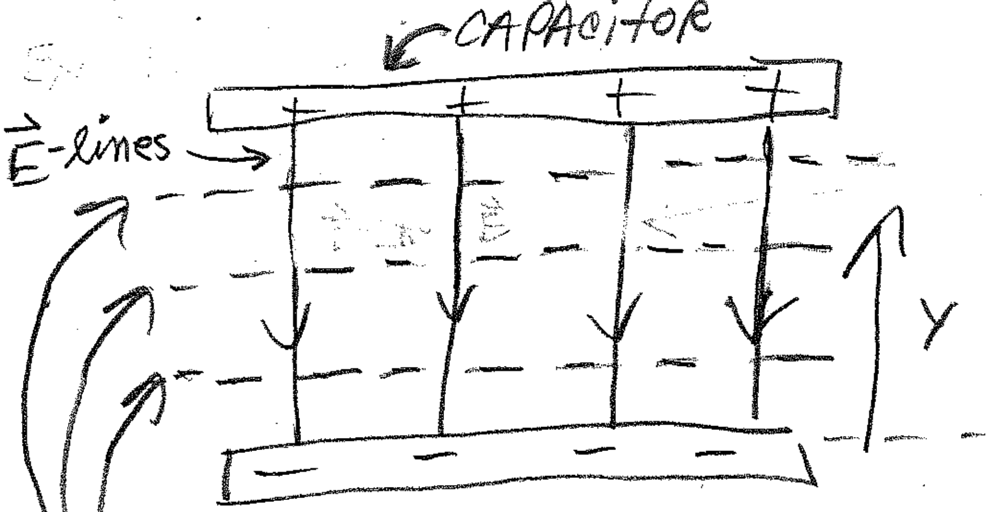
2-28-14

ch23

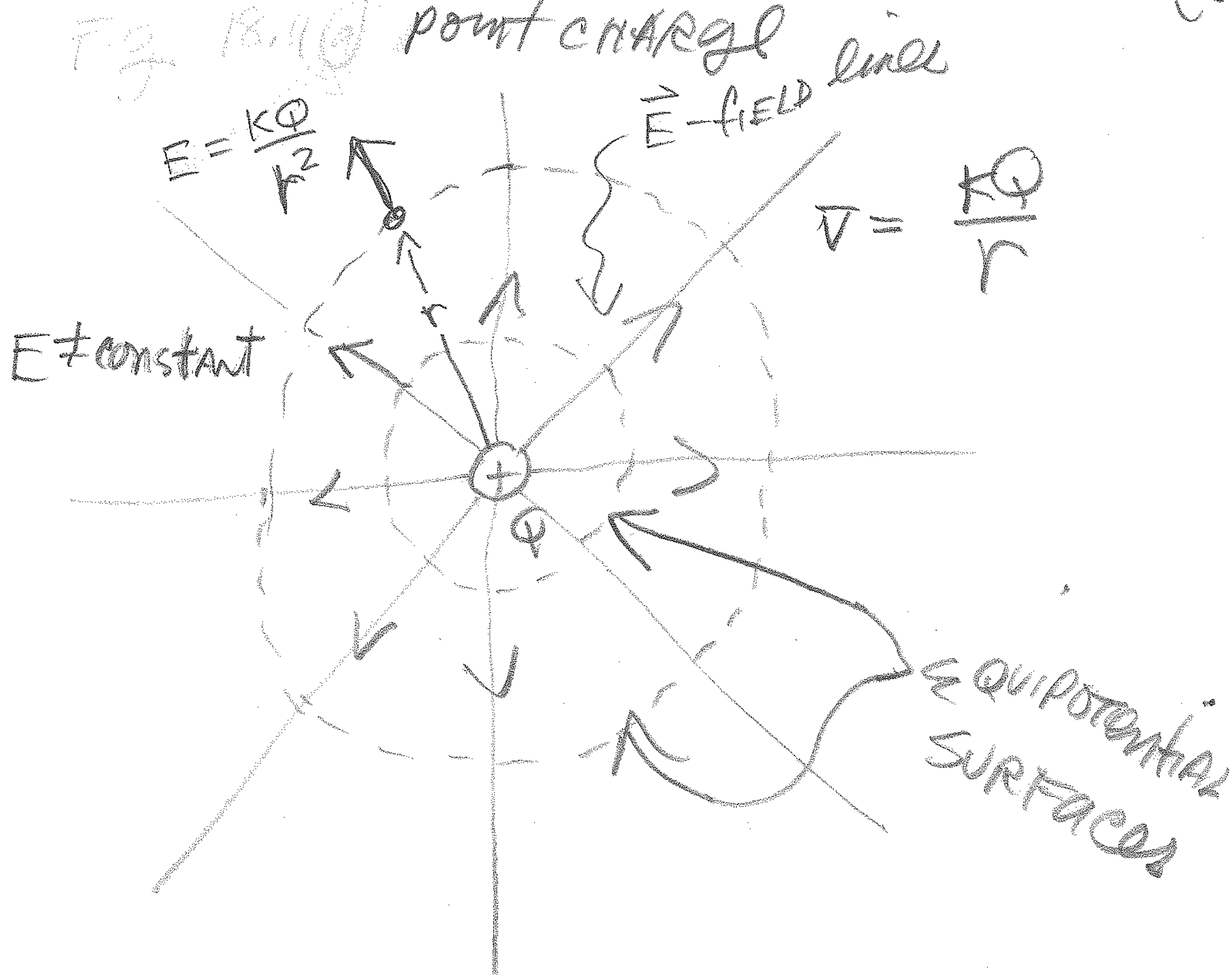
Equipotential surfaces



$V = E \cdot Y$

V = CONSTANT when y = CONSTANT

