Quiz 2: CS4640   Name _____

1. Show the associativity of correlation for the filters: $[-1, 1] \circ [1, -1] \circ [-1, 1]$. Give details as to how each value in the correlation is produced at each step.

$\left([-1\ 1] \circ [1, -1] \right) \circ [-1\ 1]$ $[-1\ 1] \circ \left([1, -1] \circ [-1\ 1] \right)$

$\begin{array}{ll} & [-1\ 1] \\ [1\ -1] & 1 \\ & [1\ -1]\ -2 \\ & [1\ -1]\ 1 \end{array}$ $\begin{array}{ll} & [1\ -2\ 1] \\ [-1\ 1] & 1 \\ & [-1\ 1]\ -3 \\ & [-1\ 1]\ 3 \\ & [-1\ 1]\ -1 \end{array}$ $\begin{array}{ll} & [-1\ 1] \\ [1\ -2\ 1] & -1 \\ & [1\ -2\ 1]\ 3 \\ & [1\ -2\ 1]\ -3 \\ & 1 \end{array}$ $\begin{array}{ll} & [1\ -1] \\ [-1\ 1] & 1 \\ & [-1\ 1]\ -2 \\ & [-1\ 1]\ 1 \end{array}$

$[1\ -3\ 3\ -1] \quad \text{vrs} \quad [-1\ 3\ -3\ 1]$
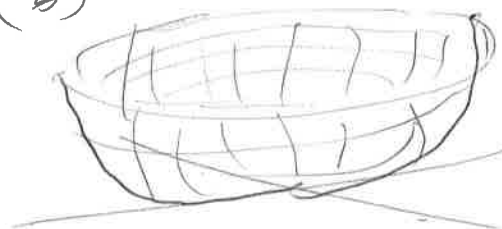
$$\neq \qquad \text{not associative}$$

2. Given a hemisphere function centered at (0,0) and with radius 4, (a) draw the gradient vectors in the plane under it, and (b) draw the magnitude of the gradient for each location under the hemisphere (i.e., draw the surface mag(x,y)).

(a)
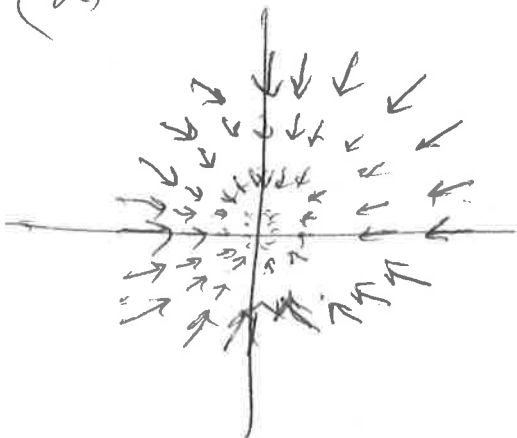
all point to origin
+ larger at boundary

(b)

bowl shape

3. Write the following Matlab function:

```
function cor = CS4640_1D_corr(f,w)
% CS4640_1D_corr - correlation of a 1D signal and a filter
%     handle boundary by starting where w fits (i.e., do not compute
%     for places where the w lies outside f
% On input:
%     f (1xn vector): input signal
%     w (1xk vector): filter
% On output:
%     cor (1xn vector): correlation of f with w
% Call:
%     c = CS4640_1D_corr(rand(1,1000),0.5*ones(1,21));
% Author:
%     Your name
%     UU
%     Spring 2018
%
```

$len\_f = length(f)$

$cor = zeros(1, len\_f);$

$a = (length(w) - 1)/2;$

$for \; p = 1+a : len\_f - a$

$\quad v = f(p-a : p+a);$

$\quad cor(p) = dot(v, w);$

end