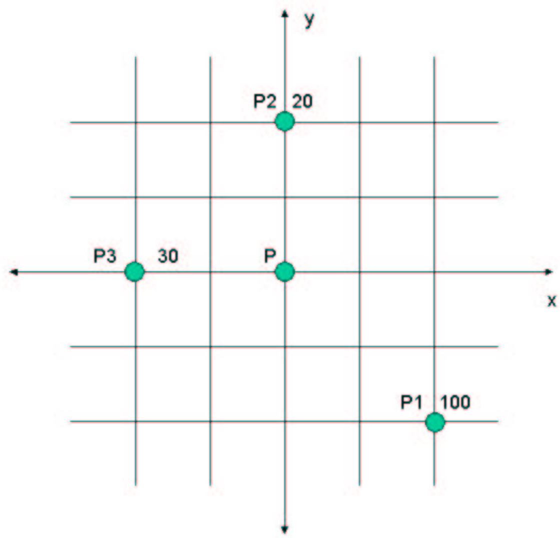
READ ME FIRST

- Don't spend too much time on any one problem. This exam will take approximately 60 minutes.
- Amount of time spent on a problem is not necessarily proportional to the points.
- Scan through the entire test and do the easy problems first.
- If something is not clear, ASK.
- BE NEAT. We cannot give you points for something that we can't read.
- Write down your assumptions.
- Don't just write your answer, show how you got them.
- This is a CLOSED BOOK, CLOSED NOTES exam.

1	25 points	Shepard's	
2	25 points	Contour Lines	
3	25 points	Flow on Surface	
4	25 points	Integration	
	100 points	GRAND TOTAL	

1. **Shepard's Interpolation (25 points)**

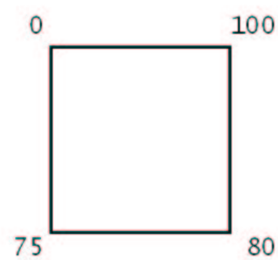
   Given the three points: P1(2,-2), P2(0,2), P3(-2,0) and their corresponding values 100, 20, 30 (see figure below). Find the value at P(0,0) using Shepard's Interpolation when $u = 2$, i.e. inverse distance square.



2. **Contour Lines and Pseudocoloring (25 points)**

   (a) Contour line (**10 points**):

   Find the edge intersections (between 0..1) of a contour line with a value of 50 through the following cell:



   (b) Pseudocolor (**15 points**):

   If the data range for the data set is 0 .. 100, and the standard rainbow colormap is used, what are the red, green and blue components of the contour line?

3. **Flow on Surface (25 points)**

   A polygon on an isosurface has a normal of $N : [1, 1, 1]$. The velocity field where that polygon is located is $V : [1, 2, 3]$. What is the velocity *on* the surface of the polygon? That is, what is the projection of V on the polygon whose normal is N?

4. **Integration (25 points)**

   Assume that a one dimensional velocity field is define by $V(p_i) = 1 + p_i$, and integration step $h = 0.1$.

   (a) Euler integration (**5 points**):

   Where is the streamline at p_1 when $p_0 = 0$?

   (b) RK4 integration (**20 points**):

   Where is the streamline at p_1 when $p_0 = 0$?

   Recall:

$$p_{n+1} = p_n + \tfrac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$$
$$k_1 = hV(p_n)$$
$$k_2 = hV(p_n + \tfrac{k_1}{2})$$
$$k_3 = hV(p_n + \tfrac{k_2}{2})$$
$$k_4 = hV(p_n + k_3)$$