EQUIPOTENTIAL SURFACES ARE PLANES

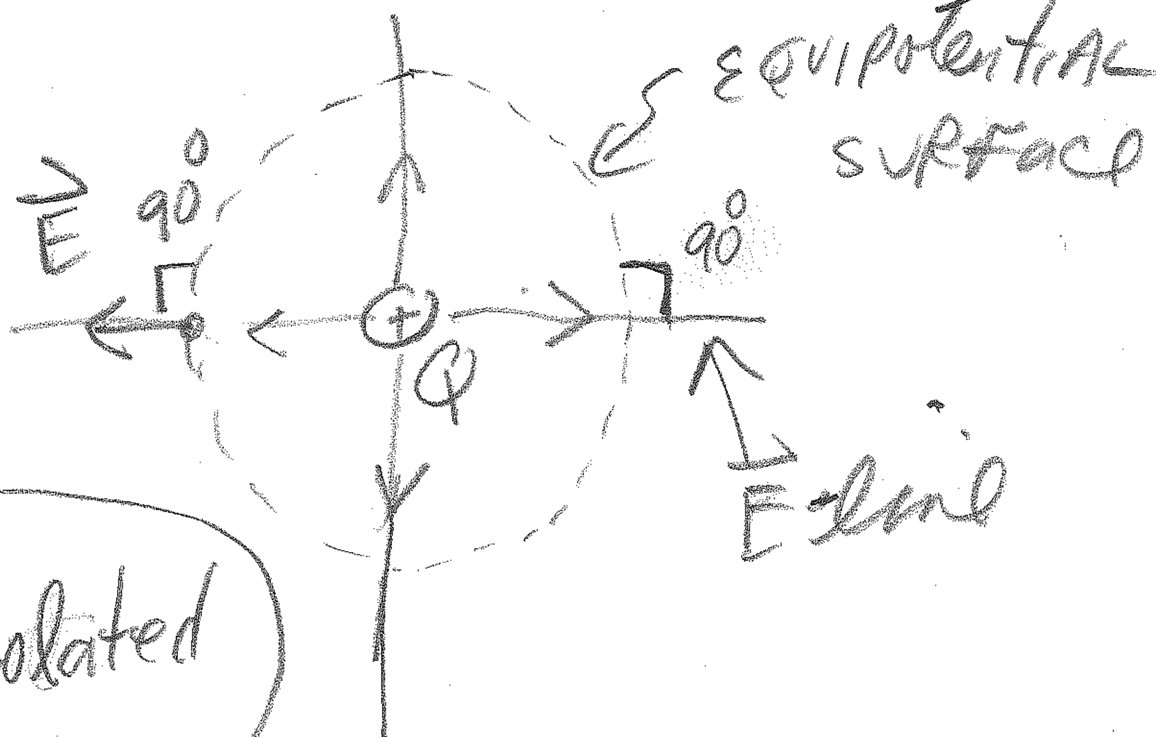


V = constant when r = constant.

Equipotential surfaces are spherical shells.

