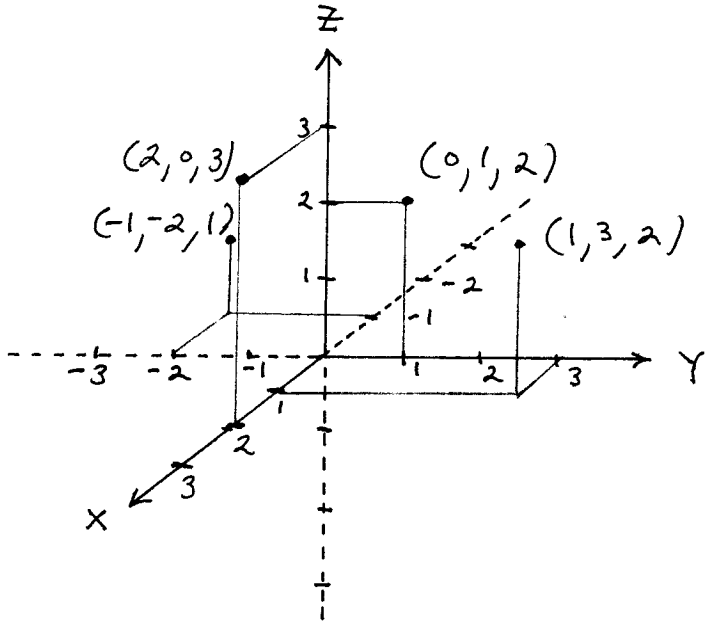
Section 10.1

3.)

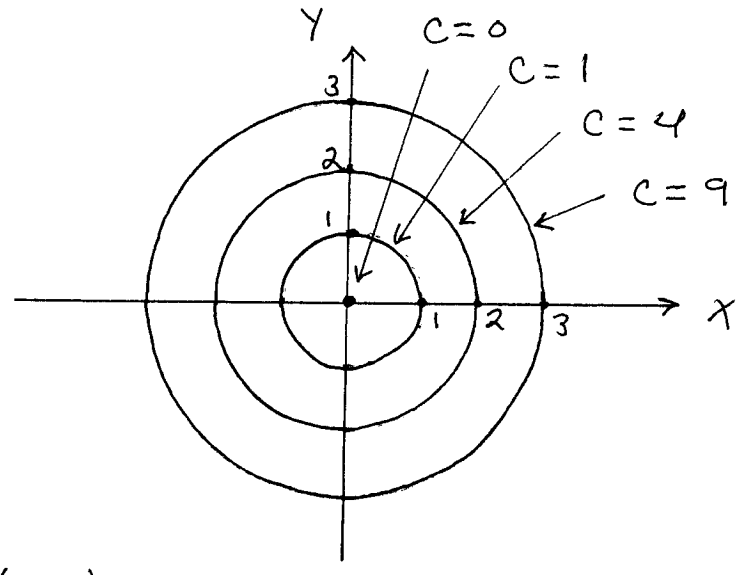


5.) $f(x,y) = \dfrac{2x}{x^2+y^2}$ so $f(2,3) = \dfrac{2(2)}{2^2+3^2} = \dfrac{4}{13}$

6.) $f(x,y,z) = \sqrt{x^2 - 3y + z}$ so

$f(3,-1,1) = \sqrt{3^2 - 3(-1) + (1)} = \sqrt{13}$

13.)



$f(x,y) = x^2 + y^2$

Domain: all pts. (x,y)

