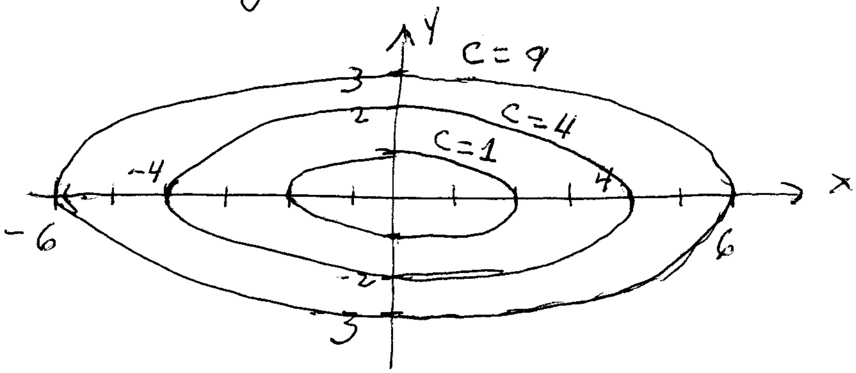
Math. 302-03, Spring, 2013, First exam answers, page 1, 2/19/2013.

(1)



(2) We compute first a normal vector: Direction vectors can be $(0,-1,0)-(-1,0,0)=(1,-1,0)$ and

$$(0,0,-1)-(-1,0,0)=(1,0,-1).$$

A normal vector to the plane is thus:

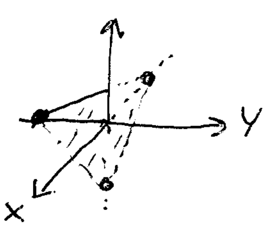
$$\begin{vmatrix} \vec{i} & \vec{j} & \vec{k} \\ 1 & -1 & 0 \\ 1 & 0 & -1 \end{vmatrix} = \vec{i}\begin{vmatrix} -1 & 0 \\ 0 & -1 \end{vmatrix} - \vec{j}\begin{vmatrix} 1 & 0 \\ 1 & -1 \end{vmatrix} + \vec{k}\begin{vmatrix} 1 & -1 \\ 1 & 0 \end{vmatrix}$$

$$= \vec{i}+\vec{j}+\vec{k} = (1,1,1).$$

An equation for the plane is thus:

$(1,1,1)\circ[(x,y,z)-(-1,0,0)]=0$, that is,

$x+1+y+z=0$, or $\boxed{x+y+z=-1}$.

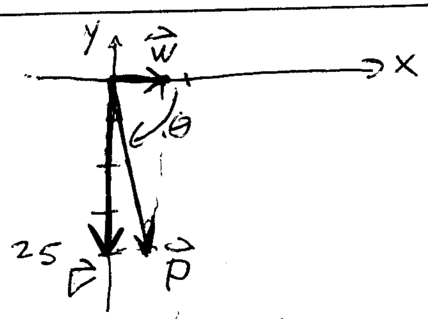


(3) A vector perpendicular to the plane is obtained from the coefficients:

$$\boxed{\vec{n}=(1,-2,3).}$$

(4) For $(x,y) \neq (0,0)$, $f(x,y) = \frac{(x+y)^3}{(x+y)^2} = x+y \to 0$
as $(x,y) \to (0,0)$.
Therefore, $\lim\limits_{(x,y)\to(0,0)} \frac{x^3+3x^2y+3xy^2+y^3}{x^2+2xy+y^2} = \boxed{0}$

(5) (a)



The boat's path is given by $\vec{p} = \vec{v} + \vec{w}$.

(b) $\vec{p} = (0,-25) + (4,0) = (4,-25)$,
so $\|\vec{p}\| = \sqrt{25^2+4^2} \approx \boxed{25.32 \text{ km/hr}}$

(c) $\theta = \text{atan}\left(\frac{-25}{4}\right) = \text{atan}(-6.25) \approx -1.412$ radians
$\approx \boxed{-81°}$