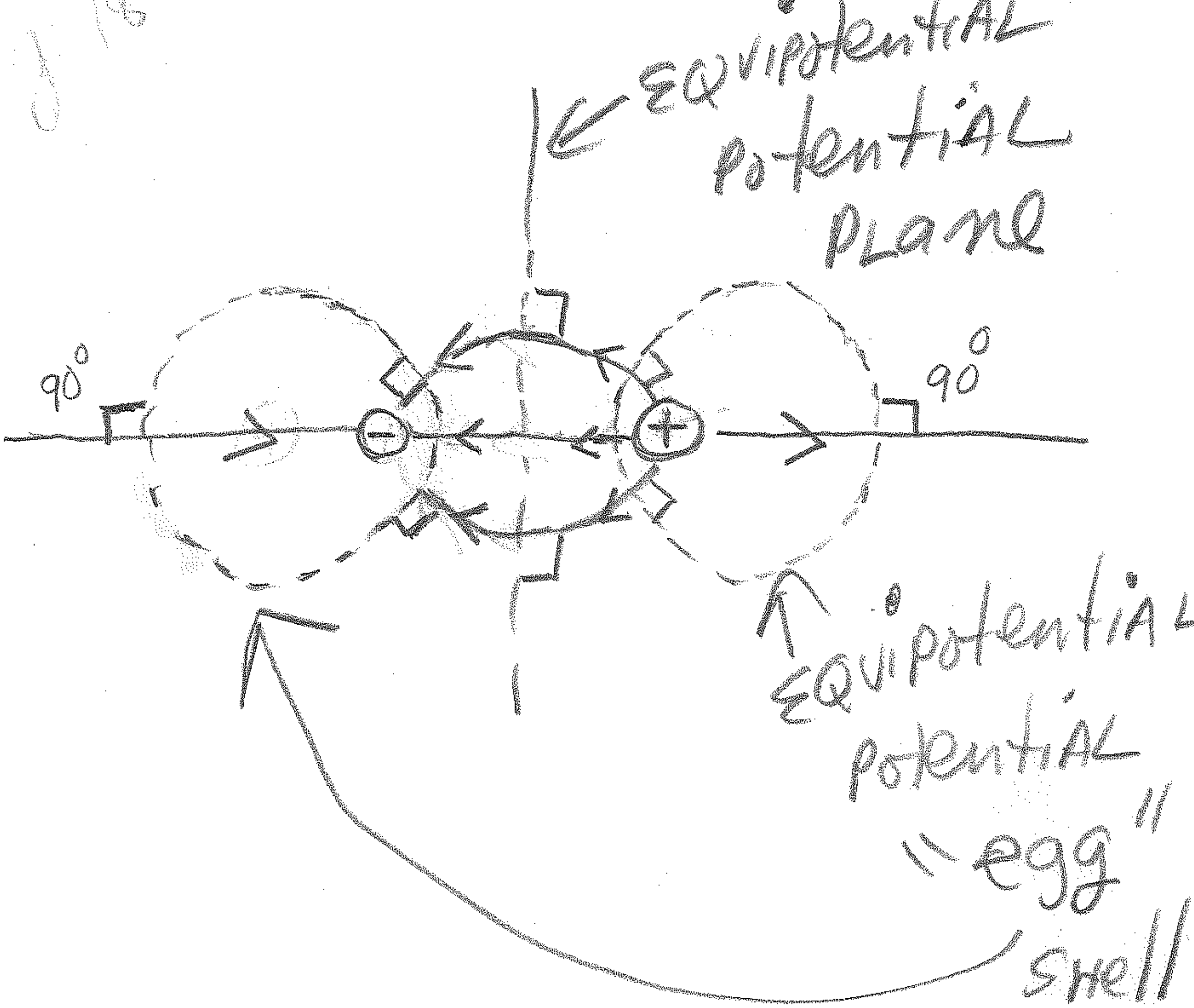
Note!