Range: $z \geq 0$

level curves

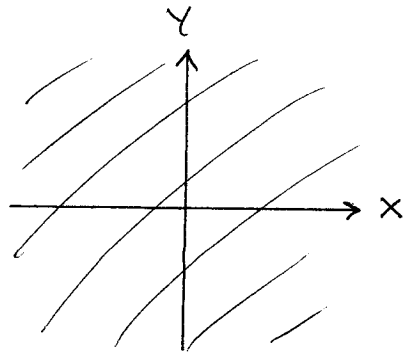
$c=0$: $x^2+y^2=0$

$\rightarrow x=0, y=0$

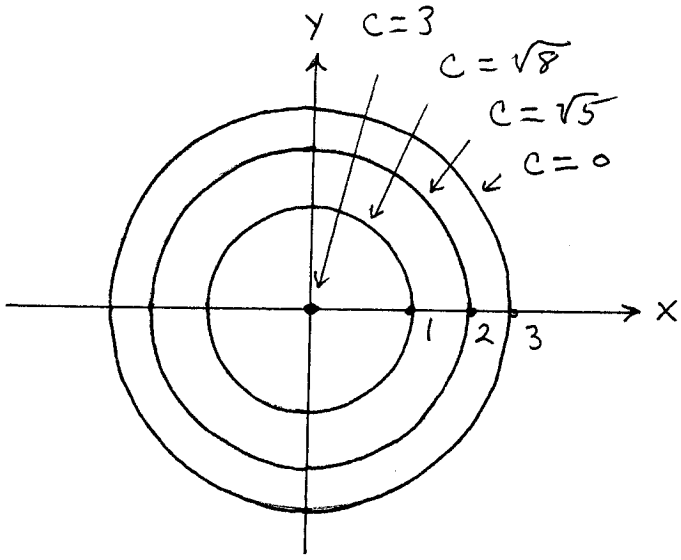
$c=1$: $x^2+y^2=1$

$c=4$: $x^2+y^2=4=2^2$

$c=9$: $x^2+y^2=9=3^2$



14.)



level curves

$c=0$: $0=\sqrt{9-x^2-y^2} \rightarrow$

$x^2+y^2=9$

$c=\sqrt{5}$: $\sqrt{5}=\sqrt{9-x^2-y^2} \rightarrow$

$x^2+y^2=4$

$c=\sqrt{8}$: $\sqrt{8}=\sqrt{9-x^2-y^2} \rightarrow$

$x^2+y^2=1$

$c=3$: $3=\sqrt{9-x^2-y^2} \rightarrow$

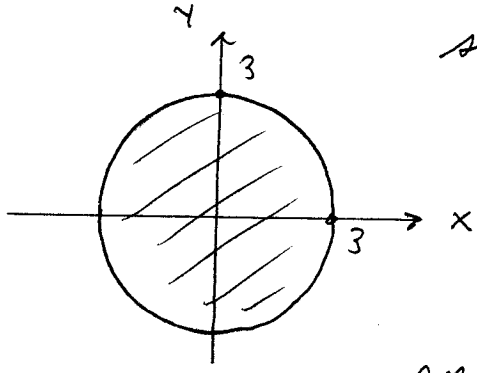
$x^2+y^2=0 \rightarrow x=0,\ y=0$

$f(x,y)=\sqrt{9-x^2-y^2} \rightarrow z=\sqrt{9-x^2-y^2} \geq 0 \rightarrow$

$z^2=9-x^2-y^2 \rightarrow x^2+y^2+z^2=3^2$ (sphere);

Domain: $9-x^2-y^2 \geq 0 \rightarrow x^2+y^2 \leq 3^2$

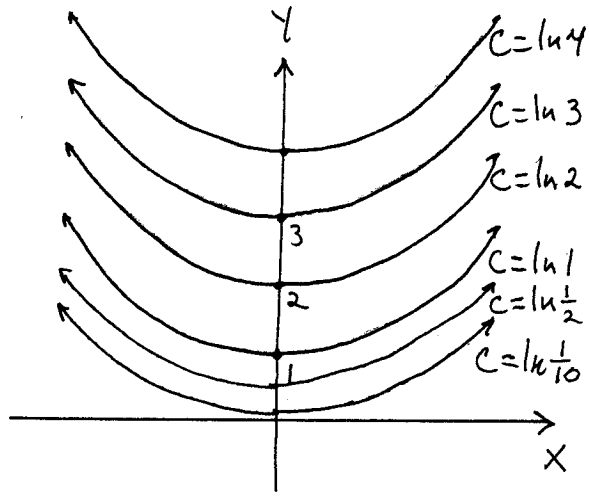
so domain is set of pts. (x,y) on or inside circle $x^2+y^2=3^2$.



