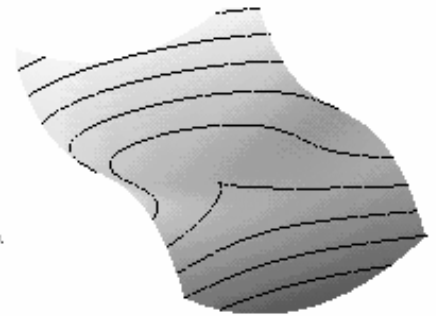


Figure F

Match each of the six functions below to its graph above. The axes are not in the same position for each of the figures.

4. (9 points) Which figure is the graph of $x^2 + y^2$?

5. (9 points) Which figure is the graph of $x^2 - y^2$?

6. (9 points) Which figure is the graph of $\frac{(x+y)^2}{10}$?

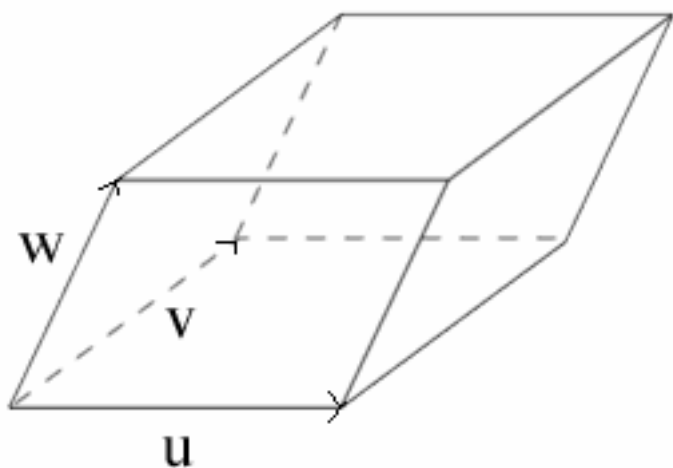
7. (9 points) Which figure is the graph of $e^{x^2-y^2}$?

8. (9 points) Which figure is the graph of $x^3 + y^2$?

9. (9 points) Which figure is the graph of $-e^{-x^2-y^2} \sin(x^2 + y^2)$?

10. (10 points) Give an example of a function of three variables which has a level surface that is just a single point.

11. (22 points) Let $\vec{u} = 2\hat{i}$, $\vec{v} = \hat{i} - 2\hat{j}$, and $\vec{w} = \hat{i} + \hat{j} + \hat{k}$. Compute the volume of the parallelepiped spanned by $\vec{u}, \vec{v}, \vec{w}$ using the triple product.



Extra credit *Do not work on extra credit until you have finished the rest of the exam!*

A) (6 points) There are many functions whose contour diagram looks like the figure below . Give an example of **one** such function.

