Directions:
(1) Turn off or completely silence your cell phone
(2) Remove everything from your desk except for this exam sheet, a blue book or two, a writing and erasing utensil or two, and a two sided sheet of handwritten notes.
(3) Write your name and section number on your blue book
(4) On the front of your blue book, copy the chart on the board
(5) Write any work that you want to be considered for credit in your blue book, not on this exam sheet. Answers without work will not receive credit.
(6) When you are done with the exam, remain seated with the exam in front of you until given further instructions. You should keep your notes and this exam sheet and turn in only your blue book when instructed to do so.

If you fail to follow the directions in a way that inconveniences the TAs or instructor, a point will be deducted from your total score.
1. (8 points) For each letter, write the number of the corresponding function which the picture is a graph of. Note that there are more functions than graphs, so not every function will be used. Correct answers will receive full credit without an explanation, but providing a very solid explanation may be worth some partial credit even if your final answer is incorrect.

   i) \( f(x, y) = x + y \)
   ii) \( f(x, y) = |x| + |y| \)
   iii) \( \frac{|x||y|}{x^2 + y^2} - 1 \)
   iv) \( \frac{1}{1 + 9x^2 + 9y^2} \)
   v) \( \cos(y^2)e^{-1(x^2+y^2)} \)
   vi) \( \sin(xy) \)
   vii) \( \cos(x - y) \)
   viii) \( x^2 + y^2 \)
   ix) \( x^2 + y^2 - 1 \)

2. (7 points) Find the equation of the plane containing the points (1, 0, -3), (2, 2, 1), and (4, -1, -1).

3. (8 points) Let \( \overrightarrow{a} = (2, -1, -3) \). State whether each vector is i) parallel to \( \overrightarrow{a} \), ii) perpendicular to \( \overrightarrow{a} \), or iii) neither parallel nor perpendicular to \( \overrightarrow{a} \).
   a) \( (0, 1, 1) \)
   b) \( (-3, 0, 2) \)
   c) \( (4, -1, -1) \)
   d) \( (-10, 5, 15) \)

4. (6 points) Consider the function, whose graph is a plane, defined by \( f(x, y) = -3x + 2y + 12 \).
   a) Is the point (2, -1, 6) on the plane?
   b) Is the point (4, 2, 2) on the plane?
   c) Find \( y \) and \( z \) so that the point \( (-3, y, z) \) is on the plane.

5. (5 points) Use the algebraic and geometric definitions of dot product to find the angle between \( \overrightarrow{u} \) and \( \overrightarrow{v} \) if \( \overrightarrow{u} = (3, 4, 0) \) and \( \overrightarrow{v} = (4, 1, -4) \). Your answer may be left in terms of \( \cos^{-1} \).