Range: (Top half of sphere $x^2+y^2+z^2=3^2$)

$\boxed{0 \leq z \leq 3}$

15.) Level curves



$c = \ln 1$: $\ln 1 = \ln(y - x^2) \rightarrow$

$1 = y - x^2 \rightarrow y = x^2 + 1$

$c = \ln 2$: $\ln 2 = \ln(y - x^2) \rightarrow$

$2 = y - x^2 \rightarrow y = x^2 + 2$

$c = \ln 3$: $\ln 3 = \ln(y - x^2) \rightarrow$

$3 = y - x^2 \rightarrow y = x^2 + 3$

$c = \ln 4$: $\ln 4 = \ln(y - x^2) \rightarrow$

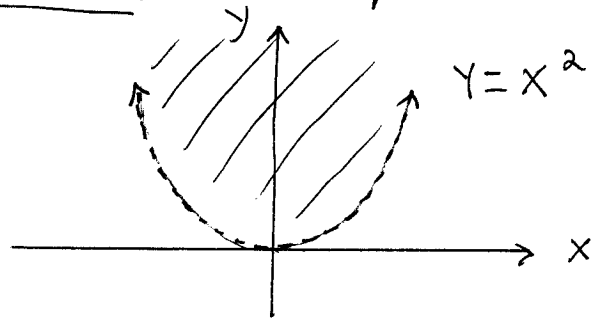
$4 = y - x^2 \rightarrow y = x^2 + 4$

$c = \ln \frac{1}{2}$: $\ln \frac{1}{2} = \ln(y - x^2) \rightarrow \frac{1}{2} = y - x^2 \rightarrow y = x^2 + \frac{1}{2}$

$c = \ln \frac{1}{10}$: $\ln \frac{1}{10} = \ln(y - x^2) \rightarrow \frac{1}{10} = y - x^2 \rightarrow y = x^2 + \frac{1}{10}$

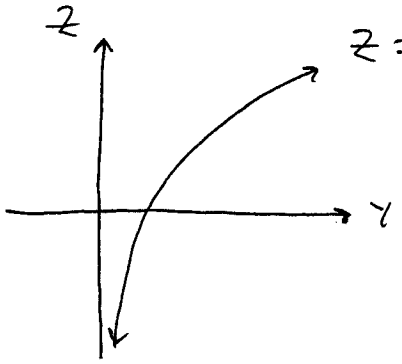
$f(x,y) = \ln(y - x^2)$; $y - x^2 > 0 \rightarrow$

$y > x^2$ so Domain: all pts. (x,y) lying above the graph of $y = x^2$



Range: Consider pts. $(0,Y)$ on positive Y-axis, then $z = \ln(Y - x^2) = \ln(Y - 0^2)$ $\rightarrow z = \ln Y$; the values of z range from $-\infty$ to ∞ so range of $z = \ln(Y - x^2)$ is

$$\boxed{-\infty < z < \infty}.$$



16.) level curves

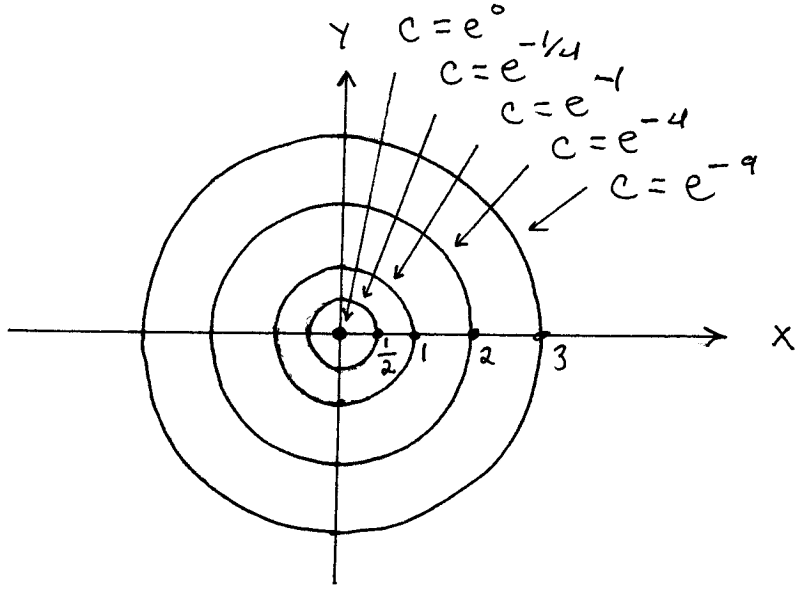
$c = e^0$: $e^0 = e^{-(x^2+y^2)} \rightarrow x^2 + y^2 = 0 \rightarrow x = 0,\ y = 0$,

$c = e^{-\frac{1}{4}}$: $e^{-\frac{1}{4}} = e^{-(x^2+y^2)} \rightarrow x^2 + y^2 = \left(\frac{1}{2}\right)^2$,