$\vec{E} \perp$ EQUIPOTENTIAL SURFACE:



isolated
Q

fig 15-1(b)


EQUIPOTENTIAL
POTENTIAL
PLANE
90°
90°
EQUIPOTENTIAL
POTENTIAL
"egg"
shell

$$\vec{E} = -\vec{\nabla}\, V(x,y,z) = \left(-\frac{\partial V}{\partial x}, -\frac{\partial V}{\partial y}, -\frac{\partial V}{\partial z}\right)$$

Example of (in 2 dimensions)

$$\vec{E} = \left(-\frac{\partial V}{\partial x}, -\frac{\partial V}{\partial y}\right)$$

$$E_x = -\frac{\partial V}{\partial x} \text{ and } E_y = -\frac{\partial V}{\partial y}$$

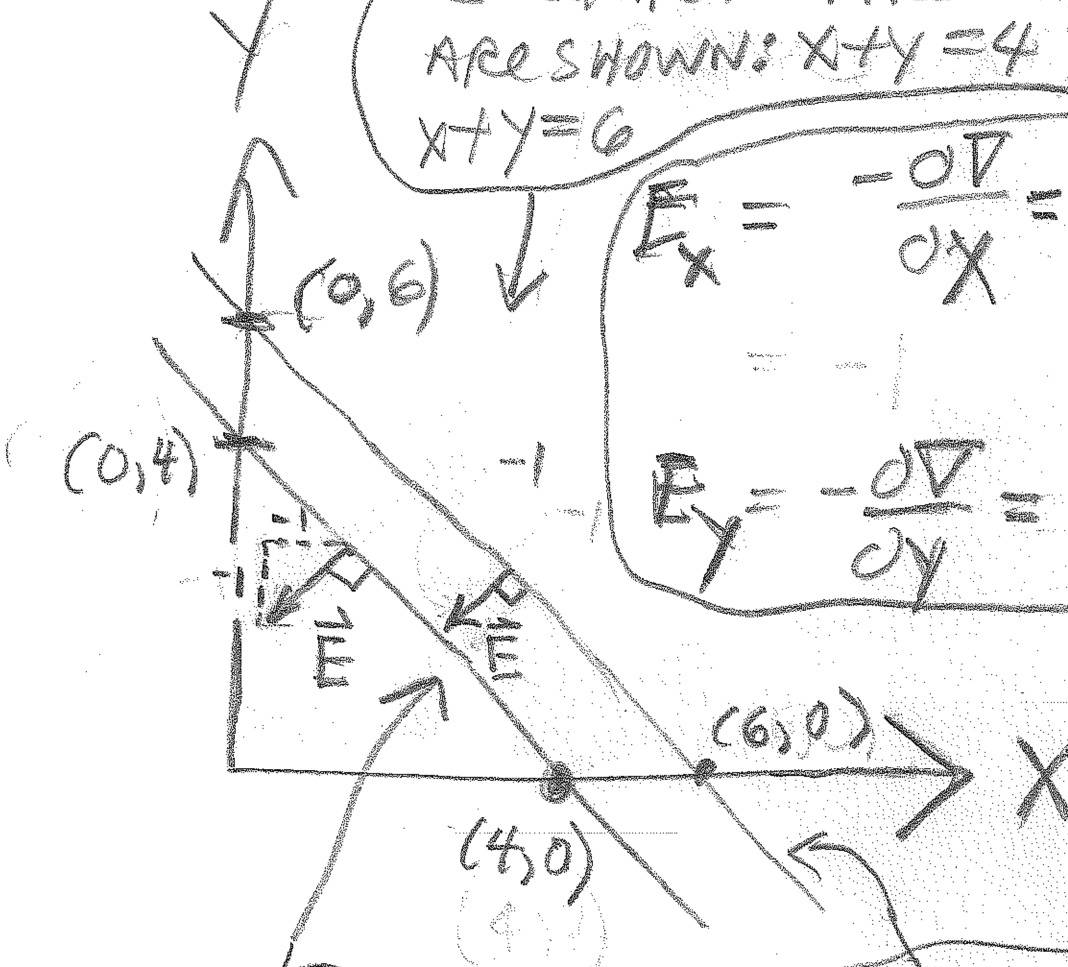
$$\vec{E} = E_x \hat{i} + E_y \hat{j}$$

$\vec{E}$ – direction is the direction in which V decreases the <u>most</u>.

Example of PLANAR EQUIPOTENTIAL SURFACES IN 3D; $\vec{E}$ = CONSTANT IN THIS CASE.

LET $V(x,y) = x + y$ LINEAR IN x and y

2 EQUIPOTENTIAL SURFACES ARE SHOWN: $x+y=4$ and $x+y=6$



$$E_x = -\frac{\partial V}{\partial x} = -1$$

$$E_y = -\frac{\partial V}{\partial y} = -1$$

$x+y=4$

$x+y=6$

$\boxed{\vec{E} \text{ is constant if } V(x,y) = Ax + By}$

$$E_x = -A$$

$$E_y = -B$$