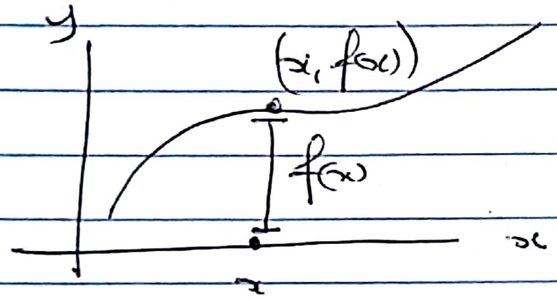
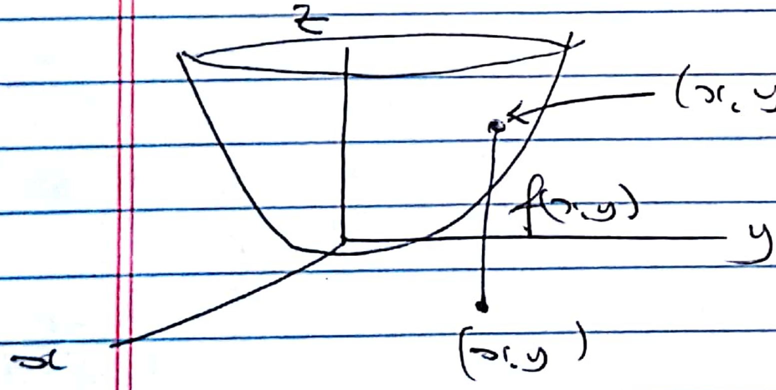
14.1 VISUALIZING FUNCTIONS $z = f(x,y)$

CALC I REVIEW To visualize $y = f(x)$ regard $f(x)$ = HEIGHT above x-axis at pt $x \in \mathbb{R}$.



Graph of f = Set of pts $(x, f(x))$ in $\mathbb{R}^2$
= Curve in plane.

CALC III To visualize $z = f(x,y)$ regard $f(x,y)$ = HEIGHT above xy-plane at pt $(x,y) \in \mathbb{R}^2$



Graph of f = Set of pts $(x, y, f(x,y))$ in $\mathbb{R}^3$
= Surface in space.

LEVEL CURVES (CONTOURS) of $z=f(x,y)$

If we intersect (SLICE) the graph of $z=f(x,y)$ with the plane $z=k$ we get the curve

$$f(x,y)=k \quad \text{in the } xy\text{-plane.}$$

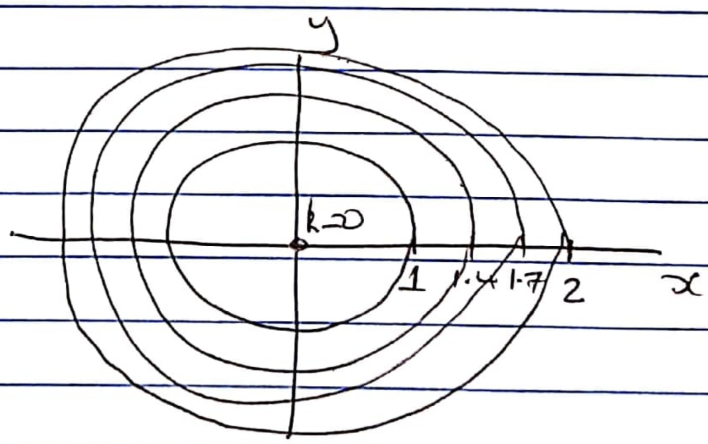
- At every point on a given level curve the height of graph is the same, namely k.
- If we use several (equally-spaced) k values we get a CONTOUR MAP.

EXS

① $z=f(x,y)=x^2+y^2$.

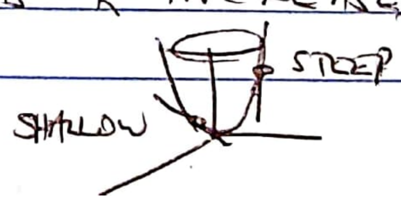
$x^2+y^2=k$ CIRCLE radius $R=\sqrt{k}$

k	$R=\sqrt{k}$
0	0
1	1
2	$\sqrt{2} \sim 1.4$
3	$\sqrt{3} \sim 1.7$
4	$\sqrt{4}=2$



SPACING BETWEEN CIRCLES DECREASE AS k INCREASES

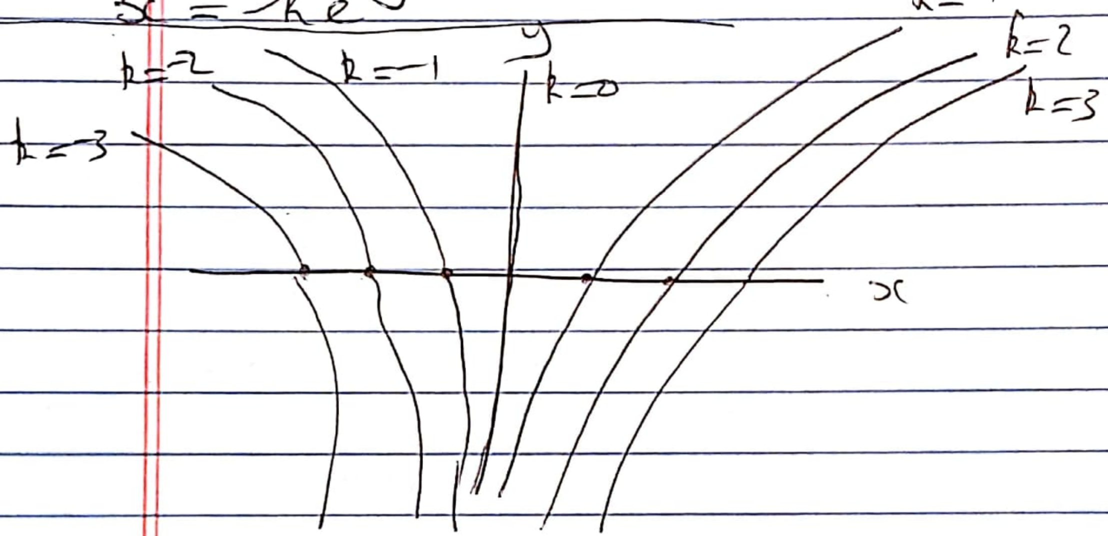
$\Leftrightarrow$ WALLS GET STEEPER



2 $f(x,y) = xe^{-y}$

$xe^{-y} = k$

$x = ke^{y}$



$\boxed{\text{MATCHING PROBLEMS}}$