$c = e^{-1}$: $e^{-1} = e^{-(x^2+y^2)} \rightarrow x^2 + y^2 = (1)^2$,

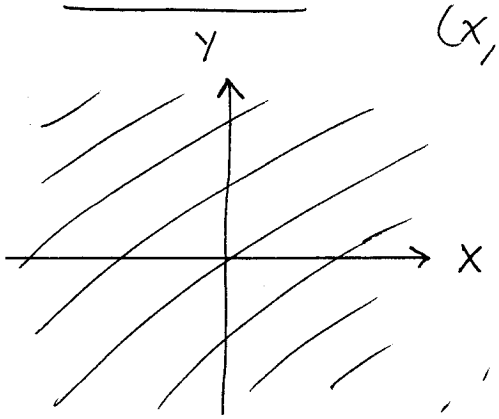
$c = e^{-4}$: $e^{-4} = e^{-(x^2+y^2)} \rightarrow x^2 + y^2 = (2)^2$,

$c = e^{-9}$: $e^{-9} = e^{-(x^2+y^2)} \rightarrow x^2 + y^2 = (3)^2$



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

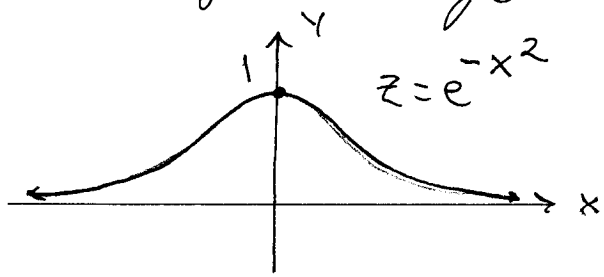
Domain: all pts. (x, y)



Range: Consider pts. $(x, 0)$ on x-axis, then

$$z = e^{-(x^2+y^2)} = e^{-(x^2+0^2)} \rightarrow$$

$$z = e^{-x^2}$$; the values of z range from 0 to 1 so range of $z = e^{-(x^2+y^2)}$ is

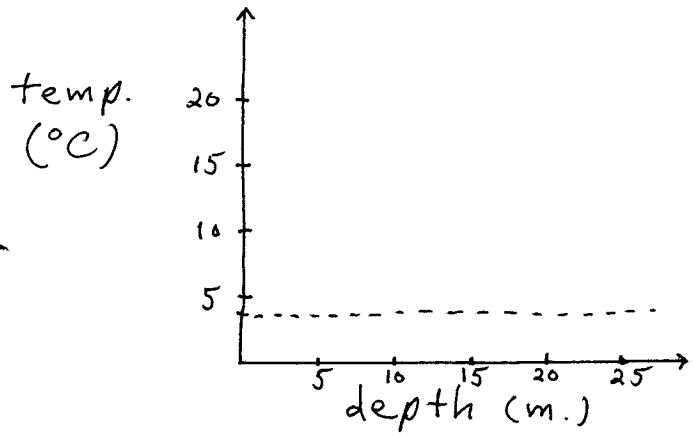


$$\boxed{0 < z \leq 1}$$

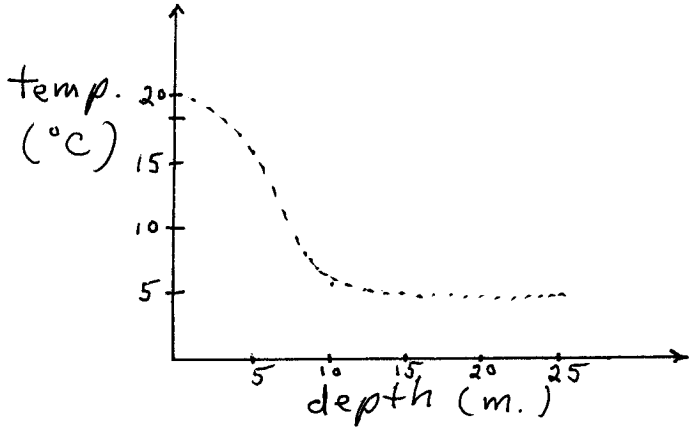
19.) Fig. 10.23

22.) Fig. 10.21

24.) a.) March



June



25.) day 180: depth of 22 m. or more
day 200: depth of 15 m. or more
day 220: depth of 14 m. or more